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DISSERTATION

The Macroeconomic Dimensions of Credit: A Comprehensive

Analysis of Finance, Inequality and Growth

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The Macroeconomic Dimensions of Credit: A Comprehensive Analysis of Finance, Inequality and Growth

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Zusammenfassung

Das Finanzsystem ist seit vielen Jahrhunderten ein kritischer Bestandteil jeder Volkswirtschaft, der bestimmt, wie gut die Realwirtschaft funktionieren kann. Die weitreichende Interdependenz aus Real- und Finanzwirtschaft wird häufig dann deutlich, wenn es wie in den Jahren 2007/2008 zu einer Krise im Finanzsektor kommt, die die Gesamtwirtschaft in tiefe Rezessionen und Schuldenkrisen stürzte.

Viele Ökonomen, darunter Adam Smith, John Hicks und Joseph Schumpeter haben schon früh die Bedeutung des Finanzsystems für den wirtschaftlichen Erfolg von Volkswirtschaften erkannt. Besonders einflussreich für das moderne Verständnis zur makroökonomischen Rolle von Banken und Kredit ist dabei die monetäre Wachstumstheorie von Schumpeter, die er im Rahmen seiner „*Theorie der wirtschaftlichen Entwicklung*" aufstellte. Diese Theorie, die die vorliegende Dissertation in Kapitel 2 detailliert darlegt, verdeutlicht, dass Schumpeter das Finanzsystem als eine unabhängige Quelle der Kaufkraft betrachtet. Banken haben als Produzenten von Geld und Kredit „aus dem Nichts" die Fähigkeit, innovative Investoren zu finanzieren, wodurch langfristiges wirtschaftliches Wachstum erzeugt wird. Voraussetzung dafür ist, dass die Kredite produktiv, d.h. nicht spekulativ oder konsumtiv eingesetzt werden. In diesem Fall kommt es durch verstärkte Kreditvergabe mittel- bis langfristig auch nicht zu Inflation, da die Angebotsseite ausgeweitet wird.

Ausgehend von Schumpeters Theorie wird in dieser Dissertation die makroökonomische Rolle des Finanzsystems, insbesondere von Krediten, für die (1) Erzeugung von Wirtschaftswachstum, (2) Lenkung von ökonomischen Ressourcen und (3) Verteilung von Wohlstand untersucht.

Kapitel 3 diskutiert zunächst den allgemeinen Zusammenhang von Finanzsystem und Wirtschaftswachstum, und wie dieser in der empirischen Standardliteratur dargestellt wird. Diese ist insbesondere von drei Autoren, nämlich Robert G. King, Ross Levine and Thorsten Beck geprägt, und präsentiert überwiegend positive Wachstumseffekte. Die Autoren berufen sich dabei ebenfalls auf die Wachstumstheorie von Schumpeter. Im Laufe des Kapitels wird allerdings deutlich, dass die Literatur die Schumpetersche Wachstumstheorie falsch, d.h. im Lichte der sogenannten "realen Analyse" darstellt. Diese zeichnet sich dadurch aus, dass ein Einheitsgut austauschbar als reales oder finanzielles Wirtschaftsgut verwendet wird, was die Rolle von Banken auf die Reduzierung von Friktionen bei der Durchleitung von dem gesparten Einheitsgut an Investoren reduziert. Schumpeter betont in seiner monetären Theorie jedoch, dass Banken eigenständig, d.h. ohne die Notwendigkeit von Sparen, Kaufkraft schöpfen und Wachstum generieren können. Ursächlich dafür ist das Zugrundelegen von separaten realen und finanziellen Wirtschaftsgütern. Eine wichtige Implikation dessen ist auch, dass Kredite in der monetären Analyse, im Gegensatz zur realen Analyse, nicht zwangsläufig produktiv verwendet werden müssen, da sie auch spekulativ oder konsumtiv eingesetzt werden können.

Nachdem in Kapitel 3 aufgezeigt wird, welche vielfältigen, auch empirische Probleme sich durch die Zugrundelegung einer faktisch realen Theorie ergeben, folgt eine empirische Analyse der "wahren" Schumpeterschen Hypothesen. Basierend auf Paneldatenregressionen, strukturellen Vektorautoregressionsmodellen, sowie Granger-Kausalitätsprüfungen und Prognosefehlervarianzzerlegungen wird gezeigt, dass 1.) ein positiver Zusammenhang zwischen dem Wachstum von Krediten und Wirtschaftswachstum besteht, auch für entwickelte Länder, 2.) kein empirischer Zusammenhang von Haushaltssparen und Wirtschaftswachstum festgestellt werden kann, und 3.) auf länderspezifischer Ebene sowohl positive, als auch negative und insignifikante Effekte von Kredit auf Wirtschaftswachstum existieren. Letzteres ist mit Schumpeters "Sekundärwellen"-Ansatz vereinbar, jedoch nicht mit den Mechanismen der realen Analyse. Alles in allem zeigt sich damit eine breite empirische Evidenz für Schumpeters Hypothesen.

Ein zentraler Punkt von Schumpeters Wachstumstheorie ist die Rolle von Banken bei der Generierung von Wachstum. Genauer legt Schumpeter dar, dass die Kreditvergabe der Banken ein dezentrales Instrument zur Umverteilung von Ressourcen hin zu den innovativsten Unternehmern ist, die ohne Banken nur von einer zentralen Behörde durchgeführt werden könnte. Eine besonders interessante Anwendung von Schumpeters Wachstumstheorie zeigt sich daher im Fall der Volksrepublik China. Anstelle der beiden vorangegangenen Optionen, Banker vs. zentrale Behörde, liegt dort ein hybrides Mischmodell vor, das die aktive Rolle des Bankensystems bei der Steuerung von Ressourcen verdeutlicht und die Perspektive für einen "unternehmerischen Staat" eröffnet.

In Kapitel 4 wird daher zunächst dargelegt, inwiefern die Volksrepublik China über ihr staatseigenes Bankensystem Einfluss auf die Kreditvergabe nehmen, und inwiefern dies zur Umsetzung seiner industriepolitischen Bestrebungen beitragen kann. Motiviert dadurch wird eine Panelanalyse basierend auf einem neuen, eigens erstellten Datensatz über 31 chinesischen Provinzen durchgeführt, um 1.) empirische Evidenz für den Zusammenhang von Finanzsystem und Wachstum in China zu liefern, und 2.) um zu untersuchen, wie erfolgreich das chinesische Bankensystem dazu beigetragen hat, im Rahmen der chinesischen Industriepolitik Ressourcen zu reallokieren, um Wirtschaftswachstum zu generieren. Die Ergebnisse legen nahe, dass es generell einen positiven Zusammenhang zwischen Kredit- und Wirtschaftswachstum in China gibt, der aber nicht linear ist. Insbesondere gibt es hier regionale und zeitliche Unterschiede, sowie in Bezug auf die Größe des Finanzsystems. Weiterhin deuten die Ergebnisse in Kapitel 4 darauf hin, dass die kreditfinanzierte Industriepolitik in China zu mehr Investitionen und BIP-Wachstum beigetragen haben könnte, wobei es jedoch Nichtlinearitäten zwischen einzelnen Branchen und Unternehmenstypen gibt. Insbesondere scheint Kredit in den letzten Jahren zu mehr wachstumsfördernden Investitionen im Automobilsektor beigetragen zu haben, der sich durch einen hohen Anteil an Joint Venture Firmen auszeichnet, wohingegen für rein private und rein staatliche Firmen kein signifikanter Unterschied festgestellt werden kann.

Nachdem sich Kapitel 3 und 4 mit der Rolle des Finanzsystems bei der Generierung von Wirtschaftswachstum befasst haben, genauer mit den Mechanismen und Anwendungen von Schumpeters monetärer Wachstumstheorie, wird in Kapitel 5 die Frage aufgeworfen, welche Rolle das Finanzsystem bei der Verteilung des erzeugten Wohlstands spielt. Sowohl Theorie als auch Empirie kommen dabei zu widersprüchlichen Ergebnissen. Während es einerseits möglich ist, dass eine stärkere Kreditvergabe die Ungleichheit von Vermögen reduziert, wenn vor allem ärmere Haushalte von einer Ausweitung des Finanzsystems profitieren (z.B. durch geringere Kreditrestriktionen), ist es auch denkbar, dass eine Ausweitung der Kreditvergabe vor allem den Haushalten zu Gute kommt, die bereits Teil des Finanzmarktes sind, wohingegen ärmere Haushalte weiterhin auf informelle Finanzmärkte zurückgreifen müssen.

In Kapitel 5 wird dargelegt, dass die Verwendung von Vermögensdaten bei der Analyse des Nexus von Kredit und Ungleichheit unabdingbar ist. Während ein Großteil der Literatur aufgrund von Datenlücken auf Indikatoren der Einkommensverteilung zurückgreift, ergeben sich dadurch nicht nur Abweichungen zur zugrundeliegenden Theorie, sondern auch in Bezug auf die empirischen Ergebnisse. Moderne Machine Learning Techniken ermöglichen hingegen eine komplexe Aufbereitung fehlender Datenpunkte und liefern damit neue empirische Ergebnisse. So zeigt sich, dass Kredite an Haushalte und Unternehmen, zusammen mit Indikatoren zum Arbeits- und Sparverhalten, sowie zur Altersstruktur der Bevölkerung, die wichtigsten Determinanten von Vermögensungleichheit sind. Dahingegen kommt dem Finanzsystem in der Literatur zu Bestimmungsfaktoren von Einkommensungleichheit höchstens eine untergeordnete Rolle zu.

Zuletzt werden auch verschiedene Nichtlinearitäten im Zusammenhang von Krediten und Vermögensungleichheit geprüft. Es zeigt sich etwa, dass Haushaltskredite die Vermögensungleichheit tendenziell verringern, wenn Ländern über relativ entwickelte Finanzsysteme verfügen, während Kredite die Vermögensungleichheit in Ländern mit weniger entwickelten Finanzsystemen erhöhen. Darüber hinaus scheint die Wohneigentumsquote eine wichtige Rolle dabei zu spielen, ob Kredite zu einer gleichmäßigeren oder ungleicheren Verteilung von Vermögen führen. In Ländern mit einer hohen Wohneigentumsquote, wie in Spanien oder Portugal, besteht ein negativer Zusammenhang zwischen Krediten und Vermögensungleichheit, während der Zusammenhang in Ländern mit einer relativ niedrigen Wohneigentumsquote, wie in Deutschland oder Österreich, positiv ist.

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Würzburg, im Dezember 2023 Lisa Geißendörfer

Contents

List of Abbreviations

2SLS	Two Stage Least Squares
APE	Average partial effect
BIS	Bank for International Settlements
BL	Barro-Lee Educational Attainment Data
CATE	Conditional average treatment effect
CNKI	China National Knowledge Infrastructure
e.g.	exempli gratia
ECB	European Central Bank
EU	European Union
Eurostat	European Statistical Office
FDI	Foreign direct investment
FE	Fixed effects
FEVD	Forecast Error Variance Decomposition
FRED	Federal Reserve Economic Data
GDP	Gross domestic product
GPBoost	Gaussian process and grouped random effects tree-boosting
GPG	General purpose good
HFCS	Eurosystem Household Finance and Consumption Survey
HMR	Household main residence
i.e.	id est
IDDS	Innovation-driven Development Strategy
ILO	International Labour Organization
IMF	International Monetary Fund
IV	Instrumental variables
JSCB	Joint-stock commerical bank
JST	Jordà-Schularick-Taylor Macrohistory Database
KNN	k-nearest neighbors
LASSO	Least Absolute Shrinkage and Selection Operators
(G)LMM	(Generalized) linear mixed model

MA	Monetary analysis
MAPE	Mean absolute percentage error
MERF	Mixed-effects random forest
MICE-CART	Multiple imputation by chained equation based on classification and regression trees
MLP	Medium to Long term Program of Science and Technology
MSE	Mean squared error
NBS	National Bureau of Statistics of China
NEV	New energy vehicle
NPISH	Non-profit institutions serving households
OECD	Organisation for Economic Co-operation and Development
(P)OLS	(Pooled) Ordinary Least Squares
PBoC	People's Bank of China
PRC	People's Republic of China
PV	Photovoltaic
R&D	Research and development
RA	Real analysis
RE	Random effects
RF	Random forest
RSS	Residual sum of squares
SEI	Strategic Emerging Industries
SHAP	Shapley additive explanations
SMERF	Stochastic mixed-effects random forest
SOCB	State-owned commercial bank
SOE	State-owned enterprise
(S)VAR	(Structural) Vector Autoregressive model
SWIID	Standardized World Income Inequality Database
TL3	Territorial level 3
UN	United Nations
US(A)	United States of America
WID	World Inequality Database
WTO	World Trade Organization
XGBoost	Extreme gradient boosting

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1 Introduction

"Finance is, as it were, the stomach of the country, from which all the other organs take their tone."

Gladstone (1858)
Former British Prime Minister

1.1 The macroeconomic dimensions of credit: Outline and overview

The preceding quote by former British Prime Minister William Gladstone, formulated more than 165 years ago, has not lost any of its meaning to this day. On the contrary, the financial system is now an even more critical part of the global economy, acting as a lubricant of economic activity and determining how well the real sectors function. This has been demonstrated not least in the context of the past global financial crisis, which plunged entire economies into deep recessions (Baily & Elliott, 2013).

The wide-ranging impact of money and credit was recognized early on by economists and policymakers. Smith (1776), for example, attributed a significant role to money in reducing transaction costs, which facilitates specialization and strengthens productivity and innovation. Hamilton (1781), one of the founding fathers of the United States of America, stated that "[m]*ost commercial nations have found it necessary to institute banks, and they have proved to be the happiest engines that ever were invented for advancing trade*". Furthermore, Hicks (1969) pointed out that the development of the British financial system was key in fueling the industrial revolution in the United Kingdom. The economic and political rise of the Netherlands in the 17th century and that of the United States in the 20th century were similarly preceded by a marked development of national financial systems (Beck, 2011). However, one of the most famous economists addressing the economic importance of banks and credit is certainly Joseph A. Schumpeter. He is famous above all for coining the expression of 'creative destruction' in his book '*Capitalism, Socialism and Democracy*' (Schumpeter, 1942), but much more important for economic theory are his monetary analyses of the relationship between the financial system and economic development, as the upcoming chapters of this thesis will show.

From a **microeconomic perspective**, the financial system fulfills four key functions: (1) providing payment services, (2) credit, and (3) liquidity, as well as (4) managing risks. While providing payment services reduces transaction costs and makes the exchange of goods and services more efficient (Beck, 2011), credit provision increases the room for maneuver of economic actors. Businesses are thus able to invest beyond their liquid resources, households can acquire real estate without having to save the full cost of it in advance, and governments can smooth their spending despite cyclical fluctuations in tax revenues. The provision of liquidity relates, on the one hand, to the supply of cash to companies and households in the event of unexpected needs, e.g. in the form of overnight money or credit lines. On the other hand, it concerns liquidity on the financial markets, i.e., how quickly and at what price a position can be bought or sold. Finally, the financial system provides tools for managing risks to businesses and households, mainly through the provision of derivatives. By this means, risks to the future development of the economy and financial markets can be pooled (Baily & Elliott, 2013).

The monetary development theory of Schumpeter (1934b), that is described in detail in chapter 2, opens the perspective for the **macroeconomic functions of the financial system**. Schumpeter regards the financial system as an independent source of purchasing power. As producers of money and credit, banks have the unique power to finance innovative investors 'out of nothing' and create long-term economic development, when credit is used productively. Based on Schumpeter's theory, this dissertation examines the macroeconomic role of the financial system, particularly credit, in (1) **generating growth**, (2) **directing resources**, and (3) **distributing wealth**.

First, chapter 3 discusses the general **nexus between the financial system and economic development**, and how it is presented in the standard literature. This chapter was co-authored with Peter Bofinger, Thomas Haas and Fabian Mayer. While a vast literature on the nexus between finance and growth has developed since the 1990s, there are three authors that have considerably influenced the research on this topic: Robert G. King, Ross Levine and Thorsten Beck (Beck, Levine, & Loayza, 2000; King & Levine, 1993a; Levine, 2005, 2021). Although these results have recently been challenged, the literature finds primarily growth-enhancing effects of credit.

The starting point of chapter 3 is the observation that, by taking a fundamentally different paradigm as a basis, a systematic misinterpretation of Schumpeter's monetary growth theory has taken place within the finance and growth literature, that poses major challenges to most of the empirical research to date. More presciently, Schumpeter's theories are misrepresented in light of real analysis, whose critical assumption lies in a general purpose good (GPG) that can be used interchangeably as a real asset, i.e., consumption and investment good, and as a financial asset, i.e., capital or saving. Based on this assumption, only a waiver of GPG consumption (i.e. saving) can free up funds for investment, which reduces the role of banks to the mere transmission of the GPG from savers to investors, i.e. to the "easing of frictions" (Levine, 1997; Woodford, 2010). Banking crises and, more generally, negative effects of the financial system on the economy are not possible within this model, as (1) the role of banks is limited to the easing of frictions in the intermediation of funds between savers and borrowers, so that they can do little harm, even if the financial system expands; (2) financing is only provided for productive investment, as there is no room for the financing of speculation and household consumption; and (3) the banking system cannot actively contribute to an over-expansion of credit, as funds are only released by household saving which is a comparatively stable variable.

Schumpeter himself described the fundamental differences between real and monetary analysis in his "*History of Economic Analysis*" (Schumpeter, 1954), emphasizing the monetary character of his own growth theory. In contrast to real analysis, monetary analysis is characterized by financial assets (money and bonds) existing separately from real assets (consumption goods and investment goods). In this model, saving provides no supply of funds and it has therefore no direct impact on the financial sphere. Instead, banks are the sole producers of financial funds, i.e., money, "out of nothing" by creating credit. This enables a shift in purchasing power that allows the most innovative firms to access productive resources in the economy, which generates economic growth. Schumpeter's theory also makes clear that an expansion of credit can have an inflationary effect in the short run, that is however offset by the subsequent expansion of supply. Furthermore, Schumpeter is aware of potential adverse effects of credit creation ("secondary wave"). He points out that, while credit that is used for productive purposes should have a clear positive effect on economic growth, credit used for unproductive means could even negatively affect economic development.

The consequence of the misinterpretation of Schumpeter's theory is reflected in various flaws in the literature. First, the standard literature cannot provide empirical evidence for the positive role of saving in the growth process, which would be decisive for the underlying real theory (Beck, Levine, & Loayza, 2000; Mohan, 2006; Saltz, 1999). Moreover, there is a lack of evidence for the finance and growth nexus in advanced economies, as they are typically underrepresented in prevalent empirical studies (Bijlsma, Kool, & Non, 2018; De Gregorio & Guidotti, 1995; Neusser & Kugler, 1998). A major problem for the recent literature is also the observation of "vanishing effects" in the initially positive relationship between the financial system and economic growth. Various authors show that the impact of finance on gross domestic product (GDP) growth becomes insignificant or even negative above a certain size of the financial system and in more recent data (Arcand, Berkes, & Panizza, 2012; Cecchetti & Kharroubi, 2012; Rousseau & Wachtel, 2011). These results are difficult to hold with a theory in which unproductive use of credit is not possible by definition of the GPG.

Based on these findings, chapter 3 provides its own empirical analysis to test the hypotheses that can be derived from a correct interpretation of Schumpeter's thoughts. Accordingly, a positive correlation would generally be expected between credit growth and GDP growth, but not between saving growth and GDP growth. Moreover, the results would have to leave room for the existence of unproductive credit, i.e., for negative or zero correlations.

Using a panel of 43 developed and developing countries between 1940 and 2019 to explore the relationships between the important variables of the finance and growth literature, we find broad empirical support for Schumpeter's growth theory. In detail, we apply standard panel estimation methods, such as Fixed and Random Effects, as well as Instrumental Variable approaches, and find that there is a positive empirical link between credit growth and GDP growth for developed and for developing countries, as soon as dynamic credit indicators are applied. On the other hand, and in line with the literature, our empirical analysis cannot find effects of saving on GDP growth. Both findings are also supported by a structural vector autoregressive (SVAR) model from a dynamic perspective. To test the causality between credit growth and GDP growth we run Granger causality tests and Forecast Error Variance Decompositions (FEVD). The results show that the causality runs in both directions, also providing evidence for negative and insignificant effects of credit growth and economic growth on an individual country level. This is compatible with Schumpeter's 'secondary wave' approach, however, not with real analysis.

In sum, a correct interpretation of Schumpeter helps to overcome the theoretical and empirical challenges which confront the prevailing finance and growth literature. At the same time, Schumpeter's growth model is shown to be well suited to highlight the macroeconomic contribution of the banking system for the development of economies and fits perfectly with real-life empirical data.

One point that is central to understanding Schumpeter's growth theory is the role of banks as creators of purchasing power and, thus, economic development, by creating credit. In detail, Schumpeter posits that bank lending is a decentralized instrument for reallocating resources within an economy to the most innovative endeavors, which, without banks, could only be carried out by a central authority. A particularly interesting application of Schumpeter's growth theory can hence be seen in the case of the People's Republic of China (PRC). Instead of the two options Schumpeter envisages for the reallocation of resources, the banker vs. a central authority, a hybrid mixed model is present there, elucidating the **active role of the banking system in directing resources** and opening the perspective for an '*entrepreneurial state*' (Mazzucato, 2015). Since the late 1970s, and more narrowly with the initiation of the 'Strategic Emerging Industries' (SEI) programme in 2010, the Chinese government has been undertaking major efforts in developing their countries economy by means of industrial policy, and their state-owned banking system has fundamentally contributed to its realization. Therefore, in chapter 4 Thomas Haas and I make use of a new self-constructed data set originating from Chinese official statistics to study the finance and growth nexus within China. More precisely, we examine how the Chinese banking system has contributed to redirect resources within the Chinese industrial policy strategy, in order to generate economic growth. To the best of our knowledge, a similar analysis has not been carried out yet.

Based on a panel data set for 31 Chinese provinces over the period from 1985 to 2019 we find that there is generally a positive relationship between credit provision to the corporate sector and GDP growth in China. Total credit provision to all sectors, an indicator including a higher proportion of unproductively used credit, is noticeably less statistically significant in generating economic growth. Moreover, the nexus between credit growth and GDP growth is non-linear in terms of Chinese regions and credit-to-GDP ratio. It shows that credit has a weaker effect on GDP growth in provinces with already high credit shares in GDP, and that credit provision to western and central-northern provinces is in general less growth-enhancing than credit provision to eastern provinces. The results also suggests that in particular the western Chinese region has been catching up economically to the East after the Chinese accession to the World Trade Organization (WTO) in 2001.

Secondly, the results in chapter 4 indicate that industrial policy targeting could have led to more investment and GDP growth, however, there are differences among industries and firm types. While we find no robust evidence that credit provision to private or state-owned enterprises was more effective for investment or GDP growth after the start of the SEI program, we can observe recently that credit growth has significantly and positively impacted investment growth in the automotive sector, which is characterized by a large share of joint-venture firms. Due to missing data we could not include this firm type in the previous analysis. On the other hand, there are no significant improvements observable in the energy sector, that is marked by a larger share of purely private (mainly in the renewable energy sector) or state-owned firms (mainly in the traditional energy sector).

While chapter 3 and 4 examine the role of the financial system in generating economic growth, i.e. the mechanisms and applications of Schumpeter's monetary theory, chapter 5 raises the question of **what role the financial system plays in distributing the generated wealth**. This chapter is based on a paper written in single authorship. Theory here provides two opposing hypotheses. First, it is possible that credit operates at the "*intensive margin*", i.e., that the financial system favors wealthy people because less wealthy people rely more heavily on informal markets, and therefore any improvement in the financial system increases the gap between rich and poor (Greenwood & Jovanovic, 1990; Piketty, 1997). On the other hand, it is possible that credit has an "*extensive*" effect, i.e., that an expansion of the financial system benefits the relatively poorer because they gain access to financial services (e.g. through fewer credit constraints or lower borrowing costs) (Aghion & Bolton, 1997; Banerjee & Newman, 1993; Galor &

Moav, 2004).

Empirical evidence on this topic is quite limited. There are only a few studies that explicitly address the relationship between "finance" and wealth inequality. By contrast, the bulk of other studies on the empirical link between the financial system and inequality (e.g. Beck, Demirgüç-Kunt, and Levine (2007); Jaumotte, Lall, and Papageorgiou (2013); Park and Shin (2017); Thornton and Di Tommaso (2020)) focus on income inequality, on which data is more widely available, but which is also only a rough proxy for wealth inequality, and thus cannot adequately investigate the two hypotheses presented above. The literature as a whole also finds no consistent results on whether credit tends to increase or decrease inequality.

Chapter 5 therefore applies state of the art machine learning techniques that enable complex imputation and analysis of incomplete data. In this way, a comprehensive study on the relationship between credit and wealth inequality in developed and less developed countries worldwide can be undertaken that yield novel empirical insights. The results show that credit provision to businesses and households, as well as factors such as the working and saving behavior and the age structure in an economy are the most important variables that determine wealth inequality. On the other hand, the literature indicates that credit has only a minor role in determining income inequality.

Furthermore, the chapter contributes to the literature by testing for various non-linearities within the nexus of credit and wealth inequality. For instance, it shows that credit tends to lower wealth inequality in countries with a high level of financial development, while credit increases wealth inequality once countries have less developed financial systems. Moreover, the home ownership ratio seems to play a significant role in whether credit tends to distribute wealth more equally or more unequally. In countries with high home ownership ratios, such as Spain or Portugal, there is a negative relationship between credit and wealth inequality, and in countries with relatively low home ownership ratios, such as Germany or Austria, the relationship is positive.

As a whole, this dissertation gives insights into some of the most important macroeconomic dimensions of credit. It shows how important it is to map economic relationships in a realistic and sufficiently complex way at the theoretical level, and to test them empirically based on this. It also demonstrates how complex the role of the banking and financial system is in the economic process and what great potential it offers. At the same time, Schumpeter also described the possible risks posed by the financial system which are not explicitly covered by this dissertation, but must be pointed out nonetheless. With the ability to create money ex nihilo, banks can create credit cycles independently of saving. These cycles do not necessarily finance productive investments but, as the great financial crisis has shown, also housing booms and excessive consumption. Typically, low mortgage rates and often lax lending standards cause an overheating in the real estate sector, that causes real estate prices, and thus the collateral of borrowers to raise. As a consequence, more credit is granted as the profitable lending business supports the banks' capital position. A subsequent bursting of the bubble can cause loan defaults, bank insolvencies and bank runs, followed by deep economic recessions. Claessens, Kose, and Terrones (2009), for instance, show that economic recessions related to banking crises are relatively deeper and longer.

1.2 Trends in financial development

Before this thesis continues with the discussion of the macroeconomic implications of the financial system in more detail, a brief overview of the measurement of "finance" and "financial development" as well as the global trends of the corresponding indicators is presented.

First of all, the following chart shows the percentage of the population over 15 years of age that held an account at a bank or other financial institution in 2021. What can be observed are fundamental global differences in access to financial services. While, on average, 76 percent of the population worldwide owned an account, this figure is equivalent to 96 percent in high-income countries and 39 percent in low-income countries. More precisely, while virtually 100 percent of adults in Denmark, Iceland, Germany, Austria, the United Kingdom, Netherlands, Sweden, Ireland, Canada and Finland own a financial account, only 6 percent of the population aged 15 and above holds an account in South Sudan. Afghanistan (10 percent), Iraq (19 percent) and Lebanon and Pakistan (both 21 percent) exhibit similarly low values.

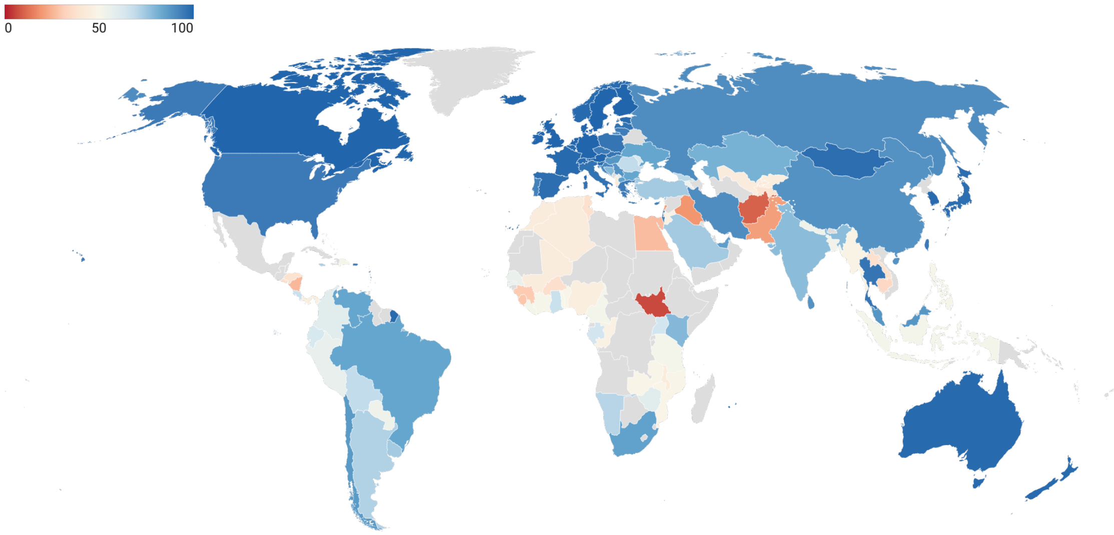


Figure 1: Share of population aged 15 and above that have an account at a bank or another type of financial institution in 2021, in percent.
Source: World Bank, Global Findex Database 2021.

While the previous chart gives a good first overview on the general accessibility of finance worldwide, most of the empirical studies on finance and growth, for instance, make use of other finance indicators, such as the volume of private credit to GDP. An important assumption underlying those analyses, as by King, Beck and Levine, is a positive correlation between size and quality of the financial system (Levine, 2021).

The problem of approximating quality with size, however, becomes obvious if one looks at the values of private credit to GDP, e.g. in 1960. It would imply that at that time the quality of the financial systems in Congo (22.2 %) and Senegal (19.2 %) was higher than that of the Netherlands (18.6 %) and the UK (17.1 %) (World Bank Financial Structure Database). Already Goldsmith (1969, p. 45) argued that there are important factors explaining the level of financial intermediation that are not necessarily related to the quality of a financial system:

> *"The level of the financial interrelations ratio thus can be traced back to fundamental features in a country's economic structure, such as the concentration of production, the distribution of wealth, the incentive to invest, the propensity to save, and the extent to which business activities are legally separated from household activities by devices such as incorporation."*

A possible explanation for inter-country differences in the value of private credit to GDP in advanced economies is the growing importance of mortgage lending which is included in the preferred indicator "private credit to GDP". Jordà, Schularick, and Taylor (2014) demonstrate that already in 1970, the share of mortgage lending to total bank lending was rather high in some advanced countries (Sweden, United States, Denmark). This has significant implications for private credit to GDP as indicator for the functions which the literature attributes to them. Beck, Büyükkarabacak, Rioja, and Valev (2012) for example, show that enterprise credit has a significantly stronger effect on GDP growth than household credit. This means that studies without a differentiated look at the recipients of credit tend to underestimate the effect of credit on growth.

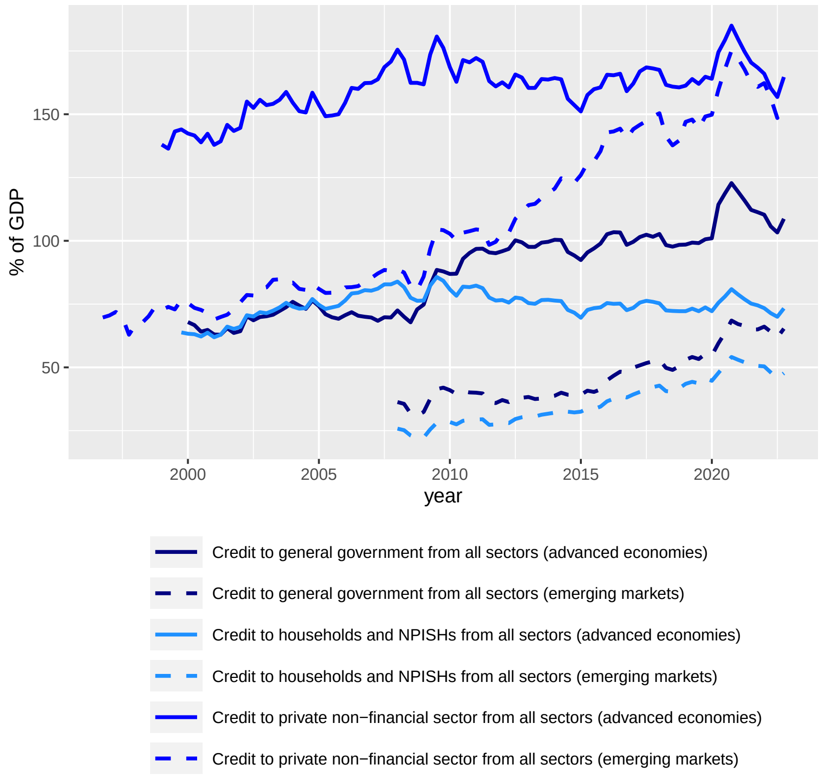


Figure 2: Development of credit to GDP by borrowing institution, 1997-2022.
Source: Bank for International Settlements (BIS).

The chart above illustrates the development of different types of credit in advanced (solid lines) and emerging economies (dashed lines) since 1997. On average, credit to the private non-financial sector accounted for about 160.3 percent of GDP in advanced economies, and 106.4 percent in emerging economies, while credit to households and non-profit institutions serving households (NPISH) in advanced economies amounted to 74.7 percent of GDP (36.4 percent for emerging economies). Credit to general government was on average 88 percent of GDP for advanced economies and 46.6 percent of GDP for emerging economies. The sharpest increase during this period can be observed in credit to non-financial corporations in emerging economies. It should be noted for all indicators below that they are influenced not only by changes in the volume of credit, but also by changes in GDP.

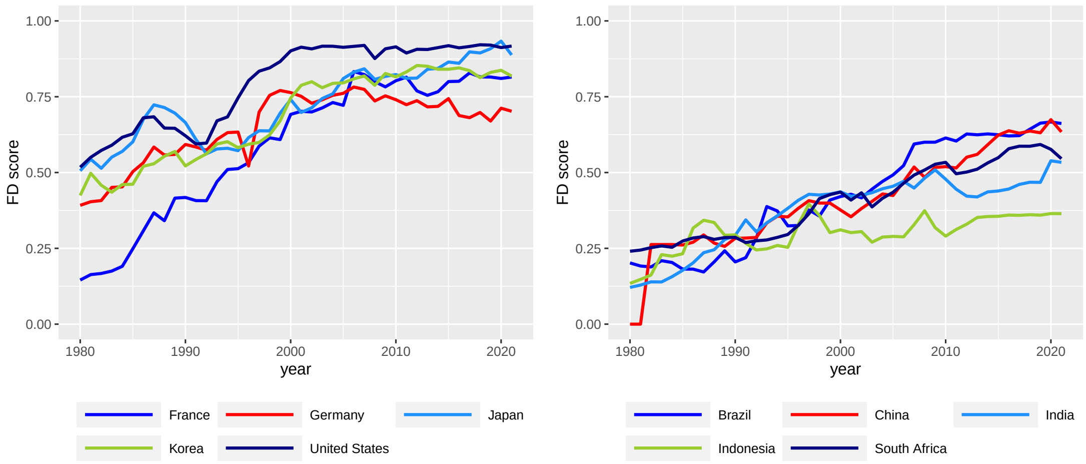
All in all, indicators focusing on the size of the banking sector must necessarily be considered *"crude proxies"* (Beck, Döttling, Lambert, & Van Dijk, 2020, p. 4) in empirical studies on finance and growth. For example, Andrés, Hernando, and López-Salido (1999) argue that the weakness of the finance-growth relationship that they found in their sample of OECD (Organization for Economic Cooperation and Development) countries could be attributed to the shortcomings of a quantitative credit indicator. Furthermore, using credit to GDP as an indicator for the quality of the financial system is difficult to reconcile with the literature on financial crises where a rapid increase in the debt to GDP ratio is not regarded as an indication for a better quality of the financial system but on contrary as important warning signal for a crisis (Borio & Drehmann, 2009; Borio & Lowe, 2002; Kaminsky, 1998).

By contrast, one of the first analyses on the relationship between finance and growth was carried out by Goldsmith (1969), who, in line with Schumpeter's theory and as opposed to the previous approach, defines "financial development" as a dynamic process:

> *"Financial development is change in financial structure. Hence, the study of financial development essentially requires information on changes in financial structure over shorter or longer periods of time. This can be provided either by information on the flows of financial transactions over continuous periods of time or by the comparison of financial structure at different points of time"* (Goldsmith, 1969, p. 37).

In the following analyses of the financial system and its role in generating growth, we therefore follow this dynamic definition and draw predominantly on the growth rates of the different types of credit. Similar approaches are also shown by Dullien (2009) and Bezemer, Grydaki, and Zhang (2016).

Beyond analyzing the trends in credit provision, it can also be interesting to have a look at the development of the financial system as a whole (financial institutions *and* financial markets). A comprehensive overview is provided, for example, by the IMF's financial development index, which, in addition to credit development, takes into account factors such as bank branches per 100,000 adults, lending-deposit spreads, stock market capitalization to GDP and the stock market turnover ratio. Figure 3 illustrates the financial development index for selected countries since 1980.



(a) Advanced economies (b) Emerging economies

Figure 3: Financial development in selected countries, 1980-2021.
Source: International Monetary Fund (IMF), Financial Development Index Database.

What emerges from this is that advanced economies tend to have more developed financial systems than less developed countries. Of the countries shown, the United States have the highest level of financial development, followed by Japan and Korea. Indonesia, India and South Africa, on the other hand, have a very low financial development index. In the entire IMF data set, the first ranks in 2021 are taken as follows: (1) Switzerland, (2) United States, (3) Australia, (4) Japan, (5) Canada, (6) United Kingdom and (7) Korea. The worst ranked are: (177) Sierra Leone, (178) Chad, (179) Democratic Republic of Congo, (180) Federated States of Micronesia, (181) Comoros, (182) South Sudan and (183) Central African Republic.

The political economic literature has been addressing this observation for some time, mainly attributing it to different political regimes (Barth, Caprio, & Levine, 2006) and political accountability (Verdier & Quintyn, 2010). Beck (2011, p. 4) notes that: "*given the intertemporal nature of financial contracts, the financial system is one of the most institution-sensitive sectors of the economy*". Bordo and Rousseau (2006), for example, show empirically that constraints on political power and stable political systems contribute to the positive development of financial systems. That this does not always have to hold is shown by countries such as China, which according to the IMF ranked 27th globally in 2021, only 7 ranks behind Germany.

2 The Schumpeterian Idea of Finance and Growth

Until today, Joseph Schumpeter's theories form the theoretical basis for most papers on the finance and growth nexus. His theory of credit and growth has been layed out most clearly in his book *"Theorie der wirtschaftlichen Entwicklung"* (*Theory of economic development*) (Schumpeter, 1934a) and can be summarized as follows:

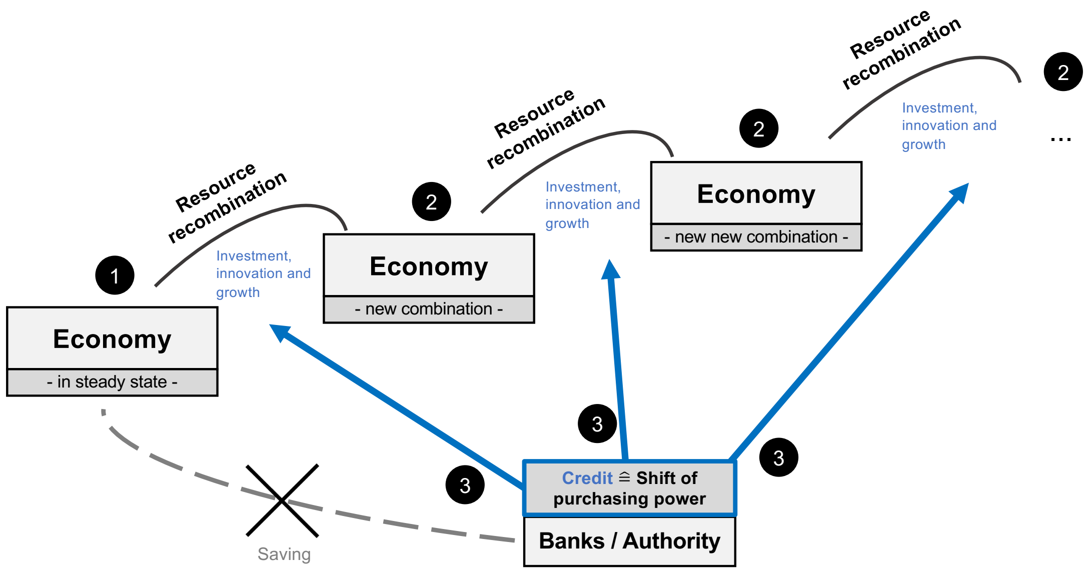


Figure 4: Growth through banks in the Schumpeterian growth model.

1) Economy in equilibrium

In the status quo, the economy is in equilibrium, all resources are bound in existing combinations and are not available for innovative use. New (innovative) firms have no money and no access to productive resources in the economy.

2) Economic development

To create substantial, innovative growth, existing resources in the economy have to be used in a different way so that entrepreneurs have access to financial means in order to finance their investment projects. Without credit, this can only be achieved by direct control of a central authority. Substantial growth relies on *"Andersverwendung"*, a reallocation of resources from their use within the steady-state economy towards innovative endeavours. The economy reaches a "new steady state", higher than the initial steady state.

3) Investment financed by credit

If the reallocation of resources is not achieved through a central authority, it has to be initiated by credit. Banks create credit themselves. Credit allows a shift of purchasing power that allows firms to access productive resources in the economy.

I will now develop these points made by Schumpeter in detail.

2.1 Economy in equilibrium

One of Schumpeter's key elements is that there is no such thing as an equilibrium in a growing economy, although he starts his theory of development from this theoretical concept. This out–of–equilibrium approach is closely related to Schumpeter's famous concept of "creative destruction" which opposes a static view of the economy and argues instead that there is a constant process whereby more productive firms drain resources from less productive firms. This leads to the destruction or exit of the less productive enterprises while the more productive enterprises flourish. However, although his arguments lead to this dynamic view of the economy, Schumpeter begins to lay out his theory of economic development with the economy in equilibrium and develops his model from that point.

An economic equilibrium is characterized by the fact that all goods and all money are already scheduled for use: "*All money would circulate, would be fixed in definite established channels.*" (Schumpeter, 1934b, p. 72). If an economy is in equilibrium, this means that all of its rational agents have already used up all resources for production - or have scheduled the use of future resources for future production. In this case, no resources are or will be available for innovative processes. Only if individuals decide to change their plans (which should be unlikely given that their initial plans were rational) could they reallocate resources to new, innovative projects (cf. Schumpeter (1934b, p. 72)). To generate **substantial** growth, resources have to be freed from their intended use within the steady–state economy. An important point here is that Schumpeter assumes a constant population, no major political and social changes and a generally stable environment without exogenous shocks. Thus, the only way for the economy to break out of equilibrium is if entrepreneurs start new investment projects.

2.2 Economic development

If the economy is in equilibrium, all production factors are used or their use is planned. This would also mean that the money needed for these resources is bound and not available for other uses. Since there are no "free" resources - a statement that applies to an economy in equilibrium and that is mostly true for the actual economy - real resources for innovative projects must be taken from other undertakings for which their use was planned originally: "*To produce other things, or the same things by a different method, means to combine these materials and forces differently.*" (Schumpeter, 1934b, p. 65). There are two ways for *"Andersverwendung"*, i.e. the redistribution of real resources, such as labour, machinery, etc.: Firstly, a central authority could give the order to allocate resources in a new and potentially more productive way. At the time Schumpeter developed his theses, totalitarianism was globally on the rise and central planners were more than a theoretical argument, so this was seen as one valid option. The other, more favorable option Schumpeter saw was to redistribute resources in a more subtle way through credit creation. Therefore, banks, by providing financial means to entrepreneurs that entail the reallocation of real resources, are the origin of the development process.

2.3 Investment financed by credit

Thus, the only way to get access to resources needed for (starting) innovative processes without direct force through a central authority lies in generating new money. Money therefore plays a central role in Schumpeter's growth model, as it not only serves as a numéraire good for all existing goods and services, but also sets in motion the reallocation of resources that is crucial for economic development. While a reallocation of resources in Schumpeter's theory would imply a shift in purchasing power and thus a "*canceling of an old and the issuing of a new "order" to the owners of factors*" (Schumpeter, 1939, p. 110), reallocation through new money creation initiates a "*reduction of the purchasing power of existing funds which are left with the old firms while newly created funds are put at the disposal of entrepreneurs*" (Schumpeter, 1939, p. 110). Bank credit thus entails a restriction of GPG consumption in the first case, while money creation results in a shift of labor force to more productive (innovative) companies that can then pay higher wages, without cutting consumption in the latter. In this way, the bank-led creation of money "generates" purchasing power in order to give entrepreneurs access to the goods they need for innovation and growth: "*It is always a question* [in money creation by banks] , *not of transforming purchasing power which already exists in someone's possession, but of the creation of new* *purchasing power out of nothing* [...] (Schumpeter, 1934b, p. 73). The fundamental function of credit for development is then closely linked to the role of the entrepreneur in Schumpeter's view of the economy: *"The creation of purchasing power characterises, in principle, the method by which development is carried out in a system with private property and division of labor. By credit, entrepreneurs are given access to the social stream of goods before they have acquired the normal claim to it."* (Schumpeter, 1934b, p. 107). In a hypothetical example, Schumpeter (1939, p. 109) elucidates this idea as follows: *"Entrepreneurs borrow all the "funds" they need both for creating and for operating their plants—-i.e., for acquiring both their fixed and their working capital. Nobody else borrows. Those "funds" consist in means of payment created ad hoc. But although in themselves these propositions are nothing but pieces of analytic scaffolding, to be removed when they have served their purpose, the logical relation which they embody, between what is called "credit creation by banks" and innovation, will not be lost again."*

By introducing new claims on goods and services (i.e. money), the existing claims are lowered, individuals within the economy experience a "*compressing* [of] *the existing purchasing power*" (Schumpeter, 1934b, p. 108f.). Those that gained their claim through providing goods or services will not receive their share of other goods and service in return as measured by their wages, but a smaller share. As the existing claims are reduced, some goods and services, resources, are freed up for other uses or taken from the circulation of goods as Schumpeter puts it (cf. Schumpeter (1934b, p. 96)). These other purposes are, or at least should be, innovative projects that lead to economic growth: "*Normal credit creates claims to the social dividend, which represents and may be thought of as certifying services rendered and previous delivery of existing goods. That kind of credit, which is designated by traditional option as abnormal, also creates claims to the social product, which, however, in the absence of past productive services or of goods yet to produced.*" (Schumpeter, 1934b, p. 101). Schumpeter emphasises that the claims on past output are in reality indistinguishable from claims on future output, since claims on money are treated like money in practice (see Schumpeter (1934b, p. 101)). This process may sound unfair at first, but it does not have to be so – for two reasons: First, not all claims will be claimed. As mentioned above, there is an incentive to "save", which means that some resources will be reserved for use emergencies or for retirement, etc. Second, while in the first step the new claims will lead to claims outweighing available goods and services, the freed resources will generate growth through innovative projects, at least at the macro level. This means that while reducing individual claims at first, the creation of money through productive credit will increase individual claims in the long run.

Since in reality this process is not step–by–step but rather continuous, the effect will be positive at all times (abstracting from crises).

The importance of banks which is often neglected in modern economic theory, becomes very clear when following Schumpeter's theory and was emphasized by Schumpeter (1934b, p.74): "*The banker, therefore, is not so much primarily a middleman in the commodity "purchasing power" as a producer of this commodity.* [...] *He stands between those who wish to form new combinations and the possessors of productive means. He is essentially a phenomenon of development, though only when no central authority directs the social process. He makes possible the carrying out of new combinations, authorises people, in the name of society as it were, to form them. He is the ephor of the exchange economy.*"[1] This importance of banks and credit is often neglected in growth models based on Schumpeter's theories (e.g. Aghion, Akcigit, and Howitt (2015); Aghion and Howitt (1990)).

However, there is of course an important difference between money that is already circulating within the economy and money that is being created. Undoubtedly, the ability to create money out of nothing has its limits. Bankers cannot create unlimited amounts of purchasing power, i.e. money, as this would have to lead to inflation at some point. Broken down radically, money can be seen as a claim on an economy's goods and services usually, but not necessarily, provided by supply of goods and/or services to the economy, which is usually, but not necessarily, in turn remunerated with money. Thus, money creation itself adds new claims on the existing goods and services of the economy without providing additional goods (yet). Like any other good, the value of money is determined relative to all other goods. If the money supply increases significantly without generating a similar rise in other goods, the value of money then must decline. The key point then is the productivity of the credit recipients.

Schumpeter is clear that credit creation is only beneficial if the credit is used productively: *"Granting credit in this sense operates as an order to the economic system to accommodate itself to the purposes of the entrepreneur, as an order on the goods which he needs: it means entrusting him with productive forces"*(Schumpeter, 1934b, p. 107). The main point here is that as long as loans made from freshly generated money are used productively and are not used for consumption or investment in existing assets (such as real estate), inflation should not be a problem. In fact, if

[1] Ephors were ancient Spartan magistrates and leaders who controlled the kings.

the resources used by the borrower lead to an overall increase in goods within the economy that is greater than the initial credit (this should be the case if the borrower has to pay positive interest rates), then the result would rather be a deflationary than an inflationary tendency (see Schumpeter (1934b, p. 110f)). The amount of potential credit is thus not limited by past and present goods in the economy, but rather by the realistic production of future goods (Schumpeter, 1934a, p. 165). This point was also made by Herr (2010, p. 80):

> "*Credit expansion can only lead to development when credits are used for investment in the real economy. If credit is expansion is used to finance asset price bubbles in the stock market or the real estate sector sustainable development is not possible.*"

In the eyes of Schumpeter (1939, p. 145f.), the effect of credit is veiled by the lack of distinction between productive credit ("primary wave" in Schumpeter's terms) and unproductive use of credit that follows the productive credit and consists mainly of speculation (secondary wave in Schumpeter's terms):

> "*This is one reason why the element of innovation has been so much neglected by the traditional analysis of the business cycle: it hides behind, and is sometimes entirely overlaid by, the phenomena of what appears at first glance to be simply a general prosperity, which is conspicuous in many branches and strata and apparently unconnected with any activity that could in any way be called innovating, let alone "inventing"* " (Schumpeter, 1939, p. 146).

Schumpeter (1939, p. 147f.) argues:

> "*The only conclusion that really follows* [from the problem of a "secondary wave" of credit] *is that the credit machine is so designed as to serve the improvement of the productive apparatus and to punish any other use.* [...] *it should be pointed out that distinction between debts according to purpose, however difficult to carry out, is always relevant to diagnosis and may be relevant to preventive policy.*"

According to Otter and Siemon (2013b, p. 68f.), the creation of purchasing power during the Schumpeterian primary wave gets handed down from entrepreneurs to owners of goods necessary for innovation. This results in a surge in overall demand that yields temporary profits across the whole economy (not just the innovative part) that in turn leads to an anticipation of prosperity. This anticipation causes a general spread in loans for both businesses and private households that is called the "secondary wave".

> *"A country that is going to continue its catching-up or leapfrogging development process must have innovative entrepreneurs paving the way for all other kinds of entrepreneurs. These innovators have to be allowed, able, and willing to adapt and transform their resources ('input': knowledge, capital, natural resources, etc.) within their domestic markets in order to induce positive linkages to all sectors of industry."* (Otter & Siemon, 2013a).

From all this, it is clear that an increase in credit is not just the by-product of a growing economy. Rather, Schumpeter argues that credit must be the source of all economic growth because it is the only way to free up means of production or resources for innovative use, which is the sole way to generate growth: *"In one sense no goods and certainly no new goods correspond to the newly created purchasing power. But room for it is squeezed out at the cost of previously existing purchasing power"*(Schumpeter, 1934b, p. 109). This phenomenon was associated with the phrase "Vorschußökonomie" (advance-economics) by Schumpeter (see Schumpeter (1934b, p. 96)). *"And although the meaning and object of this process* [withdrawing means of production from the economy] *lies in a movement of goods from their old towards new employments, it* ***cannot*** *be described entirely in terms of goods without overlooking something essential, which happens in the sphere of money and credit and upon which depends the explanation of important phenomena in the capitalist form of economic organization, in contrast to other types"*(Schumpeter, 1934b, p. 71).

3 The Finance and Growth Nexus Revisited from a Truly Schumpeterian Perspective[2]

3.1 Introduction

The nexus between the financial system and economic development is an issue that is as important for economic theory as it is for economic policy. The high relevance of this topic is reflected in an enormous number of academic publications that have been released for more than 100 years, as well as in the serious economic consequences triggered by financial crises. Only recently, in 2022, the Sveriges Riksbank has awarded Ben Bernanke, Douglas W. Diamond and Philip Dybvig the Nobel Prize for their research on the economic role of banks.

Our paper provides a theoretical and empirical analysis of the standard literature on the finance and growth nexus, which has been shaped over the past three decades by the work of authors like Ross Levine, Robert King and Thorsten Beck. From the outset, Joseph A. Schumpeter was used as the academic patron for this research program.

The starting point of our study is the theoretical finding that Schumpeter is completely misinterpreted in this literature. He is presented as a representative of a theoretical paradigm in which the monetary and the real spheres are identical. This approach, which Schumpeter describes with the term **"real analysis"**, reduces banks to the role of intermediaries of funds between savers and investors. Schumpeter, however, calls for a **"monetary analysis"** in which the monetary sphere has a life of its own vis-à-vis the real sphere with the consequence that banks are not intermediaries but "*producers of purchasing power*" as he calls it (Schumpeter, 1934a, p. 62).

[2] This chapter is based on joint work with Prof. Dr. Peter Bofinger, Thomas Haas and Fabian Mayer. An early version appeared as Bofinger, Geißendörfer, Haas, and Mayer (2021). The paper has been submitted to a journal and is in an advanced review process there.

In our discussion of the empirical literature and our own empirical analysis, we show that this misinterpretation has far-reaching consequences for the empirical research on the finance and growth nexus. The standard literature must admit that after decades of research it has difficulties in explaining fundamental relationships, such as the liquidity creation by banks. It has not been successful in providing convincing evidence of the positive effects of the financial system on growth in advanced economies. Neither can it provide a theoretical explanation for negative implications of bank lending. There is also no evidence for a link between saving and credit growth and a link between saving and economic growth, which both constitute the central transmission channels of the real analysis.

Our own empirical analysis shows that a correct interpretation of Schumpeter helps to overcome the empirical challenges in the prevailing literature:

- In the real analysis, the contribution of banks to growth is captured by the **level of credit to GDP** which is supposed to reflect the quality of the intermediation process. In the monetary analysis, with banks as credit creating institutions, it is the **growth of credit** that matters for GDP growth.
- If banks are regarded as mere intermediaries of savings that are used for **productive investment**, it is difficult to explain why a higher level of credit to GDP can have negative effects. This is different if banks produce purchasing power, which can be used for productive as well as for **unproductive investment**.
- Regarding **saving** as the only source for financial funds requires empirical evidence for a positive relationship between saving and growth. If funds are produced by banks, financing is unrelated to saving.[3]

Using panel estimations, structural vector autoregressive (SVAR) models and Granger causality tests as well as forecast error variance decompositions (FEVD) on a credit data set, we provide an empirical analysis that supports the hypothesis of the monetary analysis. First, our panel estimations show that saving has no explanatory power for economic growth. Second, we do find a statistically significant effect of credit growth on GDP growth, which is not the case for the standard, static credit indicator. Both findings are also supported by our SVAR model from a dynamic perspective. Third, the Granger causality tests, FEVD and impulse-

[3] Throughout this paper, when we use the term "saving" we refer to the national accounts definition of unconsumed income.

response functions also provide evidence for negative effects of credit growth on economic growth on an individual country level. While the latter findings are widely in line with related empirical literature, monetary analysis provides a theoretical framework to explain these results in a coherent way.

3.2 The misinterpretation of Schumpeter in the finance and growth literature

3.2.1 The mechanics of real and monetary analysis

A decisive feature of Schumpeter's financial theory (that has been laid out in detail in chapter 2) is the fundamental differentiation between the macroeconomic paradigms of "real analysis" and "monetary analysis" (Schumpeter, 1954). Schumpeter (1954, p. 264) describes the "real analysis" as follows:

> *"Real Analysis proceeds from the* ***principle that all the essential phenomena of economic life are capable of being described in terms of goods and services****, of decisions about them, and of relations between them. Money enters the picture only in the modest role of a technical device that has been adopted in order to facilitate transactions. This device can no doubt get out of order, and if it does it will indeed produce phenomena that are specifically attributable to its modus operandi. But so long as it functions normally, it does not affect the economic process, which behaves in the same way as it would in a barter economy: this is essentially what the concept of Neutral Money implies. Thus, money has been called a 'garb' or 'veil' of the things that really matter, both to households or firms in their everyday practice and to the analyst who observes them. Not only can it be discarded whenever we are analysing the fundamental features of the economic process but it must be discarded just as a veil must be drawn aside if we are to see the face behind it. (...); saving and investment must be interpreted to mean saving of some real factors of production and their conversion into real capital goods, such as buildings, machines, raw materials; and, though 'in the form of money', it is these physical capital goods that are 'really' lent when an industrial borrower arranges for a loan."*

Real analysis shapes the loanable funds theory and the neoclassical interest rate theory. It relies on the critical assumption of a general purpose good (GPG) that can be used interchangeably as a real asset (consumption good and investment good) and a financial asset ("capital" or "savings"). Due to this assumption, saving, i.e. not consuming the GPG, is the only source for funds and investment. The role of banks is reduced to the intermediation of the GPG, i.e., the "easing of frictions" (Levine, 1997; Woodford, 2010) between savers and investors. As there are only saving/consumption decisions and investment decisions, and as the only asset can be used simultaneously as real and as financial asset, the financial sphere is identical with the real sphere.

In the **"monetary analysis"** which Schumpeter propagates, financial assets (money and bonds) exist separately from real assets (consumption goods and investment goods). In the words of Schumpeter (1954, p. 265):

> *"Monetary Analysis, in the first place, spells denial of the proposition that, with the exception of what may be called monetary disorders, the element of money is of secondary importance in the explanation of the economic process of reality. (...) Monetary Analysis introduces the element of money on the very ground floor of our analytic structure and abandons the idea that all essential features of economic life can be represented by a barter-economy model.* ***Money prices, money incomes, and saving and investment decisions bearing upon these money incomes****, no longer appear as expressions —sometimes convenient, sometimes misleading, but always nonessential —of quantities of commodities and services and of exchange ratios between them:* ***they acquire a life and an importance of their own****, and it has to be recognized that essential features of the capitalist process may depend upon the 'veil' and that the 'face behind it' is incomplete without it. It should be stated once for all that as a matter of fact this is almost universally recognized by modern economists, at least in principle, and that, taken in this sense, Monetary Analysis has established itself."*

Although Schumpeter (1954) highlighted the differences between "real analysis" and "monetary analysis", he never explicitly elaborated their paradigms. This also applies to Keynes (1933), who advocated a similar differentiation under the labels "real-exchange economy" and "monetary economy".[4] As these terms are also not common in the economic terminology, we

[4] Keynes (1933, p. 408): *"Most treatises on the principles of economics are concerned mainly, if not entirely, with a real exchange economy; and – which is more peculiar – the same thing is also true of most treatises on the theory of money. (...) The theory which I desiderate would deal, in contradistinction to this, with an economy in which money plays a part of its own and affects motives and decisions and is, in short, one of the operative factors in the situation, so that the course of events cannot be predicted, either in the long period or in the short, without a knowledge of the behaviour of money between the first state and the last. And it is this which we ought to mean when we speak of a monetary economy. (...) Everyone would, of course, agree that it is in a monetary economy in my sense of the term that we actually live. (...) The idea that it is*

give a short presentation of the model design of the two concepts, their "critical assumptions" and their "dominant causal mechanisms" (Rodrik, 2015). We will see that these mechanisms are diametrically opposed. This underlines the importance of Schumpeter's differentiation among the two concepts. It also shows that the misinterpretation of his work is not only relevant for a correct representation of the history of economic theory. It also matters for the empirical relevance of models that try to analyse the role of the financial system and its contribution to economic development.

3.2.1.1 Real analysis: The banker as middleman of purchasing power

The theoretical core of the real analysis is the classical theory of the financial market (or loanable funds theory) as it is presented in standard macroeconomic textbooks (e.g. Mankiw (2019)). The theory was shaped by Böhm-Bawerk (1890) and Fisher (1930). It uses the analytical framework for the **intra-temporal exchange** of two goods to analyse the **inter-temporal exchange**, where a good today is exchanged for the same good tomorrow. In the words of Fisher (1930, p. II.IV.3):

> *"The theory of interest bears a close resemblance to the theory of prices, of which, in fact, it is a special aspect. The rate of interest expresses a price in the exchange between present and future goods."*

This model is based on the *"critical assumption"* (Rodrik, 2015) of a general purpose good (GPG), that can be used interchangeably as a

- consumption good,
- financial asset ("savings"), if it is saved by private households and becomes available as a supply of "funds",
- investment good ("capital"), which increases the capital stock, and
- sole output of the production process for consumption in the future.

Barro and Sala-i Martin (2004, p. 25) illustrate the assumption of the general purpose good as follows:

comparatively easy to adapt the hypothetical conclusions of a real wage economics to the real world of monetary economics is a mistake."

"One way to think about the one-sector technology is to draw an analogy with farm animals, which can be eaten or used as inputs to produce more farm animals. The literature on economic growth has used more inventive examples – with such terms as shmoos, putty or ectoplasm – to reflect the easy transmutation of capital goods into consumables, and vice versa."[5]

As the GPG is a hermaphrodite of a real and a financial asset, the model can be presented as model for the goods market or the financial market although it leaves no role for money, i.e., bank deposits or cash. This is the reason why Schumpeter speaks of a "real analysis".

The assumption of a GPG has far-reaching implications. As the only financial asset is at the same time a real asset, financial transactions and flows are identical with real transactions and flows. Financial decisions are identical with consumption or investment decisions:

- The supply of the GPG, i.e., the **supply of "savings"** on the capital market, is identical with the saving decision which is identical with the consumption decision,
- The demand for the GPG, i.e., the **demand for "savings"** on the capital market, is identical with the investment decision.

Thus, real analysis leaves no room for financial decisions that are not identical with consumption decisions (=saving decisions) or investment decisions that increase the capital stock. The financial sphere is identical with the real sphere (Bertocco, 2007). Borio (2016, p. 268) speaks of "real economies disguised as monetary ones". Or as Schumpeter (1954, p. 265) puts it, financial transactions cannot "acquire a life and an importance of their own".

In this model world, private households and their saving decisions play a decisive role for the financing of investments. Only if consumers are willing to give up consumption, the GPG becomes available as a supply of funds or "savings" which investors can borrow on the capital market and then use as "capital" in the production process. Correspondingly, the role of banks and other financial institutions is limited. As they are unable to produce the GPG, they can

[5]See also Obstfeld and Rogoff (1996, p. 15): *"A unit of capital is created from a unit of the consumption good. This process is reversible, so that a unit of capital, after having been used to produce output, can be 'eaten.' You may find these assumptions unrealistic, but they help us sidestep some technical issues that aren't really central here."*. This assumption also dominates the neoclassical growth theory: *"Probably the best method of exposition is to think of the neoclassical growth model as being a story about an imaginary economy that has only one produced good that can be consumed directly or stockpiled for use as a capital good. It is then an exact theory of that economy; and it becomes a difficult practical matter whether it provides a useful analogy of a multi-commodity economy"* (Solow, 2000, p. 351).

only operate as "resource-trading intermediaries that, wholly or primarily, store, borrow and lend physical commodities" (Jakab & Kumhof, 2019, p. 1). Thus, the "financial intermediation theory" is a logical outflow of the real analysis.

As the quotes from the finance and growth literature make clear, this line of research is based unreservedly on the "real analysis". Accordingly, for these authors, the contribution of banks can only consist in the intermediary function of "easing market frictions" between savers and investors. Levine (1997, p. 699) describes the functions of financial intermediaries as follows:

> *"Mobilizing the savings of many disparate savers is costly, however. It involves (a) overcoming the transaction costs associated with collecting savings from different individuals and (b) overcoming the informational asymmetries associated with making savers feel comfortable in relinquishing control of their savings."*

The difference to Schumpeter's views is obvious. While he emphasized the role of the banker as a producer of purchasing power, the real analysis reduces the banker to a virtual "middleman" collecting the savings of private households and transferring them to investors.

A closer look, e.g. at the function "mobilizing of savings" even casts doubt on the role of banks in the real analysis. Levine (1997, p. 699) describes this function in the following way:

> *"Furthermore, mobilization involves the creation of small denomination instruments. These instruments provide opportunities for households to hold diversified portfolios, invest in efficient scale firms, and to increase asset liquidity. Without pooling, households would have to buy and sell entire firms. By enhancing risk diversification, liquidity, and the size of feasible firms, therefore, mobilization improves resource allocation."*

These functions are typically not performed by banks but by stock markets that provide small denomination instruments and make it possible for households to invest in firms without the need to buy and sell entire firms.

3.2.1.2 Monetary analysis: The banker as producer of purchasing power

The monetary analysis is based on a more complex model of the economy and the financial system. The IS/LM-model provides a simple analytical framework for this approach. An obvious contrast to the real analysis are the more realistic critical assumptions: There is an explicit role for money, i.e., bank deposits, as a means of payment and a store of value. There are also other financial assets such as bonds and central bank reserves. On the real side of the model, there are a consumption good and an investment good which are not interchangeable and cannot be used as a financial asset. In fact, these critical assumptions produce a substantive difference in the conclusions of the model.

Above all, the financial market is no longer identical with the goods market. The IS/LM model nicely shows this feature of the monetary analysis. While the IS-curve represents the equilibrium on the goods market which is determined by consumption/saving and investment decisions, the LM-curve represents the equilibrium on the financial market which is determined by

- **the monetary policy of the central bank** which controls the interest rate or the supply of the monetary base,
- the **lending of commercial banks**, which is independent of saving but controlled by the central bank. The control of bank lending can be either performed with the policy rate of the central bank (Bofinger, Reischle, & Schächter, 2001) or with the supply of the monetary base. The letter is presented with the flawed multiplier approach (Bofinger et al., 2001; Ihrig, Weinbach, & Wolla, 2021; Werner, 2014);
- the **portfolio decisions of money holders** who can decide to hold either bank deposits ("speculative demand for money") or long-term bonds as a store of value.

In this model, saving provides no supply of funds and it has therefore no direct impact on the financial sphere. Changes in the propensity to save only affect the slope of the IS-curve.

Instead of providing a source of funds, in the monetary analysis saving becomes the *"economic Disturber General"* (Schumpeter, 1954, p. 267). This can be explained with a simple example that analyses the economic process as a *"stream of expenditures"* (Schumpeter, 1954, p. 267).

We split up the economy in the business sector and the household sector. As a default case, let us assume, Jane normally spends her whole monthly income of 3,000 USD. In this case at the end of the month, Jane has nothing on her bank account and her net wealth is zero. The business sector has 3,000 USD on its bank account and its net wealth is 3,000 (assuming no costs for inputs). Thus in the default case, the money flow which started with wage payments returns to the business sector.

What happens, if Jane decides to save 3,000 USD by reducing her consumption? In this case, the money flow that started with the wage payment to Jane stops. At the end of the month, Jane has 3,000 USD on her bank account and her net wealth has increased by 3,000 USD. The business sector has 3,000 USD less on its bank account and its net wealth is 3,000 USD lower. Thus, saving does not increase the amount of funds in the economy. Compared with the default situation, it simply redistributes the existing funds from the business sector to the household sector. But instead of stimulating investment by lowering interest rates, saving discourages investment by a lower cash-flow and lower profits of the business sector.

Accordingly, in the monetary analysis, banks are the sole producers of financial funds, i.e., money. While the finance and growth literature has neglected this mechanism since decades, in recent years the Bundesbank (2017) and the Bank of England (McLeay, Radia, & Thomas, 2014) have supported this key insight of the monetary analysis. E.g., the Bundesbank (2017, p. 17) argues:

> *"(...) a bank can grant loans without any prior inflows of customer deposits. In fact, book money is created as a result of an accounting entry: when a bank grants a loan, it posts the associated credit entry for the customer as a sight deposit by the latter and therefore as a liability on the liability side of its own balance sheet. This refutes a popular misconception that banks act simply as intermediaries at the time of lending – ie that banks can only grant loans using funds placed with them previously as deposits by other customers."*

With the dominant role of banks in the monetary analysis, the need for an "easing of financial frictions" which the finance and growth literature regards as the key role of banks, is less obvious. This applies above all to the "mobilization of savings" (Levine, 2021). While in the real analysis, more saving implies more investment, in the monetary analysis, more saving is detrimental to investment. In addition, as the example shows, the saving of households automatically leads to an increase of their bank deposits so there is no need for banks to "mobilize savings".

In the same way, the role of banks to *"(1) screen investments and choose where to allocate resources — and hence economic opportunities, (2) exert corporate governance over the resources that they provide to firms and individuals (...)"* (Levine, 2021, p. 6) is not an "easing of frictions" between savers and investors. It is the core function of banks in a monetary economy as they cannot lend without screening investments.

Finally, monetary analysis opens the perspective for transactions for which there is no room in the real analysis:

- A household borrows to finance consumption expenditure
- An investor borrows to finance the purchase of an asset that already exists, i.e., a house or a company.

Thus, in contrast to the logic of real analysis there is no necessary link between finance and investments that increase the capital stock. The perspective of the monetary analysis provides explanations for **negative effects** of finance on growth that were already addressed by Schumpeter, but which, according to Levine (2021), have so far not been explained by researchers.

3.2.1.3 The incompatibility of the two paradigms

The description of the two paradigms highlights the differences in their critical assumptions and their dominant causal mechanisms. Following Rodrik (2015), one can say that the empirical relevance of a model depends on the realism of its critical assumptions:

> *"For a model to be useful in the sense of tracking reality, its critical assumptions also have to track reality sufficiently closely"* (Rodrik, 2015, p. 27).

There is no doubt that the critical assumptions of the monetary analysis approximate the real world better than the real analysis. One can even go so far as to argue that the critical assumptions of the real analysis *"grossly violate reality"* (Rodrik, 2015, p. 29). Comparing real and monetary analysis, we have shown that the GPG-assumption is "critical" in the sense of Rodrik as a *"modification in an arguably more realistic direction would produce a substantive difference in the conclusions provided by the model"* (Rodrik, 2015, p. 27). Thus, it can be argued that the whole literature on the finance and growth nexus is built upon a model which violates Rodrik's fourth commandment for economists:

"Unrealistic assumptions are OK; unrealistic critical assumptions are not OK" (Rodrik, 2015, p. 116).

As we have shown, the critical assumptions matter for the direction of "dominant causal mechanisms" (Rodrik, 2015, p. 51) in the financial system.

- In the real analysis, saving causes investment by releasing financial funds. In the monetary analysis, investment increases national income via the investment multiplier which allows the households to save more.
- In the real analysis, bank deposits create bank credit. In the monetary analysis, bank credit creates deposits.

Due to the opposite causal mechanisms, it is also not possible to build a synthesis of these two approaches. This puts into question above all the so-called neoclassical synthesis. Bofinger (2020) shows the problems that are associated with such attempts.

3.2.2 Schumpeter's monetary analysis of the finance and growth nexus

The distinction between real and monetary analysis has far-reaching consequences for the modelling of the financial system. Following a "truly Schumpeterian", i.e. monetary approach, this has the following implications:

- **Savers** (i.e., private households), which are the decisive agents in the real analysis, are irrelevant to finance (or at least overvalued) because "savings" are not required as an input to the financial system: *"[I]t is much more realistic to say that banks "create credit", that is, that they create deposits in their act of lending, than to say that they lend the deposits entrusted to them"* (Schumpeter, 1954, p. 1080). While he rejects the view that saving is a source for funds, Schumpeter goes even further as to regard saving as detrimental for the financial streams of the economic system: *"we may be led to identify Saving with obstruction to that flow of expenditure and, in the limiting case, to see it in the role of economic Disturber General"* (Schumpeter, 1954, p. 267).
- In the monetary analysis **banks** are key players as they create deposits by lending:

  "The banker, therefore, is not so much primarily a middleman in the commodity 'purchasing power' as a ***producer*** [emphasis in original] *of this commodity. However, since all reserve funds and savings today usually flow to him, and the total demand for free purchasing power, whether existing or to be created, concentrates on him, he*

has either replaced private capitalists or become their agent; he has himself become the capitalist par excellence. He stands between those who wish to form new combinations and the possessors of productive means. He is essentially a phenomenon of development, though only when no central authority directs the social process. He makes possible the carrying out of new combinations, authorises people, in the name of society as it were, to form them" (Schumpeter, 1934a, p. 62).

Credit provision is therefore a dynamic process. Banks are crucial for the process of **economic development and innovation**: "*The essential function of credit in our sense consist in enabling the entrepreneur to withdraw the producers' goods which he needs from their previous employments, by exercising demand for them, and thereby to force the economic system into new channels*" (Schumpeter, 1934a, p. 93). In other words, credit provision can lead to a more productive (re-)combination of resources and is therefore at the core of economic growth. The creation of purchasing power through credit can thus in the first stage lead to an inflationary impulse, however, if the purchasing power that was created is used productively the direction of this impulse reverses. Once the increase in productivity caused by the recombination of goods manifests, the ratio of goods relative to purchasing power re-balances. Schumpeter refers to this phenomenon as **"autodeflation"** (Schumpeter, 1934a).

- Schumpeter's "monetary analysis" opens up the perspective of **financial instability** and unproductive credit that is absent in the "real analysis", where financing is identified with productive investment: "*Speculation in the narrower sense will take the hint and* [...] *stage a boom even before prosperity in business has had time to develop. New borrowing will then no longer be confined to entrepreneurs, and "deposits" will be created to finance general expansion*" (Schumpeter, 1939, p. 150-151).[6] This highlights the importance of distinguishing between credit used for productive purposes and credit used for unproductive means. While the former should have a clear positive effect on economic growth, the latter could in fact even have adverse growth effects.

  "*[I]t should be pointed out that distinction between debts according to purpose, however difficult to carry out, is always relevant to diagnosis and may be relevant to preventive policy*" (Schumpeter, 1939, p. 153).

[6] This point is made by Bezemer (2014) in a paper titled "Schumpeter might be right again".

3.2.3 The misinterpretation of Schumpeter in the finance and growth literature

Since the 1990s, a vast literature on the finance and growth nexus has developed. The main contributors are above all Robert G. King, Ross Levine and Thorsten Beck with numerous and widely cited papers and contributions to handbooks (e.g. King and Levine (1993a), Levine (2005), Levine (2021) and Beck, Levine, and Loayza (2000)). We will therefore focus on the work by these authors. In almost all papers they quote Schumpeter as a theoretical pioneer for their research. The title of one of the first papers by King and Levine (1993a) is "Finance and Growth: Schumpeter might be right". Until today, this study is regarded as important evidence for *"large, positive, and statistically significant relationships between economic growth and financial development"* (Levine, 2021, p. 25). In this paper, the authors assert:

> "[...] *we are developing a more complete Schumpeterian vision of development by incorporating key roles for financial intermediaries*" (King & Levine, 1993a, p. 735)

As a proof, King and Levine provide the above-mentioned Schumpeter (1934a) quote, but in a strongly abbreviated and misleading form that omits the decisive role of banks as "**producers**" of purchasing power:

> "*Yet, an integral part of the Schumpeterian story is that financial intermediaries make possible technological innovation and economic development. "The banker ... authorizes people, in the name of society as it were, to ... [innovate]" [Schumpeter, 1911, p. 74].*"[7]
> (King & Levine, 1993a, p. 735)

A closer look at this literature shows that it has very little in common with Schumpeter's approach. In their theoretical analyses, the authors disregard Schumpeter's distinction between real analysis and monetary analysis. Instead, the theoretical foundations of their research are based on real analysis so that banks are treated as pure intermediaries between savers and investors:

> "*Schumpeter was stressing that one of the key functions of the financial system is deciding which firms and individuals get to use society's savings.*" (Levine, 2021, p. 13)

With this misinterpretation, the literature also misses his point that the banker is the decisive actor in the innovation process. Instead, the papers emphasize the key role of entrepreneurs and savers. Due to the limitations of the real analysis, the authors are unable to capture the

[7] Brackets and ellipses in original quote.

essence of liquidity creation by banks which is reflected in a recent paper by (Beck et al., 2020). Despite its title, the study focuses on static balance sheet variables, and not on dynamic growth rates of financial variables.

In sum, the publications by King, Levine, Beck and other scholars in this field present Schumpeter as a representative of a paradigm which he explicitly rejected. Nevertheless, their theoretical and empirical analyses dominate the majority view on the finance and growth nexus until today.

The misinterpretation of Schumpeter as a representative of the intermediation approach has the effect that in the empirical analyses of the finance and growth nexus "financial development" is not a dynamic concept, as suggested e.g. by Goldsmith (1969)[8]. Instead, the authors use a static concept, the level of a financial aggregate, mostly credit, in relation to GDP as key explanatory variable.

Levine (2021, p.25) still refers to his seminal study (King & Levine, 1993a) that comes to the conclusion that credit to private firms divided by GDP is a good predictor of long-term growth over the next 10 to 30 years. He even goes so far to pretend: "[...] *if Bolivia had the average value of financial development in 1960, then, holding other things constant, it would have grown about 0.4 percent faster per annum, so that by 1990 real per capita GDP would have been about 13 percent larger than it was.*"

Similar conclusions were reached by King and Levine (1993b), Levine (2002), and Méndez-Heras and Ongena (2020) and others. These findings are robust at the industry or even firm-level (Rajan and Zingales (1998), Beck, Levine, and Loayza (2000)) and also hold for emerging markets (Garcia-Escribano, Góes, and Karpowicz (2015)).

[8] "*Financial development is change in financial structure. Hence, the study of financial development essentially requires information on changes in financial structure over shorter or longer periods of time.*" Goldsmith (1969, p. 37).

3.2.4 Flaws of the finance and growth literature

The two alternative paradigms have important implications for the empirical analysis of the finance and growth nexus. At first glance, King, Levine, and others seem to provide a broad confirmation for real analysis, but a closer look shows that the results are not so clear cut. This concerns the link between saving and credit growth and saving and economic growth which is decisive for the real analysis. In addition, for the group of advanced economies the link between credit to GDP, which is the preferred variable in this literature, and GDP growth is weak. Also, the negative effects of credit to GDP which have become more pronounced in the last two decades, cannot be reconciled with the theory underlying this literature. Finally, there is insufficient research on whether and how the liquidity creation by banks contributes to growth.

3.2.4.1 Missing links between saving and growth and saving and the financial system

In the real analysis, saving, which is identical with the supply of funds, is the key variable for the financing of growth. Therefore, the literature emphasises the 'mobilization of savings' as a key function of the financial system (Levine, 2005). This implies a positive correlation between saving and economic growth. Although this is a central mechanism of the real analysis, it has rarely been investigated in empirical studies. One of the few analyses is by Saltz (1999) using data from 18 Latin American and East Asian developing or Newly Industrialized Countries from 1960-1991. His findings do not lend support to the hypothesis that higher growth rates of saving cause higher growth rates of real GDP. He concludes:

> *"If any conclusion can be drawn, it should be that a higher rate of growth of real GDP causes a faster growth of savings"* (Saltz, 1999, p. 93).

A study by Mohan (2006, p. 6) for 25 countries comes to a similar result:

> *"(...), in most countries under investigation, the empirical results show that the causality is from economic growth rate to growth rate of savings."*

These findings, in turn, pose a fundamental problem for real analysis where saving is regarded as the main source for bank credits, investment, and thus for growth. However, they are compatible with the dominant causal mechanism of the monetary analysis, where economic growth and higher incomes create room for higher saving rates, and saving itself is irrelevant for the financing of growth and growth.

Thus, while the literature has intensively analysed the nexus between private credit to GDP and economic growth, it has not paid much attention to the transmission channels between saving and the financial system and between saving and economic growth. The research interest in the relationship between the financial system and investment has been similarly weak, even though this transmission channel is equally central to real analysis.

One of the few empirical analyses on the relationship between financial development on the one hand and saving and investment on the other hand is from Beck, Levine, and Loayza (2000, p. 266) who admit that they "*do not find a robust relation between financial intermediary development and either physical capital accumulation or private savings rates.*" Beck, Levine, and Loayza (2000, p. 293) present results that "*do not suggest that banking sector development exerts a strong, positive effect on private saving rates.*" Grigoli, Herman, and Schmidt-Hebbel (2014) examine the impact of financial depth on saving. Their estimates show that the effect of financial deepening on private saving is zero, on household saving it is even negative but also insignificant. Levine (2021, p. 2) who regards the "*mobilization of savings*" as a key function of banks, admits quite frankly that financial development does not increase saving rates.

3.2.4.2 Missing evidence for positive effects of the financial system in advanced economies

A fundamental problem of the mainstream literature is the lack of evidence for advanced economies, which are underrepresented in the analyses of King, Levine and Beck, where they typically account for only about one fourth or one fifth of the samples. Therefore, the studies are dominated by relatively small developing countries.

In a study in which De Gregorio and Guidotti (1995, p.441) use cross-country growth regressions on a sample of 98 countries in 1960–1985, it is concluded:

> "*Compared to the rest of the sample, the effect of financial development on growth in high-income countries is relatively small. In particular, the effect in 1970-85 is not significantly different from zero* [...]".

Similar results can be found in Neusser and Kugler (1998), Andrés et al. (1999), Pagano and Pica (2012) and Leahy, Schich, Wehinger, Pelgrin, and Thorgeirsson (2001).

A meta-analysis based on 68 empirical surveys and over 500 estimates (Bijlsma et al., 2018, p. 6144) identifies a significant publication bias and comes to a more nuanced assessment: "[...] *the idea that growth can be stimulated by increasing the financial sector is overly optimistic, especially for well-developed countries.*"

Ram (1999), makes the more general point that **at the national level** the predominant correlation between financial development and economic growth is negligible or even weakly negative. The contrast of the average individual country correlations with the cross-country correlations between the same variables indicate that the cross-country estimates used in most studies might be spurious. Due to the huge parametric heterogeneity across the sample countries, Ram (1999, p. 172) points to "*the illegitimacy of statements being made about the subgroups on the basis of the full-sample estimates*".

Another more fundamental problem is the **causality between finance and growth** in the empirical literature by King, Levine, and Beck, who only claim that finance is correlated with growth, but "*do not deal formally with the issue of causality*" (Levine, 2005, p. 892). Already in 1996, Demetriades and Hussein (1996, p.391) argued that the results of King and Levine (1993a) were indicative, but "*they cannot be seen as substitutes for standard causality tests using time-series data.*" In their own time-series analysis they come to the result that there can be no *"wholesale"* acceptance of the view that *"finance follows growth"*. J. Shan and Morris (2002) suggest similar results.

3.2.4.3 Vanishing and negative growth effects of financial development

After the financial crisis, one can identify a systematic shift in the empirical results. Rousseau and Wachtel (2011) were among the first to observe a so-called "**vanishing effect**" of the impact of financial depth on GDP growth over time. While this effect had been statistically significant and positive in the sub-period 1960–1989, it became insignificant and negative in the subperiod 1990–2004. Cecchetti and Kharroubi (2012) find "unambiguous" evidence that faster growth in finance is bad for aggregate real growth in 20 countries in the OECD. Arcand et al. (2012) show that the positive effect of finance on real GDP growth vanishes over time and is no longer significant in more recent data. The positive effect is reversed when the amount of private credit relative to GDP reaches a threshold of around 100% to GDP. Cournède and Denk

(2015, p. 8) studied 32 OECD countries between 1970 and 2011 and conclude:

> "*Financial sector value added and credit to the non-financial private sector* [...] *both exhibit a tight negative link with GDP growth, on average across countries at the levels observed over the past decades.*"

These results are mainly explained by questioning the measures of financial depth and intermediation used (Hasan, Wachtel, & Zhou, 2009), or by the use of credit for productive or unproductive purposes depending on the recipient of the credit (Beck et al., 2012) and especially for house purchases (Bezemer & Zhang, 2014). Nevertheless, the negative results pose a puzzle for the theory of real analysis which due to its all-purpose asset cannot not differentiate between productive and unproductive investment. Overall, Beck (2013) admits that the "*findings of this literature, however, sit uncomfortably with the recent experience of many developed countries.*"

3.2.4.4 Liquidity creation by banks

While the literature emphasizes the importance of liquidity creation as a key function of banks, there is little research focusing on whether and how liquidity creation contributes to growth. In a recent paper Beck et al. (2020, p. 4) try to *"provide[s] a unified framework that features liquidity creation by banks as a key mechanism to help understand a number of important findings in the finance and growth literature."* The authors develop a measure of liquidity creation, which incorporates the contributions of all bank assets, liabilities, equity, and off-balance sheet activities. They explain the rationale of this indicator as follows:

> *"As it is recognized that banks create liquidity when they engage in certain activities but reduce liquidity when they engage in other activities, the measure classifies and weights all bank activities based on the liquidity they create or destroy"* (Beck et al., 2020, p. 6)

The authors use three liquidity weights: liquid, semiliquid, and illiquid. They argue that since liquidity is created when illiquid assets are transformed into liquid liabilities, both illiquid assets and liquid liabilities are given a positive weight. Following a similar logic, a negative liquidity weight is given to liquid assets, illiquid liabilities, and equity. Liquidity is destroyed when liquid assets are transformed into illiquid liabilities or equity. Because liquidity creation is only half determined by the source or use of funds alone, the study assigns weights of +1/2 and -1/2.

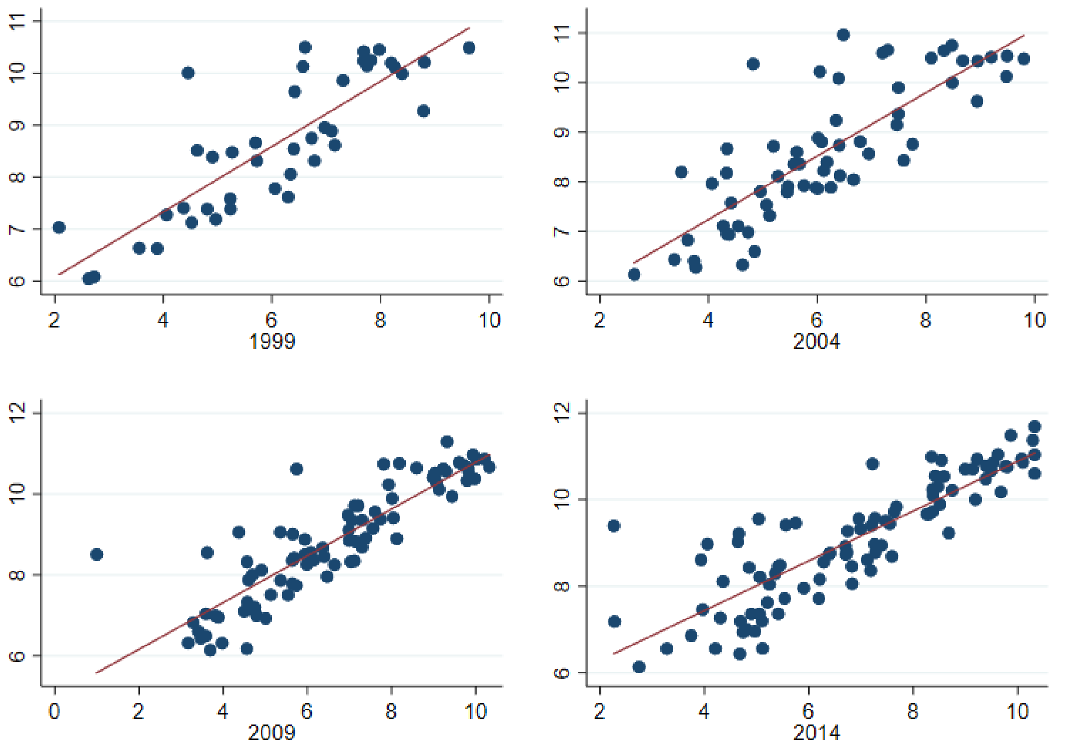
The logic of this indicator can be explained as follows: If a bank lends 1.000 Euro to a borrower, the bank balance sheet shows 1.000 Euro as credit on its asset side and 1.000 Euro as a deposit on its liability side. With a positive weight of 0.5 on the illiquid credit and on the liquid deposit, "liquidity creation" is 1.000 Euro. In the "monetary analysis" this transaction would be recorded as an increase of the **money stock M1** of 1.000 Euro. Thus, in the balance sheet of the bank there is no conceptual difference between "liquidity creation" and the money stock M1. While "liquidity creation" seems to be a flow variable, it is a weighted sum of balance sheet items and therefore a **stock variable** like the money stock.

Thus, "liquidity creation" as defined by Beck et al. (2020) is a confusing concept. E.g., one can read:

> *"Total liquidity created by the US banking sector has clearly increased over time—though not monotonically—and reached almost $4.8 trillion in 2014"* (Beck et al., 2020, p. 9).

Assume there is country A with only one bank, which gives a credit of 1.000 Euro each year over a period of ten years. On the liability side, the deposits grow in tandem. After ten years, the indicator "liquidity creation" would reach a value of 10.000 Euro. According to the logic of Beck et al. (2020) this would imply that liquidity creation in year one has been 1,000 Euro and 10,000 Euro in year 10.

Thus, with "liquidity creation", Beck et al. (2020) have not developed a new indicator for financial development. Instead, they have created a **specific variant of a money stock aggregate**, which is conceptually not different from the 1990s estimates where such indicators were widely used in the literature on the finance and growth nexus. But in contrast to this literature, Beck et al. (2020) do not analyse the relation between a financial variable and **real GDP growth**. Instead, they focus on the relationship between "liquidity creation" and the **level of nominal GDP**. Interpreting "liquidity creation" as a money stock aggregate, one can explain the positive correlation between nominal GDP per capita and "liquidity creation per capita" in the charts presented by Beck et al. (2020) as a variant of the **quantity theory of money**. It postulates a positive correlation between the money stock and nominal GDP, but it does not provide an argument that a higher money stock leads to a higher real GDP.



The figure shows the relation between log GDP per capita on the y-axis and log on-balance sheet liquidity creation per capita on the x-axis for the whole sample comprising 100 countries in 1999, 2004, 2009 and 2014.

Figure 5: On-balance sheet liquidity creation and GDP per capita.
Source: Beck et al. (2020, p. 37)

While liquidity creation is a simple concept in the monetary analysis, it requires unrealistic critical assumptions to explain it within the framework of the real analysis (see Box 1).

Box 1:

The limitations of the real analysis become especially obvious in the analysis of **liquidity creation**. For the monetary analysis, liquidity creation is a central and simple concept. Whenever a bank gives a credit, it creates money and thus liquidity: on the asset side, the bank holds a new credit with a longer maturity than the newly created sight deposit on the liability side of its balance sheet. Money creation, credit creation and liquidity creation are all the same. For the real analysis with only a general purpose good, liquidity creation is a difficult concept as banks can only intermediate the GPG submitted by households to investors without changing its substance.

This conceptual difficulty explains the popularity of the seminal paper by Diamond and Dybvig (1983). In this two-period model, consumers do not know whether they die at the end of period 1 or of period 2. If the GPG is invested, it does not generate a return in period 1, but only in period 2. Thus, without banks, consumers who die in period 1 will not receive a return on their investment. The Diamond/Dybvig bank functions de facto as an insurance company protecting consumers against the (unobservable) risk to die in the first period. It pays them an interest rate already in period 1 although the GPG has not yet generated a return. This payment reduces the return for consumers who survive until period 2. They receive a return which is lower than the full return of the GPG in period 2. The difference can be regarded as an insurance premium.

Following Rodrik (2017), one can identify three *"unrealistic critical assumptions"*:

- First, the bank offers a fixed interest rate contract for period 1 without knowing the mortality probability of people dying in period 1. But under such conditions, an **insurance contract** would not be possible.
- Second, by paying interest in period 1 before receiving a return of the invested GPGs, the Diamond/Dybvig bank would be **insolvent** in period 1.
- Third, the model assumes without any explanation that the return of the GPG is zero in the first period and positive in the second period. With the more realistic assumption of **identical returns** in both periods, the model collapses as there is no longer a need to insure consumers that might die at the end of the first period.

3.3 Testing the finance and growth nexus from a truly Schumpeterian perspective

The previous section has shown that the evidence for the central transmission channels of real analysis is relatively weak. This suggests that the link between the financial system and growth should be examined from the perspective of monetary analysis.

There is little empirical work to date that has explicitly set itself the task of developing a monetary alternative to the approach of the standard literature. Mayer, Biggs, and Pick (2010) emphasize that economic activity is generally closely connected to changes in flows of credit, not stocks of credit. The effects of credit growth on GDP growth play an important role in Bezemer et al. (2016); Werner (1997, 2005) and Werner (2016), and in L. Zhang and Bezemer (2016) who argue that in the Chinese context increased credit flows positively affect income growth whereas high credit stocks have negative longer-term effects on growth. The latter result is also confirmed for the United States (US) by Juselius and Drehmann (2020).

The previous section has shown that the evidence for the central transmission channels of real analysis is relatively weak. This suggests that the static approach of the real analysis is inadequate to capture the economic effects of "financial development". In the monetary analysis, financial development is a dynamic concept reflecting the role of banks as producers of purchasing power. Thus, the key explanatory variable is not the level of credit relative to GDP, but credit growth.

In the following we want to test the main hypothesis of a monetary analysis based on a truly Schumpeterian approach:

- As we have shown in the previous section, there is little empirical evidence for the hypothesis that saving has an effect on credit growth. Since **household saving is thus not a prerequisite for investment**, there should also be no correlation between saving and economic growth. For the real analysis, a missing link between saving and credit puts the whole paradigm into question.
- The effects of the financial system on economic growth result primarily from the **growth in the volume of credit**. This dynamic approach differs from the real analysis, which tries to capture the effects of the financial system based on static variables, above all the volume of credit to GDP.
- As credit can also be used for **productive and unproductive purposes**, there is not necessarily a positive relationship between credit and growth. This differs from the real analysis where it is difficult to explain why the easing of frictions of financial systems could have negative effects.

To test these hypotheses, we use panel estimations, SVAR models and Granger causality tests as well as FEVD.

3.3.1 Data set

For our analysis we use the credit database of the BIS. We draw on a large, unbalanced panel of 43 countries with quarterly data for 1940–2019. Twenty-five of the countries are considered developed and 18 are developing countries.

Following Schumpeter's idea that banks play a central role in the growth process, we primarily use data on the annual growth of bank credit to the private non-financial sector ($\triangle$CREDIT$_{Bank}$). In addition, to provide some deeper analysis on credit types and temporal heterogeneities, we also include some estimations containing further credit variables in the Appendix. In detail, we supplement total private credit growth, which also includes credits provided by non-banks ($\triangle$CREDIT$_{Total}$), as well as growth of total private credit to households ($\triangle$CREDIT$_{Household}$) and growth of total private credit to non-financial corporations ($\triangle$CREDIT$_{Corporate}$). We also derive an indicator of "other credit" to the private non-financial sector by taking the difference between total credit to the private non-financial sector and bank credit to the private non-financial sector. We refer to this variable as "alternative credit" (CREDIT$_{Alt}$). In detail, CREDIT$_{Bank}$ includes domestic bank credit and debt securities (bonds and short-term paper) held by domestic banks (e.g. commercial banks, savings banks, money-market funds and credit unions). CREDIT$_{Alt}$ on the other hand includes non-bank credit and debt securities that are held by non-banks (e.g. domestic financial and non-financial institutions, general government or households, including non-profit institutions serving households, as well as non- residents) (Dembiermont, Drehmann, & Muksakunratana, 2013). We therefore consider CREDIT$_{Alt}$ as a proxy for capital market-lending, as opposed to bank lending. Due to the nature of the BIS data we have to approximate credit flows by the change in credit stocks.

Saving in the real analysis refers to household saving. Thus, for saving we use the growth rate in net household saving ($\triangle$NHS), and percentage changes in the net saving rates at the household level ($\triangle$NHSR). Our preferred indicator is the former ($\triangle$NHS), as it indicates the isolated effect of saving, whereas changes in the saving rate may also be due to changes in household income. Since the availability of data on net saving (rates) is limited, we created a large-scale database on saving rates at a household level based on national accounts data from national statistical authorities and supplemented by data from the United Nations (UN), the annual macro-economic database of the European Commission (AMECO), and the OECD.

GDP growth (GROWTH) is measured in terms of the annual growth rate of GDP per capita; data are taken from the World Bank's world development indicators database. A more detailed description of our whole data set can be found in the Appendix.

3.3.2 Baseline results

For our baseline estimation we first apply standard panel analysis methods, i.e. fixed effects (FE) and random effects (RE). We assume that the explanatory variables in our data set correlate with the unobservable characteristics of the observations - that is, they are not random - and mainly focus on the FE regressions. This approach is also consistent with the results of the Hausman test.

We use a representation of the growth process as it is often found in literature and estimate the following model, in which we essentially follow King and Levine (1993a) in line with Barro (1991):

$$GROWTH_{it} = \beta \cdot FINANCE_{it} + \boldsymbol{\gamma} \cdot \mathbf{X_{it}} + \delta_t + \eta_i + u_{it}, \tag{1}$$

where i denotes the country, t refers to the time period, and X_{it} includes various control variables. By including δ_t, we account for time (macroeconomic) FE, and by η_i, we control for country FE, and u_{it} is the random error term. We also add time dummies to account for trends in our data, and include robust standard errors for heteroscedasticity. $FINANCE$ represents factors that drive financial development. Here, we differ from the standard literature as we use the growth rates of the financial variables. $GROWTH$ indicates the annual growth rate of per capita GDP. As most saving data are only available on an annual basis, we aggregate the BIS credit data to annual figures and calculated their year-on-year percentage growth rates on this basis.

Following the finance and growth literature (i.e., King and Levine (1993a), Beck, Levine, and Loayza (2000), Levine and Zervos (1998), and Rousseau and Wachtel (2011), amongst many others) we assume that education, trade, government consumption, and inflation are key factors that, along with financial variables, influence economic growth. In addition to the FINANCE variables ($\triangle$NHS, $\triangle$NHSR and $\triangle$CREDIT$_{Bank}$), we apply the following control variables to our analysis:

- Log(INITIAL GDP) from Penn World Table 10.0 to control for convergence (Barro and Sala-i Martin (1995); Barro and Sala-i Martin (1992)),
- Secondary school enrollment rate (SCHOOL) from the World Bank's World Development Indicators dataset as a measure for human capital accumulation (Solow (1956); Barro and Sala-i Martin (1995)),

as well as macroeconomic indicators, like

- General government final consumption expenditure (GOV),
- A logarithmic measure for trade (OPENNESS), given as the sum of exports and imports relative to GDP, and
- Consumer price inflation (INFL),

from the World Development Indicators database to take into account findings by Easterly and Rebelo (1993), S. Fischer (1993) and Bruno and Easterly (1998) that underline the negative growth effects of macroeconomic instability and budgetary deficits. Surveys by Balassa (1978) and Krueger (1998) indicate that trade could be positively associated with economic growth. A brief overview of the descriptive statistics can be found in the Appendix (section 3.3.1).

Table 1 shows the results of our panel analysis. For all subsequent panel estimations we include random effects and 3- and 5-year averages as robustness checks to account for medium-term fluctuations in our data (see Appendix). The results of these robustness checks are widely in line with the findings we present here.

	FE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-1.531**	-1.860***	-3.084**	-2.354***	-3.332**	-2.108***
	(0.630)	(0.514)	(1.294)	(0.565)	(1.244)	(0.583)
SCHOOL	0.013	0.019**	0.015*	0.019**	0.017*	0.020**
	(0.010)	(0.008)	(0.009)	(0.007)	(0.009)	(0.007)
GOV	-0.311***	-0.422***	-0.596***	-0.645***	-0.548***	-0.593***
	(0.090)	(0.063)	(0.140)	(0.106)	(0.145)	(0.109)
log(OPENNESS)	2.404**	2.287**	2.118**	1.660**	2.601***	2.067***
	(0.927)	(0.846)	(0.787)	(0.706)	(0.749)	(0.702)
INFL	-0.018***	-0.102***	-0.099***	-0.118***	-0.137***	-0.161***
	(0.003)	(0.016)	(0.032)	(0.042)	(0.035)	(0.049)
$\Delta CREDIT_{Bank}$		0.098***			0.075***	0.067***
		(0.016)			(0.023)	(0.021)
ΔNHS			0.000**		0.000***	
			(0.000)		(0.000)	
$\Delta NHSR$				0.000		0.000
				(0.000)		(0.000)
Constant	13.579**	17.022***	34.522**	30.285***	33.021**	24.657***
	(6.578)	(5.777)	(12.592)	(6.061)	(11.952)	(5.887)
Observations	1,509	1,399	842	936	834	928
Countries	41	41	31	34	31	34
Adj. R-squared	0.3172	0.4183	0.4504	0.4481	0.4863	0.4764

	RE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-1.014***	-0.830***	-0.871***	-1.299***	-0.726***	-1.078***
	(0.252)	(0.244)	(0.217)	(0.402)	(0.212)	(0.301)
SCHOOL	0.018	0.021*	0.007	0.019***	0.008	0.015*
	(0.012)	(0.011)	(0.008)	(0.007)	(0.007)	(0.009)
GOV	-0.096*	-0.107**	-0.113*	-0.439***	-0.104*	-0.146**
	(0.049)	(0.048)	(0.066)	(0.083)	(0.063)	(0.066)
log(OPENNESS)	0.917***	0.727***	0.956***	1.513***	0.873**	0.767**
	(0.216)	(0.252)	(0.306)	(0.469)	(0.364)	(0.362)
INFL	-0.020***	-0.114***	-0.113***	-0.119***	-0.166***	-0.198***
	(0.003)	(0.014)	(0.039)	(0.042)	(0.030)	(0.035)
$\Delta CREDIT_{Bank}$		0.104***			0.086***	0.098***
		(0.015)			(0.021)	(0.020)
ΔNHS			0.000		0.000	
			(0.000)		(0.000)	
$\Delta NHSR$				0.000		0.000
				(0.000)		(0.000)
Constant	10.655***	8.580***	10.454***	17.235***	7.906***	12.468***
	(2.080)	(2.093)	(1.922)	(4.360)	(2.138)	(3.019)
Observations	1,509	1,399	842	936	834	928
Countries	41	41	31	34	31	34
Adj. R-squared	0.4285	0.5318	0.5178	0.5928	0.5503	0.6153

Notes: Heteroskedasticiy-consistent standard errors are indicated in parentheses. Estimation errors are normally distributed. GROWTH=growth of GDP per capita in %; log(INITIAL GDP)=logarithm of current expenditure side GDP from previous period at current PPPs; SCHOOL=secondary school enrollment rate (% of population in secondary school age); GOV=general government final consumption expenditure (% of GDP); log(OPENNESS)=logarithm of trade as sum of exports and imports of goods and services (% of GDP); INFL=inflation in consumer prices (% change); $\Delta CREDIT_{Bank}$ *= annual growth rate of domestic bank credit to non-financial private sector (%);* ΔNHS*=annual growth in household sector net saving (%);* $\Delta NHSR$ *= annual growth in share of net saving to net disposable income (household sector, %).*

Table 1: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Fixed Effects and Random Effects.

The results of the baseline estimations are largely as expected from the empirical literature and do not differ widely among the two panel methods applied. While human capital accumulation (*SCHOOL*) and openness to trade (*log(OPENNESS)*) consistently suggest positive and mostly significant effects on growth, inflation (*INFL*) and general government consumption expenditure (*GOV*) are negatively correlated with per capita GDP growth. The initial level of GDP (*log(INITIAL GDP)*) has a negative and highly significant link with per capita GDP growth, which underlines the convergence theory as shown by Barro and Sala-i Martin (1992) and Barro and Sala-i Martin (1995).

Adding the growth rate of bank credit to the non-financial private sector (ΔCREDIT$_{Bank}$), which serves as our indicator for financial development, confirms the positive relationship between finance and growth that is generally found in the literature. Across both estimation methods in table 1, we detect a positive and strongly significant link with the GDP growth rate. Even at the 95% confidence interval, the ΔCREDIT$_{Bank}$ coefficient is always positive. This is particularly noteworthy, because our panel includes an almost equal number of developed and less developed countries, and the existing literature often fails to find significant positive effects of "finance" on growth for advanced economies.

3.3.3 Saving and GDP growth

One of our previous criticisms on the standard finance and growth literature is that it models the relationship between finance and growth in monetary terms (by using indicators of credit), but applies a theory based on household saving as a prerequisite for lending. To check this hypothesis - that household saving is a driver of economic growth - we now use saving variables instead of credit variables. In the logic of the "real analysis" - where household saving is identical with credit - the result should be rather similar.

We employ the percentage change in household net saving rates (ΔNHSR), as the use of saving ratios (albeit often as a percentage of GDP) is more common in the empirical literature than the use of absolute saving, if saving is part of the empirical estimation at all. We also analyse the impact of the growth rates of household saving volumes (ΔNHS), which, unlike changes in relative saving rates, does not depend on changes in the denominator (i.e., disposable income). Thus, ΔNHS can provide a better picture of the actual effect of household saving. This indicator has, however, slightly fewer data points than ΔNHSR.

The results in table 1 show that in contrast to ΔCREDIT$_{Bank}$, both saving variables have no link to GDP growth, regardless of the estimation methodology used, or whether considered in an isolated way or simultaneously with our bank credit indicator.

One could argue that household saving has a delayed effect on credit and growth, as banks first mobilise and pool savings to subsequently pass them on as credit to investors. To test whether household saving activities have a delayed relationship with per capita GDP growth, we therefore repeat the FE estimation for both saving variables with up to three lags (i.e., t-1 to t-3), which equals three years. Our results indicate that this is not the case. Again, we find an effect size of zero for both saving variables, regardless of the number of lags (table 2).[9]

Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-3.084**	-2.354***	-3.180**	-2.616**	-2.447**	-2.021***	-1.546**	-1.558**
	(1.294)	(0.565)	(1.308)	(1.157)	(1.078)	(0.611)	(0.641)	(0.680)
SCHOOL	0.015*	0.019**	0.014	0.013	0.013	0.020***	0.019**	0.019**
	(0.009)	(0.007)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)
GOV	-0.596***	-0.645***	-0.606***	-0.670***	-0.671***	-0.673***	-0.732***	-0.745***
	(0.140)	(0.106)	(0.144)	(0.145)	(0.150)	(0.111)	(0.116)	(0.123)
log(OPENNESS)	2.118**	1.660**	2.027**	2.032**	1.951**	1.495*	1.549**	1.752**
	(0.787)	(0.706)	(0.858)	(0.890)	(0.829)	(0.749)	(0.736)	(0.675)
INFL	-0.099***	-0.118***	-0.105***	-0.057	-0.104*	-0.138***	-0.118	-0.172**
	(0.032)	(0.042)	(0.030)	(0.059)	(0.059)	(0.044)	(0.070)	(0.067)
ΔNHS	0.000**							
	(0.000)							
ΔNHSR		0.000						
		(0.000)						
ΔNHS_{t-1}			0.000*					
			(0.000)					
ΔNHS_{t-2}				0.000*				
				(0.000)				
ΔNHS_{t-3}					0.000**			
					(0.000)			
$\Delta NHSR_{t-1}$						0.000*		
						(0.000)		
$\Delta NHSR_{t-2}$							0.000**	
							(0.000)	
$\Delta NHSR_{t-3}$								0.000
								(0.000)
Observations	842	936	820	797	770	912	887	858
Countries	31	34	31	31	31	34	34	34
Adj. R-squared	0.4504	0.4481	0.4524	0.4674	0.4780	0.4499	0.4640	0.4790

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. Estimation errors are normally distributed.

Table 2: Growth effects of household saving growth and household saving rate growth incl. lagged variables, estimated with Fixed Effects.

Based on the findings of our panel analysis, we can conclude that there seems to be a highly significant and positive link between dynamic credit variables, especially private bank credit

[9] In contrast to credit, which is a stock variable, saving is already a flow variable. Thus, when we compare the effect of credit flows (approximated here as credit growth) and saving flows, one could also use absolute saving. To make the estimations comparable, we still resort to credit and saving growth but provide the results of the estimation with absolute saving as a robustness check in the Appendix (see table 23 and 24). The results do not change.

growth, and per capita GDP growth. Our panel analysis also shows that there is no evidence for a relationship between saving and per capita GDP growth. This result is also supported by other empirical studies (e.g. Levine and Zervos (1998), Carroll and Weil (1993) and Mohan (2006).

It is important to note, however, that our cross-country panel analysis can only show average growth effects. To get a better understanding of the dynamics between key variables in individual countries, we thus extend our analysis with a VAR model. We focus on the United States, where quarterly data, especially on household saving, are available for a long time horizon. In the appendix (see section A.1.3), we provide more country-individual results.[10]

We use a structural vector-autoregressive model (VAR) to assess the effects of an exogenous credit supply shock on growth compared to an exogenous saving shock. Following the logic of the real analysis, the shock-responses should be rather similar.

For the assessment of qualitative differences between credit and saving shocks, we estimate two structural VARs. Equation 2 provides a structural representation of the relevant variables:

$$A_0 x_t = c + \sum_{i=1}^{k} A_i x_{t-i} + \varepsilon_t. \tag{2}$$

A_i is an $n \times n$ matrix including autoregressive coefficients at lag, i = 1, . . . , k , and A_0 captures contemporaneous impact coefficients. k is the lag length, and ε_t is a vector of independent and identically distributed structural shocks. The constant is represented by the variable c. The $n \times 1$ vector x_t includes the following $n = 3$ variables in this order, $x = [y\ cr\ int]'$. For our second structural VAR, we substitute bank credit with household saving and thus the $n \times 1$ vector x_t comprises the following $n = 3$ variables in this order, $x = [y\ sav\ int]'$. The data for bank credit are still taken from the BIS credit statistics, data for GDP, policy rate and household saving are now uniformly taken from the database of the Federal Reserve Bank of

[10] Here we use the quarterly bank credit data by the BIS and real GDP (deflated nominal GDP) and short-term interest rate data by the OECD. Albeit the picture is rather heterogeneous, we also find a statistically significant negative impact of a credit supply shock on GDP growth for some countries, which could be an indicator for the adverse effects of credit growth that Schumpeter alluded to in his "secondary wave" analogy.

St. Louis. Compared with the previous panel analyses and in line with the existing literature we now estimate the model at a quarterly frequency to have a larger sample size. Data at the quarterly frequency is not available for the previous analyses. Our data for the US cover the period from 1954Q4 to 2019Q4. Data for economic growth (*y*), credit (*cr*) and saving (*sav*) are in log difference to be consistent with the preceding panel analysis and to draw on dynamic indicators. The policy rate is represented by *int*. Due to better data availability for quarterly time series we limit our VAR analysis with household saving data to the United States.

We estimate the reduced-form VAR representation of Equation 2 using the respectively suggested lag length of several information criteria. To recover the structural VAR representation we impose restrictions on elements in A_0. Thereby we segregate exogenous credit supply changes from endogenous reactions to other variables in the model.

We follow the literature (e.g. Gilchrist and Zakrajšek (2013)) by assuming that shocks in macroeconomic variables impact financial variables contemporaneously, whereas shocks in financial variables affect the real economy with a time lag. For the identification strategy we apply a Cholesky factorization to the variance–covariance matrix of the reduced-form regression residuals, u_t. Then we use the Cholesky factor for A_0, which provides $u_t = A_0^{-1}\varepsilon_t$ and recovers the structural representation. We allow the policy rate to contemporaneously react to credit shocks within the recursive identification scheme (Sims, 1992). This recursive SVAR framework is in line with previous studies on credit shocks, e.g. Bassett, Chosak, Driscoll, and Zakrajšek (2014); Lown and Morgan (2006) as well as Boivin, Giannoni, and Stevanović (2020). While other studies employed alternative identification strategies such as sign restrictions, the results remain similar. As Littlejohn (2019, p. 5) states: *"Despite the variation across identification methods, a procyclic relationship between credit shocks and output growth is consistent across these studies, especially in the short-run."*

Figure 7 shows the impulse response function of a bank credit supply shock on GDP and the policy rate. The impulse response functions suggest a positive impact of a bank credit growth supply shock on economic growth. The effect is statistically significant for several quarters and then vanishes. We also find a positive and statistically significant reaction of the policy rate immediately after the shock. Our SVAR therefore provides some insights into the dynamic effect of a credit shock on growth. Due to the higher frequency of our VAR (quarterly) compared to our panel (annual), we can show that there might be a time lag between the credit impulse and the GDP reaction. The effect becomes larger over a period of three quarters and then vanishes. Thus, while these findings are in line with the panel result of a statistically significant effect of credit on growth within one year, the dynamic representation of the effect allows to show the time lag between credit provision and effect on growth.

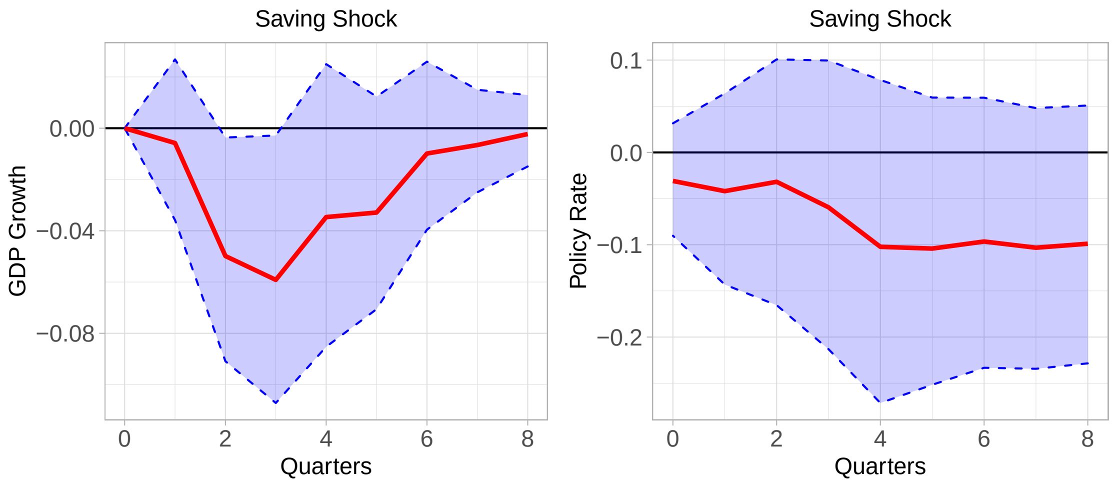


Figure 6: Impulse-Response Functions of a household saving shock on GDP and the policy rate.
Note: Based on the BIS total credit statistics and Federal Reserve Economic Data (FRED). The red line denotes the estimated response, while the blue area represents 90 percent confidence bands derived from 5,000 bootstrap runs.

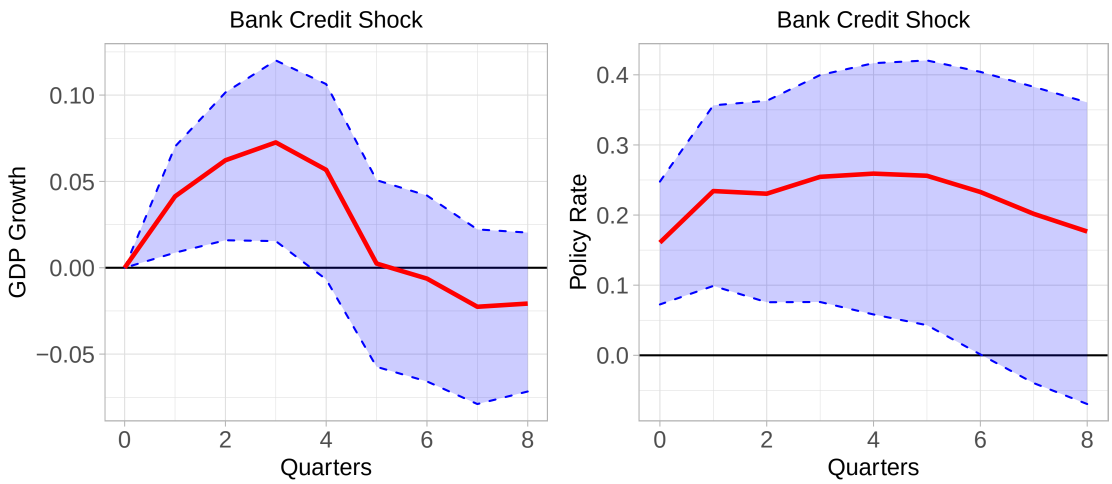


Figure 7: Impulse-Response Functions of a bank credit supply shock on GDP and the policy rate.
Note: Based on the BIS total credit statistics and FRED. The red line denotes the estimated response, while the blue area represents 90 percent confidence bands derived from 5,000 bootstrap runs.

Figure 6, on the other hand, shows the impulse-response functions of our SVAR to a household saving shock. The effects of this shock on GDP growth and the policy rate are negative and insignificant. "Real analysis" would suggest that a shock in household saving should lead to more credit and thus should have similar effects as the credit supply shock. However, while for the saving shock we find negative and insignificant results, the credit growth shock has a positive and significant effect on GDP growth. These findings are also robust when we use real GDP or real GDP per capita for economic growth, albeit the effects of bank credit on growth are less pronounced and less significant. The effect of a saving shock is still negative and insignificant on economic growth and the policy rate.[11] This evidence supports our previous cross-country panel analysis and is in line with the literature that examined the causal relationship between saving and growth.

3.3.4 Correct indicator choice

Next, figure 8 and 9 show that using credit growth rates instead of static credit variables yields fundamentally different results on the correlation between credit (growth) and GDP growth. As suggested by Schumpeter and Goldsmith, dynamic credit indicators show a pronounced positive correlation between credit growth and GDP growth for developing and developed countries alike, while there is a very weak negative correlation between the level of bank credit and GDP growth for developing countries and a more pronounced negative correlation for developed countries.

[11] The results for household saving are also robust when we use the shadow rate by J. C. Wu and Xia (2016) for the period of 2009Q4 to 2015Q4. The effect of bank credit on economic growth is again less pronounced and less significant if we use the shadow rate.

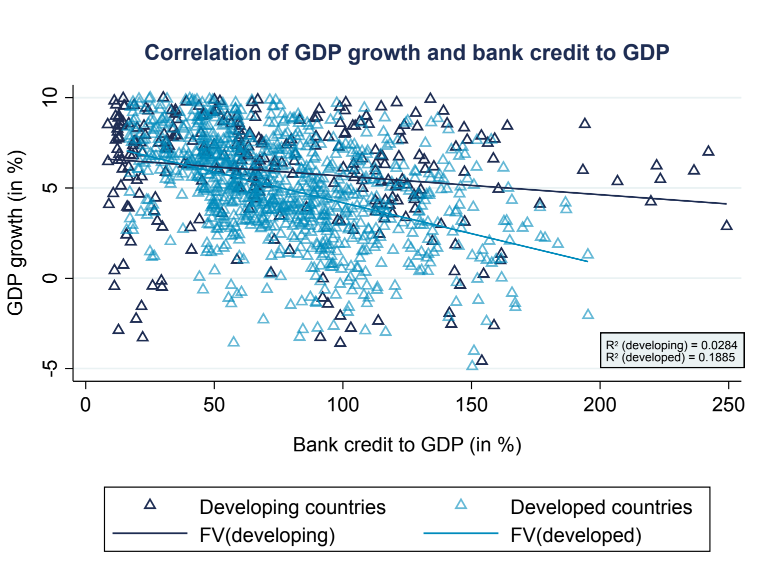


Figure 8: Correlation of bank credit to the non-financial private sector as share of GDP and GDP growth.
Source: BIS total credit statistics.

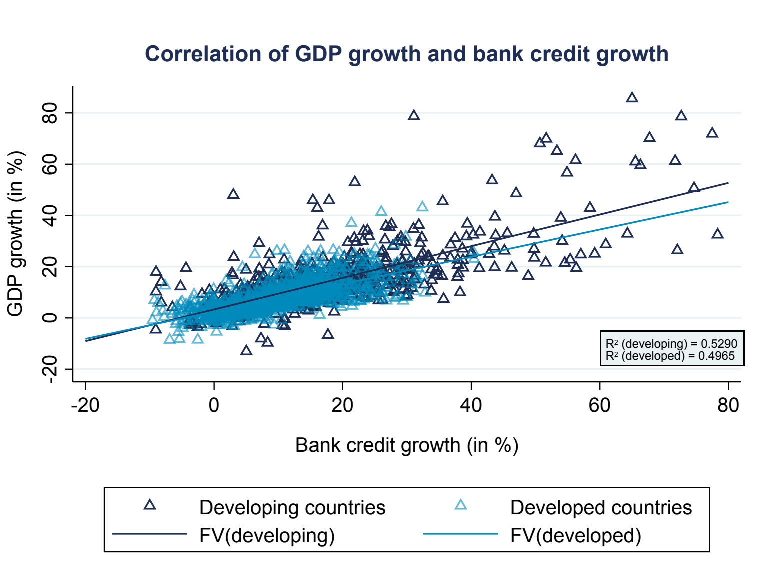


Figure 9: Correlation of growth of bank credit to the non-financial private sector and GDP growth.
Source: BIS total credit statistics.

Also from an econometric perspective, we can show that the use of dynamic credit variables yields fundamentally different results than the static variables that are used in the standard literature. We run the previous baseline panel estimation again, now also using static credit variables (i.e., credit levels). To avoid endogeneity, we now exclusively resort to instrumental variable (IV) estimation with two stage least squares (2SLS) estimators, where we estimate the two credit variables (ΔCREDIT$_{Bank}$ and CREDIT$_{Bank}$) each by their own value in the previous period (t-1) (see table 3).

Dependent Variable: GROWTH	(1)	(2)
log(INITIAL GDP)	-0.883***	-0.802***
	(0.107)	(0.106)
SCHOOL	0.004	0.008*
	(0.005)	(0.005)
GOV	-0.104***	-0.103***
	(0.023)	(0.022)
log(OPENNESS)	0.603***	0.564***
	(0.158)	(0.153)
INFL	-0.017**	-0.065***
	(0.008)	(0.018)
CREDIT$_{Bank}$	0.000	
	(0.000)	
$\triangle$CREDIT$_{Bank}$		0.053***
		(0.018)
Constant	10.066***	8.725***
	(0.960)	(1.018)
Observations	1,399	1,387
Countries	41	41
Adj. R-squared	0.1483	0.2351

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. Estimation errors are normally distributed.

Table 3: Growth effects of dynamic and static bank credit, estimated with Instrumental Variables.

The results support our findings from the previous estimations. While the growth rate of bank credit ($\triangle$CREDIT$_{Bank}$) is strongly significantly and positively related to GDP per capita growth, the absolute level of bank credit to GDP has neither significant nor positive effects.

3.3.5 Vanishing and negative effects

As we have argued in Chapter 3.2, credit is a key component of growth if used productively, but Schumpeter also asserts that it can have neutral or even negative effects if used in other ways. Asanović (2020, p. 102) points out that "[d]*espite the large volume of empirical research, many questions still remain unresolved and there is still no consensus on the direction of the relation between financial and real sector.*" Therefore, we will now examine the directions of the relationship between credit (financial sector) and economic growth (real sector).

A standard approach to determine the usefulness of one time series for forecasting another is the so-called Granger causality. In short, the test is based on the idea that one series (call it x) Granger-causes another series y if the forecasts of y improve when x is included in the forecasting process (Granger, 1969).

In general mathematical terms, a series x Granger-causes another series y if the extension of the univariate regression of y_t on its past values

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + ... + \alpha_m y_{t-m} + error_t \tag{3}$$

by series x

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + ... + \alpha_m y_{t-m} + \beta_p x_{t-p} + ... + \beta_q x_{t-q} + error_t \tag{4}$$

yields values for β_p to β_{t-p} that are significantly different from zero according to their t-statistics and increases the explanatory power of the regression as measured by an F-test.

For each country, we pass the test a matrix consisting of two columns, $X1$ and $X2$, with the null hypothesis that the second column, $X2$, does not Granger-cause the first column $X1$ meaning that our null hypothesis is that all coefficients on $X2$ are not significantly different from zero. We reject the null hypothesis if the reported p-values of the test are below a certain level for which we choose the conventional thresholds of 0.10, 0.05 and 0.01.

First, we test the null hypothesis that credit growth does not Granger-cause GDP growth. We then repeat the test for the opposite null hypothesis that GDP does not Granger-cause credit growth. The result of this two-sided test for almost the entire sample period from the first quarter of 1950 to the first quarter of 2020 is shown in Table 4.[12]

		Share of significant relations					
Test order	Countries	Credit growth Granger causes GDP growth			GDP growth Granger causes credit growth		
Significance level		0.1	0.05	0.01	0.1	0.05	0.01
Full sample	43	51.16%	39.53%	18.60%	62.79%	53.49%	34.88%
Developed countries	25	44.00%	36.00%	20.00%	52.00%	44.00%	24.00%
Developing countries	18	61.11%	44.44%	16.67%	77.78%	66.67%	50.00%

Note: The full sample covers a period from 1950Q1 to 2020Q1.

Table 4: Granger Causality p-values for overall period and by development level.

The test results provide a mixed picture with Granger causality pointing in two directions (table 4). At the 10% significance level we find that in 51% of the countries in our sample there

[12] We exclude the sparse data from the third quarter of 1944 to the end of 1949 because there are plausible concerns about biases due to World War II and its immediate aftermath.

is a significant effect of credit growth on GDP growth. For the opposite direction (effect of GDP growth on credit growth), the share of countries with a significant effect is even higher (62.79%).[13] Even at lower significance levels, the effect of GDP on credit growth is higher than the effect of credit on GDP growth.

When we compare the p-values of the Granger causalities for individual countries, we can order them according to the relative strength of the test (table 5).[14] For a majority of countries we find a significant relationship between credit growth and GDP growth. The number of countries in which GDP growth leads to credit growth is higher than the share of countries for which the data infer growth-generating lending. In about a third of the countries we find significant effects from credit growth on GDP growth and vice versa. In 20% of the countries, there is no empirical evidence for any relationship between finance and growth. The bi-directional effect that emerges from the analysis of Granger causalities might also derive from second order effects (not to be confused with "secondary wave" effects) of GDP on credit, which are rooted in income effects that facilitate the credit provision of banks - and thus increase credit growth (Bofinger & Schächter, 1995).

[13] As there is the possibility of both-way causality, the numbers do not have to add up to 100%.

[14] We classify that credit growth Granger causes GDP growth when the p-values for credit growth Granger-causing GDP growth are significant at the 10% significance level, and the p-values for GDP growth Granger-causing credit growth are not significant; and vice versa. "Both directions" indicates that the p-values for credit growth Granger-causing GDP growth are significant at the 10% significance level and the p-values for GDP growth Granger-causing credit growth are also significant. "No relationship" is found when the p-values for credit growth Granger-causing GDP growth are not significant, just as the p-values for GDP growth Granger-causing credit growth.

Credit Granger causes GDP	Both directions	GDP Granger causes credit	No relationship
Australia	Argentina	Brazil	Austria
Belgium	Chile	Canada	Colombia
Germany	China	Finland	Czech Republic
Hungary	Denmark	France	Greece
India	Indonesia	Hong Kong	Ireland
Japan	Israel	Luxembourg	Poland
Russia	Italy	Malaysia	Saudi Arabia
Switzerland	Korea	Norway	Spain
	Mexico	Portugal	
	Netherlands	Sweden	
	New Zealand	Thailand	
	Singapore	Turkey	
	South Africa	United Kingdom	
	United States		

Note: The full sample covers a period from 1950Q1 to 2020Q1.

Table 5: Overview on directions of p-values using all available data for the entire time period.

In order to quantify the impact of credit growth on GDP growth and vice versa, we furthermore apply Forecast Error Variance Decomposition (FEVD). This approach is based on estimating a VAR from the data, in our case a bivariate VAR, and then using the fitted model to forecast multiple periods by implementing exogenous shocks. In contrast to the structural VAR above, the bivariate VAR can easily be computed with our BIS dataset without the need for country specific data that go beyond this data set. The mean squared error (MSE) of this forecasting process is given by the formula

$$MSE[y_{j,t}(h)] = \sum_{i=0}^{h-1} \sum_{k=1}^{K} (e_j^{'} \Theta_i e_k)^2 \quad (5)$$

following the standard matrix notation of a VAR. This formula can be used to calculate the contribution of each variable (i.e. each time series) to the variance of the forecast error:

$$\omega_{jk,h} = \frac{\sum_{i=0}^{h-1} (e_j^{'} \Theta_i e_k)^2}{MSE[y_{j,t}(h)]} \quad (6)$$

$\omega_{jk,h}$ thus measures the proportion of forecast error variance of variable j that can be attributed to an exogenous shock to variable k (compare Lütkepohl and Krätzig (2004, p. 180f)).

We determine the optimal lag-length using standard information criteria and estimate a VAR that has a similar form to equation 4. We apply our model to forecast 8 periods (=two years) and use exogenous shocks to generate the MSEs and finally to decompose the variance of the MSEs to obtain the impact of one variable on the other as described above.

We estimate the FEVD for all the available data for each country (see table 51 in the Appendix). The results are shown in figure 10 and 11. The colours of the bars indicate the respective results for each country from Granger tests from table 5.

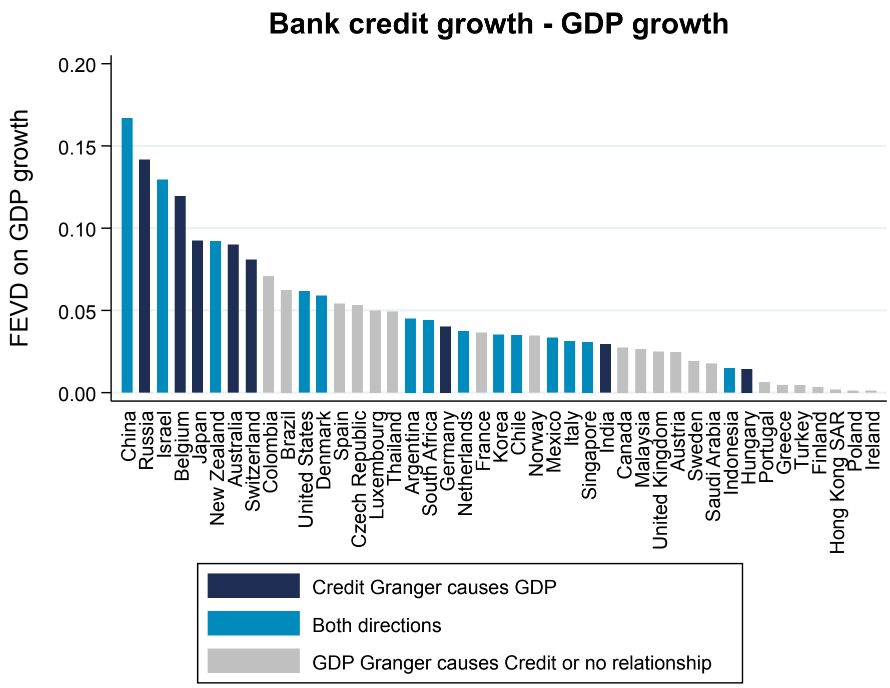


Figure 10: FEVD for GDP with credit shock.
Note: Based on the BIS total credit statistics (see chapter A.1.1 for detailed description). Color of bars indicate how results fit to table 5.

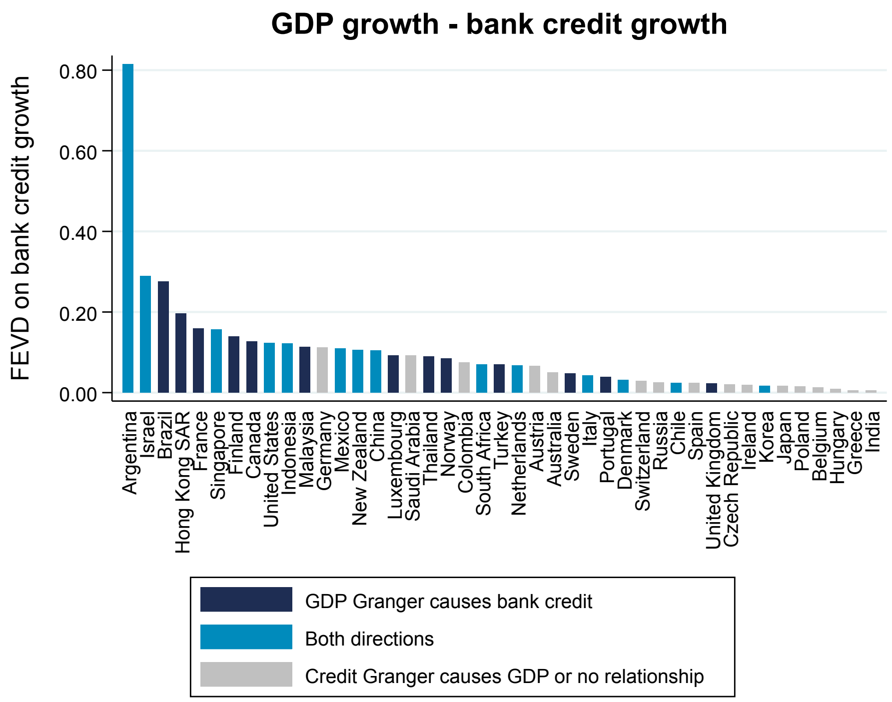


Figure 11: FEVD for Credit with GDP shock.
Note: Based on the BIS total credit statistics (see chapter A.1.1 for detailed description). Color of bars indicate how results fit to table 5.

These findings generally match and confirm the results of our Granger causality tests. For countries where we find that credit growth Granger-causes GDP growth, or where the Granger tests suggest a both-way significant relationship, we also find a high effect of credit growth on GDP growth. The same applies for countries where GDP growth Granger-causes credit growth or Granger tests suggest a both-way significant relationship. We also detect a statistically significant negative impact of a credit supply shock on GDP growth for some countries using the SVAR from above (see Appendix figure 46).

The previous results can be interpreted as follows. According to the standard finance and growth theory (see section 3.2.2) one would expect that credit growth is a sign of an easing of credit frictions and financial deepening that should always be beneficial for economic growth. It is still difficult to reconcile the theoretical concept based on real analysis, where credit is always used productively, with the empirical findings in the literature and in this paper.

The inconclusive results also challenge the critical assumptions of real analysis. As Bofinger (2020, p. 69) puts it: "[I]*n RA* [real analysis] *"investment" is limited to transactions that increase the stock of real assets in the economy.*" It is therefore difficult to explain the proportion of inconclusive results with a model that assumes that credit can only be used for productive investment or with one that aligns credit provision with financial deepening that is set to benefit economic growth.

3.4 Conclusion

Solow (1994, p. 45) made a remarkable statement: "*Schumpeter is a kind of patron saint in this field. Perhaps I am the only one who thinks he should be treated like a patron saint: paraded one day a year and more or less ignored the rest of the time.*" The main problem with this lies in the fact that the majority of the finance and growth literature is dominated by the "real analysis", which is in direct contrast to the "monetary analysis" that Schumpeter propagated. Our contribution shows that the misinterpretation of Schumpeter is not only a problem for the history of economic thought; it has also led theoretical and empirical research down the wrong track. At a general level, it is not surprising that a model in which the financial sphere is identical to the real sphere is unable to understand how finance causes growth in the modern financial system, where the financial system is often completely detached from the real sector.

Based on our criticism of the standard empirical literature on finance and growth, our own empirical analyses showed that 1.) dynamic credit variables are better suitable to describe the finance and growth nexus, than static credit variables, 2.) as saving is not a prerequisite for credit, we do not find a statistically significant relationship between household saving and GDP growth, and 3.) in line with the empirical literature, we find a bi-directional relationship between credit and GDP growth. This can only be explained by monetary analysis that allows for the unproductive use of credit. In detail,

- Understanding the role of bankers as "purchasing power producers" implies that financial development is a dynamic concept, so that its impact on growth must be analysed with the growth rates of financial aggregates. Therefore, we conduct our empirical analysis using dynamic variables and find statistically significant links between bank credit growth and GDP growth. The existing literature has generally failed to establish such a relationship, especially in the post-crisis years.
- While we find a positive and significant relationship for bank credit and GDP growth, we also find insignificant and even statistically significant negative effects of bank credit on growth, which could be due to the "secondary wave" Schumpeter alluded to. Since the

loanable funds model assumes that financing always involves an increase in the stock of capital, it is unable to deal with "unproductive credit" (Schumpeter, 1939), which finances consumption or the speculative purchase of existing assets. Monetary analysis in contrast is able to explain these effects just as the lack of a link between "savings" and the financial system that we have also established empirically.

The lack of empirical evidence for the main transmission channels of the literature and the evidence for the hypotheses of the "true" Schumpeter have implications that go beyond the finance–growth nexus. They call into question the entire macroeconomic literature on finance, which is still based on the paradigm of real analysis, where the monetary sphere is nothing but a disguised real sphere.

4 Lending a Hand to Industry: The Role of Credit for Industrial Policy in China[15]

4.1 Introduction

Especially during major economic crises, the role of the state in counterbalancing market forces is often subject of an intense debate. One country that has been establishing a hybrid economic model of market-based state intervention for many decades now, and that has been quite successful in doing so, is the People's Republic of China. Since the late 1970s, the Chinese government has been undertaking major efforts in industrial policy, initially to master the transition from a planned to a market economy, but more recently also to secure global supremacy in strategically important industries and to become more independent from foreign countries. China's state-dominated banking system is seen as playing a vital role in the financing of these endeavors (Naughton, 2021). By directing (financial) resources to drive the economic development process, the case of China can thus be seen as a particularly interesting application of Joseph A. Schumpeter's "*Theory of Economic Development*", as we will show in this paper.

While the relationship between lending and GDP growth on the one hand, and the success of individual industrial policy measures on the other have already been the subject of empirical studies for China, to the best of our knowledge, no empirical analysis of the GDP growth effect of credit, as means of financing industrial policy, has been carried out yet. Based on a self-constructed data set from Chinese provincial yearbooks and Chinese industry yearbooks, we will therefore show that (1) there is generally a positive relationship between credit provision to the corporate sector and GDP growth in China, (2) this relationship is non-linear in terms of Chinese regions , and (3) that industrial policy targeting could have led to more investment and GDP growth, however, there are differences among industries and firm types.

[15] This chapter is based on joint work with Thomas Haas. An early version appeared as Geißendörfer and Haas (2022). The paper has been submitted to a journal and is currently under review.

The rest of this paper is organized as follows: in Chapter 4.2, we briefly reintroduce Schumpeter's theory on the relationship between credit and economic development in the context of China. Chapter 4.3 discusses the characteristics of Chinese industrial policy and the structure of China's banking system over time. Chapter 4.4 provides a review of the related literature. Based on the methodological approach and the data set that is described in Chapter 4.5, we present our empirical results in Chapter 4.6. Chapter 4.7 discusses our empirical results, while Chapter 4.8 concludes.

4.2 The Schumpeterian idea of finance and growth in the context of China

As shown in chapter 2, Schumpeter's theoretical model on the nexus between finance and economic development starts in an economy in equilibrium and is developed from this point on. In this fictitious state, all resources are bound in existing combinations and not up for innovative use. To create substantial, innovative growth, existing resources in the economy have to be reallocated. As there are no "free" resources for innovative projects, they have to be taken from other endeavors for which their use was planned originally. Without credit, this can only be achieved by direct control of a central authority. The economy then reaches a "new steady state" higher than the initial steady state (Schumpeter, 1934a).

The only way to get access to resources needed for starting innovative processes without direct force lies in generating new money, as Schumpeter argues, and is thus initiated by credit creation of the banking system. Through credit creation, the existing claims on goods and services are reduced, and some goods and services ("resources"), are freed for other use or taken from the circulation of goods. These other purposes are or at least should be innovative projects leading towards economic growth. It is, however, important to note that this only holds for productive use of credit, not for unproductive credit, as this would lead to inflation at some point. The central point is therefore the productivity of the recipients of credit (Schumpeter, 1934a).

We argue that the Chinese economy is a particularly interesting application of Schumpeter's growth model, as the central role of the creator of credit, and thus purchasing power, is simultaneously taken by banks and the state. One could indeed say that China's economic system constitutes a real-life hybrid model of Schumpeter's theory. The background to this is not only that banking is hardly separable from the state in China due to the dominance of state-owned banks, but also that the Chinese state, as a "central authority", takes a highly active role in directing credit according to its strict development and industrial policy strategies, as we will show below.

4.3 Industrial policy and the banking system in China

Industrial policy can generally be defined as *"interventions intended to improve structurally the performance of the domestic business sector"* (OECD, 2022, p.4). Industrial policy strategies are thus a coherent and articulated set of policy instruments aimed at achieving a specific policy objective (OECD, 2022). While such strategies have traditionally concentrated on sectoral or regional orientations (with the objective of a catching-up process of less developed regions), more recent strategies are focused on specific technologies or follow a mission-oriented approach, i.e., a formulation of a society-wide goal to be achieved across all sectors (Larrue, 2021; Mazzucato, 2015, 2016; OECD, 2022).

4.3.1 Industrial policy in China

The idea of Chinese industrial policy originated in the search for a new economic conception after the death of Mao Zedong in 1976 (Shih, 2014). If one wants to follow a more narrow definition of "industrial policy", however, China's active industrial policy, in the sense of a future-oriented development strategy, began only from the 2010s, while previous measures were fundamentally focusing on transforming a centrally planned system into a market economy (Naughton, 2021).

The first phase of China's strengthened industrial policy is usually divided into three core elements in the literature: the launch of the *"Medium to Long term Program of Science and Technology"* (MLP), the crisis measures following the financial crisis in 2008, and the formulation of the *"Strategic Emerging Industry"* (SEI) program. Although "industrial policy" was officially mentioned for the first time in the MLP, this project initially involved only individual, experimental micro-projects, which were only brought into a systematic and larger-scale framework after the financial crisis (SEI program) (Naughton, 2021). The second phase of Chinese industrial policy, which the Chinese government calls the "*Innovation-driven Development Strategy*" (IDDS), also including "*Made in China 2025*" and "*Internet Plus*", is China's effort to bundle and expand its previous industrial policy efforts and rebuild them into a holistic and more binding approach. While many (sub-)industries were added to the IDDS, especially in the high-tech sector, almost all industries from the SEI program can also be found there, such as Information Technology, New Energy and New Energy Vehicles (Defraigne, 2014; Naughton, 2021). Therefore, in line with the literature, we consider the SEI program as the starting point of China's more targeted and long-term industrial policy in the further course of this paper.

With the *"State Council's Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries"*, published in October 2010, the Chinese government substantiated their idea of the Strategic Emerging Industries Program for the first time. The document starts with emphasizing the forward-looking role of the SEI:

> *"Strategic emerging industries are an important force to guide future economic and social development.* [...] *They are knowledge- and technology-intensive industries with low consumption of material resources, high growth potential and good comprehensive benefits. Accelerating the cultivation and development of strategic new industries is of strategic importance to the modernization of China."* (State Council of the People's Republic of China, 2010, p. 1, translated)

The program document then goes on to state that the industries that are characterized as SEIs are those that are considered to be particularly important in the future and in which **no competitors have yet established themselves worldwide** ("leap-frogging") (State Council of the People's Republic of China, 2010). The SEI's thus include 20 industries that can be aggregated into the following segments: 1.) Environmental protection and energy conservation, 2.) Information Technology (e.g. Core electronic components and high end software), 3.) Biotechnology (e.g. biopharmaceuticals and biological agriculture), 4.) (Precision) Machinery (e.g. satellites, aircraft and smart manufacturing equipment), 5.) New Energy (e.g. wind and solar power), 6.) New Materials and 7.) New Energy Vehicles (i.e., electric vehicles and hybrid vehicles) (Naughton, 2021). The general idea is that the government sets favourable conditions for firms that are part of the SEI, for example through preferential granting of credit (by state-owned financial institutions), increased investment funds (e.g. venture funds), tax exemptions or regulatory facilitation. By these means, in principle all companies within the SEI have access to (mostly indirect) governmental support (Naughton, 2021).

To date, the SEIs remain a crucial part of China's industrial policy strategy. Thereby, in contrast to earlier industrial policies, the Chinese government has set quite specific targets and timelines, not only in the presented concept paper, but especially in the subsequent sector-specific five-year plans (Naughton, 2021).

4.3.2 The role of banks in industrial policy

As we will show, bank lending has played an important role as instrument for the implementation of industrial policy in China, thus constituting a hybrid form of Schumpeter's growth model between central planning and bank-led generation of purchasing power. This has its origins in the fact that, after China abolished its Mono-banking system in 1979, the People's Bank of China (PBoC) gradually transferred its commercial functions to the so-called "Big Four" banks that are still under significant state control today (Tobin & Volz, 2018). This is not only reflected insofar as the state is the clear majority shareholder of the state-owned commercial banks (SOCB) (L. Lu, 2016), but also because all of the bank's board members and senior managers are appointed by the government, i.e., the State Council (Dong, Firth, Hou, & Yang, 2016).

Until now, those "state-owned commercial banks" remain the backbone of China's financial system (Herr, 2010). Although their dominance has fallen since the 1980s (Q. Ye, Xu, & Fang, 2012), they still account for about 37% of total assets in China today (Almanac of China's Finance and Banking, data for 2018). The second largest category of banks includes joint-stock commercial banks (JSCBs, 18% of total assets), followed by city commercial banks (13%), policy banks (10%) and rural commercial banks (9.7%). Due to their historical development, those banks are, however, also under significant state influence. Thus, around 88% of total assets can be attributed to financial institutions under full or partial state control. The same holds for lending, where *"[a] few large state-controlled banks form the core of the credit system in China"* (Vernikov, 2015, p. 180). In 2018, the SOCB's accounted for about 39.4% of total lending (Almanach of China's Finance and Banking, and Sun (2020)). Andersson, Burzynska, and Opper (2016) show that lending of the four dominating banking forms in 2008 (SOCBs, JSCBs, Policy Banks and rural commercial banks) had a combined market share of about 85% of total lending.

Furthermore, when looking at data for the sources of investment in the Chinese industry sector, it becomes clear that - after self-financing - financing through credit is the most important financial resource in China, accounting for on average 24.8% of all financing (average for the years 2010 to 2017). China's financial system is thus traditionally characterized as being bank-based (Herr, 2010), which is also reflected in its relatively low stock market capitalization (average for the years 2010 to 2017: 56% of GDP) (Beck, Demirgüç-Kunt, & Levine, 2000, 2009; Čihák, Demirgüç-Kunt, Feyen, & Levine, 2012). Bonds account for only about 0.6% of total investment financing (China Provincial Statistical Yearbooks).[16]

We thus conclude that banks, as vehicle of the state, might have a particular importance in the financing of industrial policy projects in China. As Naughton (2021, p. 122) puts it:

> *"Indeed, the commitment from the banking system inevitably sets the overall framework for the volume of resources flowing through the overall industrial policy program."*

4.4 Empirical literature review

Our paper is related to several strands of the existing empirical literature. While the general finance and growth literature (1), as well as the literature on industrial policy (2) creates the framework for our paper, we are particularly interested in the conjunction of both literature strands, with special emphasis on the Chinese case (3).

(1) Literature on finance and growth

One of the first empirical analyses of the **finance-growth nexus** was conducted by Goldsmith (1969). However, it was the seminal work of King and Levine (1993a) that led to a substantial increase in work in that field. Still today, their generally positive assessment of the finance and growth nexus is considered an important piece of evidence (Levine, 2021) and has been confirmed by several other studies, e.g. Beck, Levine, and Loayza (2000); Bezemer et al. (2016); Méndez-Heras and Ongena (2020). More recently, however, the assessment has been more heterogeneous, with studies also highlighting the risk of financial instability and crisis (Arcand et al., 2012; Cecchetti & Kharroubi, 2012; Rousseau & Wachtel, 2011).

The empirical literature on the finance and growth nexus in China generally presents a rather

[16] Other sources of investment finance (averages from 2010 to 2017): self-financed: 60.4%; state-financed: 7.1%; foreign-financed: 7% (China Provincial Statistical Yearbooks).

mixed picture. While some studies report overall negative effects of the financial system on growth (T. Chang, 2002; Guariglia & Poncet, 2008; Y. Ma & Jalil, 2008; Xu, 2016), others find more positive effects (Han & He, 2018; Jalil, Feridun, & Ma, 2010; Y. Zhang, Yao, & Zhang, 2020). Interestingly, the perception of the finance- and growth nexus in the literature on China is changing in the opposite direction to the perception in the general finance and growth literature: While this nexus is generally perceived more negatively due to the presence of vanishing effects, studies in China have recently found more positive results. Of course, there is also a problem of causality in these studies, especially since the data situation for China is generally worse than for cross-country studies. Maswana (2006) and J. Shan and Jianhong (2006), for example, show that there might be bidirectional causality between measures of financial development and GDP growth, while J. Z. Shan, Morris, and Sun (2001), J. Shan (2005) and Liang and Teng (2006) report unidirectional causality from economic growth to financial development. T. Chang (2002) found neither direction of causality to be statistically significant. J. Li (2009) detects hints for causality running from financial development to economic growth but also reports government distortions in the financial sector that appear to hinder economic growth.

Most studies with positive aggregate effects point to several caveats in their findings: Yao (2010) finds an overall positive effect but signs for inefficiencies in the credit provision. Allen, Qian, and Qian (2005) show overall positive effects of the financial system but attribute them more to alternative financing sources. Bank credit is mainly issued to state owned companies and the banking system is described as inefficient. Similarly, Cull and Xu (2000) argue that while banks chose to lend to state-owned enterprises with higher subsequent productivity in the 1980s, it softened lending constraints to SOEs in the 1990s. Aziz and Duenwald (2002) find overall positive effects but show that the effect is strongly driven by foreign investment and non-bank sources of finance. They also attribute the negative effects to large proportions of lending flowing to the SOE sector. The negative effects of the strong interrelation between the banking system and the state are also confirmed by Hasan et al. (2009), who also find positive aggregate effects of the financial system but not of bank lending. Finally, L. Zhang and Bezemer (2016) report positive effects of credit flows on economic growth but negative effects of credit stocks. They explain their findings with inefficient over-investment in gross capital formation and exports relative to consumption, which led to a reallocation of resources that was detrimental to income growth.

Some studies on the finance and growth relationship in China also focus on the **role of different types of banks** (Andersson et al., 2016; Boyreau-Debray, 2003; J. Zhang, Wang, & Wang, 2012) and show that China's bank lending favors state-owned industrial enterprises and that this lending bias reduces the effectiveness of other policies to promote growth in non-government sectors. P. C. Chang, Jia, and Wang (2010) analyze the impact of lending by state-owned commercial banks on economic growth and conclude that this relationship became more positive over time due to market-oriented reforms. Few other studies study the effects of **stock market development on economic growth** in China (Levine, 1998; Pan & Mishra, 2018).

Besides, there are also a few studies with a stronger focus on **regional differences**. K. C. Chen, Wu, and Wen (2013) for instance show that there is a strongly positive effect of finance on economic growth in high-income provinces, and a negative one for low-income provinces. Tsai, Weng, and Chang (2016) find that the positive relationship between finance and growth is especially pronounced in the eastern Chinese provinces, and more negative for western and central Chinese regions. The authors attribute this partly to the fact that lending in western regions was for a long time dominated by state-owned banks that directed credit to less efficient, state-owned enterprises.

(2) Literature on industrial policy and growth

The second strand of literature related to our paper addresses the relationship between industrial policy and economic growth. Besides more general papers that find mostly positive effects of industrial policy on growth (Bartelme, Costinot, Donaldson, & Rodríguez-Clare, 2019; Criscuolo, Martin, Overman, & Van Reenen, 2019; Farla, 2015), there are also some studies investigating the effectiveness of specific industrial policy instruments. The assessment of those instruments, such as tax exemptions, feed-in tariffs, and research and development (R&D) investment, is also rather positive (Aldy, Gerarden, & Sweeney, 2018; Bloom, Griffith, & Van Reenen, 2002; Dang & Samaniego, 2022; Lane, 2022; Wee, Coffman, & La Croix, 2018). Relatively few authors such as Beason and Weinstein (1996) and J.-W. Lee (1995) find negative effects of industrial policy.

Similarly, for the **literature on China** there seems to be an overall positive perception of industrial policy effects (Barwick, Kalouptsidi, & Zahur, 2019; Mao, Tang, Xiao, & Zhi, 2021; Wen & Zhao, 2021; Y. Wu, Zhu, & Groenewold, 2019), that also holds for investigations of specific industrial policy instruments (Aghion, Dewatripont, Du, Harrison, & Legros, 2012; Wen & Zhao, 2021). Besides, some authors have a closer look at **regional industrial policies** (see Alder, Shao, and Zilibotti (2016), J. Wang (2013) and Cheng and Kwan (2000)) or **specific industries** (e.g. Zhao, Li, Zhao, and Ma (2019), D. Zhang and Kong (2022), Shen and Luo (2015)).

(3) Literature on the role of banks for industrial policy and growth

The last strand of literature, which is the most central for us, deals with the connection of both previous strands of literature, namely the role of the financial system for industrial policy in China. There are, however, only few studies that precisely address this issue. Yet there is evidence that Chinese firms are highly dependent on formal bank lending (L.-w. Li & Kong, 2020), while higher credit provision leads to an improvement in industrial structures (Yang & Sun, 2009; C. Ye & Tang, 2018; X. Zhang & Bai, 2017). Moreover, industrial policy seems to lower the cost of borrowing for targeted industries and increases the availability of credit, especially for state-owned enterprises (SOEs) (D. Chen, Li, & Xin, 2017; Jiali & Rui, 2017; G. Li & Liu, 2020; W. Ma & He, 2017; Z. Zhang, Yu, & Zhang, 2020). If an industry receives more financial support in terms of subsidies, this could lead to more economic growth (Zheng & Shen, 2018). One of the few papers with a more negative assessment of industrial policy is by Xinmin, Zhang, and Chen (2017), who find that enterprises, especially non-SOEs and enterprises without political connections, are more dependent on finance after local governments implement industrial policy. This would make business investment less efficient.

Our paper thus contributes to the existing literature by focusing on the question, whether the Chinese banking system has, by providing credit to industries that were targeted by industrial policy (i.e., the SEI program), promoted GDP and investment growth in the past. While the relationship between credit and growth, as well as between industrial policy (instruments) and certain indicators of success, such as GDP or productivity growth, has already been examined individually in the empirical literature on China, to the best of our knowledge, no study has yet addressed this particular question.

4.5 Empirical approach

Based on Schumpeter's idea of finance and growth, the characteristics of China's development process, and in light of the literature just discussed, the following research questions therefore arise for us:

1. Is there generally a **link between credit growth and GDP growth** in China?
2. If so, was **credit to non-financial corporations** in particular even more growth-enhancing than lending overall?
3. Can this be traced back to **industrial policy**?
4. Are there heterogeneous effects observable for **individual industries**?

Our empirical analysis essentially consist of two parts: In the first part, we focus on the question to which extent lending has influenced economic growth in the Chinese provinces over the past 34 years (see chapter 4.6.1). In the second part, we will then look at the background to this relationship by analyzing whether bank-led industrial policy in China has, by directing credit to selected target industries, influenced the finance and growth channel (chapter 4.6.2).

4.5.1 Methodology

Due to the nature of our data we resort to standard panel data estimation methods to assess those questions. We choose between three estimation methods: Fixed effects (FE), random effects (RE) and pooled ordinary least squares (POLS) estimations. As POLS assumes an independent and identical distribution of residuals, thus pooling all province observations (Bell & Jones, 2015), we can quickly exclude this method from further consideration.

Given our data structure (annual observations across 31 provinces), we assume that our individual observations are correlated, so we need estimators that control for this. FE and RE both absorb the correlated, i.e., systematic variability in our data, so that afterwards only the normal error due to random deviations remains, which is thus uncorrelated and heteroskedastic (Wooldridge, 2020). In (simplified) mathematical terms we have

$$y_{it} = \beta_0 + \beta \cdot X_{it} + \eta_i + u_{it}, \qquad (7)$$

with the intercept β_0, *i* as province identifier, therefore η_i as the unobserved province effect (that could also be extended to unobserved time effects) and the error term u_{it}. The difference between RE and FE is that the individual unobserved country (and time) effects are constant, i.e. fixed, over time for FE. Accordingly we have

$$y_{it} - \bar{y}_i = \beta_0 + \beta \cdot (X_{it} - \bar{X}_i) + (\eta_i - \bar{\eta}_i) + (u_{it} - \bar{u}_i) \tag{8}$$

with $(\eta_i - \bar{\eta}_i) = 0$. In the case of RE, on the other hand, the respective time and country effects are assumed to be uncorrelated with the observations, so that $(\eta_i - \bar{\eta}_i) \neq 0$ (Wooldridge, 2020).

The standard approach in deciding between FE and RE is the Hausman test, that is, a Wald test of the difference between the FE and RE coefficients in terms of exogeneity, which, as we see above, is a critical assumption for RE, but not for FE (Wooldridge, 2002). Applying it to our data we get a preference for FE modeling, which might be considered as the *"gold standard"* in panel data modeling (Schurer & Yong, 2012). Bell and Jones (2015) and Clark and Linzer (2015), however, show that carrying out methodological decisions solely based on the Hausman test, due to its strict focus on exogeneity, might be *"neither necessary nor sufficient"*(Clark & Linzer, 2015, p. 2) as FE has some considerable disadvantages over RE, depending on the underlying research issue. They argue that, in order to understand the role of higher-level entities (here: provinces), it requires an econometric model that accounts for effects both within and between those entities. By deleting higher-level differences (between effects), as with FE modeling, one would control out heterogeneity bias, but at the cost of losing information on the underlying entities (Bell & Jones, 2015).

For this reason, we have adopted the following methodological approach: To avoid endogeneity bias, we perform FE estimations whenever possible, but always complemented by RE estimations as robustness checks. After the basic estimations, we then increasingly resort to RE in order to map province- and time period-specific features in particular.

As robustness checks we repeat our estimations with logarithmic credit growth rates and lagged credit variables. Since the literature often resorts to using 3 or 5-year averages to rule out cyclical effects we also include estimations based on 3- and 5-year moving averages. The estimation tables are provided in the Appendix, and the findings are widely in line with the results presented in section 4.6. As especially for the effect of industrial policy we are interested in the initial impulse of credit, we refrain from including 3- or 5-year averages in the industrial policy part of our estimation, but apply lagged variables and logarithmic credit growth rates.

Our representation of the economic growth process in the first part of our empirical analysis is based on the one widely used in the standard finance and growth literature. A major deviation from this lies in the use of growth rates for the credit variables, as dynamic concepts are better suited to represent the effects of lending on (also dynamic) GDP growth rates than static approaches (see also Dullien (2009), Bezemer et al. (2016) and Bofinger et al. (2021)).

Following King and Levine (1993a) in line with Barro (1991) we therefore estimate the following model:

$$GROWTH_{it} = \beta_0 + \beta \cdot FINANCE_{it} + \boldsymbol{\gamma} \cdot \mathbf{X_{it}} + \delta_t + \eta_i + u_{it} \tag{9}$$

again, with the intercept β_0, *i* as province identifier and *t* as year identifier. $GROWTH_{it}$ as the response variable equals annual real GDP growth and is therefore adjusted for inflation. $FINANCE_{it}$ pictures distinct financial development variables, hence, credit growth variables (total credit growth, $\Delta CREDIT_{tot}$, corporate credit growth, $\Delta CREDIT_{NFC}$, and growth of investment financed by credit, ΔINV_{credit}). X_{it} represents a set of different control variables. This includes, as established in the standard literature (e.g., King and Levine (1993a), Beck, Levine, and Loayza (2000), Levine and Zervos (1998), Rousseau and Wachtel (2011)), measures of education, government consumption and trade, as well as the representation of the absolute, initial GDP to control for convergence.

In detail, we include

- log(INITIAL GDP) to control for convergence (as in Barro and Sala-i Martin (1995); Barro and Sala-i Martin (1992)),
- Secondary school enrollment rate (SCHOOL) to capture human capital accumulation (see Solow (1956); Barro and Sala-i Martin (1995)),

and macroeconomic indicators, as

- General government expenditure (log(GOV)) (refering amongst others to Easterly and Rebelo (1993); S. Fischer (1993)), and
- Trade (log(OPENNESS)), as the sum of exports and imports divided by GDP (see Balassa (1978); Krueger (1998))

u_{it} is the random error term, δ_t includes time fixed effects, and η_i controls for province fixed effects. Furthermore we add time dummies to account for trends in our data, and include robust standard errors for heteroscedasticity. All variables are collected from the Chinese Provincial Statistical Yearbooks (see chapter 4.5.2).[17]

Following our estimations on the relationship between credit and GDP growth, we methodically use the same approach to assess the success of industrial policy through the credit channel in the second part of our empirical analysis. Referring to random effects estimations, we therefore analyze the relationship of credit and GDP growth, as well as of credit and investment growth before and after the start of SEI measures in 2010, as our proxy for (more narrow) industrial policy, and perform robustness checks with respect to credit type and target industry. To show in more detail, how targeted credit provision as an industrial policy instruments affects firms, we supplement our GDP growth estimation with the following investment growth equation:

$$INV_{it} = \beta_0 + \beta \cdot FINANCE_{it} + \boldsymbol{\gamma} \cdot \mathbf{X_{it}} + \delta_t + \eta_i + u_{it}, \tag{10}$$

with INV_{it} being growth of investment in fixed assets and $FINANCE_{it}$ as financial development variable, i.e., credit growth. The set of control variables X_{it} includes industrial revenues, ownership (volume of state capital, resp. foreign capital in an industry) and dummy variables for Chinese regions.[18] We collected the data for estimating the investment equation from the China Industry Statistical Yearbooks that aggregate firm data at the total industry level, and also by industrial sector.

[17] A detailed listing of all variable definitions and sources can be found in the Appendix.

[18] The selection of these variables depends predominantly on the availability of data in the Chinese Industry Statistical Yearbooks.

4.5.2 Data set

In line with Kerola and Mojon (2021) and Aziz and Duenwald (2002) we argue that using province data to analyze China's development is more informative than using aggregated data for the country as a whole. Another advantage of this approach is that provincial data are commonly seen as being of better quality and more reliable. Furthermore, we draw on official Chinese statistics for the whole data set, so that the data is internally consistent, even if systematic measurement errors cannot be ruled out. Thus, our main dataset contains data from 31 provinces over the period from 1985 to 2019, all retrieved from the China statistical yearbooks database, which gives us access to the annual *"Provincial Yearbooks"* of the National Bureau of Statistics of China (NBS).[19]

Since the variables from the *Provincial Yearbooks* are largely not available as uniform time series, but are provided in individual files of different formats, organized by individual years and individual provinces, the creation of a uniform dataset required the manual review and transformation of these raw data in over 10,000 excel spreadsheets. To our knowledge, no comparable credit data set based on the Chinese Provincial Statistical Yearbooks exists that would allow a detailed analysis of the finance and growth relationship at the provincial level in China. While some variables have relatively good availability, e.g. data on population, GDP and investment, other data such as sector-level credit variables are only available in a fragmented way.[20] This means that the credit variables provided per province have changed over the years. Specifically, for example, for Anhui province, data for total credit are consistently and uniformly available from 1985 to 2018. Credit data for enterprise sectors are not consistent and explicitly reported. Instead, data for industry credit, commercial credit, enterprise credit, construction credit or innovation credit are available from 1990 to 2009. Between 2010 and 2014, only unit credit data are available, and from 2015 to 2019, these are labeled enterprise or business credit. While the data are thus internally consistent, structural breaks are unavoidable when they are merged. These would distort our estimation results.

For this reason, and because credit growth rates are also the more relevant variables from a theoretical point of view (Bofinger et al., 2021; Dullien, 2009), we first calculated internally

[19] The database is not freely accessible and was obtained through the paid service provider CrossAsia.
[20] An overview of all variables used can be found in Table 52 in the Appendix.

consistent growth rates for all individual data series, then merged them into one data series ($CREDIT_{NFC}$) and interpolated them.[21] Thus, $CREDIT_{NFC}$ represents a proxy for credit to the non-financial corporate sector. As a large share of business / unit credit flows to the industrial sector, this data series is closely related to credit to the industrial sector. Time series for total credit and investment financed by credit were uniformly available.

Variable	n	Mean	Median	Standard deviation	Min. value	Max. value
ΔGDP_{real}	1,085	.1486019	.1396355	.0767196	-.1015	.5157978
log(INITIAL GDP)	1,085	7.887701	7.957527	1.734574	2.829087	11.58977
SCHOOL	1,111	.3649428	.3756213	.0881579	.1081185	.603925
log(GOV)	1,115	6.159305	6.114346	1.829535	1.774952	9.765993
log(OPENNESS)	1,090	-3.678122	-4.024214	1.162173	-6.805961	.795448
$\Delta CREDIT_{tot}$	992	24.41916	.1673668	539.5656	-.9998846	12327.35
$\Delta CREDIT_{NFC}$	1,054	.1389735	.1291336	.1669354	-.3989602	2.885309
ΔINV_{credit}	899	.2066672	.156876	.4074168	-.9997833	6.19027

Table 6: Descriptive statistics (macro panel).
Source: China Provincial Statistical Yearbooks.

We also use aggregate firm balance sheet data in the second part of our analysis, also reported at the 31-province level, and from 1985 to 2020. However, this panel is even more fragmented than the previous macro panel. The data also come from the Chinese statistical yearbooks database ("*China Industry Statistical Yearbooks*", various volumes), and include variables for profits and revenues, investments, ownership shares, assets, and liabilities, among others. For all sectors, the most central variable for us, $CREDIT$, is approximated from the difference in liabilities and owner's equity.

Variable	n	Mean	Median	Standard deviation	Min. value	Max. value
ΔINV_{tot}	1,014	.1954235	.1810637	.1580953	-.6351365	1.162663
ΔINV_{auto}	156	.187439	.0781992	.666351	-.9115297	4.777609
ΔINV_{energy}	526	.6200826	.1482293	10.06496	-.993197	230.8935
$\Delta STATECAP_{ind}$	589	.1332996	.0819591	.3836459	-.8606861	3.616322
$\Delta FORECAP_{ind}$	557	.2663167	.0816602	2.675658	-.80000	62.33333
ΔREV_{ind}	1,052	.1609298	.151823	.1529956	-.4164921	1.333333
$\Delta CREDIT_{firm}$	545	.1434175	.0825537	.5407102	-.9327303	8.551471
$\Delta CREDIT_{state}$	526	.1582304	.0713436	.5747422	-.7894853	8.257886
$\Delta CREDIT_{private}$	419	1.384476	.2556187	11.47857	-.9933515	161.0615

Table 7: Descriptive statistics (aggregated firm balance sheet data).
Source: China Industry Statistical Yearbooks.

One advantage of this data set is that the aggregated company data is given for the entire Chinese industrial sector on the one hand, but also subdivided by ownership structure, i.e. by state

[21] Our subsequent results refer to the interpolated credit data series, but are also robust using the non-interpolated data series.

and private ownership, and by industrial sector, i.e. by automobile or energy sector[22]. Particularly when subdivided by industrial sector, however, the availability of data diminishes, so that observations for the automotive sector do not start until 2012, and for the energy sector not until 2005. Also, there is no data available for other important ownership groups, such as joint ventures or collective enterprises.

4.6 Empirical analysis

4.6.1 Finance and growth nexus in China

We now turn to the results of our empirical analyses. To begin with we present the results from estimating the baseline form of the finance and growth equation introduced earlier in chapter 4.5 (see Tables 8 and 9).

The results for all control variables are as expected. Due to convergence, $log(INITIALGDP)$ has a significantly negative effect on real GDP growth, secondary schooling is - even though not significantly - positively related to growth, and government expenditures have a significantly positive effect as well. The results for fixed effects and random effects estimations are quite similar, except for the trade indicator ($log(OPENNESS)$). However, its effect is approximately zero for both estimation methods. For $\Delta CREDIT_{NFC}$ we find statistically significant positive effects on GDP growth. $\Delta CREDIT_{tot}$ also has a significant growth effect that is, however, negligible in size. Credit-financed investment is only significant for the RE estimation and insignificant for FE.

As the effect of credit on GDP growth could also materialize with a time lag, we also include lagged credit variables in our estimations. Our findings show that our previous results are also robust to using lags up to two years (*l1* and *l2*), although some variables become insignificant for two lags. The previous findings are robust to including 3- and 5-year averages. For all subsequent estimations we show the effects of lagged credit variables, 3- and 5-year averages in the Appendix.

[22] In the China Industry Statistical Yearbook, this sector is called "Production of Electricity, Heat, Gas, Water".

	FE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.118***	-0.124***	-0.131***	-0.101***	-0.0974***	-0.0982***	-0.109***	-0.118***	-0.128***
	(0.0239)	(0.0238)	(0.0237)	(0.0231)	(0.0194)	(0.0230)	(0.0212)	(0.0210)	(0.0185)
$SCHOOL$	0.0899	0.0863	0.0790	0.0791	0.0710	0.0913	0.0730	0.0738	0.0727
	(0.0562)	(0.0569)	(0.0563)	(0.0583)	(0.0554)	(0.0583)	(0.0609)	(0.0619)	(0.0624)
$log(GOV)$	0.118***	0.119***	0.122***	0.107***	0.103***	0.107***	0.114***	0.118***	0.122***
	(0.0220)	(0.0222)	(0.0219)	(0.0202)	(0.0190)	(0.0206)	(0.0194)	(0.0194)	(0.0183)
$log(OPENNESS)$	-0.00903**	-0.00923**	-0.0106**	-0.00838*	-0.00979*	-0.00724*	-0.00952**	-0.00967*	-0.0125**
	(0.00409)	(0.00434)	(0.00458)	(0.00414)	(0.00493)	(0.00382)	(0.00462)	(0.00528)	(0.00502)
$\Delta CREDIT_{tot}$	7.47e-07**								
	(3.32e-07)								
$\Delta CREDIT_{tot(l1)}$		1.65e-06***							
		(4.31e-07)							
$\Delta CREDIT_{tot(l2)}$			6.11e-07						
			(4.16e-07)						
$\Delta CREDIT_{NFC}$				0.0151*					
				(0.00778)					
$\Delta CREDIT_{NFC(l1)}$					0.0162*				
					(0.00916)				
$\Delta CREDIT_{NFC(l2)}$						-0.00116			
						(0.0142)			
ΔINV_{credit}							0.00249		
							(0.00248)		
$\Delta INV_{credit(l1)}$								0.000559	
								(0.00287)	
$\Delta INV_{credit(l2)}$									-0.00403
									(0.00324)
Constant	0.281***	0.311***	0.340***	0.248***	0.240**	0.239**	0.289***	0.323***	0.351***
	(0.0960)	(0.0964)	(0.101)	(0.0890)	(0.0876)	(0.0899)	(0.0971)	(0.0991)	(0.0962)
Observations	981	957	931	1,040	1,016	1,009	891	877	863
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.726	0.719	0.714	0.736	0.749	0.742	0.726	0.715	0.711

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Growth effects of dynamic credit indicators and lagged credit indicators, estimated with Fixed Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0102*	-0.0126**	-0.0206***	-0.0142***	-0.0175***	-0.0144**	-0.0313***	-0.0212***	-0.0151**
	(0.00549)	(0.00558)	(0.00579)	(0.00548)	(0.00543)	(0.00606)	(0.00697)	(0.00627)	(0.00594)
$SCHOOL$	0.00352	0.0149	0.0435	-0.00208	-0.00227	0.00451	0.0296	0.00115	-0.0262
	(0.0618)	(0.0611)	(0.0583)	(0.0621)	(0.0587)	(0.0624)	(0.0624)	(0.0647)	(0.0653)
$log(GOV)$	0.0179**	0.0214**	0.0331***	0.0249***	0.0298***	0.0242**	0.0502***	0.0348***	0.0260***
	(0.00862)	(0.00897)	(0.00958)	(0.00923)	(0.00921)	(0.00999)	(0.0111)	(0.0103)	(0.00958)
$log(OPENNESS)$	0.000609	0.000732	0.000185	0.000656	2.15e-05	0.000720	0.000113	0.00109	0.00180
	(0.00215)	(0.00222)	(0.00249)	(0.00223)	(0.00236)	(0.00227)	(0.00246)	(0.00243)	(0.00238)
$\Delta CREDIT_{tot}$	1.66e-06***								
	(4.62e-07)								
$\Delta CREDIT_{tot(l1)}$		2.91e-06***							
		(5.41e-07)							
$\Delta CREDIT_{tot(l2)}$			1.77e-06***						
			(5.08e-07)						
$\Delta CREDIT_{NFC}$				0.0261***					
				(0.00944)					
$\Delta CREDIT_{NFC(l1)}$					0.0253**				
					(0.0109)				
$\Delta CREDIT_{NFC(l2)}$						0.00939			
						(0.0175)			
ΔINV_{credit}							0.00590**		
							(0.00274)		
$\Delta INV_{credit(l1)}$								0.00404	
								(0.00275)	
$\Delta INV_{credit(l2)}$									-0.00197
									(0.00292)
Constant	0.140***	0.138***	0.126***	0.137***	0.129***	0.145***	0.151***	0.166***	0.178***
	(0.0334)	(0.0340)	(0.0362)	(0.0375)	(0.0316)	(0.0340)	(0.0288)	(0.0287)	(0.0285)
Observations	981	957	931	1,040	1,016	1,009	891	877	863
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.715	0.707	0.701	0.724	0.740	0.732	0.713	0.701	0.697

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Growth effects of dynamic credit indicators and lagged credit indicators, estimated with Random Effects.

Due to the empirically substantiated differences in the economic development of the Chinese provinces (see box 2), we now want to add a **regional component** to our previous empirical analysis.

Box 2:

A look at the real GDP growth rates of all Chinese provinces suggests systematic regionally different growth dynamics, which we have to take into account in our subsequent estimations. At the median from 2010 to 2019, provincial growth varied significantly, from 3.72 percent annually in Heilongjiang to 15.16 percent in Guizhou. The strongest growth rates were recently observed in the western part of the country (see figures below). As we will show in more detail later, this is related to the catching-up process of China's western provinces. Between 1990 and 1999, by contrast, the eastern coastal provinces grew much faster, with median growth rates of 26.36 percent in Fujian and 24.13 percent in Shanghai, with the central Chinese provinces of Yunnan and Shanxi bringing up the rear with growth rates of about 15 percent. Needless to say, growth rates at the end of the 20th century were much higher than today, averaging 19 percent.

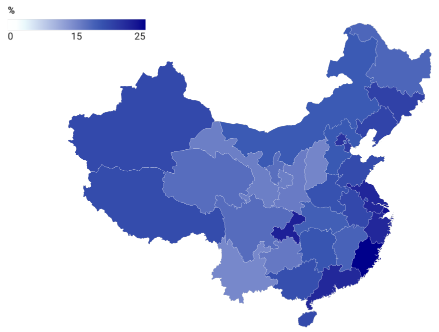


Figure 12: Median values of real GDP growth in the years 1990-1999, China.

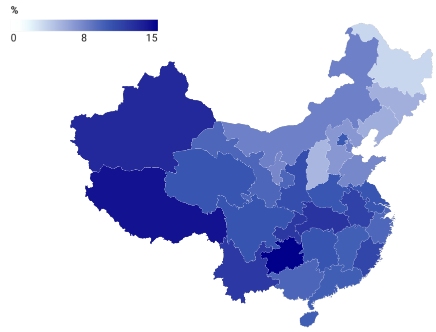


Figure 13: Median values of real GDP growth in the years 2010-2019, China.

Source: China Provincial Statistical Yearbooks.

Therefore, in the remainder of this paper we will work with a geographical classification of all provinces into the regions "Western China", "East Coast" and "Central and Northern China". This classification is based on similar economic developments of the provinces in the past that can be described as follows:

- **East Coast:** During China's transition from a centrally planned to a market economy, the establishment of special economic zones (SEZs) played an important role. Because of their advantageous location for international trade, the east coast provinces of Shanghai, Guangdong, Fujian and Hainan were chosen for this purpose. Based on this, and other preferential policies, the provinces on the east coast are still the most prosperous and populous in the country today (Crane, Albrecht, Duffin, & Albrecht, 2018).

- **Western China:** Since the originally intended spill-over effects of the East Coast region on the other provinces of China did not materialize and the regional disparities became increasingly clear, the government launched the "China Western Development" program in the late 1990s. As a result, the western regions, which are predominated by agriculture, received support for the expansion of infrastructure, education and health care, as well as preferential policies for foreign direct investment (FDI) (Crane et al., 2018). The Belt and Road Initiative, announced in 2009, is further favouring economic development in China's western regions.
- **Central and Northern China:** Also in central and northern China, only limited spillover effects from the coastal regions could be observed, which is why similar development programs were launched for these regions from the early 2000s (called "Rise of Central China" and "Revitalize Northeast China"). Both regions have structural problems, which, in addition to their poorer location compared to the coastal regions, stem in particular from the many state-owned enterprises (SOEs) located in central and northern China, as these regions are relatively rich in natural resources. For this reason, only few FDI flow there and productivity is lower (Crane et al., 2018). While the central provinces benefit from at least minor spillover effects, however, the northern provinces (especially Heilongjiang and Jilin) are also referred to as China's "Rust Belt". This is because these regions are home to a lot of state-owned heavy industry, which has become increasingly unprofitable over time due to decreasing global demand. At the same time, these companies are considered particularly inflexible in adapting to the new market situation (Rechtschaffen, 2017).

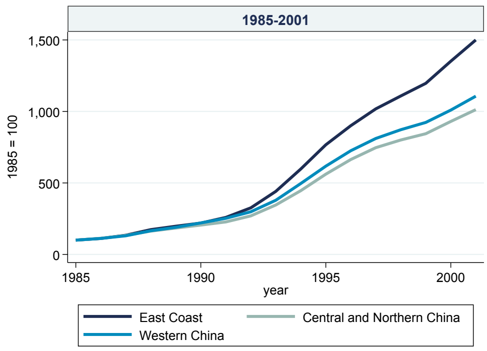


Figure 14: Indexed means of GDP by Chinese region (1985 = 100), range 1985 - 2001.

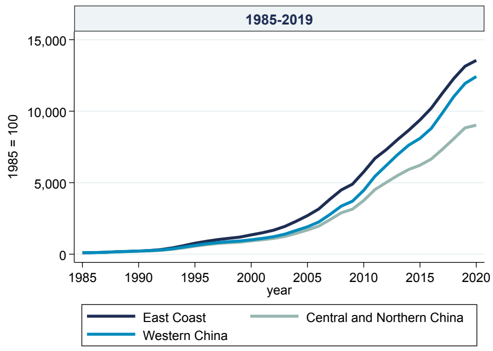


Figure 15: Indexed means of GDP by Chinese region (1985 = 100), full range.

Source: China Provincial Statistical Yearbooks.

The structural differences between the individual regions just described are also reflected in their GDP growth rate trajectories. Until 2001, the eastern provinces clearly dominated the rest, both indexed and in absolute GDP values. From the mid-2000s onward, the western Chinese provinces began to catch up, whereas central and northern China followed a much flatter development path. However, with a GDP of approximately RMB 50.98 trillion (about USD 7.61 trillion), eastern China still accounts for about 51.9 percent of China's total GDP today (as of 2019). In the same year, central and northern China combined had a GDP of RMB 26.76 trillion (USD 4.0 trillion) and western China had a GDP of RMB 20.49 trillion (USD 3.06 trillion).

Hence, we repeat our baseline estimation by adding regional dummy variables, $GEO_{centralnorth}$ and GEO_{west}, and by controlling for periodic differences by adding a time dummy ($year_{2001}$). While the geographical classification of all provinces into the regions "Western China", "East Coast" and "Central and Northern China" is grouping them by similar economic developments in the past, 2001 equivalences the year of China's accession to the World Trade Organization (WTO). GEO_{east} serves as reference category, because it is the most developed today, and because there are strong political efforts to bring the other regions in line with the economic situation of the East Coast.

Our estimation results can be found in Table 10. Due to the nature of FE we will now focus on the RE results. Our results show that, compared to the development on the East Coast, economic growth was overall significantly weaker in the central and northern region of China, while there is no statistically significant difference between the economic development of the western and eastern provinces of China. However, this was not the case before the year 2001, when western regions had also significantly lower GDP growth rates than the Chinese East coast region.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year <2001			year >= 2001	
$log(INITIALGDP)$	-0.0174**	-0.0201***	-0.0459***	-0.0141	-0.00821	-0.0275**	-0.0325***	-0.0350***	-0.0388***
	(0.00793)	(0.00763)	(0.0106)	(0.0148)	(0.0134)	(0.0121)	(0.00903)	(0.00852)	(0.00949)
$SCHOOL$	0.0431	0.0295	0.0551	0.00384	-0.0269	-0.0435	0.0599	0.0614	0.0631
	(0.0552)	(0.0547)	(0.0566)	(0.0705)	(0.0635)	(0.0691)	(0.0530)	(0.0489)	(0.0518)
$log(GOV)$	0.0292**	0.0341***	0.0698***	0.0282	0.0212	0.0451***	0.0505***	0.0543***	0.0600***
	(0.0114)	(0.0112)	(0.0146)	(0.0190)	(0.0166)	(0.0173)	(0.0140)	(0.0131)	(0.0143)
$log(OPENNESS)$	-0.00613*	-0.00549	-0.00784**	-0.00171	5.40e-05	-0.00243	-0.00495	-0.00432	-0.00379
	(0.00335)	(0.00334)	(0.00360)	(0.00450)	(0.00418)	(0.00471)	(0.00386)	(0.00370)	(0.00390)
$\Delta CREDIT_{tot}$	2.41e-06***			0.00456			1.47e-06***		
	(5.93e-07)			(0.00418)			(3.92e-07)		
$\Delta CREDIT_{NFC}$		0.0256***			0.0256			0.0201***	
		(0.00854)			(0.0200)			(0.00672)	
ΔINV_{credit}			0.00417			0.00971			0.00247
			(0.00261)			(0.00936)			(0.00316)
$GEO_{centralnorth}$	-0.0271***	-0.0261**	-0.0332***	-0.0322***	-0.0298***	-0.0363***	-0.0207*	-0.0184	-0.0171
	(0.0104)	(0.0102)	(0.0124)	(0.0103)	(0.00973)	(0.0122)	(0.0124)	(0.0119)	(0.0128)
GEO_{west}	-0.0168	-0.0167	-0.0295**	-0.0270*	-0.0225*	-0.0350**	-0.00906	-0.00933	-0.00890
	(0.0112)	(0.0110)	(0.0135)	(0.0142)	(0.0127)	(0.0146)	(0.0116)	(0.0111)	(0.0121)
Constant	0.115***	0.117***	0.144***	0.132***	0.140***	0.182***	-0.110**		-0.0609
	(0.0328)	(0.0354)	(0.0256)	(0.0378)	(0.0380)	(0.0300)	(0.0546)		(0.0662)
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.715	0.724	0.713	0.700	0.705	0.708	0.691	0.713	0.658

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

After 2001, we cannot observe any statistically significant differences from the GDP growth of western and central-northern provinces to the GDP growth of eastern provinces, except for total credit in the central-northern provinces. In other words, economic growth in eastern provinces (that were the first to experience an economic boom after China's opening up) slowed over the last two decades in comparison to those provinces that are currently in the development process. This illustrates the convergence process that regions outside the East Coast have been undergoing in recent decades. What we are, however, particularly interested in is what role (bank) lending has played in this process.

We therefore extend our baseline credit and growth estimations with an interaction of the regional dummy variables and our credit variables (Table 11).

When adding the interaction terms, our first finding is that especially the coefficient of corporate credit growth (without interaction) is now dramatically increasing compared to the results from Table 10. The interaction terms show the combined effect of credit growth and a province being in a specific region vis-à-vis credit provision in eastern provinces. Again, credit provision to western and central-northern provinces is in general less growth-enhancing than credit provision to eastern provinces. Significant results can be found in particular for the corporate credit variables. Total credit provision to central-northern provinces seems to be slightly less effective than to western regions in terms of GDP growth, particularly after 2001. Hence, our results that are also robust for using logarithmic growth rates and moving averages, indicate a vanishing of significant differences between lending to central-northern or western provinces after 2001 compared to eastern provinces.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year <2001			year >= 2001	
$log(INITIALGDP)$	-0.0171**	-0.0191**	-0.0522***	-0.0134	-0.00769	-0.0277**	-0.0262***	-0.0343***	-0.0320***
	(0.00796)	(0.00748)	(0.0116)	(0.0142)	(0.0133)	(0.0117)	(0.00932)	(0.00833)	(0.00883)
$SCHOOL$	0.0386	0.0185	0.0589	0.0178	-0.0265	-0.0393	0.0539	0.0524	0.0591
	(0.0567)	(0.0546)	(0.0564)	(0.0673)	(0.0640)	(0.0683)	(0.0554)	(0.0521)	(0.0540)
$log(GOV)$	0.0287**	0.0332***	0.0783***	0.0275	0.0208	0.0452***	0.0423***	0.0536***	0.0501***
	(0.0114)	(0.0111)	(0.0156)	(0.0183)	(0.0166)	(0.0168)	(0.0139)	(0.0130)	(0.0139)
$log(OPENNESS)$	-0.00606*	-0.00502	-0.00842**	-0.00206	-0.000133	-0.00286	-0.00488	-0.00404	-0.00430
	(0.00332)	(0.00310)	(0.00361)	(0.00410)	(0.00413)	(0.00469)	(0.00378)	(0.00357)	(0.00381)
$\Delta CREDIT_{tot}$	0.0125			0.0755			0.00398		
	(0.0162)			(0.0732)			(0.00539)		
$\Delta CREDIT_{NFC}$		0.0878***			0.0611***			0.0589***	
		(0.0165)			(0.0220)			(0.0220)	
ΔINV_{credit}			0.00972*			0.0284			0.000555
			(0.00558)			(0.0238)			(0.00520)
$GEO_{centralnorth}$	-0.0245**	-0.0154	-0.0333***	-0.0348*	-0.0211**	-0.0339**	-0.0185	-0.0129	-0.0151
	(0.0110)	(0.00960)	(0.0127)	(0.0179)	(0.0103)	(0.0132)	(0.0124)	(0.0107)	(0.0130)
GEO_{west}	-0.0144	-0.00468	-0.0313**	-0.0105	-0.0127	-0.0280**	-0.0189	-0.00351	-0.00791
	(0.0116)	(0.0103)	(0.0138)	(0.0193)	(0.0114)	(0.0139)	(0.0116)	(0.00995)	(0.0119)
$\Delta CREDIT_{tot} * GEO_{centralnorth}$	-0.0125			0.0210			-0.00398		
	(0.0162)			(0.0735)			(0.00539)		
$\Delta CREDIT_{tot} * GEO_{west}$	-0.0119			-0.0756			0.0751***		
	(0.0160)			(0.0732)			(0.0262)		
$\Delta CREDIT_{NFC} * GEO_{centralnorth}$		-0.0678***			-0.0511			-0.0402*	
		(0.0176)			(0.0316)			(0.0235)	
$\Delta CREDIT_{NFC} * GEO_{west}$		-0.0769***			-0.0558**			-0.0421*	
		(0.0199)			(0.0271)			(0.0253)	
$\Delta INV_{credit} * GEO_{centralnorth}$			-0.00915			-0.0125			-0.00988
			(0.0107)			(0.0304)			(0.0115)
$\Delta INV_{credit} * GEO_{west}$			-0.00879			-0.0319			0.00515
			(0.00629)			(0.0259)			(0.00679)
Constant	0.113***	0.110***	0.144***	0.106***	0.132***	0.175***			
	(0.0326)	(0.0353)	(0.0273)	(0.0378)	(0.0384)	(0.0288)			
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.715	0.725	0.712	0.703	0.704	0.708	0.692	0.712	0.659

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

As we have outlined in the literature review, a substantial, more recent strand of the literature on the relationship between finance and growth also emphasizes the importance of controlling for the **size of the financial system**. For this reason, we now also extend our analysis to include **(a)** a dummy variable, $d10(CREDIT/GDP)$, that contains the province- and time-crossing observation points that belong to the top 10 percent of the total CREDIT/GDP variable (columns (1) to (3) and (7) to (9)), and **(b)** a restriction of our dataset ("if-condition") to the observations that contain only the bottom 90 percent of the total CREDIT/GDP observations (columns (4) - (6) and (10) to (12)). Accordingly, the estimation results for category (a) must be interpreted in relation to all other deciles, while those for category (b) are interpretable in absolute terms. In that way, we approximate a measure for the size of the financial system. The results of this analysis are given in Table 12.

Compared to the baseline, full sample estimation from Table 8 and 9, no major deviations can be observed in the results for the credit variables. However, they become apparent for corporate credit growth. Once controlling for the size of the financial system, not only the effect size of $\Delta log(CREDIT_{NFC})$ increases considerably, but also the significance levels in the case of the FE modeling.

However, we see that the dummy variable for the top 10% in total CREDIT/GDP is always positive and partially significant. This indicates that the observation units that have a relatively large financial system also have higher real GDP growth rates than observation units with a smaller financial system. However, what is interesting for us is not so much this isolated effect, but the extent to which the size of the financial system affects the impact of lending on GDP growth. For this reason, we introduce an interaction term consisting of the $d10(CREDIT/GDP)$ dummy variable and the three credit variables. For all three estimates, we obtain a negative growth effect of this interaction term. The effect is highly statistically significant for corporate credit growth in the FE estimation and credit financed investment in the RE estimation. We conclude that lending to the lower financial system deciles (i.e., 1st to 9th decile) might be more growth-enhancing than lending to provinces that already have a particularly large financial system at a given point in time. This is consistent with results found in the cross-country literature.

	FE						RE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent: ΔGDP_{real}				$d(CREDIT/GDP) \leq 9$						$d(CREDIT/GDP) \leq 9$		
$log(INITIALGDP)$	-0.120***	-0.107***	-0.107***	-0.135***	-0.119***	-0.112***	-0.00927	-0.0133**	-0.0295***	-0.00644	-0.00816	-0.0140*
	(0.0242)	(0.0233)	(0.0214)	(0.0247)	(0.0238)	(0.0208)	(0.00631)	(0.00628)	(0.00742)	(0.00765)	(0.00759)	(0.00846)
$SCHOOL$	0.106*	0.0968	0.0851	0.0890	0.0731	0.0834	0.0378	0.0284	0.0424	0.0185	0.00578	-0.0169
	(0.0598)	(0.0612)	(0.0619)	(0.0717)	(0.0765)	(0.0701)	(0.0616)	(0.0628)	(0.0624)	(0.0637)	(0.0637)	(0.0698)
$log(GOV)$	0.118***	0.109***	0.114***	0.141***	0.128***	0.135***	0.0162*	0.0227**	0.0471***	0.0117	0.0144	0.0234*
	(0.0220)	(0.0201)	(0.0194)	(0.0205)	(0.0187)	(0.0172)	(0.00958)	(0.0102)	(0.0117)	(0.0110)	(0.0111)	(0.0122)
$log(OPENNESS)$	-0.00771*	-0.00875**	-0.00985**	-0.00799*	-0.00934*	-0.0139**	-2.86e-05	-0.000101	-0.000361	0.00122	0.00109	0.00136
	(0.00441)	(0.00423)	(0.00474)	(0.00468)	(0.00464)	(0.00543)	(0.00222)	(0.00228)	(0.00239)	(0.00225)	(0.00210)	(0.00202)
$\Delta CREDIT_{tot}$	7.70e-07**			7.16e-07*			1.73e-06***			1.95e-06***		
	(3.43e-07)			(3.96e-07)			(4.73e-07)			(4.95e-07)		
$\Delta CREDIT_{NFC}$		0.0212**			0.0200**			0.0318***			0.0323***	
		(0.00848)			(0.00812)			(0.0113)			(0.0111)	
ΔINV_{credit}			0.00563			0.00427			0.00938**			0.0103**
			(0.00403)			(0.00404)			(0.00412)			(0.00462)
$d10(CREDIT/GDP)$	0.0133	0.0163**	0.00976				0.000419	0.00892*	0.00359			
	(0.0111)	(0.00712)	(0.00833)				(0.00588)	(0.00482)	(0.00553)			
$d10(CREDIT/GDP) * \Delta CREDIT_{tot}$	-0.0134						0.0259					
	(0.0300)						(0.0207)					
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC}$		-0.0292*						-0.0265				
		(0.0160)						(0.0189)				
$d10(CREDIT/GDP) * \Delta INV_{credit}$			-0.00797						-0.00888*			
			(0.00475)						(0.00469)			
Constant	0.294***	0.260***	0.273***	0.304**	0.262**	0.209**	0.126***	0.122***	0.145***	0.138***	0.136***	0.170***
	(0.0998)	(0.0902)	(0.0991)	(0.113)	(0.106)	(0.0993)	(0.0342)	(0.0388)	(0.0292)	(0.0317)	(0.0350)	(0.0280)
Observations	928	960	856	834	858	771	928	960	856	834	858	771
Number of Provinces	31	31	31	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.720	0.727	0.726	0.723	0.727	0.725	0.708	0.715	0.712	0.713	0.715	0.712

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Growth effects of dynamic credit indicators with dummy variable for credit to GDP share, estimated with Fixed Effects and Random Effects.

In summary, it can be concluded from this first part of our empirical analysis that there is generally a positive relationship between finance (i.e., growth of lending) and GDP growth in China. However, this relationship exists mainly when looking at credit dynamics in the corporate sector; total credit ($\Delta CREDIT_{tot}$), on the other hand, has a less significant and only small positive contribution to growth in China. This highlights the importance of a differentiated data set that goes beyond aggregate credit variables at the provincial level.

Moreover, we have so far been able to show that there are both temporal and geographic differences in the Chinese growth process and in the effect of credit on it. While China's eastern provinces exhibited much stronger GDP growth rates than the western and central-northern provinces, especially before 2001, the latter were able to catch up in the years thereafter. Also, the size of the financial system significantly influences the relationships within the finance-growth nexus, in the sense that credit to provinces with a high credit-to-GDP ratio might be negatively affecting GDP growth in China. In this context there is also a growing literature that observes credit bubbles in China and warns of possible risks associated with it (S. Chen & Kang, 2018). Inefficient lending or use of credit or overinvestment can lead to such bubbles, which can result in financial crises and economic collapses and/or inflation. While there were temporarily higher inflation rates in China in the 1980s and 1990s, however, Chinese economic policy has so far managed to control risks to the extent that the Chinese economy has continued to grow strongly without high inflation or bursting financial bubbles.

4.6.2 Industrial policy, banks and growth

To test the hypothesis, that the government (by means of state-owned banks) may have influenced China's GDP growth in the past through targeted lending to individual industries, we now need to identify an indicator for "industrial policy". Due to the wide range and increasing interconnectedness of the targeted industries, as well as the limited detail of data from official Chinese statistics, we thereby have to resort to including a time dummy variable. Unfortunately, an experimental approach (effect of measures in targeted industry before and after the start of measures vs. situation in the comparison group) is not possible for the same reasons and because some of the time series in our data set on specific industries only start after the beginning of the industrial policy support. Thus, a before/after assessment of treatments is not possible. However, we know from the literature (e.g. Naughton (2021)) that China's targeted, i.e. vertical, industrial policy did not begin until the mid-2000s, and was first systematized with the Strategic Emerging Industries (SEI) Program in 2010. For this reason, we use 2010 as the starting point of industrial policy measures for our analysis.

We then start to repeat the finance and growth estimations, again including the usual control, credit and region variables, but now expanding them to include the $year_{>2010}$ dummy. Thus, our focus is now no longer on showing provincial convergence after 2001, but on testing the effectiveness of China's systematic industrial policy efforts after 2010, compared to the time before.

The results in Table 13 indicate that GDP growth rates before 2010 were significantly higher than those after 2010, consistent with the results we obtained earlier when dividing the data set into the pre- and post-2001 periods. This can be attributed to the development process of China's provinces, leading to decreasing GDP growth rates after the year 2010, as the stronger growth process had already taken place before.

What is of particular interest to us, however, is whether the effect of credit on growth has changed significantly since the intensified efforts of industrial policy were rolled out, starting in 2010. Our data suggest that this was the case. Corporate credit growth after 2010 had a significantly more positive effect on the GDP growth rate than credit provision before 2010. At the same time we know that credit provision to non-financial corporations generally provided a significantly positive growth impulse in the past. These results are also robust if we include lags or logarithmic credit growth rates.

Dependent: ΔGDP_{real}	RE (1)	(2)	(3)	(4)
$log(INITIALGDP)$	-0.0174**	-0.0174**	-0.0201***	-0.0150**
	(0.00793)	(0.00793)	(0.00763)	(0.00761)
$SCHOOL$	0.0431	0.0413	0.0295	0.0209
	(0.0552)	(0.0556)	(0.0547)	(0.0539)
$log(GOV)$	0.0292**	0.0290**	0.0341***	0.0272**
	(0.0114)	(0.0114)	(0.0112)	(0.0110)
$log(OPENNESS)$	-0.00613*	-0.00613*	-0.00549	-0.00476
	(0.00335)	(0.00334)	(0.00334)	(0.00332)
GEO_{west}	-0.0168	-0.0169	-0.0167	-0.0141
	(0.0112)	(0.0112)	(0.0110)	(0.0106)
$GEO_{centralnorth}$	-0.0271***	-0.0269***	-0.0261**	-0.0241**
	(0.0104)	(0.0104)	(0.0102)	(0.0101)
$\Delta CREDIT_{tot}$	2.41e-06***	0.00419		
	(5.93e-07)	(0.00420)		
$\Delta CREDIT_{NFC}$			0.0256***	0.0203**
			(0.00854)	(0.00943)
$year_{>2010}$		-0.180***		-0.190***
		(0.0326)		(0.0326)
$year_{>2010} * \Delta CREDIT_{tot}$		-0.00419		
		(0.00420)		
$year_{>2010} * \Delta CREDIT_{NFC}$				0.0452**
				(0.0216)
Constant	0.115***	0.114***	0.117***	0.120***
	(0.0328)	(0.0327)	(0.0354)	(0.0343)
Observations	981	981	1,040	1,040
Number of Provinces	31	31	31	31
Adj. R-squared	0.715	0.715	0.724	0.725

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Growth effects of dynamic credit indicators with time dummy variable for industrial policy (SEI), estimated with Random Effects.

No significant structural break is however discernible in total credit growth - if anything, total credit after 2010 even has a more negative effect than before. One potential explanation for this could be the increase in mortgage credit to households after the global financial crisis in 2008 that is included in the total credit indicator (L. Zhang & Bezemer, 2016). The significantly positive effect of credit growth to non-financial corporations controls at least to some extent for this non-productive credit.

From these results, it can be hypothesized that credit might has been used in a more growth-enhancing manner since 2010 than it was before 2010. This suggests that the more targeted lending, that the Chinese government has undertaken since the early 2010s based on its industrial strategy, could have been successful. In the literature, however, the success of China's industrial policy measures is sometimes questioned, among other things, because there is a risk that credits will "seep away", i.e., flow into firms that do not use the borrowed capital for growth-enhancing investments. For this reason, we will now take a closer look at who receives credit in China and what this means for the relationship between credit growth and GDP growth.

Based on the literature, a distinction between state-owned and private companies could be of particular interest when considering the use of credit for growth guided by industrial policy.

Since such data is not available at the macro level, we have to rely on the industry panel data for this purpose, which reduces our observations significantly. In addition to the breakdown by state-owned and private companies, a separate consideration of joint venture or collective enterprises would also be of interest, but unfortunately we do not have access to sector-specific data for these firm types.

If we now run our standard GDP growth estimation using credit to the private and state industrial sectors, respectively, we detect no statistically significant credit growth effects for the state sector and a significant negative effect for credit to the private sector (Table 14). At the same time, we cannot observe any statistically significant structural break in the effect of credit growth on GDP growth after the year 2010. The negative private credit effect however vanishes and becomes insignificant. We therefore wonder whether effects might be detected at an upstream stage, specifically concerning firms investment activities.

	RE	
Dependent: ΔGDP_{real}	(1)	(2)
$log(INITIALGDP)$	-0.0280**	-0.0347**
	(0.0130)	(0.0141)
$SCHOOL$	0.125*	0.135**
	(0.0639)	(0.0650)
$log(GOV)$	0.0421**	0.0517***
	(0.0178)	(0.0190)
$log(OPENNESS)$	0.000615	0.00226
	(0.00572)	(0.00561)
GEO_{west}	-0.000214	-0.00117
	(0.0126)	(0.0124)
$GEO_{centralnorth}$	-0.0182	-0.0177
	(0.0146)	(0.0148)
$\Delta CREDIT_{priv}$	-0.000366***	-7.45e-05
	(4.57e-05)	(0.000480)
$\Delta CREDIT_{state}$	0.00343	0.00161
	(0.00280)	(0.00327)
$year_{>2010}$		-0.0621**
		(0.0272)
$year_{>2010} * \Delta CREDIT_{priv}$		-0.000265
		(0.000489)
$year_{>2010} * \Delta CREDIT_{state}$		0.00481
		(0.00496)
Constant	0.0168	0.0138
	(0.0529)	(0.0565)
Observations	374	374
Number of Provinces	29	29
Adj. R-squared	0.685	0.684

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Growth effects of industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

We therefore continue by measuring the effect of credit growth to the state (resp. private) sector on total investment growth (Table 15). In particular, we are interested in the effect difference after the start of the SEI program. Again, we resort to data from the aggregated firm balance sheet data set, now including total investment growth (ΔINV_{tot}), receipt of state capital ($\Delta STATECAP_{ind}$) or foreign capital ($\Delta FORECAP_{ind}$), revenue growth (ΔREV_{ind}) and credit growth by sector ($\Delta CREDIT_{priv}$ and $\Delta CREDIT_{state}$).

From Table 15, we see that the receipt of foreign equity in particular had a negative, albeit insignificant impact on the growth of investments. Government equity, on the other hand, has a significantly negative effect. While central-northern provinces do not have significantly higher or lower investment growth rates than eastern provinces, the western region of China has recently invested significantly more than the eastern region. Both without and with controlling for the SEI time dummy and interactions with credit growth, we cannot find any structurally different effect of credit growth on investment growth for private and state-owned industrial firms after the start of the SEI.

	RE	
Dependent: ΔINV_{tot}	(1)	(2)
$\Delta STATECAP_{ind}$	-0.0213**	-0.0207**
	(0.0105)	(0.0103)
$\Delta FORECAP_{ind}$	-0.00868	-0.00831
	(0.00717)	(0.00741)
ΔREV_{ind}	0.304**	0.291*
	(0.155)	(0.161)
$GEO_{centralnorth}$	0.0204	0.0219
	(0.0174)	(0.0189)
GEO_{west}	0.0294**	0.0270**
	(0.0117)	(0.0129)
$\Delta CREDIT_{priv}$	0.000620	-0.00147
	(0.000384)	(0.00161)
$\Delta CREDIT_{state}$	0.00791	0.00198
	(0.00665)	(0.00529)
year >2010		-0.111**
		(0.0444)
$year_{>2010} * \Delta CREDIT_{priv}$		0.00216
		(0.00171)
$year_{>2010} * \Delta CREDIT_{state}$		0.0193
		(0.0118)
Constant	0.101***	0.104***
	(0.0211)	(0.0220)
Observations	365	365
Number of Provinces	29	29
Adj. R-squared	0.425	0.423

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Investment effects of industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

While our previous estimations were largely in line with our robustness checks, we observe a significant deviation from them here. In our estimations with logarithmic credit growth rates (see Appendix), we see that the growth of credit to the private sector now has a significantly negative effect on total investment growth across all points in time hinting at inefficiencies in the private sector. At the same time, the logarithmic variables show that credit provision to private firms after 2010 could have been more investment-enhancing than before. In other words, our robustness checks hint that with the start of the SEI program, the observed inefficiencies in the private sector might have improved. Overall, based on our empirical analysis, we thus cannot make a robust statement about the use of credit by private firms in China.

Credit provision to the state-owned industrial sector, on the other hand, does not have a significant investment effect either in the overall period or after 2010. This finding is confirmed by our robustness checks. We have two possible explanations for the insignificant results: 1) since state-owned enterprises have always been supported by "industrial policy" and had easier access to bank credit, no particular impulse can be detected after 2010, and/or 2) state-owned enterprises are more inefficient in using credit for investment. Table 8 and 9 showed that credit-financed investment generally has a positive effect on real GDP growth that is also significant, at least for the RE estimation.

In summary we can thus conclude the following: Credit provision to the non-financial corporate sector in general had a significant positive effect on real GDP growth, that increased considerably after 2010, in comparison to the time before 2010 (Table 13). We then extended our analysis with respect to ownership, to find that credit provision to the private industrial sector as well as SOEs had a negative effect on GDP growth, and no significant effect on investment growth (Table 14 and 15). Recall that our regression is based on growth rates of investment, GDP and credit. Thus, a positive credit effect would imply that the growth in credit is related to a higher growth in investment / GDP, which points at an increase in the efficiency of the use of credit. Similarly, an insignificant effect means that there are no efficiency improvements, however, this does not indicate a negative effect of credit. A significantly negative credit effect is related to a lower, but not necessarily negative growth in investment / GDP.

While Table 15 shows a positive but not significant effect of credit to the private sector after the start of the SEI program, in our robustness checks (Table 79) we find this effect to be significantly positive. This shows that at least for the private industrial sector there are hints for a structural improvement in the use of credit after the SEI program was initiated in 2010, that are, however, not robust. For the SOEs we cannot observe any structural improvements after 2010. This is in line with the general literature on the efficiency of SOEs.

These findings seem to contradict our previous results from Table 13. This is not the case, however, because while we analyzed private and state firms in particular, our general $CREDIT_{NFC}$ variable also includes other types of firms, such as joint ventures, collectively owned firms, co-operatives, and foreign firms, amongst others. However, no individual data are available to us for these types of companies. This is particularly unfortunate since we assume that joint ventures in particular have and have had a significant impact on China's economic development. Related evidence can be found, for example, in chapter 4.6.3. We thus assume that it was mainly non-private and non-state firms that used credit more efficiently after 2010. Private and state enterprises were less efficient in using credit.

Overall, our estimation results therefore provide evidence that the credit-led component of China's industrial policy since 2010 might have been successful, with the corporate sector generally undertaking more credit-financed investment and thus positively affecting real GDP growth.

4.6.3 Evidence from specific industries

Following our previous analysis of finance, industrial policy and growth at the general industry level, we will now supplement our findings by having a closer look at particularly interesting, individual industries.

For this purpose we repeat the above estimations of the impact of credit on investment, and investment on GDP growth based on our firm balance sheet data set for specific industry branches. Due to the industries' special importance for the global economy, as well as their ecological importance, we have chosen to focus on the energy sector (renewable energy, i.e., primarily solar and wind energy) on the one hand, and the automobile sector (new energy vehicles (NEV)) on the other, both industries being promoted under the SEI and subsequent strategic decisions.

	RE		
	(1)	(2)	(3)
Dependent:	ΔINV_{tot}	ΔINV_{auto}	ΔINV_{energy}
ΔREV_{ind}	0.302**	0.834	-10.72
	(0.151)	(0.645)	(9.862)
$\Delta CREDIT_{firm}$	0.00436	0.557***	-0.101
	(0.00763)	(0.163)	(0.199)
$\Delta STATECAP_{ind}$	-0.00370	-0.267***	0.270
	(0.0111)	(0.0901)	(0.456)
$\Delta FORECAP_{ind}$	-0.00736	-0.0314	0.227
	(0.00917)	(0.103)	(0.371)
$GEO_{centralnorth}$	0.0228*	-0.0756	1.084
	(0.0138)	(0.0565)	(1.126)
GEO_{west}	0.0344***	-0.0651	2.485
	(0.0117)	(0.132)	(2.202)
Constant	0.0914***	0.154	0.0711
	(0.0184)	(0.514)	(0.337)
Observations	501	128	390
Number of Provinces	30	22	29
Adj. R-squared	0.432	0.540	0.044

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Investment effects of industry credit growth by industrial sector, estimated with Random Effects.

The results of these estimations can be found in Tables 16 and 17. A breakdown into the period before and after 2010 is not possible due to the availability of the data, as these have only been recorded since 2012 for the automotive sector, and since the mid-2000s for the energy sector.

Our findings therefore primarily refer to the phase after the start of targeted political support. Note that we now apply $\Delta CREDIT_{firm}$ as credit variable from our firm data set to ensure consistency. The results show that lending to the automotive sector led to significantly more investment growth, while lending to the energy sector had no statistically significant investment growth effect (Table 16). Moreover, in the case of the automotive sector, having a larger share of government capital in owner's equity tends to lead to significantly lower investment growth, which is not the case for the energy sector.

	RE		
Dependent: ΔGDP_{real}	(1)	(2)	(3)
$log(INITIALGDP)$	-0.0252***	1.09e-05	-0.0379***
	(0.00847)	(0.0301)	(0.0118)
$SCHOOL$	0.0502	0.186	0.0865
	(0.0486)	(0.153)	(0.0590)
$log(GOV)$	0.0405***	0.0278	0.0523***
	(0.0123)	(0.0404)	(0.0163)
$log(OPENNESS)$	-0.00463	-0.000954	-0.00491
	(0.00307)	(0.00553)	(0.00416)
ΔINV_{tot}	0.118***		
	(0.0213)		
ΔINV_{auto}		0.0119	
		(0.00728)	
ΔINV_{energy}			-0.000112**
			(4.64e-05)
$GEO_{centralnorth}$	-0.0267***	-0.0193	-0.0243*
	(0.00966)	(0.0214)	(0.0132)
GEO_{west}	-0.0207*	0.0167	-0.0128
	(0.0112)	(0.0258)	(0.0139)
Constant	0.113***	0.00965	0.117***
	(0.0299)	(0.0867)	(0.0379)
Observations	995	156	521
Number of Provinces	31	22	30
Adj. R-squared	0.719	0.756	0.744

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Growth effects of investment by industrial sector, estimated with Random Effects.

Finally, Table 17 illustrates that the growth of investment in general and in the automotive sector had a positive impact on real GDP growth, albeit the effect is only significant for total investment. Our robustness checks even show significant positive effects for automobile investment on GDP growth. We find no significant growth impulse for investment in energy. These results fit with our previous findings: While in the automotive sector the majority of the firm landscape is made up of joint venture firms, the renewable energy sector contains significantly more private firms.

4.7 Discussion

From the preceding chapters, a rather positive overall impression of the success of Chinese industrial policy measures emerges. This relates on the one hand to the generally more positive impact of credit growth on GDP growth after the start of SEI measures in the corporate sector. On the other hand, one could argue that regional industrial policy has partly contributed to the catching-up process of the non-eastern provinces since the early 2000s that we have found in our empirical analysis on the finance and growth nexus in Chapter 4.6.1 and that is also found in the literature.

Despite this generally rather positive picture, there are, however, structural and industry-specific features which we would now like to analyze in more detail as part of the discussion. To begin with, part of our empirical results relate to the role of ownership structures in the corporate sector. We have found hints, especially in our robustness estimations, that there might be signs for a structural difference in the use of credit by purely private Chinese firms and SOEs, especially after the start of China's deeper, more narrow industrial policy efforts in 2010. Although there is generally no or even a slightly negative correlation between credit growth and investment growth for both types of firms, it is not clear whether private firms might have used credit more efficiently after 2010 than before 2010. If this is the case, this does not necessarily mean that an increase in credit received after 2010 leads to a disproportionate increase in investment for private firms in absolute terms (= efficient credit use), but that relative improvements do occur. In contrast, it is robust to say that no improvement in efficiency can be observed for state-owned firms. The general inefficiencies of SOEs but also of purely private Chinese firms have already been addressed in the literature from various angles (e.g. Dougherty, Herd, and He (2007); S. Li, Lin, and Selover (2014); L.-Y. Zhang (2004)) and can thus be confirmed in the context of this study from the side of the use of credit. In addition to inefficiencies in the use of credit, it would also be conceivable, especially in the case of private companies, that more credit would not lead to an increase in investment on the same scale, for example due to bureaucratic or similar hurdles.

We attributed the discrepancy from the significantly growth-enhancing credit use by the corporate sector in general, and the sometimes negative or non-significant results when looking at purely private or purely state-owned firms in isolation, to the existence of other types of firms for which we do not have any individual data. We have already suggested that joint venture firms may be particularly relevant in this context, which is also shown in the literature (e.g. Jiang, Keller, Qiu, and Ridley (2018); Y. Lu, Tao, and Zhu (2017)). Furthermore, there is a range of literature that suggests that the existence of joint-ventures positively influences the success of private firms in China through spillover effects (Jiang et al., 2018; Van Reenen & Yueh, 2012). Overall, it could thus be argued that credit after the start of SEI measures is being used more efficiently and in a growth-enhancing way, primarily by joint-venture firms (or other non-private and non-state firms), and that these positive effects are also slowly spreading to Chinese private firms. Jiang et al. (2018) also show that firms that receive government subsidies - implicitly, firms with well-developed political connections - are also more likely to be selected as joint venture partners and thus benefit from foreign expertise. Particularly with regard to state subsidies, this can also be seen as an indirect positive effect of industrial policy in China.

The industry-specific estimations from the previous chapter also provide evidence that this might be true. We showed that efficient lending (in terms of enhancing investment and growth) was observed in the automotive sector in particular, which is strongly dominated by joint venture enterprises (Y. Chen, Lawell, & Wang, 2020; Liu & Kokko, 2013; Schüller, 2015). In the renewable energy sector, on the other hand, there are many domestic private enterprises and less international cooperations (Chiu, 2017). From an empirical point of view, we could not detect any significant effect of credit on investment in the renewable energy sector. However, the literature shows that there have been large inefficiencies and overinvestment in this market in the past (e.g. Bu and Tu (2017); Shen and Luo (2015)).

The reason why we consider China's industrial policy to be positive overall lies in the fact that the Chinese government has in the end achieved its designated goal of global dominance both in the NEV market and in the market for renewable energies. China is now considered one of the world's leading economies in both markets, although the Chinese approach to the development of the two sectors has been fundamentally different. For instance, in 2020 China accounted for 33.2% of annually installed photovoltaic (PV) capacity, and 33.1% of cumulative PV capacity. China is also the largest producer and consumer of photovoltaic cells (77.7% of 2020 global production in China) and modules (69.8%), as well as the largest producer of upstream products for the production of PV systems (such as PV wafers (96% of global production in 2020), or polysilicons (76%). Of the top 5 manufacturers of solar cells, four are Chinese, as are the top 5 manufacturers of PV modules (including one Canadian company that does most of its manufacturing in China) (IEA, 2021). Furthermore, China holds the leading position in the global wind energy sector. China's share of new global wind power capacity installations was 56% in 2020. Both the onshore and offshore wind markets are experiencing above-average global growth. Globally, China accounts for approximately 39% of all onshore and 28% of all offshore wind energy installations in 2020 (GWEC, 2021).

Also in the market for new energy vehicles, China is currently emerging as a new global player. The three largest producers worldwide as of today (2022) are Tesla (USA), Volkswagen (Germany) and BYD (China), producing about one third of the global EV volume together. BYD was not even in the global top 6 in 2020. Furthermore, China currently offers the largest selection of NEV vehicles with around 300 models worldwide, compared to 184 in Europe and around 65 in the US (IEA, 2022). Sales of electric cars accounted for about 9% of the global automotive market in 2021, an increase of about 400% compared to 2019. The net increase in these sales can be attributed almost entirely to China, where the number of NEVs sold has nearly doubled since 2019. In China, NEV sales accounted for about 13.4% of all vehicle sales in 2021 (CAAM, 2022). China is also a leader in the manufacture of batteries, producing around two-thirds of all lithium-ion batteries and between 70 and 85% of the most important components for battery production. China now also has around 85% of the world's fast-charging stations, making it the world's number one country for the availability of public charging stations (IEA, 2022).

Due to the lack of foreign expertise and initially particularly market distorting industrial policies in the renewable energy sector, achieving market dominance there in particular was associated with extremely high costs. For example, industrial policy measures in renewable energies were initially not adjusted to changes in production and material prices, resulting in significant overproduction. This overproduction caused world market prices for PV systems to plummet, prompting the European Union (EU) and US to respond with import tariffs on Chinese PV products to protect their own industries (G. Chen, 2015). In addition, power grid operators were often overwhelmed by the later, rapid construction of PV systems, so that some PV systems could not be connected to the power grid after their completion (H. Wang, Zheng, Zhang, & Zhang, 2016). In sharp contrast to this, the large share of joint-ventures in the Chinese automobile market initially brought large-scale know-how into the Chinese automobile market and enabled a steady, non-disruptive development of the market, while the first purely Chinese automobile manufacturers, such as Chery (state-owned), Geely or BYD (both privately owned) were opening business only from the year 2001 (Chu, 2011).

A good indicator for China's success in reaching global dominance in new technologies is also the "Critical Technology Tracker" which has recently been developed by the Australian Strategic Policy Institute (Gaida, Wong-Leung, Robin, & Cave, 2023). The indicator focuses on a key performance measure of scientific and technological capability—high-impact research—and reveals where countries, universities and companies around the world have a competitive advantage across 44 technologies. They state that:

> *"China's global lead extends to 37 out of 44 technologies that ASPI [the Australian Strategic Policy Institute] is now tracking, covering a range of crucial technology fields spanning defence, space, robotics, energy, the environment, biotechnology, artificial intelligence (AI), advanced materials and key quantum technology areas. For some technologies, all of the world's top 10 leading research institutions are based in China and are collectively generating nine times more high-impact research papers than the second-ranked country (most often the US). [...] The US comes second in the majority of the 44 technologies examined in the Critical Technology Tracker. The US currently leads in areas such as high performance computing, quantum computing and vaccines"*[23] (Gaida et al., 2023, p.1).

Nevertheless, it is not uncommon for studies to come to a rather negative assessment of industrial policy success when looking at specific industry level (e.g. Bu and Tu (2017); Shen and Luo (2015)). We have not performed a cost-benefit analysis of the industrial policy measures in the context of this paper. This is partly because an objective assessment of all costs is insufficiently possible due to the availability of data, and partly because an assessment at this stage is probably too early - especially since the overall benefits of the industrial policy measures cannot even be seen at present. At the same time, it must be discussed whether the activity of the state per se does not have to go far beyond a pure cost-benefit consideration (see e.g. Laurenceson and Chai (2001)). In this context, we therefore need to discuss the role of the Chinese state as an entrepreneurial state in the sense of Schumpeter's growth theory in a bit more detail.

Schumpeter's growth theory was described at the outset, and China was classified as a hybrid between a central planner and a private banking system. The banker described by Schumpeter thus changes from a private institution to a state institution, and the state becomes an active

[23] The full list is provided in Appendix (see figure 49)

player on its own right. This concept of the **'entrepreneurial state'** was elaborated by Mazzucato (2014), but can already be traced back to Schumpeter (Burlamaqui, 2020). The correspondence between the Schumpeterian growth model and the entrepreneurial state in China was outlined by Burlamaqui (2020, p.14) as follows: *"[F]rom a Schumpeterian (rekindled) perspective, the Chinese entrepreneurial state encompasses the functions of ephor, entrepreneur-in-chief and policy coordinator."* Burlamaqui (2015, p.730) argues that the Chinese economic model shows all the elements contained in Schumpeter's vision of successful state involvement in economic activity, *"[t]he centrality of credit for innovation and development (instead of 'savings'), the key role of the State in steering and governing the development process (instead of 'free markets'), the strategic role of investment-development banks to provide the necessary funding, and the functionality of financial restraint to avoid the buildup of 'financial casinos' "*. This model of the entrepreneurial state in the Schumpeterian sense could be the key to the Chinese growth miracle as Herr (2010, p.86) argues: *"The secret of Chinese success seems to rest on a productive combination of government interaction and market forces. China has managed to create a sustainable Schumpeterian- Keynesian credit-investment-income-creation process which has led to economic prosperity. This process was domestically driven by political credit expansion and allocation, and by a dynamic private sector including foreign enterprises."* Our empirical analysis based on our newly created data set provides additional confirmation of this account of the Chinese growth model.

4.8 Conclusion

In this paper we analyzed the role of China's banking system in implementing industrial policy, by the example of the "Strategic Emerging Industries" program. We collected data from the Chinese statistical provincial yearbooks to construct a **new panel of financial and economic indicators** for 31 provinces over the period from 1985 to 2019 to empirically assess the **role of credit** in China's general economic development process (Chapter 4.6.1), and as transmission instrument of industrial policy to foster this development (Chapter 4.6.2). At the beginning of our empirical analysis, we defined a set of research questions based on the Schumpeterian growth model that we hoped to answer:

1.) Is there a relationship between credit and growth in China? And, if so, was credit provision to the non-financial corporate sector in particular even more conducive to growth than credit overall?

Our empirical analysis based on panel estimations suggests an overall positive relationship between credit growth and real GDP growth, especially when credit is extended to the corporate sector. The growth effects of total credit, an indicator including a higher proportion of unproductively used credit, are less statistically significant. Our data also show that there are regional and temporal differences in the finance-growth nexus. This highlights the different development processes within China. While eastern provinces had high growth rates in the pre-WTO accession period, western provinces in particular have been catching up since.

2.) Can the positive effect of credit on growth be attributed to industrial policy?

In a first step, we found that credit provision to non-financial corporations after 2010, i.e., the start of the SEI program (which marks the first systematized vertical industrial policy strategy in China) was significantly more growth-enhancing than credit provision before 2010. Thus, credit after 2010 appears to have been used in a more efficient way. However, as the literature often questions the effectiveness of industrial policy measures due to the risk of credit flowing to unproductive (mostly state-owned) firms, we then distinguished between the provision of credit to state-owned or private firms. Even though we detected no statistically significant difference in the effectiveness of credit to generate real GDP growth after the SEI program has started, we found effects at an upstream stage: Our estimations do not rule out the possibility that credit provision to private industrial enterprises could have led to higher investment growth after 2010 than before. This is not the case for state-owned industrial enterprises. Due to the overall positive growth effect of credit, we conclude that other types of firms, that we cannot analyze individually due to the lack of data (for example joint-venture enterprises), could have been particularly efficient in using credit for investment and growth, and that Chinese private firms might start catching up.

We then extended our analysis to have a closer look at the automobile industry and the renewable energy sector. We found that since the start of the SEI strategy, lending to firms has increased investment in the automotive sector (which is largely dominated by joint-venture firms), and that the latter has also had a positive effect on overall economic growth. We do not find these effects for lending to businesses in the renewable energy sector, which is in line with existing literature that finds inefficiencies and overinvestment in this sector.

All in all, we agree with Banga, Fortunato, Gottschalk, Hawkins, and Wang (2022, p. 72) when they states that:

> *"the key lesson is that debt [in China] should not be regarded as a burden but as a policy instrument."*

To the best of our knowledge, we are the first to present an econometric analysis of the impact of China's targeted lending on economic development, as well as an analysis of the role of lending on the success of China's industrial policy strategy. On the one hand, we contribute to the more general finance and growth literature on China, by applying a new data set, which spans nearly four decades and differentiates credit into total credit and more targeted credit for firms or investment. On the other hand, while there are several works that empirically analyze industrial policy and specifically industrial policy in China, few of these works examine the role of credit as a tool to implement industrial policy objectives. These papers confirm the important role of credit as an industrial policy tool, but often limit their analysis to credit conditions, showing that target industries and especially SOEs in target industries receive more credit and that industrial policy measures alleviate firms' financing constraints.

Our paper has several **limitations** that could be addressed in future research. First, it is important to emphasize that we did not analyze causal mechanisms of industrial policy or lending on growth. This is largely due to the indicator availability and structure of our data set. Furthermore, based on the data available to us, it was not possible to make any reliable statements about the use of credit in private companies. A more in-depth analysis would be desirable as soon as relevant data become available.

We are also aware that the **transferability** of our results, for example to industrial policy measures in Europe and the US, is rather limited due to the special political circumstances in China and the resulting longer-term planning, as well as the stricter implementation capability. Nevertheless, our results highlight the potential of developing medium- to long-term strategies for the advancement of strategically important industries - a project that will become more and more necessary to be able to compete with China in the future.

5

Lending for Equality? A Machine Learning Approach to the Finance-Inequality Nexus

5.1 Introduction

Economic inequality, in the sense of the distribution of income and wealth between households, has long been of interest to economists and social scientists, not only for moral and ethical reasons. For instance, it is found that high inequality might increase political and macroeconomic instability (Alesina & Perotti, 1996; Beetsma & Van Der Ploeg, 1996; Parvin, 1973; Proaño, Peña, & Saalfeld, 2022) and significantly impacts economic growth (Barro, 2000; Cingano, 2014; Kuznets, 1955).

Among the major determinants of income inequality are skill-biased technological change (Autor, Katz, & Kearney, 2006), globalization (Milanovic, 2005), and the overall development level of a country (Kuznets, 1955). In the mid-1990s, along with the emerging literature on "finance" and economic growth (Beck, Demirgüç-Kunt, & Levine, 2000; King & Levine, 1993a; Rousseau & Wachtel, 1998), researchers also began to theorize about the relationship between the financial system and economic inequality, and to test these theories empirically. They conclude that "*finance exerts a first-order impact on inequality*" (Demirgüç-Kunt & Levine, 2009, p. 289), but until today, there is still no consistent evidence if this impact might be positive or negative. Also in theory it is not clear whether financial development operates on the extensive or intensive margin, i.e., integrating relatively poor individuals on the credit markets to improve their investment abilities, or disproportionally favoring relatively rich households. As Demirgüç-Kunt and Levine (2009, p. 287) put it: "*The financial system influences who can start a business and who cannot, who can pay for education and who cannot, who can attempt to realize one's economic aspirations and who cannot. Thus, finance can shape the gap between the rich and the poor and the degree to which that gap persists across generations.*"

The remainder of this paper is organized as follows: In section 5.2 I briefly discuss the theoret-

ical and empirical literature on the nexus of finance and inequality. I will show that the vast majority of the literature focuses its analysis on income inequality, while, due to a lack of data availability, only few studies cover the impact of finance on wealth inequality. The latter, however, would be the more suitable variable to look at, according to theory.
After clarifying the data and the methodological approach in chapter 5.3, I present the results from applying different machine learning algorithms to predicting wealth inequality measures in section 5.4.1. I will show that credit variables are particularly important in these predictions. Section 5.4.2 has a look at the overall direction of the relationship between finance and wealth inequality, and examines heterogeneous effects in terms of economic and financial development levels and home ownership ratios, amongst others. Chapter 5.5 discusses the results, while chapter 5.6 concludes.

5.2 Literature review

5.2.1 The finance-inequality nexus in theory

In the economic literature, there are conflicting theories on the link between the financial system and inequality. The root of this controversy is, in principle, that credit can affect different segments of the income and wealth distribution, so that the overall effect on an aggregate of economic inequality (e.g., the Gini coefficient) is arguable.

Negative relationship between Finance and Inequality

The first strand of the literature argues that "finance" operates on the "***extensive margin***" (Demirgüç-Kunt & Levine, 2009, p. 287), indicating that better availability of financial services improves the situation of relatively poor households that were previously excluded from financial markets, for example due to high borrowing costs or other credit constraints (Demirgüç-Kunt & Levine, 2009).

The starting point of these theoretical models is usually the assumption of financial imperfections, as in the form of information and transaction costs on the credit market (Aghion & Bolton, 1997; Banerjee & Newman, 1993; Galor & Moav, 2004; Galor & Zeira, 1993). Since less wealthy individuals generally have insufficient collateral and low income, these costs will be particularly high for this group so that their access to capital is restricted. Galor and Zeira

(1993), as well as Galor and Moav (2004) thus argue that "*[i]f borrowing is difficult and costly, those who inherit a large initial wealth and do not need to borrow have better access to investment*" (Galor & Zeira, 1993, p. 36). Financial imperfections consequently not only increase economic inequality, but also reduce the efficiency of capital allocation, as individuals with low incomes have higher expected returns on investments (Thornton & Di Tommaso, 2020).

Based on this perspective, any improvement in access to the financial system, i.e., a reduction in financial imperfections, disproportionally benefits relatively poor individuals, leading to a less unequal distribution of income and wealth, as well as a more efficient accumulation of capital (Thornton & Di Tommaso, 2020). Furthermore, financial development is expected to increase the intergenerational mobility in income and wealth, as parents are less restricted in investing in their children: "*if all parents can readily borrow to finance the optimal investments in children, the degree of intergenerational mobility in earnings essentially would equal the inheritability of endowments*" (Becker & Tomes, 1986, p. 31). When facing adverse shocks to family income, children would also be less likely to have to substitute school for paid work, as long as the family has access to credit markets (Becker & Tomes, 1979, 1986; Demirgüç-Kunt & Levine, 2009).

Positive relationship between Finance and Inequality

An alternative theoretical approach is based on the idea that financial development primarily favors those with high incomes and wealth, as relatively poor households rely more heavily on informal access to capital (Thornton & Di Tommaso, 2020). According to this view, "finance" operates mostly on the "***intensive margin***" (Demirgüç-Kunt & Levine, 2009, p. 288), i.e., improving the situation for individuals that were already part of the credit market. Any improvement in the development of the financial system is thus disproportionally beneficial for relatively rich households, which would increase economic inequality and decrease intergenerational mobility.

One proponent of this thesis is Greenwood and Jovanovic (1990) who discuss the development of financial markets and income inequality in different stages of economic development. They show that financial markets in less developed countries are basically nonexistent, while income inequality is quite low. In the development process, income levels increase and financial markets start to evolve. At the same time, income differences between relatively rich and relatively poor individuals are augmenting, as income of richer households increases stronger than income of poorer households. Finally, the economy stabilizes at a higher steady-state with higher income inequality. Piketty (1997) argues that wealth mobility is lower in steady-states with higher credit rationing and lower capital accumulation, as "*there are more credit-constrained poor and the very rich accumulate more*" (Piketty, 1997, p. 185).

In addition to these two dominant strands of the literature, there are also theories on **indirect effects** of the financial system on economic inequality. Demirgüç-Kunt and Levine (2009), referring to Townsend and Ueda (2006), for example point out that changes in the allocation of credit have an influence on production and therefore the demand for (un)skilled labor. The impact of a decreasing demand for unskilled labor on the increase in income inequality, has, on the other hand, been extensively studied in the literature (Acemoglu, 1999; Autor et al., 2006; Johnson, 1997, amongst others).

In summary, **two possible hypotheses** can be formulated regarding the theoretical influence of the financial system (i.e., credit markets) on economic, in particular wealth inequality:

1. **Negative relationship: Credit could generally decrease wealth inequality** by enabling investment in physical capital (e.g. real estate, businesses) and human capital (e.g. schooling, vocational training) for relatively poor individuals. If the lower and middle class are not facing major restrictions on the credit market, credit can build up higher wealth in the medium and long term, which lowers wealth inequality and increases wealth mobility.

2. **Positive relationship: Credit could also tend to increase wealth inequality**, when relatively poor households are largely excluded from the credit market, and thus relatively wealthy individuals receive comparatively larger loans. While for low-income households, access to capital would be limited to smaller, e.g. consumer loans, richer households would be able to grow their wealth through business or real estate loans.

5.2.2 Empirical evidence

Similarly to the theoretical literature, there is also no consensus on the relationship between finance and economic inequality in the empirical analyses so far. While Demirgüç-Kunt and Levine (2009) argue that "*[t]he emerging bulk of empirical research points tentatively toward the conclusion that improvements in financial contracts, markets, and intermediaries expand economic op-*

portunities, reduce persistent inequality, and tighten the distribution of income" (Demirgüç-Kunt & Levine, 2009, p. 288), the overall pattern of empirical results today is much more differentiated.

De Haan and Sturm (2017) and Jaumotte et al. (2013), for example, find that **financial development and financial globalization is generally associated with an increase in income inequality**. Denk and Cazenave-Lacroutz (2015) conclude that larger credit markets tend to raise inequality in incomes, and that this might be linked to significant differences on the asset and liability side of European households among different income groups.

On the other hand, there are some studies that generally find a **negative relationship between finance and income inequality**, such as Beck et al. (2007), Thornton and Di Tommaso (2020), Clarke, Xu, and Zou (2006), R. Zhang and Naceur (2019), H. Li, Squire, and Zou (1998), Braun, Parro, and Valenzuela (2019), Mookerjee and Kalipioni (2010), Meniago and Asongu (2018) and J.-H. Kim (2016). That credit provision might have a positive effect on medium term income is shown by Delis, Fringuellotti, and Ongena (2020) who analyse micro data of credit applicants. They find that loan approval increases the recipients' income by about 6% after one to three years, and by about 10% after five years. They also observe a less unequal distribution of income among households whose credit application was accepted. Another study by Hamori and Hashiguchi (2012) concludes that the overall effect of financial deepening tends to reduce inequality, but shows that economic growth diminishes these equalizing effects.

Besides, there are also authors that find **mixed or non-linear effects of finance on income inequality**. Bahmani-Oskooee and Zhang (2015), for instance, show that while in about ten countries of their sample, financial market development exerts a short-run effect on diminishing income inequality, in five other countries, there is a positive link. Also, a long-run relationship can only be established for three of 17 countries (Denmark, Kenya and Türkiye). Le and Nguyen (2020) argue that there are non-linearities in terms of **credit type**, or more precisely, that commercial credit tends to increase income inequality, whereas policy credit has an equalizing effect. Law, Tan, and Azman-Saini (2014) discover that finance can only reduce income inequality after a certain level of **institutional quality** has been established. In countries with a low quality of institutions there is no link between finance and inequality. Finally, D.-H. Kim and Lin (2011) and Park and Shin (2017) examine the finance-inequality nexus regarding different levels of **financial development**. Their results suggest that in countries with low developed financial markets, finance cannot decrease income inequality. While D.-H. Kim and Lin (2011) find a negative relationship between finance and income inequality in countries with better developed financial markets, the results by Park and Shin (2017) indicate an inverted u-curve: While finance has an equalizing effect for countries with higher financial development, it can again contribute to higher inequality once financial development increases further. Brei, Ferri, and Gambacorta (2023) report that more finance increases income inequality, when financial development takes place through increasing market-based financing, while it does not increase inequality when bank-based financing is strengthened.

Somewhat related to this literature is also the work by Kumhof, Rancière, and Winant (2015), Rajan (2010), Perugini, Hölscher, and Collie (2016) and Malinen (2013), amongst others, who study the **reverse causality, i.e., effects of income inequality on credit provision**, particularly in the emergence of financial crises. While those authors find that the distribution of income has a significant impact on private sector indebtedness and credit booms, there are other studies that reported no such indications (Atkinson & Morelli, 2011; Bordo & Meissner, 2012), or only for countries with low per capita incomes and weak institutions (R. Fischer, Huerta, & Valenzuela, 2019).

What becomes apparent from the previous studies is that the vast majority of the empirical finance-inequality research has a **strong focus on income inequality, rather than wealth inequality** (see also Osakwe and Solleder (2023)), even though many theoretical models on the finance-inequality are fundamentally built around wealth inequality. Whilst this might seem surprising at first, this is largely because wealth is more complicated to measure than income (Zucman, 2019), and therefore data availability has only improved quite recently. However, in the words of Hasan, Horvath, and Mares (2020, p. 1): "*Although extensive progress has been made regarding the measurement of wealth inequality, we still lack systematic evidence about the determinants of wealth inequality across countries.*"

Some of the few empirical studies on **finance and wealth inequality** are conducted by Fouejieu, Sahay, Cihak, and Chen (2020) and Osakwe and Solleder (2023) who find that improving access to financial services might reduce wealth inequality. Both studies rely on a global panel of developed and developing countries starting in 2004, however, the empirical results of the latter study are not significant. The results of a study by Hasan et al. (2020) indicate that while financial depth increases wealth inequality, it is reduced by an increase in efficiency and access to finance. They also emphasize that financial indicators are playing a dominant role as determinant of wealth inequality.

A positive relationship between finance and wealth inequality is established by Frost, Gambacorta, and Gambacorta (2022) for the case of Italy, B. Wu, Yue, and Zuo (2023) for a panel of Chinese provinces and Von Fintel and Orthofer (2020) for South Africa.

Somewhat related to these findings are also the papers by Fagereng, Guiso, Malacrino, and Pistaferri (2020), Calvet, Campbell, and Sodini (2007) and Kaiser (2021). Fagereng et al. (2020), for instance, show that wealthier households have higher returns on financial assets and that wealth returns are correlated across generations. Similarly, the empirical results by Calvet et al. (2007) indicate that households with higher wealth or higher education have higher returns on investment, and invest more efficiently. On the other hand, Kaiser (2021) finds that home ownership was a major contributor to differences in household wealth in Germany, France, Spain and Italy in 2014.

Contribution of this paper

Based on the findings just presented, this paper contributes to the literature in the following respects:

- **Research subject**: In contrast to the vast majority of the empirical literature this paper resorts to indicators of **wealth inequality**, as opposed to income inequality, making use of recent advances in machine learning based generation of incomplete data
- **Data**: This study uses global panel data from 43 developed and developing countries over a 77-year period (1945 to 2021), complemented by a descriptive analysis of household micro data for the Euro area, and therefore covers **more countries over time** than related empirical work
- **Methodological approach**: The empirical analysis is based on state-of-the-art **Machine**

learning techniques that have, to the best of my knowledge, not been applied to the finance-inequality-nexus so far

- **Non-linearities:** In accordance to findings in the literature, this paper also analyses heterogeneous effects (**e.g. level of financial development, home ownership ratio**) that have not been previously demonstrated to such a broad extent in the literature on the finance-wealth-inequality nexus

5.3 Data and methodology

5.3.1 Methodological approach

> *"It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts"* - Sherlock Holmes (Doyle, 1892, p. 7)

The methodological approach of this paper is based on machine learning which is a powerful tool to automate the process of finding patterns in data. It is designed to learn models on the relationship between different descriptive features ($X_1, X_2, ..., X_p$) and a target feature (Y, here, measures of wealth inequality) in available data, to make predictions on unknown data (Kelleher, Mac Namee, & Aoife, 2015). Empirical analyses have shown that machine learning techniques usually yield better results than standard econometric methods (see e.g. Bajari, Nekipelov, Ryan, and Yang (2015); Cerulli (2021); W. V. Li and Kockelman (2022) and Vrontos, Galakis, and Vrontos (2021)). A machine learner thus predicts the function $\hat{f}$:

$$Y = \hat{f}(X_1, X_2, ..., X_p) + \epsilon. \tag{11}$$

Most of the time, data scientists treat $\hat{f}$ as a **black box**, as they are less interested in the exact form of $\hat{f}$, but rather in the question of how successful it is in predicting Y (James, Witten, Hastie, & Tibshirani, 2023). In this paper, I am particularly interested in understanding the relationship between the target and the descriptive features, so I will augment this purely predictive analysis by the application of statistical inference.

One fundamental idea of machine learning is the division of the available data in a **training and a test data set**. In that way, the machine learner builds models in the training data set and evaluates their performance in the test data set. As both samples are non-overlapping and usually randomly assigned, this improves the predictability of unseen data and reduces the risk of overfitting (Kelleher et al., 2015). The training-and-testing process can proceed multiple times through resampling (James et al., 2023).

A simple machine learning approach in fitting models to a data set would be based on the method of least squares. However, it has been shown that alternative, more complex algorithms are usually better in predicting (James et al., 2023). In this paper I have used the standard machine learning packages of the statistics software *R* to run algorithms relying on regularization (Least Absolute Shrinkage and Selection Operators (LASSO)) and tree-based methods (random forest, boosted random forest and related algorithms such as conditional inference forests). The decision for these algorithms is based on the one hand on their efficiency and computational power, and on the other hand on the good interpretability of their results, including the possibility to get insights into the "black box" of the resulting models. I will now briefly describe the fundamental concepts of those algorithms.

5.3.1.1 Regularization

Common regularization techniques in machine learning include LASSO (L1 regularization) and RIDGE (L2 regularization) and are based on the idea of subset selection to further reduce the problem of overfitting. As can be seen from the following formula, LASSO is adding up to classical approaches for OLS regression by minimizing the residual sum of squares (RSS) in the least squares fitting procedure. The LASSO regression coefficient values $\hat{\beta}^L$ are calculated by minimizing the following loss function:

$$\hat{\beta^L} = argmin_{\beta_j} \sum_{i=1}^{n}(y_i - \beta_0 - \sum_{j=1}^{p} \beta_j x_{ij})^2 + \lambda \sum_{j=1}^{p}|\beta_j| = argmin_{\beta_j} RSS + \lambda \sum_{j=1}^{p}|\beta_j|, \quad (12)$$

with $|\beta_j|$ being the so-called "LASSO penalty" that shrinks the coefficients of some unimportant features to zero within the fitting procedure. As a result, while initially all predictors are fitted into the regression model, some predictors will be excluded from the final model as their coefficients are penalized to zero.[24] The larger the tuning parameter λ, the higher the share of

[24] For RIDGE, all predictors will be included in the final model, while the penalty will only shrink some of the

effectively dropped variables. It has been shown that this proceeding can significantly reduce variance and increase model accuracy (James et al., 2023).

5.3.1.2 Tree-based methods

Another widely used set of methods in machine learning, that fundamentally deviates from the classical, linear regression models, are "tree-based methods", such as random forests and boosted random forests. They all go back to the construction of so-called "decision trees", but are then extended to improve prediction accuracy.

A **decision tree** is built by splitting the predictor space (i.e., the values of X_1, X_2, ..., X_p) in the training data set into several non-overlapping subregions R_1, R_2, ..., R_J. After constructing all subsets R_1, ..., R_J, we make the same prediction for each observation within the same subset, by taking its mean within the training data set. In the end, observations are rather heterogeneous across subsets, and among subsets they are rather similar. More precisely, the data set will be divided into subsets R_1, ..., R_J that minimize the RSS:

$$\sum_{j=1}^{J} \sum_{i \in R_j} (y_i - \hat{y_{R_j}})^2 \tag{13}$$

with $\hat{y_{R_j}}$ being the mean value for the observations in the jth subset. In order to grow a decision tree a multi-step procedure has to be applied: Starting from a situation where all observations belong to the same region R, all possible predictors X_1, X_2, ... X_p are initially considered for splitting the data set at the cutpoint s with the objective of achieving the greatest reduction in RSS. As an example, the algorithm could find that the predictor X_1 (e.g. $schooling$) is initially best for reducing the overall RSS, when divided into the category $s_1 <$ 5 years and $s_1 \geq$ 5 years. We would then have two subsets within the training data. In every following step, we then go on with further splitting the data set into more subsets, until a specific stopping rule is reached (e.g. minimum number of observations in a subgroup). As it is computationally expensive to consider every partition of the data set at each split, however, we apply a *top-down, greedy approach*. That means that at each splitting point ("*node*"), only the previously identified subregions are splitted further, and that the algorithm does not look ahead considering any

coefficients close, but never exactly to zero. This can be problematic for data sets with a particularly large number of predictors (James et al., 2023).

future splits. Nodes that have no additional nodes growing from them are called leaf (or terminal) nodes (James et al., 2023). Figure 16 shows an example of how a decision tree could look like.

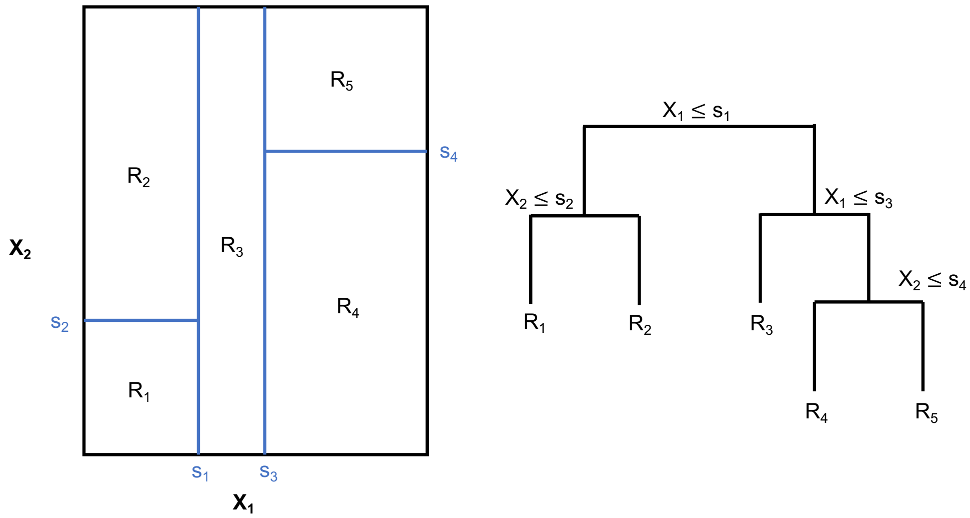


Figure 16: Subset splitting of an exemplary two-dimensional feature (left) and resulting decision tree (right).
Source: Based on James et al. (2023).

One disadvantage of decision trees is that they may not be particularly robust for small changes in the data. For this reason, other methods draw on the principle of decision trees, however, substantially improving their performance through repeated application (James et al., 2023).

One of these methods are **"random forests"**. As the name suggests, random forests consist of multiple decision trees built from bootstrapped[25] training samples. In the process of building these trees, only a random sample of $m \leq p$ predictors can be considered as split candidates at each split. Usually, the number of splitting candidates is determined as $m \approx \sqrt{p}$. This prevents that the decision trees (and the resulting predictions) are highly correlated as soon as there are relatively strong predictors in the data set, and improves overall model performance. The final prediction is made by averaging the predictions of all trees. Random forests are therefore among the most competitive methods for prediction (James et al., 2023).

Another method to improve the performance of decision trees, while also being applicable on

[25]Bootstrapping refers to the repeated drawing of samples from the training data set, while observations might be drawn several times in the same sample.

other machine learning methods, is "**boosting**". Like classical random forests, boosted random forests also rely on growing multiple decision trees, but in a sequential way. This has the advantage that each tree uses information on the previous trees. Boosting algorithms start by growing a simple tree, resulting in the estimation of a prediction model. Given this model, it calculates the residuals from the model, i.e., the difference between the actual outcome and the predicted outcome. The boosting algorithm then goes on and grows another tree, this time on the residuals instead of the actual outcomes. This new tree is subsequently added to the fitted function, so that the residuals are updated, and the process is repeated multiple times, while new trees are always grown on the residuals from the previous stage. Random forests and boosted random forests both offer several advantages, such as an automatic modelling of non-linearities, as well as higher-order interactions and the robustness to outliers and multicollinearity (James et al., 2023).

One **critical assumption** for the previously described machine learning algorithms is that the data is independently sampled from a population. For longitudinal data, as it is analysed in this paper, this assumption poses a problem, as observations are usually correlated across time and between countries. Applying the standard machine learning algorithms for prediction could therefore result in biased inference and inaccurate subgroup selection (Hu & Szymczak, 2023).

For this reason I additionally apply machine learning algorithms considering fixed and random effects within the data, both for tree-based and regularization methods. For LASSO, this results in a simple demeaning of the data before prediction, while for tree-based methods I run a mixed-effects random forest (*MERF*) that can be extended to considering serial correlation (stochastic *MERF*, i.e., *SMERF*). The MERF combines (generalized) linear mixed models ((G)LMMs) with the decision trees from the random forest. More precisely, the non-linear model to estimate the fixed effects is predicted by a random forest, while the correlation structure and random effects within a subject still rely on linear modeling (Hu & Szymczak, 2023). Similarly, the simple boosting algorithm can be extended to combining tree-boosting with Gaussian processes and grouped random effects models (*GPBoost*) (Sigrist, 2022).

Figure 17 summarizes all machine learning algorithms that will find application in this paper:

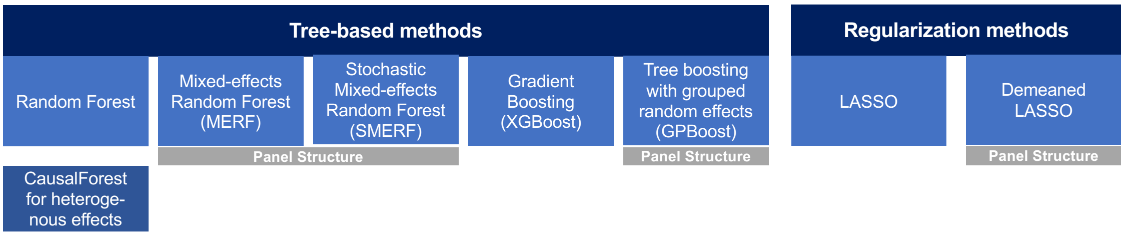


Figure 17: Overview on the machine learning algorithms adopted in this paper.

For the **evaluation of the machine learning predicted models** $\hat{f}(X_1, X_2, ..., X_p)$ there are a few measures that are usually applied on continuous target features. In this paper I focus on reporting the mean squared error (MSE) and the mean absolute percentage error (MAPE). The MSE calculates the average squared difference between the actual target feature value in the test set and the predicted target feature value from the model based on the training set:

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{f}(x_i))^2, \tag{14}$$

with *n* training instances, target feature y_i, descriptive features x_i and $\hat{f}(x_i)$ being the prediction of $\hat{f}$ for the i-th observation. Smaller MSE values within the possible range of $[0, \infty[$ point to a relatively better model performance (James et al., 2023; Kelleher et al., 2015).
Due to its better interpretability I also report the MAPE that captures the absolute difference between the actual and the predicted target feature values in n training instances, scaled to percentage units. Again, smaller MAPE values indicate a better model performance (Kelleher et al., 2015):

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\frac{abs(y_i - \hat{f}(x_i))}{abs(y_i)}. \tag{15}$$

Before applying machine learning algorithms there are a few **prerequisites** that need to be considered. One of the most important ones is that there cannot be any missing data in the data set for most of the algorithms. As this is rarely the case for real-life data, the literature has developed several approaches to address this problem:

(1) Dropping any features that contain missing values. Depending on the amount of missing data, this can, however, significantly reduce the data set and, as a consequence, predictive power.

(2) Simple imputation, i.e., replacement of missing data with simple projections of data that is available. In the literature, the most common approach in doing so is the use of mean or median values of the respective features. One disadvantage of this is that for relatively large numbers of missing data, this will significantly impact the central tendency of a feature.

(3) Complex imputation, i.e., building statistical models to predict missing data within the data set, based on machine learning algorithms. Two of the most commonly used algorithms for imputing missing data are *MICE-CART* (multiple imputation by chained equation, based on classification and regression trees) and *MissForest* (based on random forest) (Kelleher et al., 2015).

As *"[i]mputation techniques tend to give good results and avoid the data loss associated with deleting features or complete case analysis"* (Kelleher et al., 2015, p. 74), option (3) is preferred for this paper. More specifically, I have adopted the following **two-stage machine learning procedure**:

1. Based on a data set with more than 300 macroeconomic variables (see chapter 5.3.2 and Appendix) I have performed a **complex imputation of missing values, by the application of established machine learning algorithms**.

2. To increase predictive power and interpretability, highly correlated features were then deleted from the data set, resulting in a reduced data set of about 70 features. Those features were normalized into standard scores to yield values in the range [-1;1], as some machine learners are sensitive to the scaling of features. Normalized features a_i, are given as

$$a_i^{'} = \frac{a_i - \bar{a}}{sd(a)}. \tag{16}$$

3. I then apply the **predictive machine learning algorithms** introduced in this chapter to exploit what factors drive the prediction of different wealth inequality measures, and complement this with **machine learning algorithms for causal inference**, i.e., examining heterogeneous effects and non-linearities in the previous results.

This approach offers a major advantage over existing research on the finance-wealth-inequality nexus: While the literature so far is mostly restricted to estimating the finance-inequality nexus approximated by income inequality due to missing data, modern machine learning techniques can estimate missing data quite reliably using complex models. In doing so, it is particularly beneficial that, although wealth inequality and income inequality are diverging significantly, they are still highly correlated (Chancel, Piketty, Saez, & Zucman, 2022; Davies & Shorrocks, 2021; De Nardi & Fella, 2017; Osakwe & Solleder, 2023).

5.3.2 Data set and target feature variables

The data set underlying this paper covers 43 developed and less developed countries in a period from 1945 to 2021 (see Appendix). The **target feature variables** for the machine learning algorithms that were just described consist of different wealth inequality measures that will be analysed separately. More specifically, they comprise:

- **Gini index of wealth inequality ($gini_{wea}$)**: Measures the ratio of the cumulative population shares to the total share of wealth received by them. A Gini value of 0 represents a perfectly equal distribution of wealth, whereas a Gini coefficient of 100 indicates that there is a completely unequal distribution of wealth.
- **Top 1% percentile of the wealth distribution (wea_{top1})**: Represents the share of wealth that is held by the wealthiest 1% of the population (99% percentile), relative to the total population.
- **Top 10% percentile of the wealth distribution (wea_{top10})**, i.e., the share of wealth that is held by the wealthiest 10% of the population (90% percentile), relative to the total population.
- **Middle 50% percentile of the wealth distribution (wea_{p3070})**, i.e., the share of wealth that is held by the 30th to 70th percentile of the population, relative to the total population.
- **Bottom 50% percentile of the wealth distribution (wea_{bot50})**, i.e., the share of wealth that is held by the poorest 50% of the population, relative to the total population.
- **Bottom 20% percentile of the wealth distribution (wea_{bot20})**, i.e., the share of wealth that is held by the poorest 20% of the population, relative to the total population.

As presented in figure 18 by the cross-period distribution of income and wealth of the richest

10 percent of the population in selected countries, there is generally a wide gap between income and wealth shares. In Argentina, for instance, the wealthiest 10 percent of households have owned 77.5 percent of total wealth in the past, whereas the 10 percent of the population that have the highest income have held a much smaller share of 51.6 percent. This gap is particularly large for the United Kingdom, with a maximum top 10 percent wealth share of 91.6 percent in the total observation period, and a maximum income share of 38.8 percent.

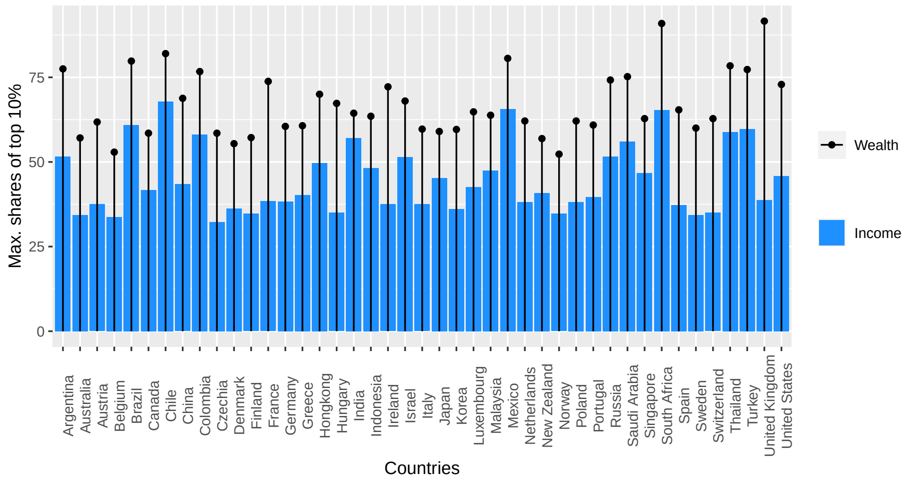


Figure 18: Shares of wealth and income held by the 90% percentile (top 10%) in selected countries (maximum shares in total observation period (1945-2021)).
Source: World Inequality Database (WID).

In 2019, the highest wealth inequality, as measured by the Gini coefficient, can be found in South Africa (95.7), followed by Chile (90.85), Brazil (90.23) and Mexico (89.64) (see figure 19). The countries with the most equal distribution of wealth were the Netherlands (Gini coefficient of 63.86), Belgium (67.29), Denmark (70.31), Spain (70.95) and Norway (72.56). Germany, along with countries like Korea, Sweden and Japan, belongs to the second quintile of global wealth distribution in 2019, while the United States, Russia, Türkiye and Austria are in the fourth quintile. If we look at the development of wealth Gini coefficient over time, we see that it is fairly constant and tends to rise rather than fall. This is particularly the case for countries that are still in the development process, such as China or Mexico.

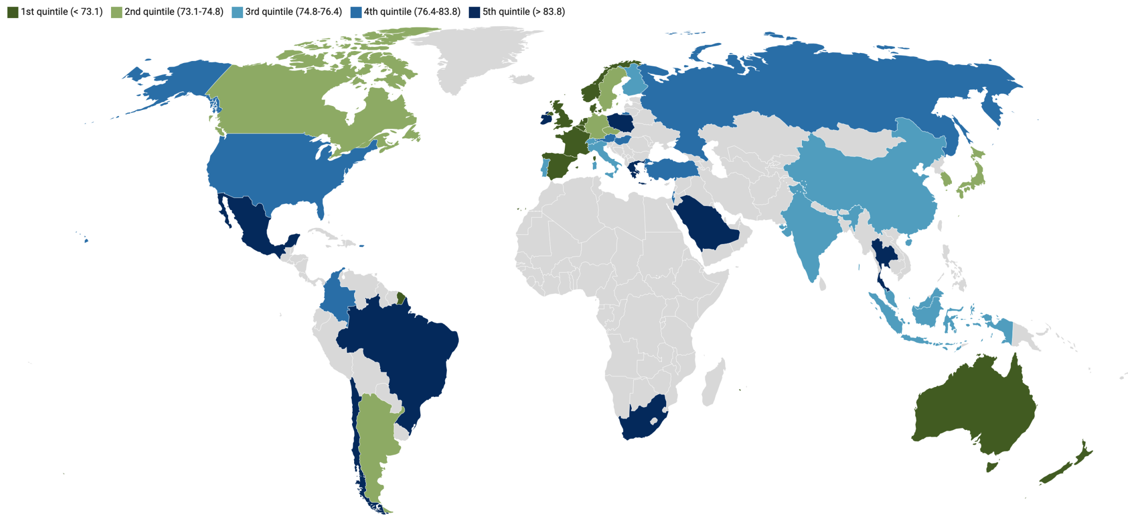


Figure 19: Global wealth inequality, as measured by the Gini coefficient, in 2019.
Source: WID.

Also, when using the Gini coefficient in 2019 as a measure of inequality, one can see the clear divergence of income and wealth inequality. Taking the same countries as an example, Germany had a wealth Gini index of 74.63, and a gross income Gini index of 51.7. The United States had a Gini index of 82.63 for wealth, and 52.6 for gross income. More examples include Korea (74.27 vs. 37.0), Sweden (74.09 vs. 52,4), Türkiye (80.22 vs. 45.4) and Austria (77.01 vs. 49.4). On average, the mean difference between wealth and gross income Gini index for all 43 countries in 2019 was 29.45.

The significant differences presented highlight the importance of analyzing the relationship between credit and inequality with an adequate measure of inequality, and that approximating wealth inequality by income inequality could potentially bias the results. As indicated in the previous chapter, the problem lies in the less than comprehensive availability of wealth distribution data. The application of machine learning algorithms can help to fill in this missing data. An important prerequisite for this is, however, that other comprehensive data are available that allow wealth inequality to be modeled as well as possible.

Studies such as those by Chancel et al. (2022); Davies and Shorrocks (2021); De Nardi and Fella (2017) and Osakwe and Solleder (2023) show that despite the significant differences in measures of wealth and income inequality, there is a high correlation between the two. This is also suggested by the positive correlation between the wealth and the income Gini index that is presented in figure 20. Supplemented by other descriptive feature variables, the data set thus provides a promising set of variables for reliably estimating missing wealth inequality data.

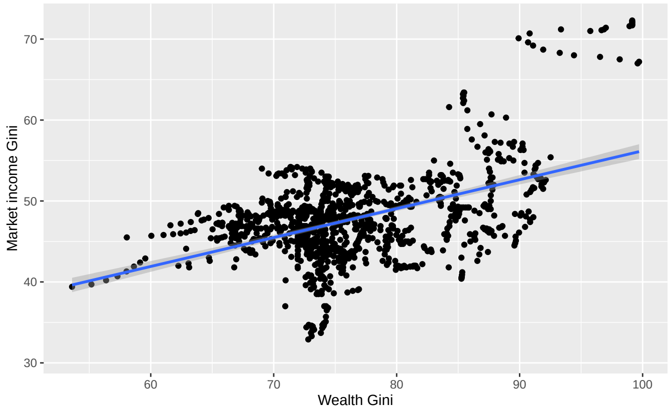


Figure 20: Correlation of the Gini coefficients for wealth inequality (x-axis) and income inequality (y-axis).
Source: WID.

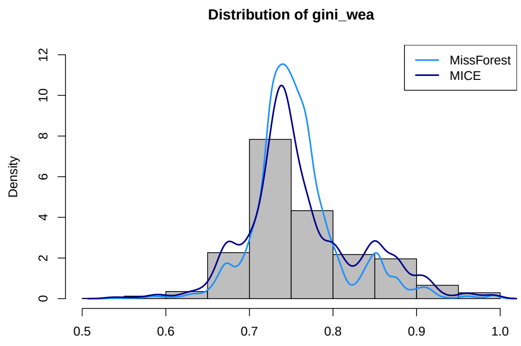
Among the set of **descriptive feature variables** there is a broad range of macro- and microeconomic variables that are listed in more detail in the Appendix.[26] In total, these include over 300 variables from the categories income and income distribution (e.g. different measures of income inequality and poverty), credit and finance, economic growth and inflation, interest rates and investment, population and demographics, education, trade, government activity, housing, employment and social security, regulation, saving and consumption.

While all of those variables were initially used for imputing missing values, the imputed data set was subsequently reduced by removing highly correlated variables. This approach corresponds to the idea of "backward stepwise selection" as proposed by James et al. (2023) and serves to improve prediction performance while leaving room for relatively open feature selection by not overly restricting the variables in the data set.

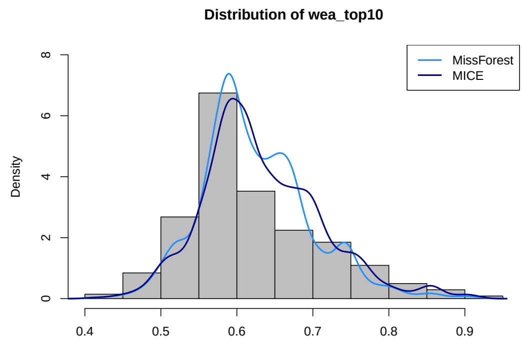
An insight into the results of the imputation process with *MissForest* (based on random forests) and *MICE-CART* (multiple imputation by chained equation, based on classification and regression trees) is shown in the following figures 21a to 22d. Although the *MissForest* and *MICE* results are comparable in most variables, in the following I employ the data set populated using the random forest algorithm (*MissForest*). This is mainly due to the fact that the *MissForest* algorithm works faster and is only for a few variables not able to completely fill up the respective data columns. The MICE algorithm on the other hand is shown to be less powerful, as evi-

[26]The target and descriptive feature variables were also transformed into growth rates.

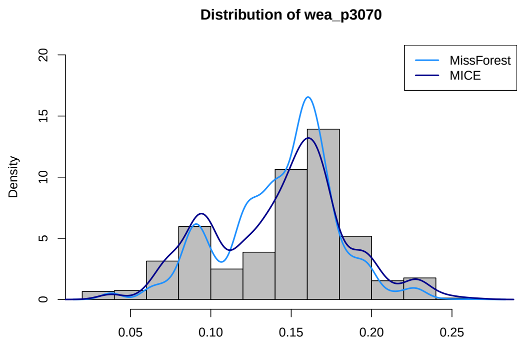
denced by larger data gaps after imputation. This observation is also confirmed by the literature (Tang & Ishwaran, 2017; Troyanskaya et al., 2001; Van Buuren, 2007; Waljee et al., 2013). As Tang and Ishwaran (2017, p. 364) put it: "*MissForest has been shown to outperform well-known methods such as k-nearest neighbors (KNN) and parametric MICE*".



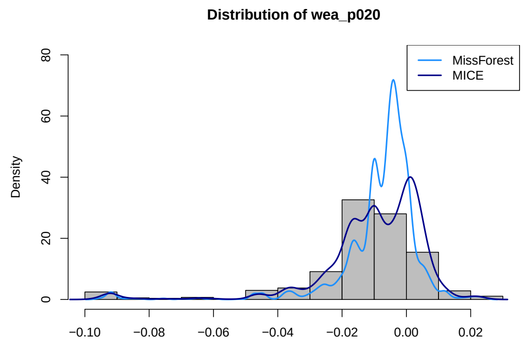
(a) Imputation results for $gini_{wea}$



(b) Imputation results for wea_{top10}



(c) Imputation results for wea_{p3070}

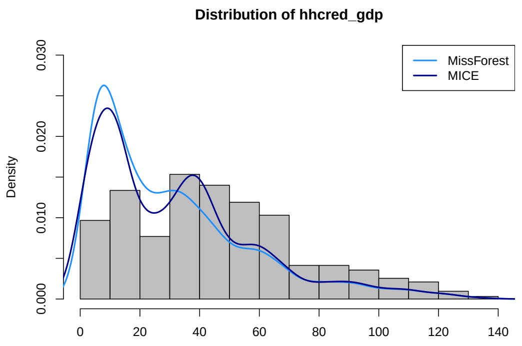


(d) Imputation results for wea_{p020}

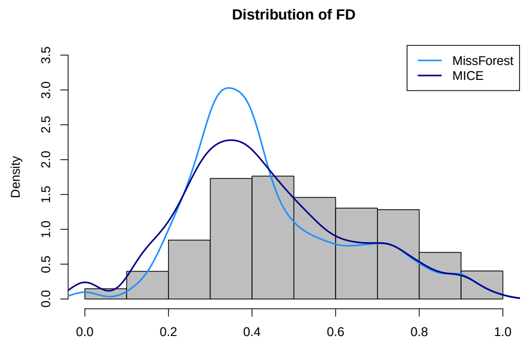
Figure 21: Imputation results from *MissForest* and *MICE* (blue lines) vs. original data distribution (grey bars) for selected measures of wealth distribution. The non-standardised variable value is indicated on the x-axis.

While the imputed density functions are largely following the distribution of the original data (illustrated with the grey bars) for the different measures of wealth inequality, there are a few deviations when looking at the imputation results for a selection of descriptive feature variables.

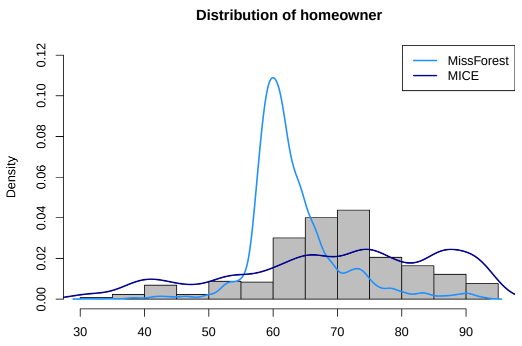
The most noticeable here is the distribution of home ownership rates (figure 22c), where the *MissForest* algorithm shows a different distribution pattern than in the original data and in the *MICE* imputation results. This is because the availability of data here is particularly fragmentary, and has only been reported on a regular basis since the 2000s, while before, there are only sporadic reports. Among the countries considered in this paper, there are, however, a few that have experienced quite considerable increases in home ownership rates since the time of the first data reporting. These include Czechia, Finland, France, Germany, Hungary, Italy, Japan, Korea, the Netherlands, Poland, Portugal, Russia, Singapore, Sweden, Switzerland and the United Kingdom. The machine learning algorithm thus assumes that the rate of home owners as a share of the total population is systematically below the homeownership rates that were observed in the last ten to twenty years, when considering the entire time horizon. The deviation of the *MissForest* imputation results from the original data is therefore not necessarily indicating a poor model performance, but could in fact provide a more realistic picture on the actual situation in the past.



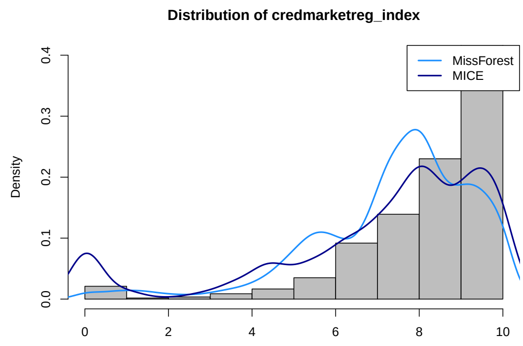
(a) Imputation results for $hhcred_{gdp}$ (household credit to GDP)



(b) Imputation results for FD (financial development index)



(c) Imputation results for homeowner (home ownership ratio)



(d) Imputation results for $credmarketreg_{index}$ (credit market regulation index)

Figure 22: Imputation results from *MissForest* and *MICE* (blue lines) vs. original data distribution (grey bars) for selection of descriptive feature variables. The non-standardised variable value is indicated on the x-axis.

5.4 Results

The results from predicting the six measures of wealth distribution based on the previously described machine learning algorithms and data set are given in the summary table below. It shows that, in general, the boosting algorithms are exhibiting the lowest prediction errors, while the algorithms are overall most successful in predicting the Gini coefficient for wealth, the top 10 wealth percentile and the middle wealth deciles (wea_{p3070}). Prediction accuracy tends to be better for the higher wealth deciles than for the lower ones. Generally, MAPE scores under 10 percent are considered as yielding very good predictions, while values under 20 percent are still indicating a good performance. MAPE scores of 50 percent and higher are not acceptable.

Predicted variable	**Performance measure**	**Standard Random Forest**	**MERF**	**SMERF**	**XGBoost**	**GPBoost**	**LASSO**	**Demeaned LASSO**
$gini_{wea}$	MSE	0.07110976	1.910078	2.042988	0.1627053	0.0678114	0.3400622	0.1213343
	MAPE	5.25317	8.619246	9.051393	1.222501	1.405171	2.686495	1.642691
wea_{top1}	MSE	0.04961035	2.112735	2.213751	0.0954261	0.0662046	36990441	0.1213665
	MAPE	14.15544	22.04871	23.28713	1.195147	1.454332	100.2189	1.641333
wea_{top10}	MSE	0.05447175	2.027198	2.149578	0.1299339	0.0583554	0.295453	0.1214216
	MAPE	8.893373	6.941769	7.757253	2.024615	1.509017	1.770797	1.65677
wea_{p3070}	MSE	0.05604458	2.031036	2.164715	0.1365387	0.0629219	0.3291328	0.1216542
	MAPE	4.17924	4.094183	4.095037	0.7817845	1.374507	1.772255	1.641711
wea_{bot50}	MSE	0.1171409	1.81203	1.967195	0.256907	0.1096382	0.4025128	0.4025128
	MAPE	7.927217	9.286597	9.980222	2.552378	1.480902	3.707104	3.707104
wea_{bot20}	MSE	0.1255601	1.708923	1.903261	0.2266128	0.1270053	0.4581495	0.1201453
	MAPE	7.969835	10.35196	10.3495	4.555104	1.493222	4.147707	1.58925

Table 18: Performance of different machine learning algorithms for predicting selected measures of wealth inequality.

Thus, since almost all predictions can be classified as good or very good, the performance of the algorithms will hereafter be considered less central to the analysis. Rather, I am interested in the mechanisms that led to these predictions, i.e., in the factors that drive wealth inequality and wealth distribution, and what role credit plays within these.

5.4.1 Determinants of wealth inequality

For this purpose, I draw on the **feature importance** in the respective predictions. The feature importance measures how important a specific feature is in predicting the target variable. More precisely, the feature importance is a measure for the increase in the prediction error of a model, when the feature is permuted (Molnar, 2023).

Figures 23 to 29 show the top 10 most important features for the prediction of all six wealth distribution variables based on random forest, boosting and LASSO algorithms. An overview on all features and their symbols can be found in the Appendix. The graphs illustrate that the key factors in predicting the Gini indicator are, in particular, the level of loans to businesses and households, average working hours, the share of the population aged 65 and over, the gross saving rate of households, the degree of centralized collective bargaining and the unemployment rate. Furthermore, variables that contain information about the cost of lending (e.g. lending interest rates, value of collateral), and the development level of a country (e.g. GDP per capita or GDP growth) seem to be important predictors for wealth inequality. Thus, there are factors that directly affect wealth, like loans, and some that have indirect effects through income, like for example working hours.

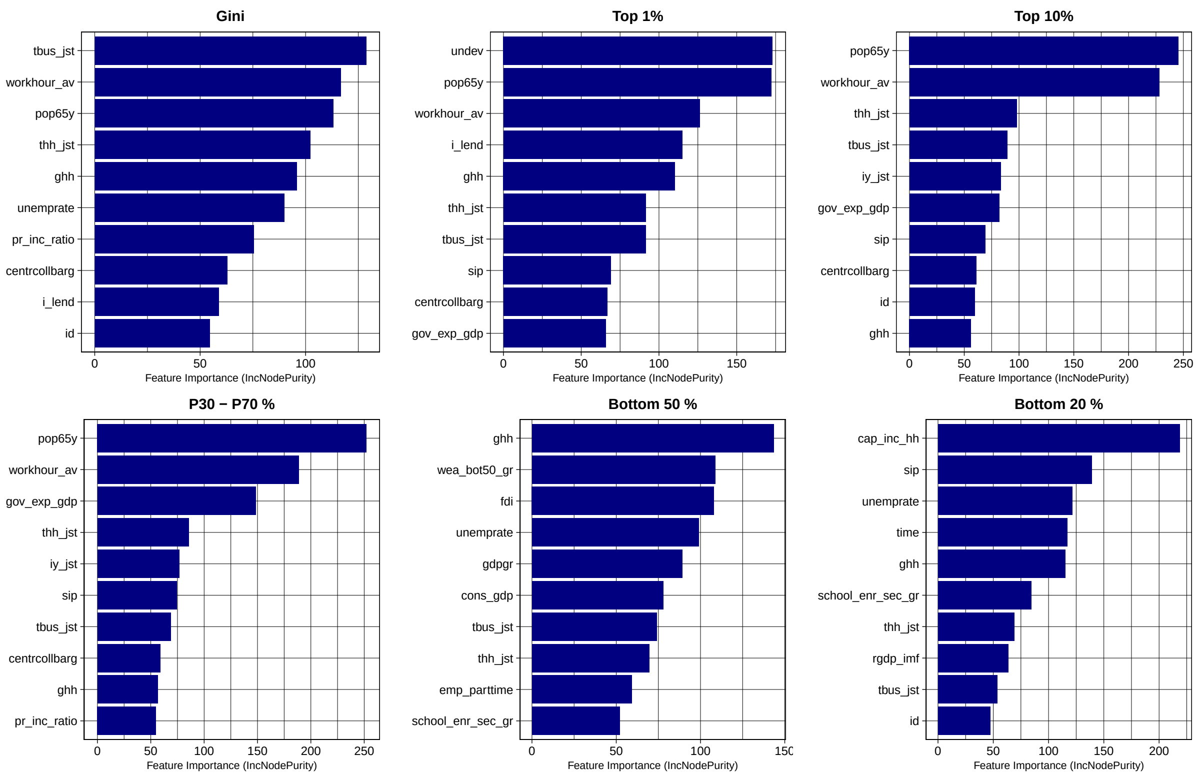


Figure 23: Top 10 feature importance for wealth inequality measures, based on standard random forest and *MissForest*.

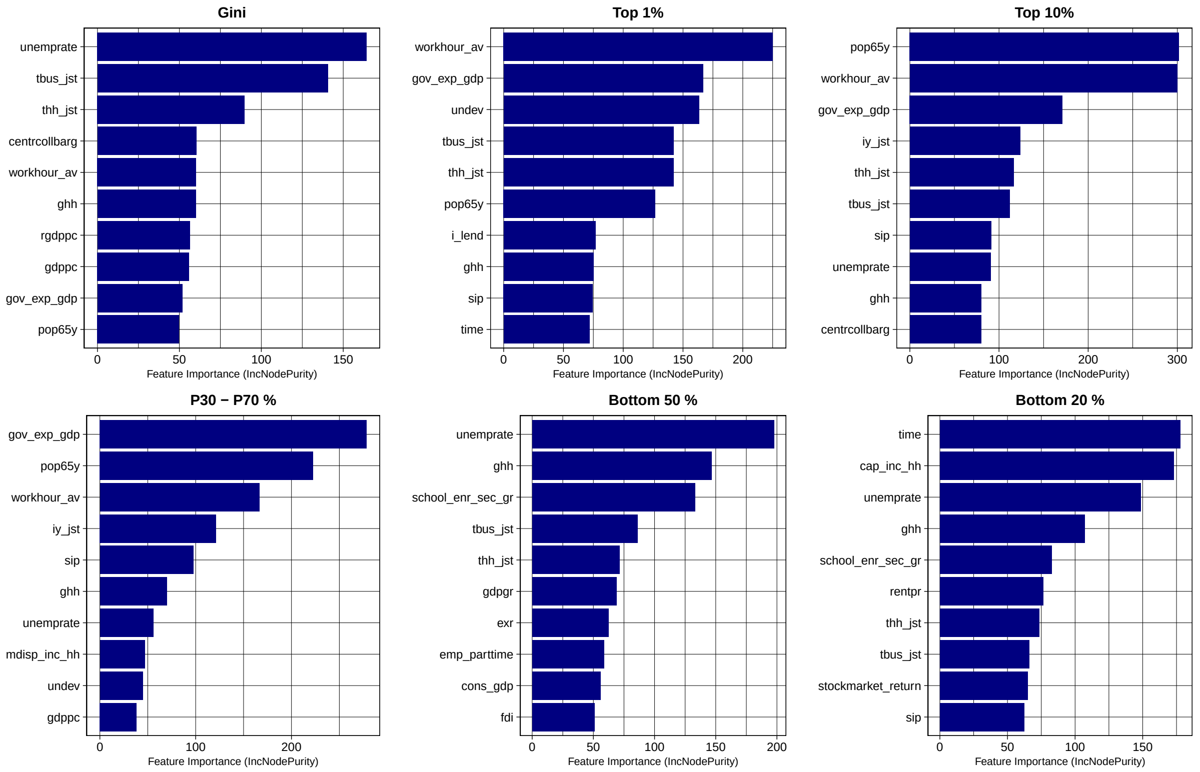


Figure 24: Top 10 feature importance for wealth inequality measures, based on MERF and *MissForest*.

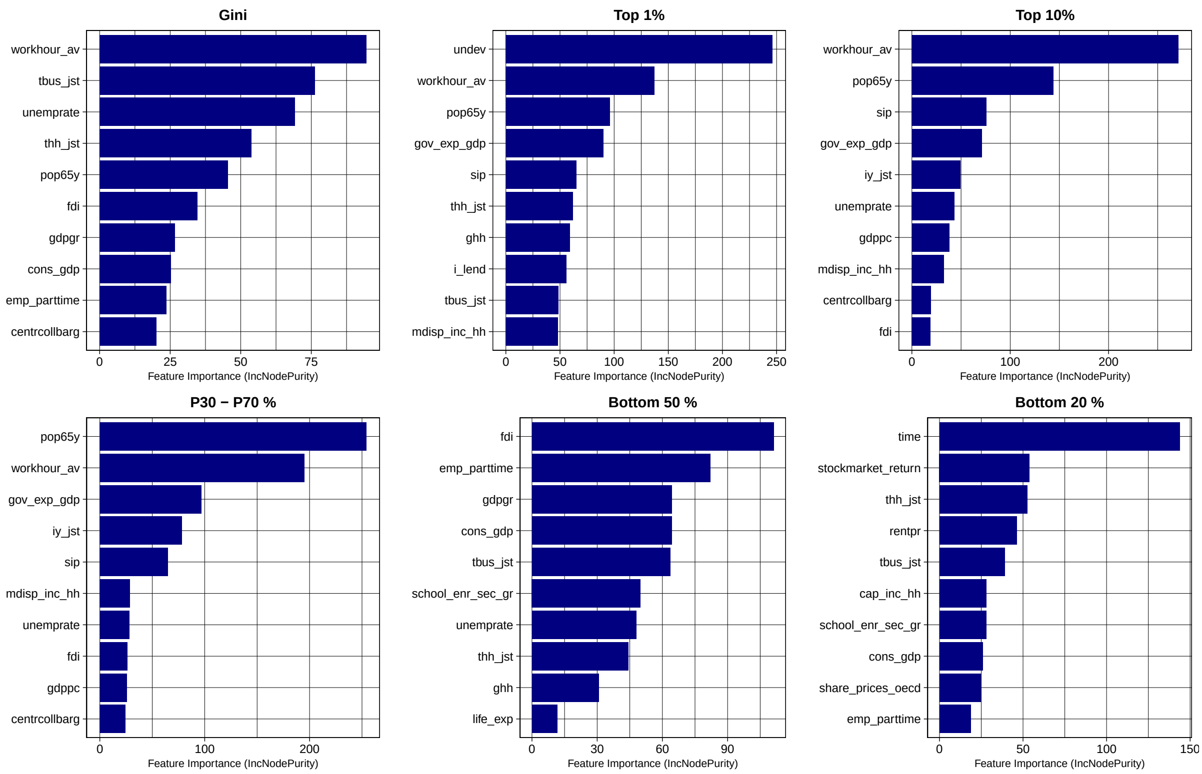


Figure 25: Top 10 feature importance for wealth inequality measures, based on SMERF and *MissForest*.

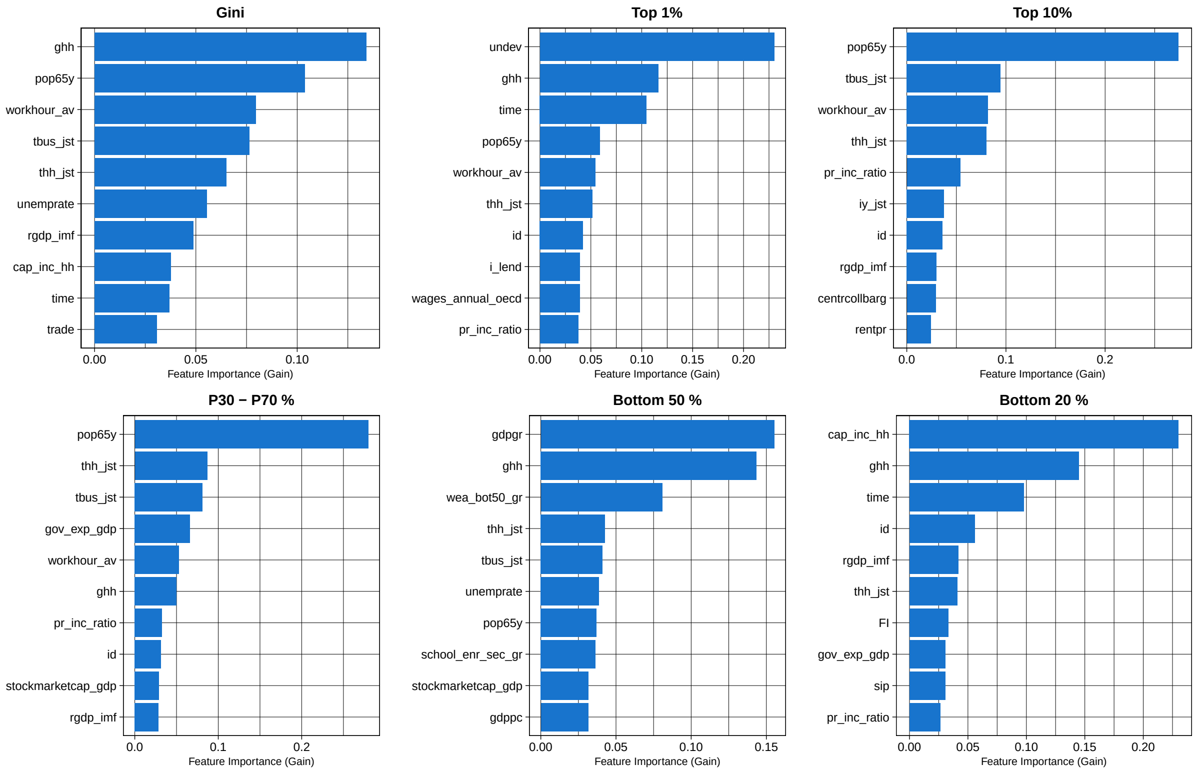


Figure 26: Top 10 feature importance for wealth inequality measures, based on XGBoost and *MissForest*.

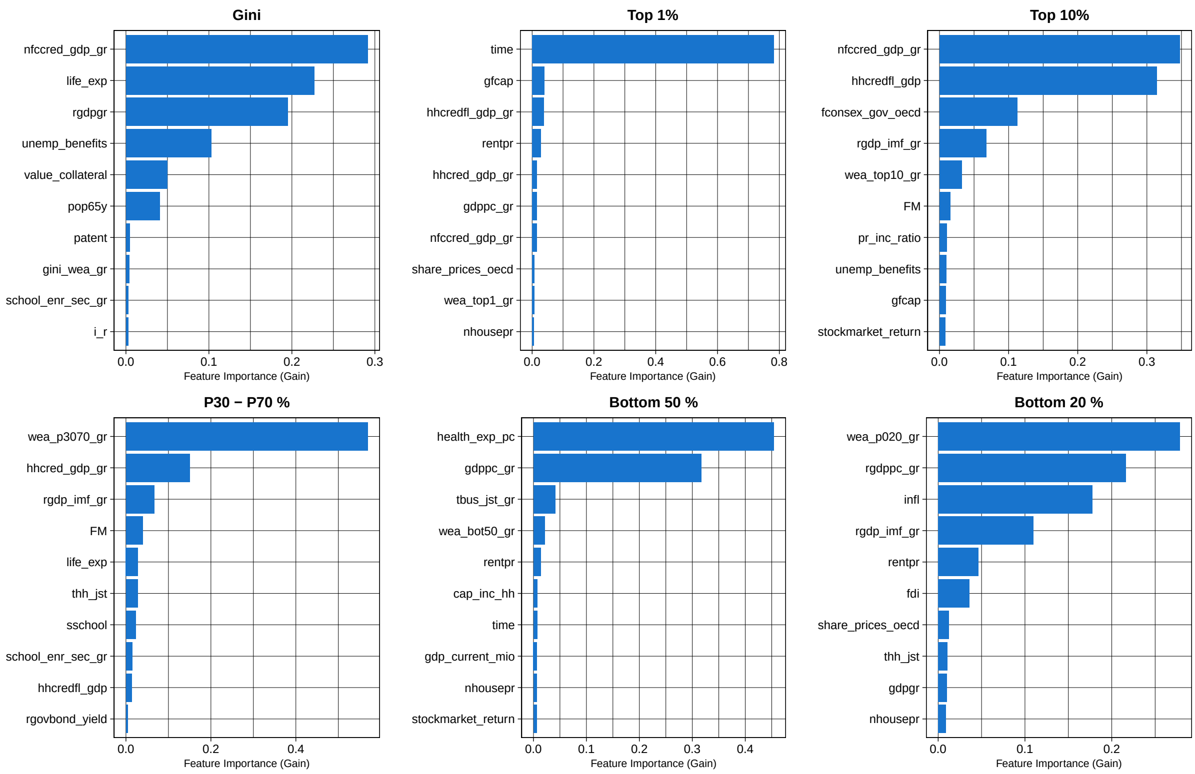


Figure 27: Top 10 feature importance for wealth inequality measures, based on GPBoost and *MissForest*.

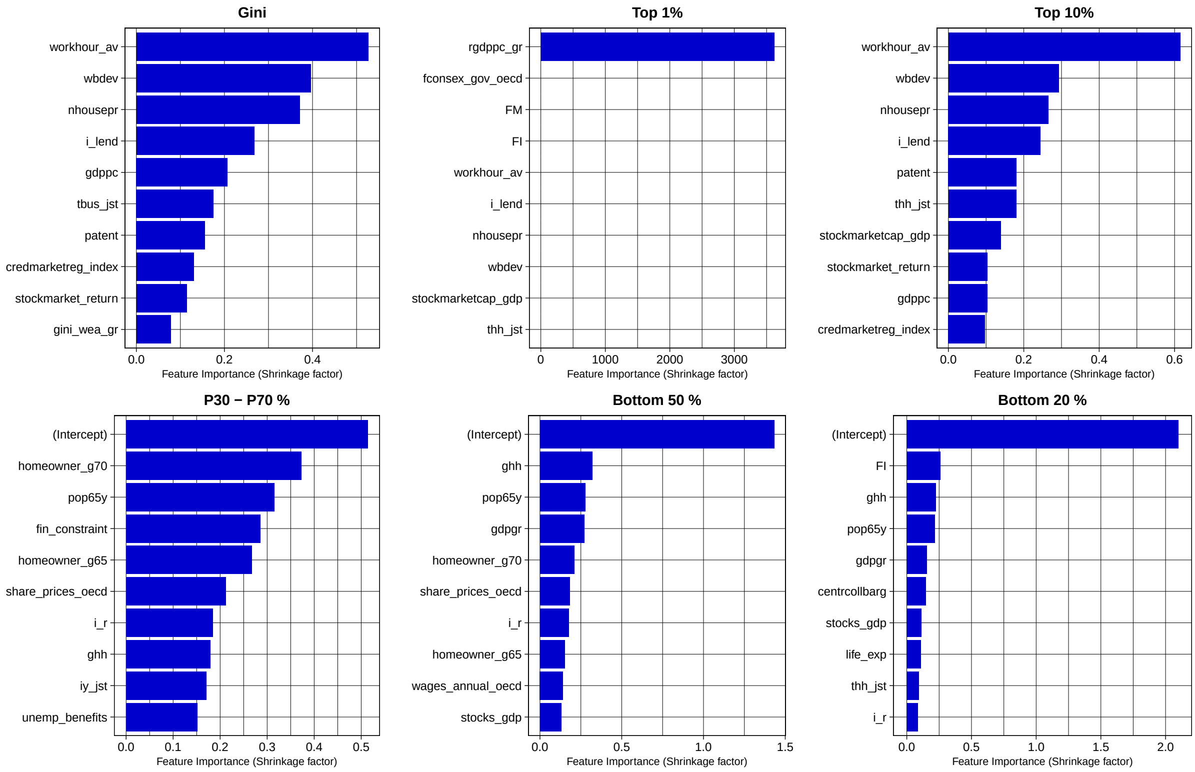


Figure 28: Top 10 feature importance for wealth inequality measures, based on LASSO and *MissForest*.

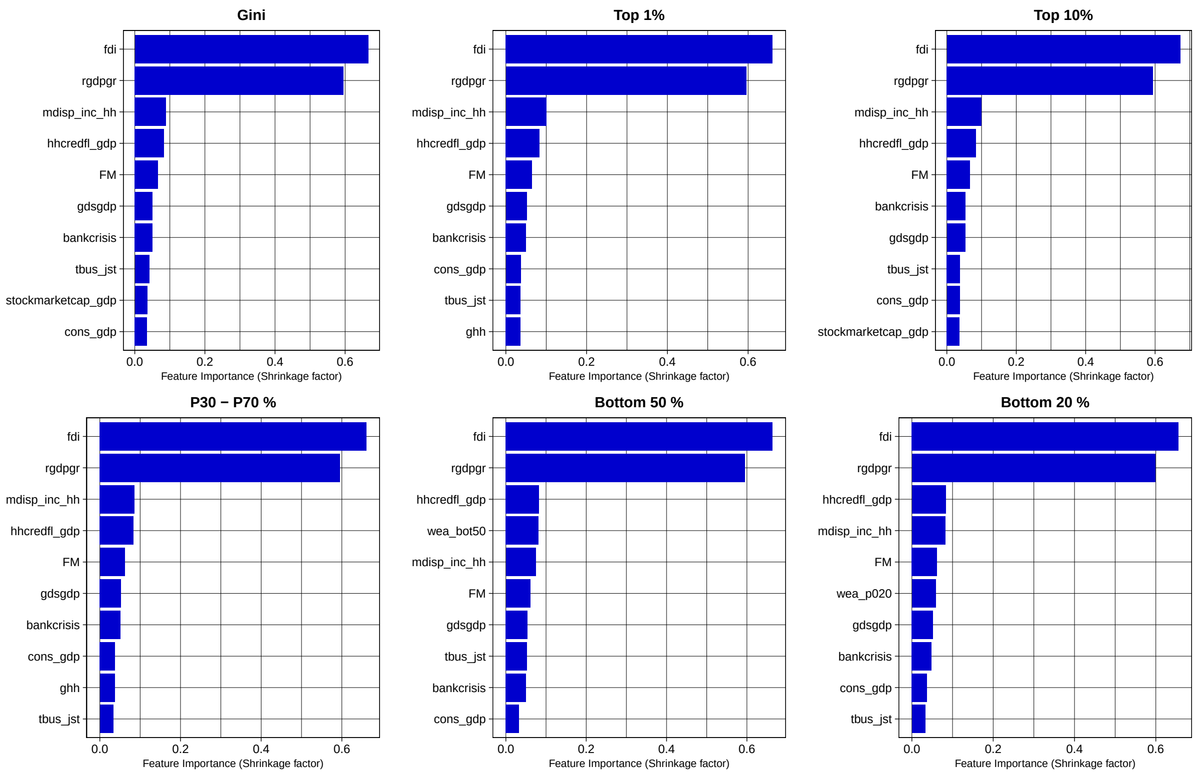


Figure 29: Top 10 feature importance for wealth inequality measures, based on demeaned LASSO and *MissForest*.

Also when predicting the different percentiles of the wealth distribution, the previous factors play an important role. While the overlaps in top 10 feature importance are particularly pronounced for the upper percentiles of the wealth distribution, some other factors, like for example schooling, seem to have a stronger impact on the wealth distribution in the lower deciles (wea_{bot50} and wea_{bot20}).

When comparing the top 10 feature importance for predicting the wealth Gini coefficient and the wealth percentiles among the different machine learning algorithms it can be seen that there are broad similarities. It also becomes obvious that controlling for the panel element in the data slightly alters the top 10 feature importance, however, without changing the fundamental structure.

Figure 30 and 31 summarize the results from the previous feature importance plots and illustrate the robustness of specific features for prediction. A darker blue indicates a higher importance for prediction.

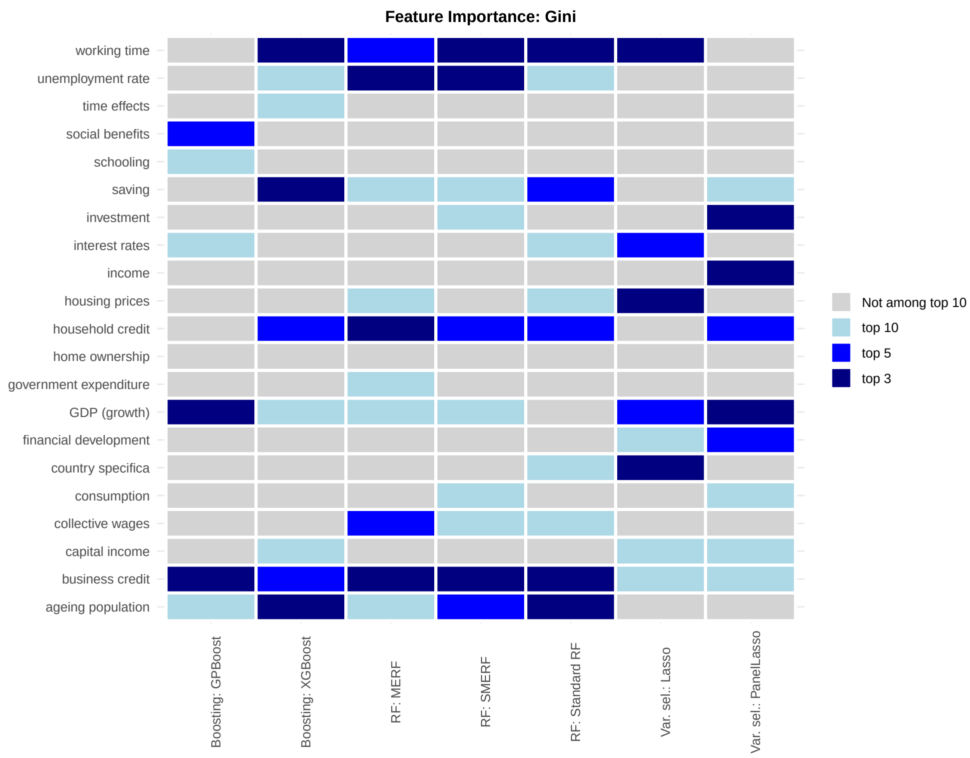
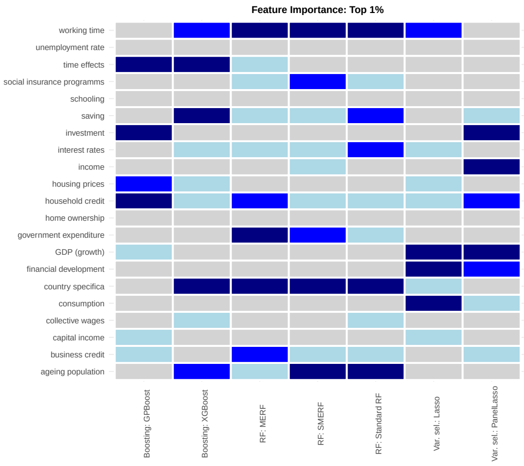
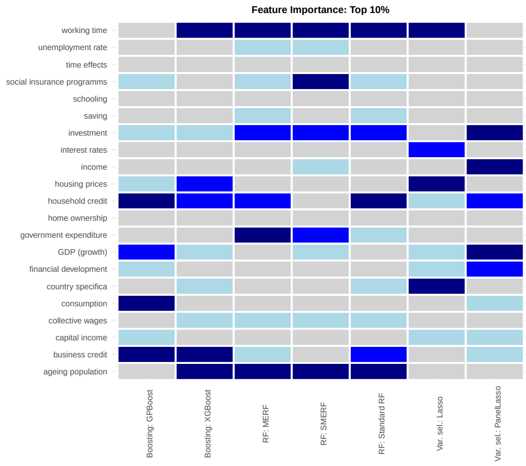


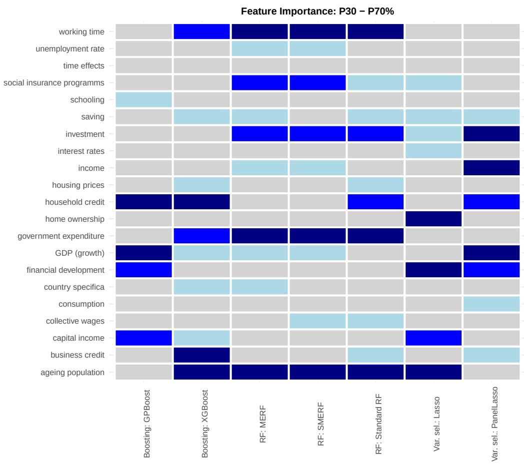
Figure 30: Feature importance ranks for wealth Gini coefficient, based on various machine learning algorithms and *MissForest*.



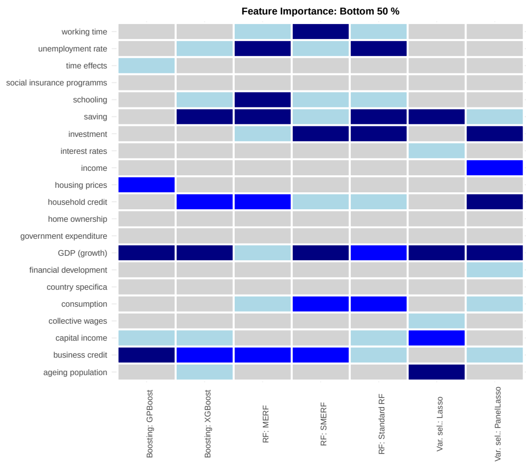
(a) Feature importance ranks for wea_{top1}.



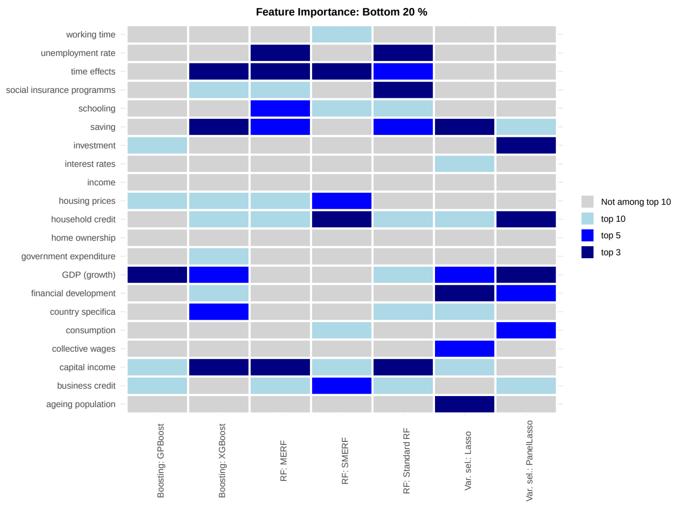
(b) Feature importance ranks for wea_{top10}.



(c) Feature importance ranks for wea_{p3070}.



(d) Feature importance ranks for wea_{bot50}.



(e) Feature importance ranks for wea_{bot20}.

Figure 31: Feature importance ranks for different wealth percentiles, based on various machine learning algorithms and *MissForest*.

Thus, for the prediction of the Gini coefficient on wealth there are four feature groups that seem to be particularly important across all algorithms: 1) Working time (e.g. average working hours, part-time employment), 2) business credit, 3) household credit, and 4) ageing population (i.e., share of population over 65 years).

For the 99 percentile of wealth (wea_{top1}), working time and country specifica (like e.g. the development level) have a strong impact on the prediction, while the most important features for the 90 percentile of wealth (wea_{top10}) mostly equal those of the Gini coefficient prediction (working time, ageing population, household credit). In addition to this, the prediction on the wealth share of the middle income deciles is also highly impacted by government expenditure. The predictions on the bottom deciles are driven by saving indicators, household credit, GDP and GDP growth, as well as business credit (in the case of wea_{bot50}), or the amount of capital income (for wea_{bot20}).

In the context of this paper I am above all interested in the role of credit as determinant for wealth inequality. The previous figures show that household credit, as well as business credit consistently play an important role for the prediction of wealth inequality and the distribution of wealth, independent of the underlying algorithm. This does not necessarily mean that the credit variables are always the most important feature for prediction, but most of the time, they are among the top 10, or even the top 3.

What lacks the previous analyses is, of course, in what direction the features influence the respective target variable. So far, for example, we know that credit seems to have a strong impact on the prediction of wealth inequality, but we do not know whether this is a positive (inequality-enhancing) or a negative (inequality-decreasing) impact. For this reason, the previous analyses are in a first step extended by the introduction of the **SHAP** (SHapley Additive exPlanations) method. The SHAP summary plot below combines feature importance, based on Shapley values, and feature effects. Shapley values are calculated for each instance and yield the contribution of each feature value to the prediction while considering the impact of other features for prediction. For better clarity I will now focus the analysis on the Gini index for wealth.

Figure 32 shows the Shapley values for the 15 most important features in the prediction of the Gini coefficient, that were computed based on a random forest. Each point represents the Shapley value for one instance. The darker the point the lower is the value of the feature for this specific instance. Negative Shapley values indicate a negative impact of the feature value for the prediction of the Gini coefficient, while positive values indicate a positive relationship. Figure 33 is computed based on the XGBoost algorithm (extreme gradient boosting) and serves as robustness check.

The SHAP summary plots show that there is generally a high degree of heterogeneity within the feature effects. For household credit and business credit, it seems that the feature effect over the whole sample is slightly negative, however, there is no particular systematology on what concerns the feature value. In other words, we cannot see that, for example, for higher values of household credit, household credit has a positive impact on predicting wealth inequality, while the relationship is negative for smaller feature values, or the other way around.

On the other hand, the plot shows that longer working hours tend to increase the predicted Gini coefficient, while there is a negative relationship for relatively short working hours. For economies with a rather young population there seem to be lower predictions on the Gini coefficient, while older populations might exhibit higher wealth inequality. When there are particularly high unemployment rates, the SHAP plot indicates rather high predictions for wealth inequality. Figure 33 also suggests that in more recent years (higher feature value for time) wealth inequality has generally increased.

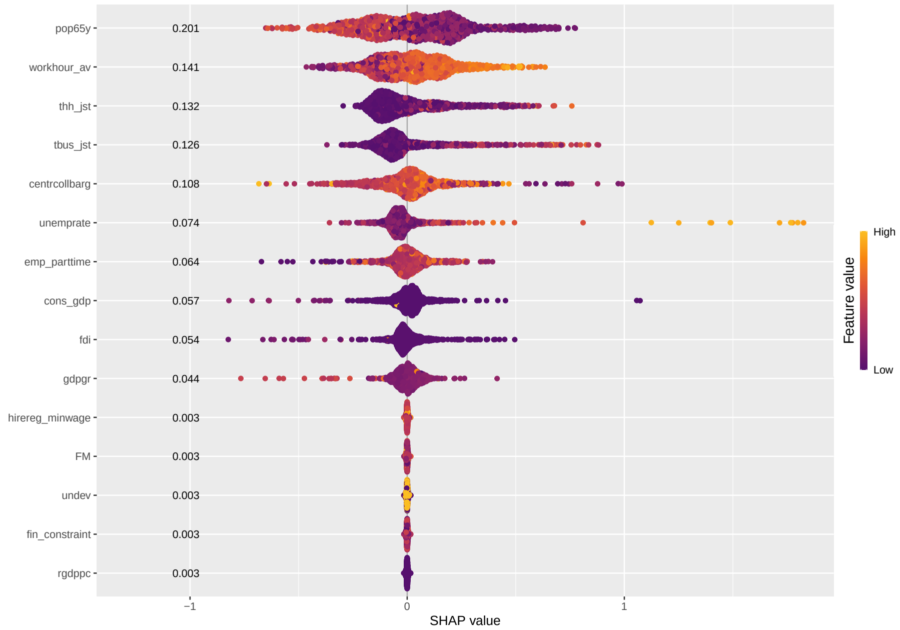


Figure 32: SHAP summary plot based on random forest algorithm.

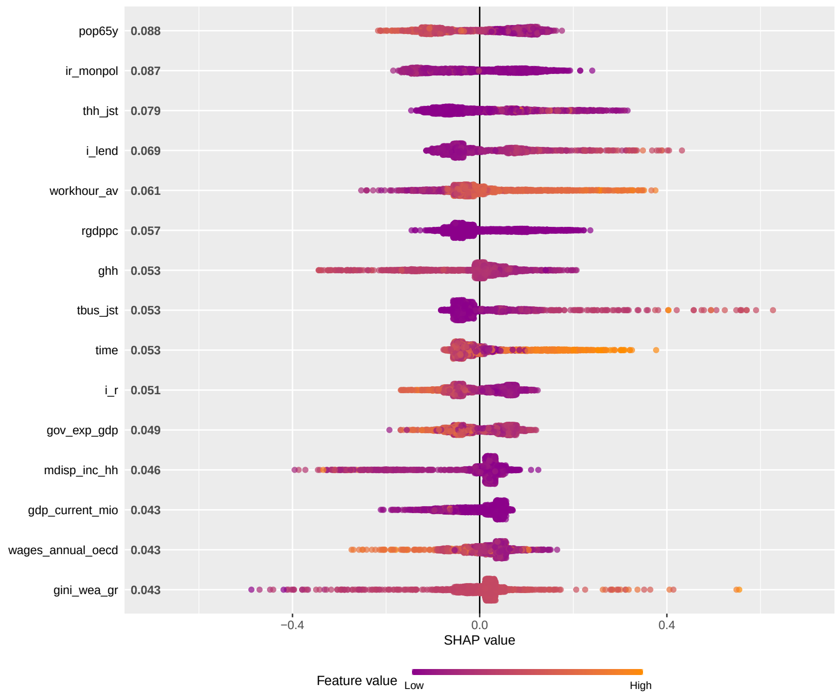


Figure 33: SHAP summary plot based on XGBoost algorithm.

One problem with the analysis of the SHAP plots in this case is that they provide feature attribution for the prediction of a specific instance, however not accounting for different conditions within the other feature variables. Also, the Shapley values are not designed to show an isolated effect of credit for the prediction of wealth inequality, but consider interactions with other feature effects. To get more systematic insights into the mechanisms that drive the relationship between finance and wealth inequality, I therefore need to provide another methodological extension.

5.4.2 Finance and wealth inequality

A tool that uses the ability of machine learning algorithms to identify similar subgroups in order to estimate the effects of one variable on another within different conditions is the **causal forest** algorithm. Causal forests fundamentally rely on the concept of decision trees and random forests, however, they differ with respect to their designated objective. While decision trees are applying a splitting rule to divide the data into sets with the most dissimilar outcome, causal trees are built by splitting the data where the difference in outcomes between treated and non-treated instances is the largest, and where the predicted outcome is still accurate. As this makes it necessary to divide the data into two parts (one half for tree partition and one half for estimating treatment effects), this method relies on applying random forests, using bootstrap samples for each decision tree (Huber, 2023). In simple words, a causal forest consists of thousands of causal trees, with each terminal leaf constituting an artificial experiment. Due to bootstrapping and random subsampling of treated and non-treated groups, causal forests are rather robust to treatment assignment biases (Tiffin, 2019).

Once all trees in each bootstrap sample are grown, estimated treatment effects are aggregated to obtain an overall estimate. In that way I can extract **average partial effects (APE)** and **conditional average treatment effects (CATE)**. Average partial effects are a measure for the average change in the target variable (here: Gini coefficient of wealth), once the treatment variable (here: household credit) is changed by one unit, while all other predictor variables are held constant. Conditional average treatment effects yield information on how the treatment effect varies accross conditions (i.e., with respect to other descriptive features).

Figure 34 presents the distribution of CATEs when estimating the effect of household credit on the Gini coefficient of wealth. It shows that there is quite a high heterogeneity of treatment effects across the entire sample: the mean of all individual effects (i.e., the average treatment effect heterogeneity) is 0.17817, with a minimum CATE of -0.73071 and a maximum CATE of 1.45588.

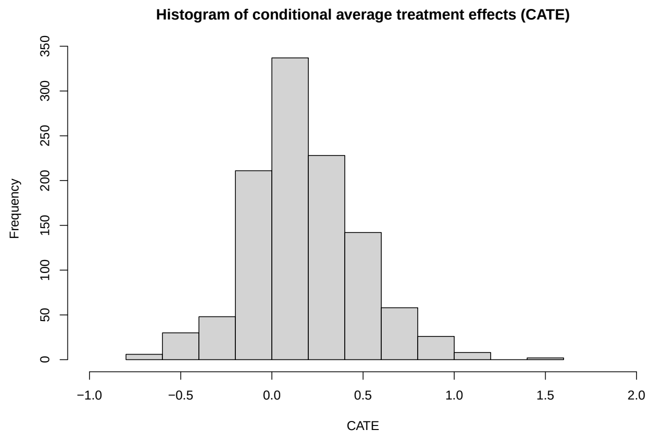


Figure 34: Histogram of conditional average treatment effects (CATE), based on random forest algorithm.

While we observed slightly negative average Shapley values for household credit in the previous chapter, it is also interesting to note that the APE of household credit on the Gini index of wealth inequality is 0.56921, with a standard error of 0.07013 and a p-value of 0.000, when analyzed in an isolated way. On average, it seems thus, that household credit tends to increase wealth inequality. This suggests that the Shapley values for household credit may indeed have been biased, such as by feature dependencies.

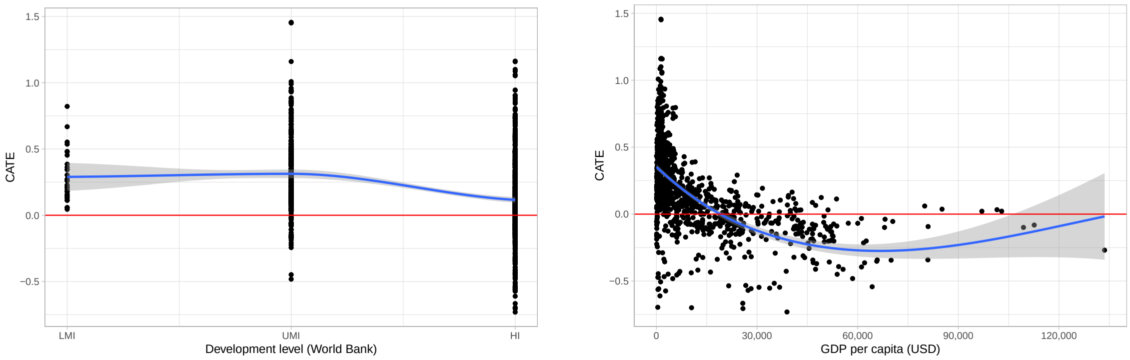
I will now have a look at some of the most interesting CATEs for the impact of household credit on the Gini coefficient for wealth. While the following observations are based on the analysis of absolute household credit, they are mostly robust to using a relative measure of household credit (household credit to GDP), with the exception of figure 41. The results for this robustness check can be found in the Appendix (see figure 51).

The following figures show the CATEs for different values of the feature variable on the x-axis. The red line represents a CATE of zero, the grey shading illustrates the confidence intervals.

Economic development and education

First of all, figure 35a indicates that there is a positive relationship between household credit and wealth inequality, regardless of a country's level of development. However, it seems that credit has weaker inequality-increasing effects in high-income countries than in less developed countries. Similarly, the positive CATE seems to turn negative after a threshold of about

20,000 USD in GDP per capita is reached (figure 35b).



(a) CATE for different development levels. (b) CATE by GDP per capita (in current USD).

Figure 35: Conditional average treatment effects (CATE) by economic development, based on *causalForest*.
Note: LMI = lower-middle income countries; UMI = upper-middle income countries; HI = high-income countries.

This may also be related to the observation in figure 36 that the effect of household credit is initially positive, i.e. inequality-increasing, when presented with respect to schooling and becomes negative after about 3.5 years of average secondary education.

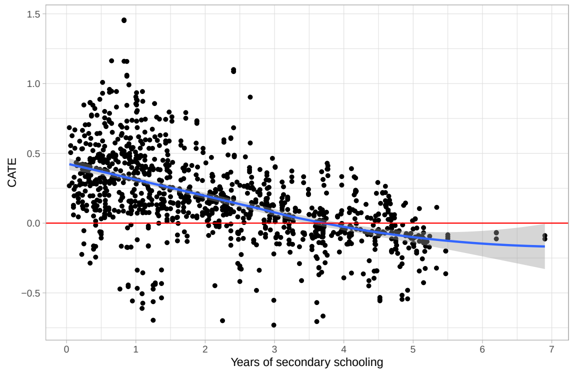


Figure 36: Conditional average treatment effects (CATE) by average years of secondary schooling, based on *causalForest*.

Financial development

Another non-linearity that is particularly emphasized in the empirical literature on the nexus between finance and income inequality, and also in the literature on wealth inequality, is the degree of financial development. The results from figure 37 suggest that in countries with less developed financial systems, household credit tends to increase wealth inequality, while it has an equalizing effect for economies with a higher degree of financial development. This is in line with the results for income inequality by D.-H. Kim and Lin (2011). While we can observe a flattening of the CATE curve for particularly high degrees of financial development, it would be too far-fetched to speak of an inverted u-curve, as found in the study by Park and Shin (2017) (who are also looking at income rather than wealth inequality).

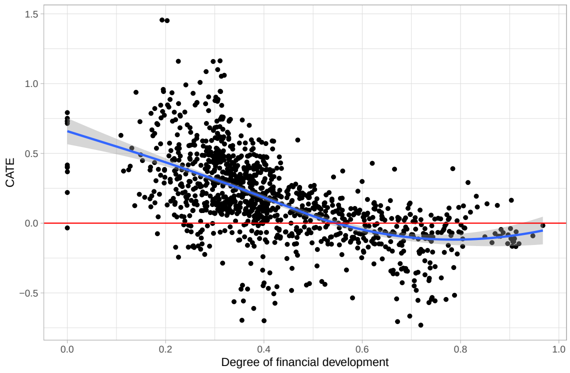
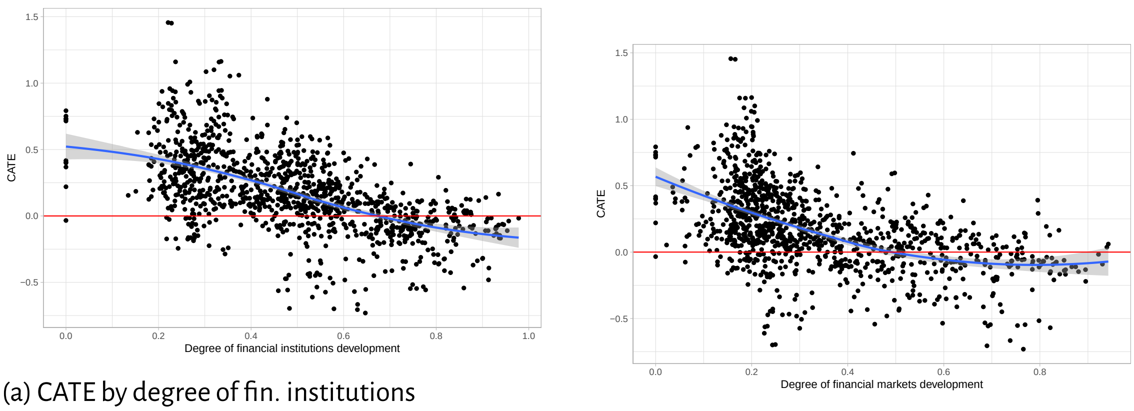


Figure 37: Conditional average treatment effects (CATE) by degree of financial development, based on *causalForest*.

The information from the *IMF Financial Development Index Database* also allows for a further differentiation of this analysis by distinguishing between the degree of development of financial institutions and financial markets (see figure 38). The results show that the previously stated negative course of the CATE is robust to both financial institutions and financial markets development. In contrast to the overall measure of financial development, there is no flattening of the curve for financial institutions. These results might aim in a similar direction as the findings by Brei et al. (2023), yet I see no evidence that strengthening lending through financial markets increases inequality in the distribution of wealth.



(a) CATE by degree of fin. institutions development.

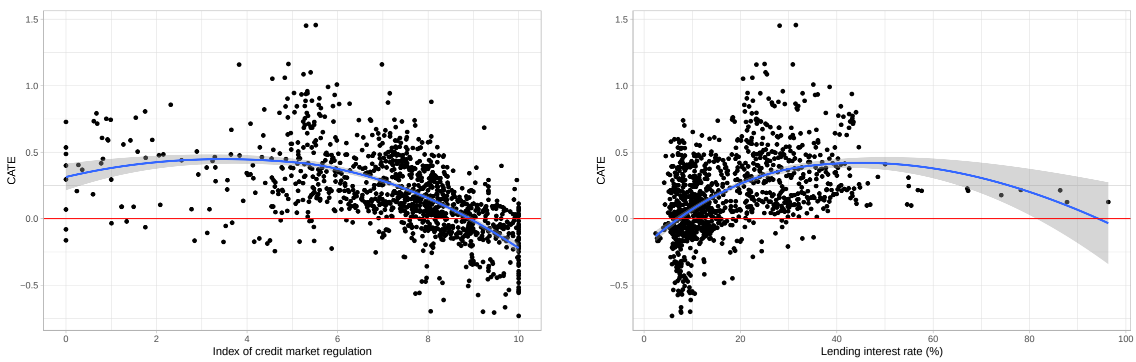
(b) CATE by degree of fin. markets development.

Figure 38: Conditional average treatment effects (CATE) by financial development of financial institutions and financial markets, based on *causalForest*.

In the Appendix (see figure 50) I have further split the previous analysis by depth, accessibility and efficiency of financial institutions and financial markets. What can be derived from this is that the course of the CATE is negative for all sub-indices except for the efficiency of financial markets. Increased depth and accessibility of the financial system, on the other hand, is consistently reducing wealth inequality. Even though increased efficiency of financial institutions, as opposed to financial markets, is also inequality-reducing, this effect sets in much later than in the case of depth and access. The results by Hasan et al. (2020), which suggest that financial depth increases wealth inequality, while access and efficiency tend to decrease it, can thus only be partially confirmed.

Figure 39a makes use of another set of indices for economic development, amongst others on the regulation of credit markets, that is published by the *Fraser Institute*. Higher index scores indicate lower credit market regulations, as measured by the classification of bank ownership structures, private sector borrowing and interest rate controls.

In line with the previous results for financial development, a lower degree of credit market regulation (i.e., higher scores in figure 39a) accordingly seems to reverse the positive relationship between household credit and wealth inequality. Also, increasing interest rates direct a disequalizing effect of household credit. Only for specifically low values of lending interest rates we can observe negative CATEs. The parabolic shape of the CATE function for lending interest rates is driven by some outliers at the right-hand margin and thus has very high confidence intervals at this point.



(a) CATE by index of credit market regulation. (b) CATE by lending interest rate.

Figure 39: Conditional average treatment effects (CATE) by credit market regulation and lending interest rate, based on *causalForest*.

Housing and social security

Due to its key role in the accumulation of wealth for households, the share of the population that owns a home is another particularly important aspect when considering heterogeneous effects between household credit and wealth inequality. Home ownership includes all kinds of dwellings (i.e. houses, apartments, condominiums, housing cooperatives) that are owner-occupied.

As Figure 40 points out, the CATE function for the home ownership ratio shows a clearly negative slope that flattens for relatively high home ownership ratios. While household credit has a tendency to increase wealth inequality for observations with home ownership ratios of below 69 percent, credit to households mitigates wealth inequality in countries with a higher share of home owners.

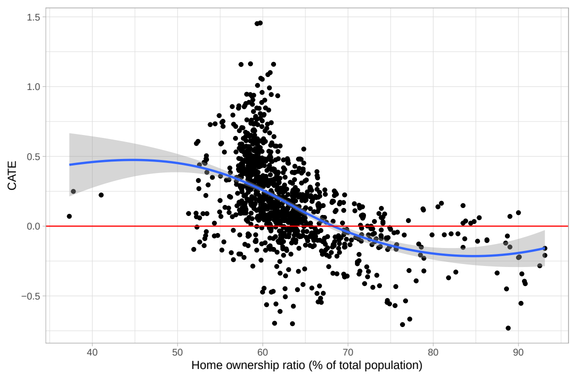


Figure 40: Conditional average treatment effects (CATE) by home ownership ratio, based on *causalForest*.

Another interesting CATE is based on the share of the population that is covered by social insurance programs, such as old age contributory pensions, health insurance, occupational injury benefits or paid maternity leave. Figure 41 shows a generally negative course of the CATE, indicating that in economies with rather low social insurance coverage, credit to households tends to increase wealth inequality, while credit decreases wealth inequality once a larger share of the population is socially secured. This result is, in contrast to all previous observations, not robust to using household credit to GDP as treatment variable.

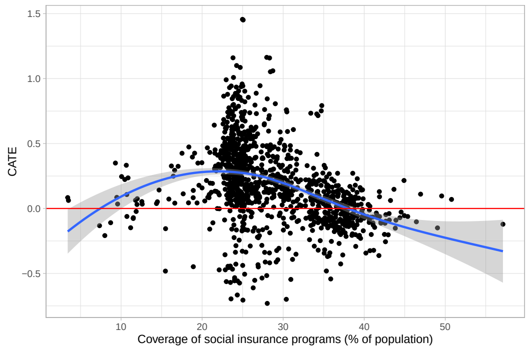


Figure 41: Conditional average treatment effects (CATE) by coverage of social insurance programs, based on *causalForest*.

5.5 Discussion

In chapter 5.2 I have shown that the vast majority of empirical studies on the finance-inequality nexus is making use of income distribution data, even though, from a theoretical point of view, **analysing data on wealth** would be more reasonable. Although the distribution of income and wealth is highly correlated, I have made the presumption that this might result in systematic differences in the understanding of the relationship between finance and inequality. Thus, I will now discuss the empirical results in more detail and show how they differ from those of existing research.

In this paper I find that wealth inequality is mostly driven by working behavior (e.g. working hours and unemployment rates), credit provision to businesses and households, including lending costs, saving behavior and the age structure in an economy. The economic situation of a country (in terms of GDP and GDP growth) and labor market power are also factors to be considered. The results by Hasan et al. (2020) and Osakwe and Solleder (2023) move in a similar direction, emphasizing above all the importance of the financial sector, as well as saving and education. When comparing those results to the empirical determinants of income inequality that have been established in the literature, we can identify some similarities, as among the determinants of wealth, some are directly related to income. These include, for example, unemployment, education and labor market institutions, such as trade union memberships (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015; Furceri & Ostry, 2019). Other main drivers of income inequality are skill-biased technological change (Autor et al., 2006), trade globalization (Milanovic, 2005) and redistribution policies. The financial system, however, has a subordinate role as determinant of income inequality, above all impacting foreign capital flows. Dabla-Norris et al. (2015), for example, argue that foreign assets and liabilities tend to flow into high-technology sectors with a high demand for skilled workers which increases the skill-premium, implying that financial globalization pushes income inequality. This substantial divergence from the literature on wealth inequality, where the financial system is one of the most important determinants, underscores the fact that the link between finance and inequality can only be adequately analyzed with the help of comprehensive wealth data.

In addition to identifying factors that generally determine wealth inequality and the distribution of wealth, the core of the previous analyses consisted of classifying the role of finance (i.e. credit) in this context. In particular, the results of the SHAP analysis and the distribution of conditional average treatment effects from the *causal forests* implied the **existence of several heterogeneous effects** that need to be discussed in more detail.

(1) Economic and financial development

First, the *causal forest* results suggest that there is a non-linear effect between credit and wealth inequality once this relationship is mapped in terms of different levels of development of a country. To be precise, the relationship between finance and wealth inequality is positive for countries with a lower GDP per capita, and turns negative after a certain threshold of GDP per capita is exceeded. In other words, credit has an inequality-enhancing effect for less developed countries, and tends to decrease wealth inequality for economically more advanced economies.

From the economic literature and in accordance with macroeconomic data we know that a country's level of development tends to be positively correlated with factors such as education and the quality of institutions, as well as the development of financial systems. This is also reflected in the fact that I find similar non-linear structures in the CATEs of secondary education and financial development. Hence, in line with the sparse literature on the relationship between wealth inequality and finance, I find that a more developed financial system is associated with an inequality-reducing effect of credit, while credit increases wealth inequality in countries with underdeveloped financial systems. In the literature there are different explanations for the existence of this non-linearity. Greenwood and Jovanovic (1990), for example, argue that the financial system must have reached a certain minimum size in order to have a positive impact on a country's wealth distribution due to natural fixed costs associated with the offering of financial services. Furthermore, J. Lee (1996) points out that there is little information on profitable projects in less developed countries, which obstructs the bankers ability to identify investment opportunities and provide credit. Less developed financial systems might also be correlated with relatively poor institutional quality, reflecting unequal access to political influence. Claessens and Perotti (2007) and D.-H. Kim and Lin (2011) show that this favors rent-seeking behavior of elites and impedes access to finance for the relatively poor. Finally, entry regulations, as for example identification requirements when opening a bank account, might also restrict access to finance in countries with low financial development (D.-H. Kim & Lin, 2011). Improving financial development, whether it occurs at financial institutions or in financial markets, would, according to my results, reduce wealth inequality, such as by having fewer barriers to access credit or by making rent-seeking behavior more expensive.

(2) Usage of credit

The granting of credit per se does, of course, not necessarily have a direct impact on the accumulation of wealth, even if access to credit is possible without major barriers. Thus, when examining the relationship between credit and wealth inequality empirically, it is also essential to understand what credit is used for. Figure 42, for example, shows the distribution of credit for the average of EU households in 2017 by type of credit. The chart is based on the third wave of a household survey conducted by European national central banks, the results of which are reported in the "Eurosystem Household Finance and Consumption Survey" (HFCS), published by the European Central Bank (ECB). The year 2017 was chosen to have the most up-to-date figures possible, but excluding special effects of the Corona pandemic in 2020, where the interviews for the 4th wave of the survey were started. In the course of the 2017 survey, 91,000 households from the 20 Euro area countries, as well as Hungary and Poland were surveyed.

The chart shows that about 47 percent of the median value of **household liabilities** consists of household main residence (HMR) mortgage, which is about the same median value as for other real estate mortgages. Non-collateralized loans are approximately 4 percent of total household liabilities, and credit from credit lines and credit card debt stand at 0.6 percent and 6.5 percent. In addition to this we can discover from the HFCS that in 2017, 20 percent of the households raised mortgage to acquire a household main residency, and 4.9 percent to purchase other property (such as a second house or flat, an industrial building, a garden, forest, or arable land or a garage). 22.1 percent of the responding households stated that they took on non-mortgage debt for other purposes, such as buying a vehicle and other consumer loans, or to finance educational costs. In summary, it can be noted that property loans, and in particular loans for acquiring the HMR play a crucial role in the overall usage of credit within the EU.

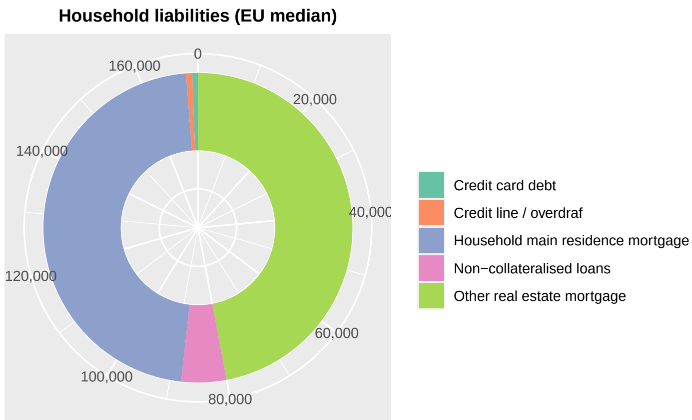


Figure 42: Household median liabilities by category, EU.
Source: ECB, Household Finance and Consumption Survey.

Many studies, such as by Kaas, Kocharkov, and Preugschat (2019); Kuhn, Schularick, and Steins (2020); Mathä, Porpiglia, and Ziegelmeyer (2017) and Kaiser (2021) have shown that housing is a, if not *the* **key driver of household wealth**. On the other hand, consumer credit rarely has an effect on building wealth, whereas loans for educational purposes take effect mostly in the medium and long term, or even intergeneratively, through higher skill premiums and higher financial literacy. The possibly negative trajectory of the CATE of credit and wealth inequality with respect to the coverage of social security programs (see previous chapter, figure 41) could also be framed by the form of the underlying loans. With low coverage, households have to increase borrowing when losing income to finance their daily expenses, which consequently does not contribute to wealth accumulation. With a higher coverage ratio, the likelihood that household borrowing will have to be used to secure everyday expenses decreases.

The close empirical relationship between household wealth and housing can also be illustrated within the HFCS. As figure 43 shows, Hungary, Poland, Spain and Portugal have the highest home ownership ratios, and the Netherlands, France, Austria and Germany have the lowest.

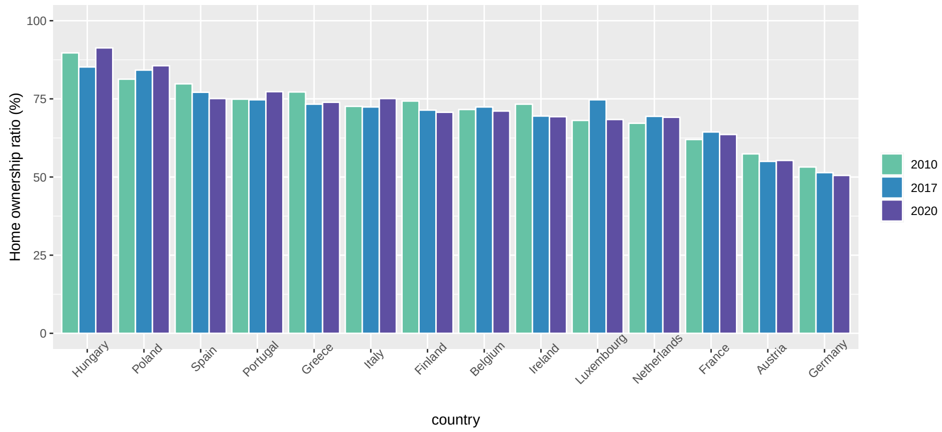


Figure 43: Home ownership ratios for selected EU countries.
Source: FRED, Eurostat, national statistical offices.

If Spain, Portugal, Austria, and Germany are taken as examples of particularly divergent countries in terms of HMR ownership, the HFCS enables the differentiation of ownership ratios by net wealth quintiles. From table 19 it becomes clear that those differences are substantial. While among the poorest 20 percent in Germany only 3.8 percent own their HMR (1.9 percent for Austria), this number increases to 20.8 percent in Spain, and 13.8 percent in Portugal. In the second quintile, three quarters of Spanish and Portuguese households own their home, compared to 5 percent in Germany, and 2 percent in Austria. The gap only begins to narrow slightly from the fourth quintile onwards.

Net wealth	**EU**	**Germany**	**Austria**	**Spain**	**Portugal**
0-20 %	7.3	3.8	1.9	20.8	13.8
20-40%	30.1	5.0	2.0	75.1	75.5
40-60%	79.1	39.5	42.5	92.8	91.8
60-80%	91.4	81.3	89.5	96.2	95.8
80-100%	94.0	90.4	93.9	94.5	95.7

Table 19: Share of population owning household main residency in percent, by quintile.
Source: ECB, Household Finance and Consumption Survey.

If one now examines the distribution of median financial and real assets in these countries, also broken down by quintiles, one sees that households in the Mediterranean countries have significantly higher real assets than German and Austrian households, particularly in the first two quintiles (see figure 44). This gap then evens out with the third or, at the latest, fourth quintile. While real assets include the value of the HMR and other real estate property, as well as vehicles and self-employment businesses, financial assets comprise values of deposits, mutual funds, bonds, publicly traded shares, money owed to household, voluntary pensions and whole life insurance. Real and financial assets combined yield total household wealth.

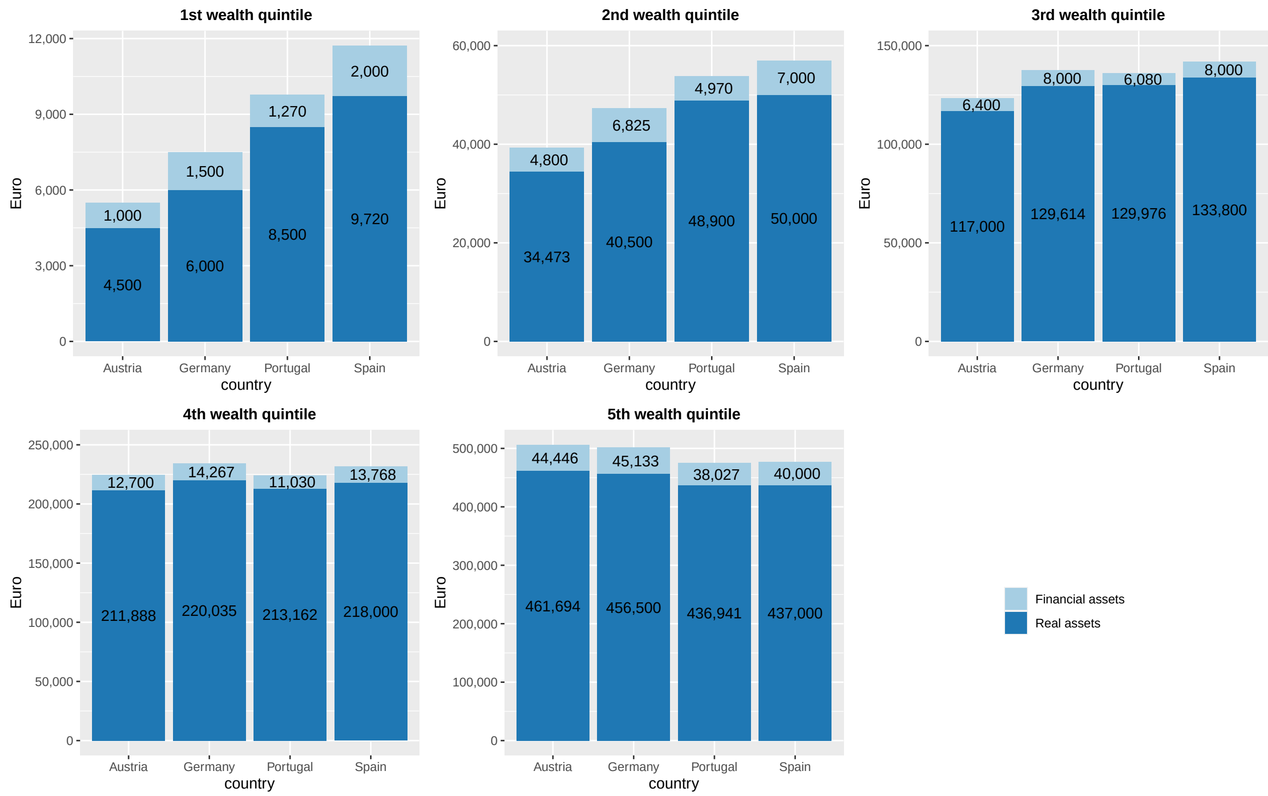


Figure 44: Median real and financial assets by wealth quintiles for Austria, Germany, Portugal and Spain.
Source: ECB, Household Finance and Consumption Survey.

In sum it has become clear that loans for the acquisition of owner-occupied and other real estate constitute the major part of household liabilities in the EU. Moreover, there are considerable signs that housing has an outstanding role in the accumulation of household wealth. Against this backdrop, the results of the *causal forests*, which suggest that with higher home ownership ratios, credit to households has a more inequality-reducing effect, fit quite well. The question that remains open is why some countries have such significantly higher ownership rates than others.

It is important to mention here that the availability and accessibility of credit is of course not the sole determinant of **households' preference to acquire property**, although it is an important factor. Spain, for example, ranked 4th of 192 in terms of global financial development in 2017, compared to rank 18 for Portugal, rank 17 for Germany and rank 30 for Austria (IMF Financial Development Index Database). In addition, however, national housing regulations are crucial. Kholodilin (2015) points out that aspects that need to be considered in particular are tenant protection and rent controls, social housing provision and rationing of housing, as well as subsidies to homeowners and taxation of residential property. A brief comparison of **housing policies and housing market characteristics** in the previously introduced example countries will clarify this.

One important decision criterion for the purchase of real estate is, of course, the development of **house prices**. As can be seen in figure 45, Germany experienced a particularly small increase in nominal house prices between 1980 and 2013, with annual growth rates of about 1.3 percent, equalling a decrease in real house prices. Due to low mortgage interest rates in the 2010s and until 2022, borrowers in the euro zone benefited from attractive financing conditions, however facing increasing house prices due to sound economic growth and a good labor market situation in Germany, as well as an increased demand for safe assets after the global financial crisis in 2008 (Schneider & Wagner, 2015). Recently house prices dropped due to higher mortgage costs associated with an increase in ECB interest rates. In Austria, house prices were also stagnant until 2005, experiencing an even more pronounced increase afterwards. Spanish house prices were constantly increasing since the 1980s, yet undergoing particularly strong growth in the early 2000s. After the Euro crisis there was a drop in nominal house prices, so that Spain has currently the lowest index among the four countries of interest. Nominal house prices in Portugal were also negatively affected by the Euro crisis, however, their growth has been much more pronounced than in Spain afterwards, now equalling the index of Germany.

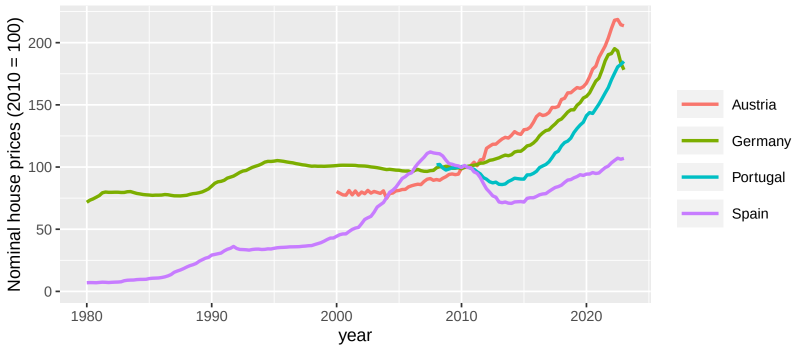


Figure 45: Nominal house prices for Austria, Germany, Spain and Portugal (Index: 2010 = 100).
Source: BIS.

In addition to the development of house prices, the extent of home ownership is also determined by the granting of **subsidies for home owners**, such as object-related subsidies, tax incentives and capital market instruments. While Spain offers tax credit for qualifying credit that finance house expenses, there are significantly fewer benefits for home owners in Germany and Austria. Moreover, while mortgage interest is tax-deductible in Spain (Pla & Módenes Cabrerizo, 2004), this is not the case in Germany and Austria. Otherwise, there is overall relatively low real estate tax expenses for Austrian and German households, even though there are high transaction costs for house sales under certain conditions to prevent speculation (Kaiser, 2021; Schneider & Wagner, 2015).

Furthermore, the **rental market** in Germany and Austria is quite well developed, with around 60 percent of the rental market in Austria consisting of social rents, which makes renting relatively attractive. Schneider and Wagner (2015) argue that the high share of regulated rents has a dampening effect on both rental and real estate prices.

Also, when comparing **household sizes** in Germany, Austria, Portugal and Spain, the share of single-person households in Germany (40.6 percent in 2017, according to the HFCS) and Austria (37.0 percent) is much higher than in Spain (25.5 percent) and Portugal (22.4 percent). While around 75 percent of households in Germany consist of two people or less, 75 percent of Spanish households include two people or more. Together with lower fertility rates it is also more common for Mediterranean people to live together in a bigger house for a longer period of time Kaiser (2021). This is reinforced by the fact that Spain still has extraordinary high youth unemployment rates.

Finally, OECD figures from the Regional Statistics database also show that Germany has significantly higher **regional mobility** compared to Austria, but even more when compared to Spain. Between 2015 and 2018, about 3.8 percent of the German population moved between TL3 regions[27], compared to 3.0 percent of Austrians and 0.9 percent of Spaniards. Of course, regional mobility and homeownership rates are mutually dependent here, but it is plausible that higher mobility makes long-term real estate ownership less attractive.

5.6 Conclusion

In this paper I have found that the **determinants of wealth inequality** show different patterns compared to the determinants of income inequality, that are often analyzed in the empirical literature due to incomplete data. By the application of different machine learning algorithms I have, amongst other things, demonstrated that wealth inequality is much stronger driven by credit provision to households and businesses. Other key drivers of wealth inequality are an economy's working behavior (e.g. working hours, unemployment), saving and age structure (i.e., share of population older than 65 years).

In a next step I have shown that there are several **non-linearities within the credit-wealth inequality nexus** that need to be considered. Based on *causal forests* it has been stated that credit tends to increase wealth inequality for economies with low **economic and financial development**, whereas credit has an equating effect for countries with highly developed financial systems. This is the case for both financial institutions development and financial markets development.

Furthermore, a higher **share of home owners in an economy** seems to significantly impact the relationship between credit and wealth inequality. In particular, credit tends to decrease wealth inequality for countries with high home ownership ratios, and increases wealth inequality once ownership ratios are relatively low. These findings also fit well when tested against survey data on EU household finance. I could demonstrate that, while credit taken out to finance real estate acquisition is the largest component of household liabilities, real estate is regarded as being the most important driver of household wealth. I have demonstrated

[27] An overview on these regions is given in OECD Centre for Entrepreneurship and Cities (2022).

this in more detail for Germany, Austria, Portugal and Spain, and elaborated on the reasons for considerably differing home ownership ratios within these countries.

The previous findings have several **implications for further research and economic policy**. First, it is important to have a stronger focus on wealth data when analyzing the finance-inequality nexus. Despite high correlation between data on the distribution of wealth and income, there are in part significant differences in the determinants of wealth inequality that can distort the results when using rather imprecise variables. The application of machine learning techniques for more complex imputation of missing data offers many opportunities here. Secondly, the development of financial systems has been shown to play a crucial role in the pass-through of credit for improving the distribution of wealth. The IMF's financial development indicator suggests that some countries, even developed ones, still have some catching up to do here. Germany, for example, ranks 12th internationally in terms of overall financial development, 25th in terms of the development of its financial institutions, and 9th in terms of the development of its financial markets. The country has particular deficiencies in the efficiency of its financial institutions, where it drops to 124th place. Related to this is the need to achieve improvements in financial literacy so that the general population can participate in the improvements to the financial system.

Finally, it became clear that even if credit is readily accessible, the wealth channel of credit is often clogged when the majority of households in a country do not own real estate. This implies that countries like Germany and Austria, for example, would need to strengthen incentives to increase the share of homeowners in their country in order to reduce wealth inequality through credit provision. National housing regulations can guide preferences in this regard. Potential here could lie, for instance, in the tax deductibility of mortgage interest expenses, in providing a more attractive regulatory framework for the construction of residential real estate or in measures that influence the mobility of households. The digitalization of the working world also offers opportunities here by creating more possibilities for mobile and therefore location-independent working, so that a change of job, for example, does not necessarily have to be accompanied by a change of residence, thus making long-term investment in residential property more attractive.

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A | Appendices

A.1 Appendix: The Finance and Growth Nexus Revisited from a Truly Schumpeterian Perspective

A.1.1 Data set

Country coverage	
Developed countries	Developing countries
Australia	Argentina
Austria	Brazil
Belgium	Chile
Canada	China
Czech Republik	Colombia
Denmark	Hong Kong
Finland	India
France	Indonesia
Germany	Israel
Greece	Korea
Hungary	Malaysia
Ireland	Mexico
Italy	Russia*
Japan	Saudi Arabia
Luxembourg	Singapore
Netherlands	South Africa
New Zealand	Thailand
Norway	Turkey
Poland	
Portugal	
Spain	
Sweden	
Switzlerland	
United Kingdom	
United States	

* Classification follows United Nations (as of June 2021).
* For reasons of better data handling, Russia has been assigned to the developing countries.

Table 20: Country coverage (global finance and growth).

Variable	n	Mean	Median	Standard devation	Min. value	Max. value
GROWTH	2,368	2.6358	2.5109	3.8545	-26.5277	52.2191
log(INITIAL GDP)	1,988	9.7065	10.0184	1.1331	5.4724	11.6260
SCHOOL	1,681	88.9921	93.2488	25.6868	18.1250	163.9347
GOV	2,273	16.3563	16.7626	5.4321	2.9755	41.9658
OPENNESS	2,024	4.1024	4.0699	0.7124	1.5935	6.0927
INFL	2,323	13.9405	3.7330	98.5185	-7.6339	2,947.7330
$\Delta CREDIT_{Bank}$	2,172	17.7141	10.9186	92.2051	-47.9853	3,803.5930
ΔNHS	1,020	-137.9257	2.4805	9,157.4160	-254,268.9000	132676.4000
$\Delta NHSR$	1,163	2.2889	-2.1110	345.8389	-3,571.1220	8,204.8710

Note: Initial GDP is in million 2017 US Dollar. All other figures are given in percent.

Table 21: Descriptive statistics (global finance and growth).

Variables and Sources			
Symbol	Variable	Definition	Data source
Dependent variables			
GROWTH	Growth of GDP per capita	Annual growth rate of GDP per capita (constant local currency) in percent	World Bank: WDI Database
Explanatory variables			
$\Delta CREDIT_{Bank}$	Bank credit growth	Annual growth rate of domestic bank credit to the private non-financial sector (in units of home currency) in percent	BIS long series on total credit
ΔNHS	Net household saving growth	Annual growth in net saving (household sector) in percent	UN, AMECO, OECD, own calculations based on national statistics agencies
ΔNHSR	Net household saving rate growth	Annual growth in the share of net saving to net disposable income (household sector) in percent	UN, AMECO, OECD, own calculations based on national statistics agencies
Control variables			
log(INITIAL GDP)	Level of initial GDP	Natural logarithm of current expenditure-side GDP at current PPPs from previous period (t-1)	Penn World Tables 10.0
SCHOOL	Secondary school enrollment rate	Gross secondary school enrollment rate (percentage of population in secondary school age group)	World Bank: WDI Database
GOV	Government expenditure	General government final consumption expenditure (percentage of GDP)	World Bank: WDI Database
OPENNESS	Trade	Natural logarithm of trade, as the sum of exports and imports of goods and services as a share of GDP	World Bank: WDI Database
INFL	Inflation	Inflation in consumer prices (annual percentage change)	World Bank: WDI Database

Table 22: Variable definitions and sources (global finance and growth).

A.1.2 Panel analysis robustness checks

	FE				RE			
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-3.456**	-3.008**	-3.046**	-2.525**	-0.879***	-0.876***	-0.878***	-0.593*
	(1.287)	(1.279)	(1.281)	(1.139)	(0.211)	(0.217)	(0.229)	(0.322)
SCHOOL	0.0173*	0.0152*	0.0141	0.0131	0.00861	0.00732	0.00643	0.00893
	(0.00866)	(0.00880)	(0.00896)	(0.00898)	(0.00846)	(0.00806)	(0.00763)	(0.00591)
GOV	-0.573***	-0.594***	-0.608***	-0.677***	-0.114*	-0.116*	-0.121*	-0.361***
	(0.129)	(0.140)	(0.144)	(0.145)	(0.0652)	(0.0653)	(0.0658)	(0.0982)
log(OPENNESS)	2.243***	2.077**	1.975**	1.890**	0.930***	0.958***	0.965***	1.367***
	(0.730)	(0.788)	(0.851)	(0.863)	(0.320)	(0.305)	(0.294)	(0.459)
INFL	-0.0733**	-0.0993***	-0.105***	-0.0579	-0.0858**	-0.113***	-0.117***	-0.0715
	(0.0333)	(0.0320)	(0.0297)	(0.0586)	(0.0417)	(0.0392)	(0.0390)	(0.0586)
NHS	-1.39e-10				-1.63e-10			
	(1.32e-09)				(1.34e-09)			
NHS_{t-1}		8.12e-10				7.18e-10		
		(1.37e-09)				(1.53e-09)		
NHS_{t-2}			1.22e-09				7.22e-10	
			(1.54e-09)				(1.72e-09)	
NHS_{t-3}				2.65e-09**				2.19e-09***
				(9.72e-10)				(7.72e-10)
Constant	36.94***	33.92**	35.05***	31.22***	10.34***	10.52***	10.72***	9.670***
	(12.23)	(12.45)	(12.22)	(10.68)	(1.883)	(1.913)	(2.076)	(3.719)
Observations	865	844	821	798	865	844	821	798
Countries	31	31	31	31	31	31	31	31
R-squared	0.475	0.484	0.486	0.501	0.511	0.518	0.518	0.528

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 23: Growth effects of credit growth and household saving, estimated with Fixed and Random Effects.

	FE				RE			
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-3.432**	-3.011**	-3.066**	-2.534**	-0.884***	-0.885***	-0.892***	-0.578*
	(1.293)	(1.303)	(1.319)	(1.177)	(0.225)	(0.231)	(0.243)	(0.341)
SCHOOL	0.0162*	0.0145	0.0137	0.0125	0.00825	0.00742	0.00704	0.00888
	(0.00837)	(0.00863)	(0.00883)	(0.00886)	(0.00814)	(0.00797)	(0.00768)	(0.00586)
GOV	-0.569***	-0.589***	-0.603***	-0.671***	-0.112*	-0.114*	-0.119*	-0.407***
	(0.128)	(0.140)	(0.144)	(0.145)	(0.0659)	(0.0661)	(0.0666)	(0.104)
log(OPENNESS)	2.313***	2.223***	2.211**	2.115**	0.910**	0.931***	0.926***	1.452***
	(0.725)	(0.770)	(0.810)	(0.830)	(0.364)	(0.350)	(0.344)	(0.506)
INFL	-0.0733**	-0.0969***	-0.100***	-0.0528	-0.0882**	-0.114***	-0.115***	-0.0677
	(0.0334)	(0.0324)	(0.0298)	(0.0579)	(0.0416)	(0.0394)	(0.0391)	(0.0595)
NHS_{GDP}	-7.74e-08				-2.41e-07			
	(3.71e-07)				(2.84e-07)			
$NHS_{GDP,t-1}$		1.97e-07				4.28e-08		
		(3.79e-07)				(3.80e-07)		
$NHS_{GDP,t-2}$			3.24e-07				-4.27e-09	
			(4.53e-07)				(4.54e-07)	
$NHS_{GDP,t-3}$				7.91e-07***				6.69e-07***
				(2.84e-07)				(2.32e-07)
Constant	36.44***	33.34**	34.24**	30.37***	10.48***	10.68***	10.92***	9.855**
	(12.23)	(12.62)	(12.53)	(11.01)	(2.146)	(2.180)	(2.338)	(3.999)
Observations	857	836	813	790	857	836	813	790
Countries	31	31	31	31	31	31	31	31
R-squared	0.477	0.485	0.486	0.501	0.514	0.520	0.519	0.529

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 24: Growth effects of credit growth and household saving to GDP, estimated with Fixed and Random Effects.

	IV					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-0.824***	-0.802***	-0.675***	-1.089***	-0.668***	-1.039***
	(0.104)	(0.106)	(0.119)	(0.129)	(0.118)	(0.125)
SCHOOL	0.001	0.008*	0.002	0.007	0.005	0.011**
	(0.004)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
GOV	-0.091***	-0.103***	-0.119***	0.162***	-0.114***	-0.152***
	(0.020)	(0.022)	(0.032)	(0.030)	(0.033)	(0.031)
log(OPENNESS)	0.702***	0.564***	0.739***	0.590***	0.663***	0.483**
	(0.148)	(0.153)	(0.210)	(0.194)	(0.223)	(0.204)
INFL	-0.019***	-0.065***	0.033	-0.047	-0.060	-0.088*
	(0.004)	(0.018)	(0.043)	(0.042)	(0.047)	(0.045)
$\Delta CREDIT_{Bank}$		0.053***			0.033*	0.050***
		(0.018)			(0.020)	(0.019)
ΔNHS			0.000		0.000	
			(0.000)		(0.000)	
$\Delta NHSR$				-0.001***		-0.001***
				(0.000)		(0.000)
Constant	9.173***	8.725***	7.776***	13.181***	7.442***	12.273***
	(0.878)	(1.018)	(1.365)	(1.415)	(1.389)	(1.396)
Observations	1,509	1,387	842	936	832	926
Countries	41	41	31	34	31	34
Adj. R-squared	0.1582	0.2351	0.1066	0.2058	0.1585	0.2695

Notes: Heteroskedasticiy-consistent standard errors are indicated in parentheses. Estimation errors are normally distributed. Instrumented variable: $\Delta CREDIT_{Bank}$ (instrumented by annual growth rate of domestic bank credit to non-financial private sector (%) of previous period (t-1)). GROWTH=growth of GDP per capita in %; log(INITIAL GDP)=logarithm of current expenditure side GDP from previous period at current PPPs; SCHOOL=secondary school enollment rate (% of population in secondary school age); GOV=general government final consumption expenditure (% of GDP); log(OPENNESS)=logarithm of trade as sum of exports and imports of goods and services (% of GDP); INFL=inflation in consumper prices (% change); ΔNHS=annual growth in household sector net saving (%); ΔNHSR=annual growth in share of net saving to net disposable income (household sector, %).

Table 25: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Instrumental Variables.

Dependent: GROWTH	Total credit	Bank credit	Alternative credit	Credit to Households	Credit to Corporations
log(INITIAL GDP)	-1.822***	-1.860***	-1.837***	-2.290***	-2.126***
	(0.501)	(0.514)	(0.581)	(0.579)	(0.744)
SCHOOL	0.018**	0.019**	0.016*	0.015**	0.012
	(0.009)	(0.008)	(0.009)	(0.007)	(0.008)
GOV	-0.415***	-0.422***	-0.439***	-0.548***	-0.524***
	(0.062)	(0.063)	(0.083)	(0.096)	(0.090)
log(OPENNESS)	2.278**	2.287**	2.413**	1.941**	2.134***
	(0.893)	(0.846)	(1.005)	(0.891)	(0.778)
INFL	-0.098***	-0.102***	-0.022	-0.095***	-0.133***
	(0.018)	(0.016)	(0.015)	(0.012)	(0.017)
ΔCREDIT	0.089***	0.098***	0.005*	0.010***	0.068***
	(0.016)	(0.016)	(0.003)	(0.002)	(0.019)
Observations	1,411	1,399	1,370	1,034	1,021
Countries	41	41	41	41	41
Adj. R-squared	0.3921	0.4183	0.3307	0.4745	0.4905

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses.

Table 26: Growth effects of dynamic credit indicators, estimated with Fixed Effects

	Bank credit		Alternative credit	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
log(INITIAL GDP)	-4.375***	-2.023*	-3.798***	-2.169
	(0.644)	(1.024)	(0.791)	(1.455)
SCHOOL	0.007	0.023	0.003	0.019
	(0.006)	(0.022)	(0.006)	(0.031)
GOV	-0.468***	-0.332***	-0.473***	-0.296*
	(0.106)	(0.103)	(0.101)	(0.147)
log(OPENNESS)	2.435**	1.670	2.325**	1.953
	(1.040)	(1.182)	(1.080)	(1.435)
INFL	-0.156***	-0.088***	-0.129***	-0.014
	(0.034)	(0.018)	(0.035)	(0.012)
ΔCREDIT	0.086***	0.090***	0.026*	0.002
	(0.020)	(0.021)	(0.015)	(0.003)
Observations	918	481	918	452
Countries	24	17	24	17
Adj. R-squared	0.5295	0.4154	0.5000	0.3277

Note: Heteroskedasticity-consistent standard errors are indicated in parentheses.

Table 27: Growth effects of bank credit and alternative credit by development level, estimated with Fixed Effects

	Total credit to household sector		Total credit to corporate sector	
	Developed countries	Less developed countries	Developed countries	Less developed countries
ΔCREDIT	0.044***	0.007***	0.071*	0.063**
	(0.014)	(0.002)	(0.036)	(0.022)
Observations	739	295	726	295
Countries	24	17	24	17
Adj. R-squared	0.5516	0.4725	0.5727	0.4820

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. For better clarity, the growth estimators other than the credit variables are not included in this table. The variables not included correspond to those from the other panel estimates from this paper.

Table 28: Growth effects of bank credit to households and corporate sector by development level, estimated with Fixed Effects

	Bank credit						Alternative credit					
	Developed countries			Less developed countries			Developed countries			Less developed countries		
Dependent: GROWTH	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010
ΔCREDIT	0.135***	0.060	0.074	0.078**	0.075**	0.143***	0.019	0.043	0.105*	0.001	0.003	-0.002
	(0.017)	(0.041)	(0.064)	(0.027)	(0.034)	(0.047)	(0.013)	(0.037)	(0.060)	(0.003)	(0.004)	(0.004)
Observations	493	403	183	213	257	116	493	403	183	184	257	116
Countries	23	24	24	14	17	16	23	24	24	14	17	16
Adj. R-squared	0.5031	0.5520	0.5206	0.3066	0.5561	0.4106	0.4278	0.5526	0.6002	0.2221	0.5132	0.2932

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. For better clarity, the growth estimators other than the credit variables are not included in this table. The variables not included correspond to those from the other panel estimates from this paper.

Table 29: Growth effects of bank credit and alternative credit by development level and decade, estimated with Fixed Effects

A.1.2.1 Random effects

Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-0.871***	-1.294***	-0.875***	-0.808***	-0.833***	-1.231***	-1.111***	-1.127***
	(0.217)	(0.338)	(0.228)	(0.233)	(0.263)	(0.367)	(0.377)	(0.373)
SCHOOL	0.00698	0.0152	0.00619	0.00651	0.00856	0.0167**	0.0160**	0.0164**
	(0.00806)	(0.0104)	(0.00763)	(0.00751)	(0.00665)	(0.00674)	(0.00688)	(0.00700)
GOV	-0.113*	-0.163**	-0.119*	-0.131**	-0.196**	-0.299***	-0.321***	-0.353***
	(0.0656)	(0.0709)	(0.0659)	(0.0658)	(0.0779)	(0.0783)	(0.0829)	(0.0888)
log(OPENNESS)	0.956***	0.920***	0.964***	0.930***	0.985***	1.204***	1.146***	1.156***
	(0.306)	(0.313)	(0.295)	(0.280)	(0.303)	(0.357)	(0.346)	(0.346)
INFL	-0.113***	-0.133***	-0.116***	-0.0682*	-0.119**	-0.142***	-0.126**	-0.186***
	(0.0386)	(0.0439)	(0.0388)	(0.0384)	(0.0511)	(0.0379)	(0.0595)	(0.0554)
ΔNHS	-1.35e-06							
	(6.40e-06)							
$\Delta NHSR$		-0.000389						
		(0.000290)						
ΔNHS_{t-1}			-4.02e-06					
			(9.92e-06)					
ΔNHS_{t-2}				3.56e-05*				
				(1.84e-05)				
ΔNHS_{t-3}					1.08e-05			
					(3.52e-05)			
$\Delta NHSR_{t-1}$						-0.000214		
						(0.000257)		
$\Delta NHSR_{t-2}$							-9.88e-05	
							(0.000219)	
$\Delta NHSR_{t-3}$								-4.76e-05
								(0.000225)
Constant	10.46***	15.46***	10.66***	10.05***	11.55***	15.85***	15.18***	16.35***
	(1.923)	(3.275)	(2.087)	(2.426)	(2.661)	(3.576)	(4.037)	(3.890)
Observations	842	936	820	797	770	912	887	858
Countries	31	34	31	31	31	34	34	34
Adj. R-squared	0.5179	0.5944	0.5189	0.5292	0.5411	0.5875	0.5919	0.6031

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 30: Growth effects of household saving growth and household saving rate growth incl. lagged variables, estimated with Random Effects.

Dependent: GROWTH	Total credit	Bank credit	Alternative credit	Credit to Households	Credit to Corporations
log(INITIAL GDP)	-0.821***	-0.830***	-1.042***	-1.096***	-1.028***
	(0.233)	(0.244)	(0.271)	(0.235)	(0.202)
SCHOOL	0.0194*	0.0209*	0.0186	0.0186**	0.0161*
	(0.0109)	(0.0108)	(0.0128)	(0.00920)	(0.00833)
GOV	-0.106**	-0.107**	-0.101*	-0.162***	-0.145***
	(0.0452)	(0.0475)	(0.0552)	(0.0509)	(0.0430)
log(OPENNESS)	0.653***	0.727***	0.780***	0.640***	0.487***
	(0.214)	(0.252)	(0.248)	(0.208)	(0.182)
INFL	-0.115***	-0.114***	-0.0287*	-0.0685***	-0.131***
	(0.0184)	(0.0144)	(0.0151)	(0.0155)	(0.0194)
$\Delta CREDIT$	0.0999***	0.104***	0.00752*	0.0129***	0.0904***
	(0.0176)	(0.0151)	(0.00440)	(0.00456)	(0.0176)
Constant	9.110***	8.580***	11.75***	14.39***	13.21***
	(2.037)	(2.093)	(2.613)	(2.063)	(1.846)
Observations	1,411	1,399	1,370	1,034	1,021
Countries	41	41	41	41	41
Adj. R-squared	0.5079	0.5318	0.4598	0.5577	0.5721

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 31: Growth effects of dynamic credit indicators, estimated with Random Effects.

	Bank credit		Alternative credit	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
log(INITIAL GDP)	-1.144***	-1.589***	-1.164***	-1.650**
	(0.275)	(0.579)	(0.317)	(0.644)
SCHOOL	0.00440	0.0625*	0.00277	0.0632
	(0.00566)	(0.0351)	(0.00634)	(0.0407)
GOV	-0.100	-0.125	-0.101*	-0.0856
	(0.0625)	(0.0809)	(0.0596)	(0.0894)
log(OPENNESS)	0.806**	1.049**	0.782**	1.007**
	(0.380)	(0.424)	(0.318)	(0.511)
INFL	-0.161***	-0.0990***	-0.135***	-0.0213
	(0.0365)	(0.0205)	(0.0386)	(0.0130)
ΔCREDIT	0.0852***	0.0962***	0.0313*	0.00410
	(0.0172)	(0.0237)	(0.0179)	(0.00355)
Constant	14.04***	8.834**	15.25***	8.370*
	(2.707)	(3.539)	(3.181)	(4.450)
Observations	918	481	918	452
Countries	24	17	24	17
Adj. R-squared	0.5552	0.5498	0.5277	0.4851

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 32: Growth effects of bank credit and alternative credit by development level, estimated with Random Effects.

	Bank credit						Alternative credit					
	Developed countries			Less developed countries			Developed countries			Less developed countries		
Dependent: GROWTH	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010
ΔCREDIT	0.119***	0.0544	0.00515	0.0884***	0.0793**	0.143***	0.0202*	0.0456	0.139**	0.00107	0.00304	-0.00161
	(0.0182)	(0.0406)	(0.0759)	(0.0313)	(0.0312)	(0.0489)	(0.0113)	(0.0379)	(0.0625)	(0.00283)	(0.00431)	(0.00386)
Observations	493	403	183	213	257	116	493	403	183	184	257	116
Countries	23	24	24	14	17	16	23	24	24	14	17	16
Adj. R-squared	0.5344	0.5819	0.6198	0.4721	0.6892	0.6593	0.4638	0.5825	0.6829	0.4178	0.6591	0.5914

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 33: Growth effects of bank credit and alternative credit by development level and decade, estimated with Random Effects.

	Total credit to household sector		Total credit to corporate sector	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
ΔCREDIT	0.0504***	0.00901***	0.0747**	0.0847***
	(0.0114)	(0.00292)	(0.0362)	(0.0192)
Observations	739	295	726	295
Countries	24	17	24	17
Adj. R-squared	0.5627	0.5866	0.5836	0.5940

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 34: Growth effects of bank credit to households and corporate sector by development level, estimated with Random Effects.

A.1.2.2 Moving averages (3 years)

	FE						RE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
log(INITIAL GDP)	-1.142	-1.460***	-2.111	-1.687***	-2.345	-1.377**	-1.113***	-0.868***	-0.654**	-1.152***	-0.746***	-1.052***
	(0.754)	(0.490)	(1.442)	(0.584)	(1.442)	(0.578)	(0.243)	(0.234)	(0.263)	(0.378)	(0.187)	(0.340)
SCHOOL	0.0121	0.0165*	0.00764	0.0170**	0.0106	0.0179**	0.0160	0.0170	0.00441	0.0156*	0.00141	0.0152**
	(0.0117)	(0.00844)	(0.00768)	(0.00790)	(0.00821)	(0.00772)	(0.0137)	(0.0113)	(0.00686)	(0.00829)	(0.00583)	(0.00719)
GOV	-0.231***	-0.370***	-0.551***	-0.619***	-0.507***	-0.571***	-0.0721	-0.0847*	-0.302***	-0.389***	-0.0776	-0.271***
	(0.0741)	(0.0499)	(0.129)	(0.100)	(0.129)	(0.101)	(0.0493)	(0.0484)	(0.0864)	(0.0767)	(0.0526)	(0.0705)
log(OPENNESS)	2.080**	2.188***	2.163**	1.621*	2.563**	2.005**	0.859***	0.688***	1.426***	1.397***	0.846***	1.174***
	(0.919)	(0.802)	(1.056)	(0.843)	(0.999)	(0.837)	(0.219)	(0.252)	(0.452)	(0.471)	(0.299)	(0.415)
INFL	-0.0214***	-0.104***	-0.0524*	-0.0784**	-0.0927**	-0.123**	-0.0234***	-0.121***	-0.0708**	-0.0820**	-0.156***	-0.144***
	(0.00581)	(0.0201)	(0.0273)	(0.0365)	(0.0409)	(0.0530)	(0.00593)	(0.0159)	(0.0336)	(0.0347)	(0.0352)	(0.0524)
$\Delta CREDIT_{Bank}$		0.100***			0.0733***	0.0642***		0.108***			0.0940***	0.0762***
		(0.0219)			(0.0192)	(0.0197)		(0.0179)			(0.0168)	(0.0194)
ΔNHS			1.25e-05		9.52e-06				1.26e-05		-1.29e-05	
			(2.83e-05)		(2.29e-05)				(2.70e-05)		(3.48e-05)	
$\Delta NHSR$				-0.000913*		-0.000748				-0.000986*		-0.000779
				(0.000506)		(0.000540)				(0.000591)		(0.000675)
Constant	10.01	12.74**	24.82*	22.74***	23.45	16.71**	11.81***	9.108***	9.740***	15.06***	8.431***	12.38***
	(7.214)	(5.015)	(14.11)	(6.265)	(13.84)	(6.146)	(1.998)	(2.005)	(2.996)	(4.092)	(2.092)	(3.720)
Observations	1,318	1,219	739	817	731	809	1,318	1,219	739	817	731	809
Countries	41	41	31	34	31	34	41	41	31	34	31	34
Adj. R-squared	0.347	0.488	0.529	0.545	0.576	0.580	0.5244	0.6520	0.6109	0.7024	0.6500	0.7263

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 35: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Fixed Effects and Random Effects.

	IV					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-0.938***	-0.815***	-0.714***	-1.021***	-0.685***	-0.941***
	(0.0839)	(0.0837)	(0.0942)	(0.110)	(0.0902)	(0.103)
SCHOOL	0.000335	0.00553	-0.00336	0.00422	0.00212	0.00887**
	(0.00356)	(0.00369)	(0.00493)	(0.00482)	(0.00439)	(0.00432)
GOV	-0.0607***	-0.0738***	-0.0911***	-0.143***	-0.0837***	-0.125***
	(0.0149)	(0.0160)	(0.0240)	(0.0233)	(0.0243)	(0.0234)
log(OPENNESS)	0.660***	0.504***	0.750***	0.596***	0.593***	0.402**
	(0.110)	(0.110)	(0.166)	(0.153)	(0.175)	(0.158)
INFL	-0.0215***	-0.0909***	-0.00455	-0.00340	-0.0667***	-0.0828***
	(0.00272)	(0.0117)	(0.0250)	(0.0273)	(0.0243)	(0.0267)
$\Delta CREDIT_{Bank}$		0.0803***			0.0686***	0.0825***
		(0.0119)			(0.0142)	(0.0139)
ΔNHS			-2.92e-06		-7.30e-06	
			(3.90e-05)		(3.16e-05)	
$\Delta NHSR$				-0.00102***		-0.000870**
				(0.000337)		(0.000340)
Constant	10.03***	8.673***	8.097***	12.28***	7.377***	11.02***
	(0.759)	(0.830)	(1.122)	(1.237)	(1.120)	(1.179)
Observations	1,318	1,209	739	817	729	807
Countries	41	41	31	34	31	34
Adj. R-squared	0.257	0.380	0.194	0.303	0.317	0.418

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 36: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Instrumental Variables.

Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-2.111	-1.687***	-1.829	-1.768	-1.667	-1.426**	-1.379**	-1.674**
	(1.442)	(0.584)	(1.372)	(1.362)	(1.417)	(0.626)	(0.672)	(0.722)
SCHOOL	0.00764	0.0170**	0.00720	0.00696	0.00719	0.0168**	0.0163**	0.0167**
	(0.00768)	(0.00790)	(0.00746)	(0.00761)	(0.00679)	(0.00771)	(0.00770)	(0.00776)
GOV	-0.551***	-0.619***	-0.571***	-0.578***	-0.567***	-0.639***	-0.654***	-0.658***
	(0.129)	(0.100)	(0.133)	(0.137)	(0.140)	(0.103)	(0.111)	(0.122)
log(OPENNESS)	2.163**	1.621*	2.137*	2.191**	2.074**	1.642*	1.786**	1.882**
	(1.056)	(0.843)	(1.047)	(1.051)	(0.902)	(0.845)	(0.810)	(0.706)
INFL	-0.0524*	-0.0784**	-0.0474	-0.0319	-0.0601	-0.0895*	-0.0910	-0.104
	(0.0273)	(0.0365)	(0.0350)	(0.0546)	(0.0591)	(0.0479)	(0.0668)	(0.0656)
ΔNHS	1.25e-05							
	(2.83e-05)							
$\Delta NHSR$		-0.000913*						
		(0.000506)						
ΔNHS_{t-1}			1.23e-05					
			(3.20e-05)					
ΔNHS_{t-2}				2.70e-05				
				(3.84e-05)				
ΔNHS_{t-3}					-4.73e-05			
					(5.77e-05)			
$\Delta NHSR_{t-1}$						-0.000714		
						(0.000558)		
$\Delta NHSR_{t-2}$							-0.000432	
							(0.000555)	
$\Delta NHSR_{t-3}$								-3.74e-05
								(0.000541)
Constant	24.82*	22.74***	22.50*	21.72*	21.41	20.57***	19.82***	21.87***
	(14.11)	(6.265)	(12.97)	(12.64)	(13.02)	(6.389)	(6.697)	(6.718)
Observations	739	817	720	698	674	797	773	746
Countries	31	34	31	31	31	34	34	34
Adj. R-squared	0.529	0.545	0.541	0.543	0.544	0.552	0.552	0.558

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 37: Growth effects of household saving growth and household saving rate growth incl. lagged variables, estimated with Fixed Effects.

Dependent: GROWTH	(1)	(2)
log(INITIAL GDP)	-0.815***	-0.968***
	(0.0837)	(0.0881)
SCHOOL	0.00553	0.00161
	(0.00369)	(0.00406)
GOV	-0.0738***	-0.0709***
	(0.0160)	(0.0176)
log(OPENNESS)	0.504***	0.582***
	(0.110)	(0.118)
INFL	-0.0909***	-0.0154**
	(0.0117)	(0.00622)
$\Delta CREDIT_{Bank}$	0.0803***	
	(0.0119)	
$CREDIT_{Bank}$		3.47e-09
		(8.39e-08)
Constant	8.673***	10.68***
	(0.830)	(0.852)
Observations	1,209	1,219
Countries	41	41
Adj. R-squared	0.380	0.250

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 38: Growth effects of dynamic and static bank credit, estimated with Instrumental Variables.

Dependent: GROWTH	Total credit	Bank credit	Alternative credit	Credit to Households	Credit to Corporations
log(INITIAL GDP)	-1.373***	-1.460***	-1.604**	-1.827***	-1.577***
	(0.489)	(0.490)	(0.616)	(0.470)	(0.486)
SCHOOL	0.0152	0.0165*	0.0145	0.00666	0.00628
	(0.00910)	(0.00844)	(0.0101)	(0.00796)	(0.00902)
GOV	-0.361***	-0.370***	-0.369***	-0.490***	-0.477***
	(0.0450)	(0.0499)	(0.0718)	(0.0981)	(0.0914)
log(OPENNESS)	2.162**	2.188***	2.241**	1.769*	2.319***
	(0.819)	(0.802)	(0.992)	(0.902)	(0.802)
INFL	-0.115***	-0.104***	-0.0296**	-0.129***	-0.127***
	(0.0202)	(0.0201)	(0.0138)	(0.0169)	(0.0172)
ΔCREDIT	0.107***	0.100***	0.0157***	0.0171***	0.0645***
	(0.0190)	(0.0219)	(0.00407)	(0.00574)	(0.0214)
Constant	12.21**	12.74**	15.32**	23.33***	17.93***
	(5.252)	(5.015)	(7.338)	(4.018)	(4.215)
Observations	1,233	1,219	1,193	895	882
Adj. R-squared	0.464	0.488	0.388	0.565	0.565
Number of country1	41	41	41	41	41

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 39: Growth effects of dynamic credit indicators, estimated with Fixed Effects.

	Bank credit		Alternative credit	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
log(INITIAL GDP)	-3.376***	-1.471	-2.600***	-1.759
	(0.696)	(1.197)	(0.890)	(1.681)
SCHOOL	0.00556	0.0252	0.00107	0.0267
	(0.00606)	(0.0267)	(0.00582)	(0.0360)
GOV	-0.381***	-0.378***	-0.383***	-0.323*
	(0.0787)	(0.112)	(0.0765)	(0.154)
log(OPENNESS)	2.681***	1.735	2.674**	1.977
	(0.930)	(1.356)	(0.955)	(1.545)
INFL	-0.146***	-0.0827***	-0.103***	-0.0221
	(0.0254)	(0.0272)	(0.0279)	(0.0135)
$\triangle$CREDIT	0.0832***	0.0837**	0.0165*	0.0111**
	(0.0164)	(0.0322)	(0.00851)	(0.00501)
Constant	32.67***	10.89	26.27***	13.90
	(7.144)	(11.26)	(8.882)	(14.67)
Observations	831	388	831	362
Countries	24	17	24	17
Adj. R-squared	0.605	0.510	0.561	0.466

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 40: Growth effects of bank credit and alternative credit by development level, estimated with Fixed Effects.

	Bank credit						Alternative credit					
	Developed countries			Less developed countries			Developed countries			Less developed countries		
Dependent: GROWTH	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010
$\triangle$CREDIT	0.119***	0.0606	0.118*	0.0230	0.0807*	0.0929***	0.0259	0.0106	0.0434	0.00375	0.0122*	0.00407
	(0.0266)	(0.0398)	(0.0654)	(0.0276)	(0.0438)	(0.0276)	(0.0180)	(0.0196)	(0.0709)	(0.00494)	(0.00642)	(0.00254)
Observations	425	385	171	155	226	107	425	385	171	129	226	107
Countries	23	24	24	13	17	15	23	24	24	13	17	15
Adj. R-squared	0.606	0.612	0.708	0.478	0.597	0.674	0.541	0.591	0.693	0.547	0.554	0.636

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 41: Growth effects of bank credit and alternative credit by development level and decade, estimated with Fixed Effects.

	Total credit to household sector		Total credit to corporate sector	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
$\triangle$CREDIT	0.0551***	0.0106*	0.0520*	0.0333
	(0.0162)	(0.00542)	(0.0296)	(0.0591)
Observations	658	237	645	237
Countries	24	17	24	17
Adj. R-squared	0.630	0.676	0.616	0.662

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 42: Growth effects of bank credit to households and corporate sector by development level, estimated with Fixed Effects.

A.1.2.3 Moving averages (5 years)

	FE						RE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
log(INITIAL GDP)	-1.237	-1.617***	-1.784	-1.694	-2.111	-2.030	-1.151***	-0.959***	-0.964***	-0.581*	-0.796***	-0.788***
	(0.765)	(0.468)	(1.623)	(1.597)	(1.570)	(1.542)	(0.327)	(0.258)	(0.183)	(0.343)	(0.162)	(0.160)
SCHOOL	0.0130	0.0148*	0.00529	0.00334	0.00900	0.00718	0.0137	0.0144*	-0.00549	0.000795	-0.00254	-0.00196
	(0.0125)	(0.00845)	(0.00809)	(0.00713)	(0.00812)	(0.00747)	(0.0122)	(0.00829)	(0.00707)	(0.00724)	(0.00619)	(0.00632)
GOV	-0.183***	-0.303***	-0.491***	-0.508***	-0.433***	-0.445***	-0.138***	-0.142***	-0.0627	-0.386***	-0.0489	-0.0493
	(0.0658)	(0.0409)	(0.117)	(0.112)	(0.106)	(0.102)	(0.0477)	(0.0407)	(0.0509)	(0.0931)	(0.0417)	(0.0418)
log(OPENNESS)	1.429	1.631*	1.697	1.621	2.068	2.061*	1.041*	0.747**	0.923***	1.348*	0.718***	0.708***
	(1.001)	(0.891)	(1.353)	(1.197)	(1.288)	(1.145)	(0.537)	(0.337)	(0.219)	(0.720)	(0.240)	(0.241)
INFL	-0.0193**	-0.103***	-0.0307	-0.0247	-0.0614	-0.0534	-0.0202***	-0.109***	-0.0969*	-0.0407	-0.152***	-0.147***
	(0.00743)	(0.0212)	(0.0339)	(0.0357)	(0.0428)	(0.0398)	(0.00746)	(0.0187)	(0.0546)	(0.0445)	(0.0437)	(0.0443)
$\Delta CREDIT_{Bank}$		0.0942***			0.0743***	0.0711***		0.0948***			0.0995***	0.0997***
		(0.0235)			(0.0156)	(0.0158)		(0.0213)			(0.0137)	(0.0139)
ΔNHS			4.19e-05		2.71e-05				0.000105**		7.48e-05**	
			(5.75e-05)		(5.11e-05)				(4.42e-05)		(3.67e-05)	
$\Delta NHSR$				-0.000153		-0.000109				-0.000146		-1.15e-05
				(0.000171)		(0.000138)				(0.000184)		(0.000130)
Constant	11.69	15.28***	22.23	21.28	21.53	20.58	11.69***	10.30***	11.41***	9.581**	8.631***	8.424***
	(7.232)	(4.101)	(15.80)	(15.09)	(15.11)	(14.68)	(2.812)	(2.158)	(1.927)	(4.364)	(2.049)	(2.133)
Observations	1,156	1,070	649	639	641	631	1,156	1,070	649	639	641	631
Countries	39	39	30	30	30	30	39	39	30	30	30	30
Adj. R-squared	0.325	0.510	0.558	0.569	0.612	0.618	0.5780	0.7182	0.6764	0.6858	0.7167	0.7227

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 43: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Fixed Effects and Random Effects.

	IV					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-1.030***	-0.881***	-0.759***	-0.757***	-0.735***	-0.723***
	(0.0788)	(0.0822)	(0.0846)	(0.0846)	(0.0818)	(0.0814)
SCHOOL	0.000187	0.00337	-0.00753	-0.00693	0.000215	0.000597
	(0.00353)	(0.00362)	(0.00511)	(0.00513)	(0.00441)	(0.00442)
GOV	-0.0390***	-0.0505***	-0.0624***	-0.0619***	-0.0523**	-0.0507**
	(0.0135)	(0.0145)	(0.0224)	(0.0223)	(0.0218)	(0.0219)
log(OPENNESS)	0.587***	0.358***	0.704***	0.701***	0.455***	0.445***
	(0.0986)	(0.101)	(0.153)	(0.153)	(0.158)	(0.158)
INFL	-0.0197***	-0.105***	0.0155	0.0163	-0.0600***	-0.0550**
	(0.00326)	(0.0121)	(0.0254)	(0.0261)	(0.0216)	(0.0214)
$\Delta CREDIT_{Bank}$		0.0878***			0.0845***	0.0861***
		(0.0114)			(0.0128)	(0.0130)
ΔNHS			0.000124***		9.04e-05***	
			(3.99e-05)		(2.90e-05)	
$\Delta NHSR$				-0.000106		-8.46e-05
				(0.000161)		(0.000120)
Constant	10.86***	9.716***	8.526***	8.463***	7.870***	7.718***
	(0.760)	(0.859)	(1.059)	(1.058)	(1.071)	(1.061)
Observations	1,156	1,062	649	639	639	629
Countries	41	41	31	34	31	34
Adj. R-squared	0.306	0.454	0.269	0.268	0.418	0.419

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 44: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Instrumental Variables.

Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-1.784	-1.694	-1.700	-1.724	-1.873	-1.604	-1.673	-1.828
	(1.623)	(1.597)	(1.646)	(1.678)	(1.717)	(1.600)	(1.619)	(1.640)
SCHOOL	0.00529	0.00334	0.00573	0.00749	0.00883	0.00280	0.00348	0.00353
	(0.00809)	(0.00713)	(0.00800)	(0.00774)	(0.00766)	(0.00713)	(0.00783)	(0.00880)
GOV	-0.491***	-0.508***	-0.496***	-0.498***	-0.483***	-0.507***	-0.510***	-0.500***
	(0.117)	(0.112)	(0.118)	(0.118)	(0.122)	(0.116)	(0.120)	(0.127)
log(OPENNESS)	1.697	1.621	1.650	1.546	1.277	1.651	1.650	1.457
	(1.353)	(1.197)	(1.319)	(1.210)	(1.058)	(1.137)	(1.075)	(1.004)
INFL	-0.0307	-0.0247	-0.0200	0.0165	0.0131	-0.0181	0.0168	0.00523
	(0.0339)	(0.0357)	(0.0445)	(0.0567)	(0.0718)	(0.0450)	(0.0566)	(0.0700)
ΔNHS	4.19e-05							
	(5.75e-05)							
$\Delta NHSR$		-0.000153						
		(0.000171)						
ΔNHS_{t-1}			2.77e-05					
			(6.54e-05)					
ΔNHS_{t-2}				-2.33e-05				
				(7.89e-05)				
ΔNHS_{t-3}					-9.76e-05			
					(9.37e-05)			
$\Delta NHSR_{t-1}$						-2.06e-05		
						(0.000143)		
$\Delta NHSR_{t-2}$							6.88e-05	
							(0.000106)	
$\Delta NHSR_{t-3}$								0.000104
								(0.000103)
Constant	22.23	21.28	21.57	21.80	24.17	20.25	20.57	22.47
	(15.80)	(15.09)	(15.67)	(15.94)	(16.16)	(14.91)	(15.24)	(15.59)
Observations	649	639	631	611	589	621	601	579
Countries	30	30	31	30	30	31	30	30
Adj. R-squared	0.558	0.569	0.560	0.559	0.559	0.569	0.565	0.562

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 45: Growth effects of household saving growth and household saving rate growth incl. lagged variables, estimated with Fixed Effects.

Dependent: GROWTH	(1)	(2)
log(INITIAL GDP)	-0.881***	-1.081***
	(0.0822)	(0.0838)
SCHOOL	0.00337	0.000298
	(0.00362)	(0.00402)
GOV	-0.0505***	-0.0457***
	(0.0145)	(0.0160)
log(OPENNESS)	0.358***	0.449***
	(0.101)	(0.109)
INFL	-0.105***	-0.0170**
	(0.0121)	(0.00680)
$CREDIT_{Bank}$		5.72e-08
		(9.69e-08)
$\Delta CREDIT_{Bank}$	0.0878***	
	(0.0114)	
Constant	9.716***	12.07***
	(0.859)	(0.880)
Observations	1,062	1,070
Countries	41	41
R-squared	0.454	0.325

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 46: Growth effects of dynamic and static bank credit, estimated with Instrumental Variables.

Dependent: GROWTH	Total credit	Bank credit	Alternative credit	Credit to Households	Credit to Corporations
log(INITIAL GDP)	-1.488***	-1.617***	-1.880***	-1.674***	-1.523***
	(0.475)	(0.468)	(0.481)	(0.525)	(0.513)
SCHOOL	0.0132	0.0148*	0.0130	0.00961	0.00879
	(0.00912)	(0.00845)	(0.00988)	(0.00856)	(0.00933)
GOV	-0.297***	-0.303***	-0.302***	-0.423***	-0.412***
	(0.0378)	(0.0409)	(0.0706)	(0.0910)	(0.0882)
log(OPENNESS)	1.628*	1.631*	1.701	1.619*	2.169**
	(0.883)	(0.891)	(1.152)	(0.952)	(0.877)
INFL	-0.118***	-0.103***	-0.0393***	-0.122***	-0.106***
	(0.0183)	(0.0212)	(0.0140)	(0.0197)	(0.0152)
ΔCREDIT	0.109***	0.0942***	0.0229***	0.0221**	0.0550**
	(0.0185)	(0.0235)	(0.00434)	(0.00873)	(0.0211)
Constant	14.14***	15.28***	18.55***	20.76***	16.37***
	(4.498)	(4.101)	(6.248)	(4.811)	(4.906)
Observations	1,084	1,070	1,044	779	766
Countries	39	39	39	38	38
Adj. R-squared	0.495	0.510	0.424	0.608	0.605

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 47: Growth effects of dynamic credit indicators, estimated with Fixed Effects.

Dependent: GROWTH	Bank credit		Alternative credit	
	Developed countries	Less developed countries	Developed countries	Less developed countries
log(INITIAL GDP)	-3.605***	-1.875	-2.465**	-2.053
	(1.002)	(1.573)	(1.028)	(1.903)
SCHOOL	0.00639	0.0220	0.000861	0.0252
	(0.00603)	(0.0304)	(0.00559)	(0.0371)
GOV	-0.330***	-0.285	-0.341***	-0.218
	(0.0629)	(0.164)	(0.0677)	(0.187)
log(OPENNESS)	2.481**	0.796	2.660**	0.843
	(0.991)	(1.429)	(1.042)	(1.742)
INFL	-0.150***	-0.0736*	-0.0921***	-0.0381*
	(0.0297)	(0.0362)	(0.0307)	(0.0179)
ΔCREDIT	0.0906***	0.0675	0.00765	0.0183**
	(0.0156)	(0.0410)	(0.0104)	(0.00736)
Constant	34.30***	17.18	23.75**	19.80
	(9.948)	(13.79)	(10.01)	(16.20)
Observations	752	318	752	292
Countries	24	15	24	15
Adj. R-squared	0.627	0.516	0.565	0.538

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 48: Growth effects of bank credit and alternative credit by development level, estimated with Fixed Effects.

	Bank credit						Alternative credit					
	Developed countries			Less developed countries			Developed countries			Less developed countries		
VARIABLES	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010
ΔCREDIT	0.105***	0.0857***	0.135**	0.00275	0.0700	0.136***	0.0219	-0.0104	-0.0869	0.00652	0.0132	0.0101***
	(0.0259)	(0.0234)	(0.0592)	(0.0213)	(0.0670)	(0.0399)	(0.0228)	(0.0235)	(0.0767)	(0.00708)	(0.00855)	(0.00334)
Observations	373	363	159	119	195	100	373	363	159	93	195	100
Countries	23	23	23	11	15	14	23	23	23	11	15	14
Adj. R-squared	0.625	0.657	0.745	0.502	0.511	0.640	0.558	0.610	0.729	0.686	0.493	0.612

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 49: Growth effects of bank credit and alternative credit by development level and decade, estimated with Fixed Effects.

	Total credit to household sector		Total credit to corporate sector	
VARIABLES	Developed countries	Less developed countries	Developed countries	Less developed countries
ΔCREDIT	0.0566***	0.0150	0.0384	0.0732
	(0.0153)	(0.0101)	(0.0278)	(0.0746)
Observations	587	192	574	192
Countries	24	14	24	14
Adj. R-squared	0.653	0.753	0.630	0.753

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Estimation errors are normally distributed.

Table 50: Growth effects of bank credit to households and corporate sector by development level, estimated with Fixed Effects.

A.1.3 Country individual impulse-response functions of structural VARs

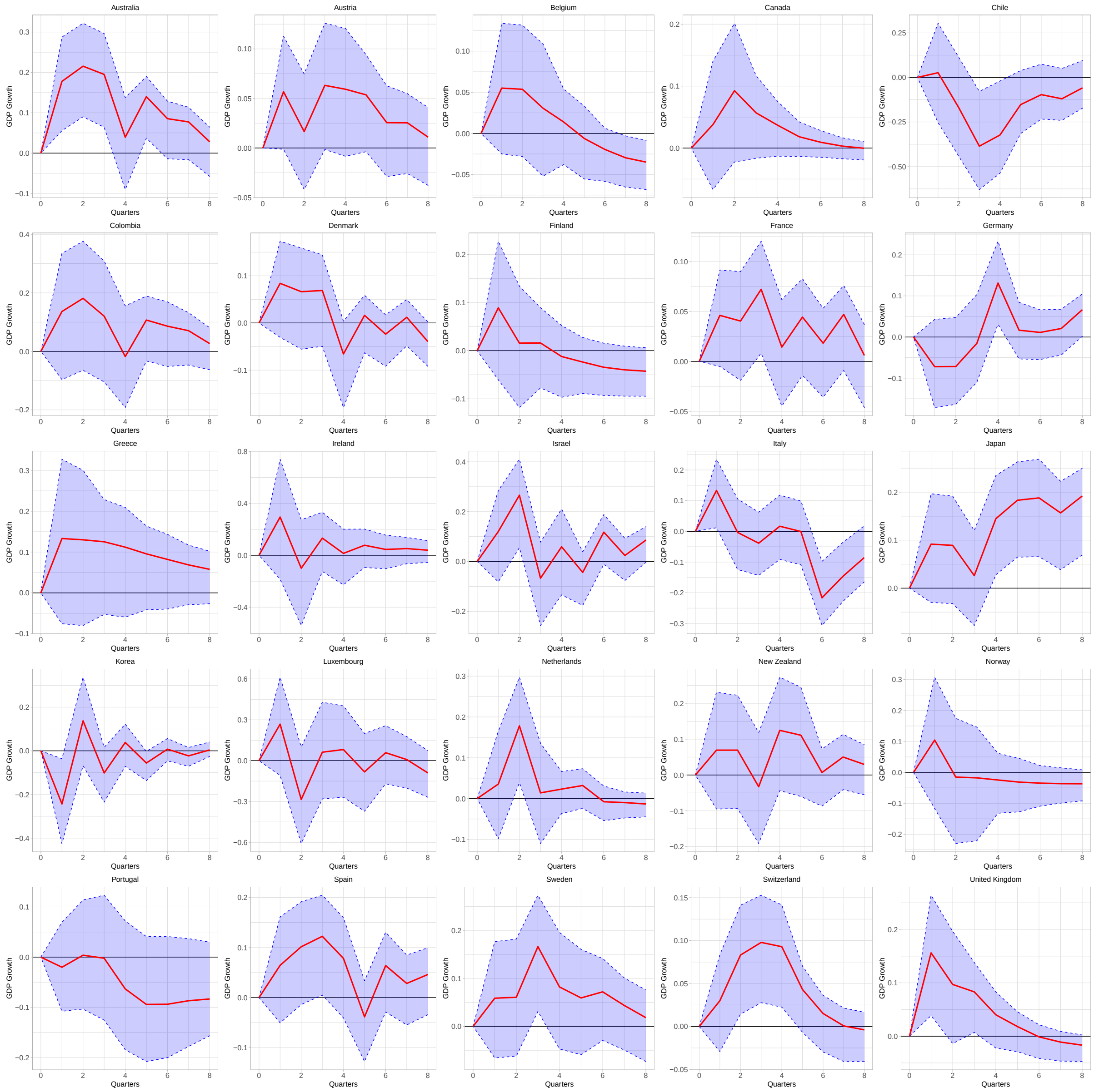


Figure 46: Impulse Response Functions of Credit Supply Shocks.
Note: Based on the BIS total credit statistics and OECD data. The red line denotes the estimated response, while the blue area represents 90 percent confidence bands derived from 5,000 bootstrap runs.

A.1.4 Forecast Error Variance Decomposition - Detailed results

Country	FEVD for	GDP	Credit
China	GDP	0,8332	0,1668
Russia	GDP	0,8584	0,1416
Israel	GDP	0,8705	0,1295
Belgium	GDP	0,8807	0,1193
Japan	GDP	0,9076	0,0924
New Zealand	GDP	0,9079	0,0921
Australia	GDP	0,9101	0,0899
Switzerland	GDP	0,9192	0,0808
Colombia	GDP	0,9292	0,0708
Brazil	GDP	0,9377	0,0623
United States	GDP	0,9384	0,0616
Denmark	GDP	0,9411	0,0589
Spain	GDP	0,9460	0,0540
Czech Republic	GDP	0,9469	0,0531
Luxembourg	GDP	0,9500	0,0500
Thailand	GDP	0,9508	0,0492
Argentina	GDP	0,9549	0,0451
South Africa	GDP	0,9558	0,0442
Germany	GDP	0,9598	0,0402
Netherlands	GDP	0,9626	0,0374
France	GDP	0,9635	0,0365
Korea	GDP	0,9648	0,0352
Chile	GDP	0,9650	0,0350
Norway	GDP	0,9653	0,0347
Mexico	GDP	0,9666	0,0334
Italy	GDP	0,9688	0,0312
Singapore	GDP	0,9692	0,0308
India	GDP	0,9706	0,0294
Canada	GDP	0,9725	0,0275
Malaysia	GDP	0,9735	0,0265
United Kingdom	GDP	0,9750	0,0250
Austria	GDP	0,9754	0,0246
Sweden	GDP	0,9809	0,0191
Saudi Arabia	GDP	0,9822	0,0178
Indonesia	GDP	0,9852	0,0148
Hungary	GDP	0,9856	0,0144
Portugal	GDP	0,9935	0,0065
Greece	GDP	0,9953	0,0047
Turkey	GDP	0,9954	0,0046
Finland	GDP	0,9965	0,0035
Hong Kong SAR	GDP	0,9981	0,0019
Poland	GDP	0,9987	0,0013
Ireland	GDP	0,9989	0,0011

Country	FEVD for	GDP	Credit
Argentina	Credit	0,8154	0,1846
Israel	Credit	0,2891	0,7109
Brazil	Credit	0,2753	0,7247
Hong Kong SAR	Credit	0,1966	0,8034
France	Credit	0,1596	0,8404
Singapore	Credit	0,1570	0,8430
Finland	Credit	0,1392	0,8608
Canada	Credit	0,1275	0,8725
United States	Credit	0,1232	0,8768
Indonesia	Credit	0,1221	0,8779
Malaysia	Credit	0,1139	0,8861
Germany	Credit	0,1119	0,8881
Mexico	Credit	0,1094	0,8906
New Zealand	Credit	0,1056	0,8944
China	Credit	0,1043	0,8957
Luxembourg	Credit	0,0928	0,9072
Saudi Arabia	Credit	0,0927	0,9073
Thailand	Credit	0,0900	0,9100
Norway	Credit	0,0850	0,9150
Colombia	Credit	0,0753	0,9247
South Africa	Credit	0,0701	0,9299
Turkey	Credit	0,0701	0,9299
Netherlands	Credit	0,0672	0,9328
Austria	Credit	0,0661	0,9339
Australia	Credit	0,0506	0,9494
Sweden	Credit	0,0479	0,9521
Italy	Credit	0,0423	0,9577
Portugal	Credit	0,0390	0,9610
Denmark	Credit	0,0318	0,9682
Switzerland	Credit	0,0288	0,9712
Russia	Credit	0,0249	0,9751
Chile	Credit	0,0245	0,9755
Spain	Credit	0,0238	0,9762
United Kingdom	Credit	0,0226	0,9774
Czech Republic	Credit	0,0199	0,9801
Ireland	Credit	0,0193	0,9807
Korea	Credit	0,0174	0,9826
Japan	Credit	0,0173	0,9827
Poland	Credit	0,0153	0,9847
Belgium	Credit	0,0132	0,9868
Hungary	Credit	0,0088	0,9912
Greece	Credit	0,0060	0,9940
India	Credit	0,0052	0,9948

Note: The full sample covers a period from 1950Q1 to 2020Q1. The table shows the contributions from each individual shock averaged over the 8 periods. As an example, approximately 94% of the variation in GDP in the United States come from shocks to GDP itself. The credit growth shocks contribute to 6% of the variation in GDP. Analogously, 88% of the variation in credit growth comes from credit growth shocks and 12% from GDP.

Table 51: Overview of FEVD results using all available data for the entire time period, sorted by size of shock. Left table is sorted by size of credit growth shock, right table is sorted by GDP growth shock.

A.2 Appendix B: Lending a Hand to Industry: The Role of Credit for Industrial Policy in China

A.2.1 Data set

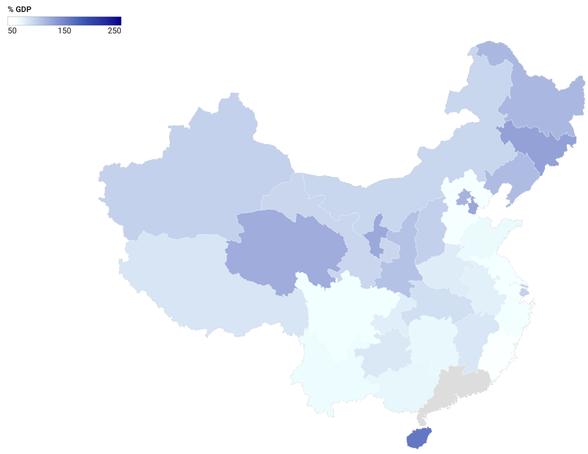
Variables and sources			
Symbol	Variable	Definition	Data source
Dependent variable			
ΔGDP_{real}	Real GDP growth	Annual growth rate of real GDP in percent	China Provincial Statistical Yearbooks, var. years
Explanatory variables			
$\Delta CREDIT_{tot}$	Total credit growth	Annual growth rate of total credit (100 mio yuan)	China Provincial Statistical Yearbooks, var. years
$\Delta CREDIT_{NFC}$	Commercial credit growth	Combined annual growth rates of various non-financial corporation / industry credit data series, interpolated, in percent	China Provincial Statistical Yearbooks, var. years
ΔINV_{credit}	Growth of credit financed investment	Annual growth rates of investment in Fixed Assets with the source of funds being domestic credit (10.000 Yuan)	China Provincial Statistical Yearbooks, var. years
Control variables			
log(INITIAL GDP)	Level of initial GDP	Natural logarithm of GDP from previous period (t-1)	China Provincial Statistical Yearbooks, var. years
SCHOOL	Secondary school enrollment rate	Share of students in secondary schooling by total students in primary and secondary schooling (percent)	China Provincial Statistical Yearbooks, var. years
log(GOV)	Government expenditure	Natural logarithm of General Public Budget Expenditure (100 Mio Yuan)	China Provincial Statistical Yearbooks, var. years
log(OPENNESS)	Trade	Natural logarithm of Openness, calculated as sum of imports and exports divided by GDP	China Provincial Statistical Yearbooks, var. years

Table 52: Data description and sources (China macro panel).

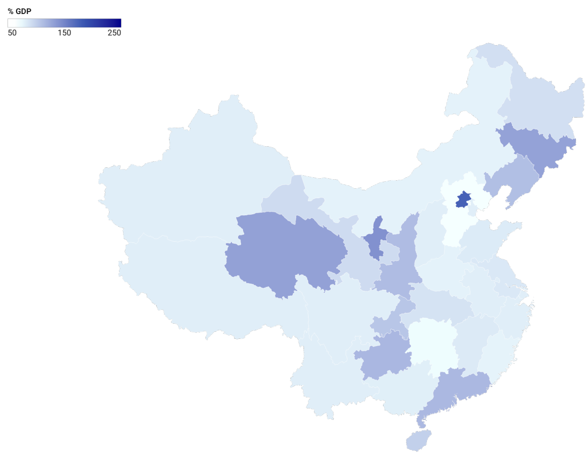
Variables and sources			
Symbol	Variable	Definition	Data source
Dependent variable			
ΔINV_{tot}	Growth of investment in fixed assets	Annual growth rate of investment in fixed assets for total industry	China Industry Statistical Yearbooks, var. years
ΔINV_{auto}	Growth of investment in fixed assets by automobile industry	Annual growth rate of investment in fixed assets for automobile industry	China Industry Statistical Yearbooks, var. years
ΔINV_{energy}	Growth of investment in fixed assets by energy industry	Annual growth rate of investment in fixed assets for energy industry	China Industry Statistical Yearbooks, var. years
Explanatory variables			
$\Delta CREDIT_{firm}$	Growth of credit to total industry (aggregate firm data)	Difference in liabilities and owner's equity for total industry	China Industry Statistical Yearbooks, var. years
$\Delta CREDIT_{priv}$	Growth of credit to private firms (aggregate firm data)	Difference in liabilities and owner's equity for private industrial enterprises	China Industry Statistical Yearbooks, var. years
$\Delta CREDIT_{state}$	Growth of credit to state-owned firms (aggregate firm data)	Difference in liabilities and owner's equity for state-holding industrial enterprises	China Industry Statistical Yearbooks, var. years
Control variables			
ΔREV_{ind}	Aggregate firm revenues	Growth of main business revenues from total industry	China Industry Statistical Yearbooks, var. years
$\Delta STATECAP_{ind}$	Receipt of state capital	Paid in state capital as part of owner's equity for total industry	China Industry Statistical Yearbooks, var. years
$\Delta FORECAP_{ind}$	Receipt of foreign capital	Paid in foreign capital as part of owner's equity for total industry	China Industry Statistical Yearbooks, var. years

Table 53: Data description and sources (China industry panel).

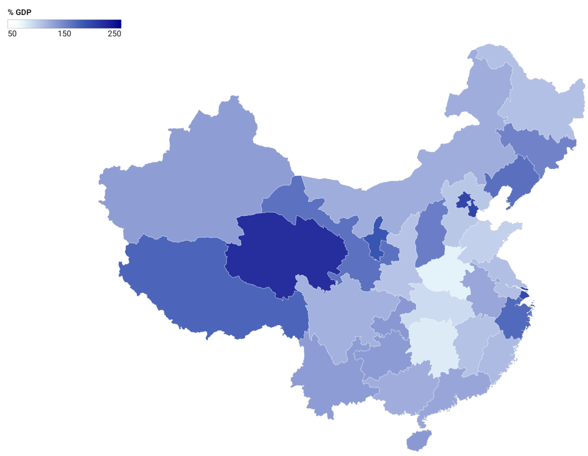
Figure 47: Provinces in China by economic categorization.
Source: China Provincial Statistical Yearbooks.



(a) 1990-1999



(b) 2000-2009



(c) 2010-2019

Figure 48: Median total credit to GDP by decade.
Source: China Provincial Statistical Yearbooks.

A.2.2 ASPI ranking

Technology	Lead country	Technology monopoly risk
Advanced materials and manufacturing		
1. Nanoscale materials and manufacturing	China	high
2. Coatings	China	high
3. Smart materials	China	medium
4. Advanced composite materials	China	medium
5. Novel metamaterials	China	medium
6. High-specification machining processes	China	medium
7. Advanced explosives and energetic materials	China	medium
8. Critical minerals extraction and processing	China	low
9. Advanced magnets and superconductors	China	low
10. Advanced protection	China	low
11. Continuous flow chemical synthesis	China	low
12. Additive manufacturing (incl. 3D printing)	China	low
Artificial intelligence, computing and communications		
13. Advanced radiofrequency communications (incl. 5G and 6G)	China	high
14. Advanced optical communications	China	medium
15. Artificial intelligence (AI) algorithms and hardware accelerators	China	medium
16. Distributed ledgers	China	medium
17. Advanced data analytics	China	medium
18. Machine learning (incl. neural networks and deep learning)	China	low
19. Protective cybersecurity technologies	China	low
20. High performance computing	USA	low
21. Advanced integrated circuit design and fabrication	USA	low
22. Natural language processing (incl. speech and text recognition and analysis)	USA	low
Energy and environment		
23. Hydrogen and ammonia for power	China	high
24. Supercapacitors	China	high
25. Electric batteries	China	high
26. Photovoltaics	China	medium
27. Nuclear waste management and recycling	China	medium
28. Directed energy technologies	China	medium
29. Biofuels	China	low
30. Nuclear energy	China	low
Quantum		
31. Quantum computing	USA	medium
32. Post-quantum cryptography	China	low
33. Quantum communications (incl. quantum key distribution)	China	low
34. Quantum sensors	China	low
Biotechnology, gene technology and vaccines		
35. Synthetic biology	China	high
36. Biological manufacturing	China	medium
37. Vaccines and medical countermeasures	USA	medium
Sensing, timing and navigation		
38. Photonic sensors	China	high
Defence, space, robotics and transportation		
39. Advanced aircraft engines (incl. hypersonics)	China	medium
40. Drones, swarming and collaborative robots	China	medium
41. Small satellites	USA	low
42. Autonomous systems operation technology	China	low
43. Advanced robotics	China	low
44. Space launch systems	USA	low

Figure 49: ASPI's critical technology tracker.
Source: Gaida et al. (2023, p. 8).

A.2.3 Robustness checks

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year <2001			year >= 2001	
$log(INITIALGDP)$	-0.0217***	-0.0235***	-0.0472***	-0.0155	-0.0101	-0.0282**	-0.0382***	-0.0395***	-0.0399***
	(0.00767)	(0.00695)	(0.00975)	(0.0140)	(0.0135)	(0.0115)	(0.00845)	(0.00771)	(0.00836)
$SCHOOL$	0.0239	0.00617	0.0502	0.00340	-0.0407	-0.0437	0.0511	0.0495	0.0591
	(0.0606)	(0.0578)	(0.0571)	(0.0678)	(0.0647)	(0.0673)	(0.0563)	(0.0515)	(0.0540)
$log(GOV)$	0.0333***	0.0376***	0.0711***	0.0289	0.0225	0.0455***	0.0567***	0.0593***	0.0595***
	(0.0116)	(0.0110)	(0.0141)	(0.0187)	(0.0174)	(0.0168)	(0.0136)	(0.0126)	(0.0136)
$log(OPENNESS)$	-0.00644*	-0.00549*	-0.00803**	-0.00228	-0.000367	-0.00278	-0.00531	-0.00419	-0.00428
	(0.00349)	(0.00324)	(0.00361)	(0.00412)	(0.00419)	(0.00466)	(0.00404)	(0.00371)	(0.00400)
$\Delta CREDIT_{tot}$	2.03e-06***			0.00296			1.30e-06***		
	(4.97e-07)			(0.00295)			(3.28e-07)		
$\Delta CREDIT_{NFC}$		0.0168*			0.00867			0.0178***	
		(0.00881)			(0.0201)			(0.00666)	
ΔINV_{credit}			0.00118			0.00113			0.00353
			(0.00358)			(0.00824)			(0.00334)
GEO_{east}	0.0219*	0.0128	0.0304**	0.0173	0.0187*	0.0306**	0.0172	0.0106	0.0151
	(0.0114)	(0.00986)	(0.0121)	(0.0180)	(0.0103)	(0.0128)	(0.0121)	(0.00994)	(0.0120)
$\Delta CREDIT_{tot} * GEO_{east}$	0.0127			0.0667			0.00285		
	(0.0161)			(0.0707)			(0.00482)		
$\Delta CREDIT_{NFC} * GEO_{east}$		0.0709***			0.0525**			0.0392*	
		(0.0164)			(0.0255)			(0.0227)	
$\Delta INV_{credit} * GEO_{east}$			0.00907			0.0258			-0.00309
			(0.00594)			(0.0255)			(0.00647)
Constant	0.104***	0.108***	0.116***	0.103***	0.124***	0.149***	-0.120*	-0.0906	
	(0.0381)	(0.0400)	(0.0281)	(0.0384)	(0.0401)	(0.0341)	(0.0616)	(0.0568)	
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.715	0.725	0.713	0.700	0.704	0.708	0.690	0.712	0.657

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 54: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

A.2.3.1 Growth process grouped by Chinese regions

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.132***	-0.115***	-0.162***	-0.135***	-0.115***	-0.163***	-0.0419	-0.0353	-0.0451	-0.0423	-0.0352	-0.0454
	(0.0370)	(0.0340)	(0.0313)	(0.0361)	(0.0338)	(0.0303)	(0.0290)	(0.0251)	(0.0295)	(0.0285)	(0.0249)	(0.0294)
$SCHOOL$	0.101*	0.0953**	0.115**	0.1000*	0.0952**	0.116**	0.0222	-0.0219	0.0262	0.0208	-0.0220	0.0262
	(0.0499)	(0.0398)	(0.0420)	(0.0499)	(0.0396)	(0.0417)	(0.0558)	(0.0515)	(0.0504)	(0.0557)	(0.0514)	(0.0504)
$log(GOV)$	0.126***	0.103***	0.122***	0.126***	0.103***	0.122***	0.0576	0.0513	0.0648*	0.0582	0.0512	0.0652*
	(0.0315)	(0.0316)	(0.0368)	(0.0310)	(0.0314)	(0.0368)	(0.0367)	(0.0314)	(0.0379)	(0.0360)	(0.0312)	(0.0378)
$log(OPENNESS)$	-0.00686	-0.00528	-0.00756	-0.00621	-0.00517	-0.00720	-0.00509	-0.00273	-0.00465	-0.00506	-0.00269	-0.00465
	(0.00895)	(0.00942)	(0.00983)	(0.00902)	(0.00934)	(0.00957)	(0.00624)	(0.00549)	(0.00674)	(0.00614)	(0.00548)	(0.00668)
$\Delta CREDIT_{tot}$	0.00341			0.00355			0.00714			0.00719		
	(0.00964)			(0.00982)			(0.0132)			(0.0134)		
$\Delta CREDIT_{NFC}$		0.0217			0.0217			0.0652***			0.0652***	
		(0.0168)			(0.0168)			(0.0155)			(0.0154)	
ΔINV_{credit}			-0.00315			-0.00312			0.00289			0.00294
			(0.00368)			(0.00367)			(0.00381)			(0.00384)
$year_{>2001}$				-0.00386*	-0.000768	-0.00223				-0.00356	-0.00138	-0.00221
				(0.00180)	(0.00199)	(0.00343)				(0.00242)	(0.00272)	(0.00402)
Constant	0.404*	0.399*	0.575**	0.422*	0.401*	0.584**	0.177***	0.171***	0.164***	0.179***	0.172***	0.166***
	(0.216)	(0.217)	(0.207)	(0.213)	(0.214)	(0.195)	(0.0209)	(0.0176)	(0.0259)	(0.0217)	(0.0177)	(0.0280)
Observations	315	334	291	315	334	291	315	334	291	315	334	291
Number of Provinces	10	10	10	10	10	10	10	10	10	10	10	10
Adj. R-squared	0.814	0.824	0.822	0.815	0.824	0.822	0.787	0.799	0.795	0.787	0.799	0.794

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 55: Growth effects of dynamic credit indicators in GEO_{east}, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.0896	-0.0660	-0.0779	-0.0872	-0.0642	-0.0765	-0.0378	-0.0204	-0.0300	-0.0374	-0.0204	-0.0302
	(0.0549)	(0.0445)	(0.0505)	(0.0555)	(0.0452)	(0.0503)	(0.0304)	(0.0250)	(0.0306)	(0.0307)	(0.0254)	(0.0308)
$SCHOOL$	-0.0888	-0.0875	-0.0729	-0.0864	-0.0821	-0.0691	-0.282	-0.260*	-0.259	-0.280	-0.257	-0.257
	(0.202)	(0.189)	(0.208)	(0.204)	(0.192)	(0.211)	(0.177)	(0.158)	(0.180)	(0.178)	(0.158)	(0.180)
$log(GOV)$	0.132**	0.110**	0.127**	0.130**	0.110**	0.127**	0.0576	0.0333	0.0513	0.0574	0.0338	0.0518
	(0.0450)	(0.0424)	(0.0409)	(0.0470)	(0.0445)	(0.0421)	(0.0392)	(0.0344)	(0.0388)	(0.0398)	(0.0352)	(0.0392)
$log(OPENNESS)$	-0.00870	-0.0144	-0.00955	-0.00843	-0.0139	-0.00909	-0.0187***	-0.0151***	-0.0178***	-0.0185***	-0.0150***	-0.0176***
	(0.00769)	(0.00795)	(0.00745)	(0.00832)	(0.00844)	(0.00822)	(0.00357)	(0.00333)	(0.00364)	(0.00364)	(0.00346)	(0.00381)
$\Delta CREDIT_{tot}$	9.10e-07			1.24e-06			2.66e-06***			2.98e-06***		
	(9.61e-07)			(1.02e-06)			(8.52e-07)			(8.94e-07)		
$\Delta CREDIT_{NFC}$		0.0184*			0.0187*			0.0216**			0.0219**	
		(0.00819)			(0.00813)			(0.00883)			(0.00904)	
ΔINV_{credit}			0.0115			0.0115			0.0150			0.0149
			(0.0188)			(0.0183)			(0.0187)			(0.0181)
$year_{>2001}$				0.00637	0.00674	0.00608				0.00692	0.00665	0.00628
				(0.00613)	(0.00545)	(0.00551)				(0.00649)	(0.00588)	(0.00580)
Constant	0.121	0.0755	0.107	0.108	0.0609	0.0967	0.137*	0.162**	0.151*	0.131	0.154**	0.146*
	(0.222)	(0.172)	(0.211)	(0.225)	(0.176)	(0.212)	(0.0829)	(0.0770)	(0.0880)	(0.0817)	(0.0768)	(0.0876)
Observations	291	305	273	291	305	273	291	305	273	291	305	273
Number of Provinces	9	9	9	9	9	9	9	9	9	9	9	9
Adj. R-squared	0.787	0.780	0.774	0.788	0.782	0.775	0.754	0.747	0.734	0.755	0.748	0.735

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 56: Growth effects of dynamic credit indicators in $GEO_{centralnorth}$, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.129**	-0.111**	-0.0876***	-0.128**	-0.111**	-0.0875***	-0.0123	-0.0143	-0.0199**	-0.0123	-0.0142	-0.0202**
	(0.0470)	(0.0422)	(0.0213)	(0.0472)	(0.0422)	(0.0217)	(0.0108)	(0.0108)	(0.00928)	(0.0108)	(0.0108)	(0.00931)
$SCHOOL$	0.118	0.141	0.0968	0.118	0.141	0.0980	0.0585	0.0728	0.0515	0.0586	0.0726	0.0525
	(0.135)	(0.136)	(0.175)	(0.135)	(0.136)	(0.175)	(0.0641)	(0.0725)	(0.0996)	(0.0640)	(0.0726)	(0.100)
$log(GOV)$	0.0744*	0.0744*	0.0617*	0.0744*	0.0743*	0.0619*	0.0222	0.0246	0.0299*	0.0222	0.0246	0.0303*
	(0.0360)	(0.0365)	(0.0287)	(0.0362)	(0.0366)	(0.0288)	(0.0174)	(0.0176)	(0.0159)	(0.0175)	(0.0176)	(0.0159)
$log(OPENNESS)$	-0.00666	-0.00723	-0.00829	-0.00667	-0.00728	-0.00830	0.00308	0.000842	0.00298	0.00300	0.000780	0.00299
	(0.00803)	(0.00735)	(0.00898)	(0.00804)	(0.00734)	(0.00906)	(0.00549)	(0.00427)	(0.00509)	(0.00556)	(0.00429)	(0.00509)
$\Delta CREDIT_{tot}$	0.00149			0.00147			0.00109			0.00101		
	(0.00238)			(0.00242)			(0.00278)			(0.00276)		
$\Delta CREDIT_{NFC}$		0.00920			0.00954			0.0117			0.0121	
		(0.0162)			(0.0161)			(0.0189)			(0.0189)	
ΔINV_{credit}			0.00283			0.00276			0.00497*			0.00489*
			(0.00311)			(0.00309)			(0.00292)			(0.00289)
$year_{>2001}$				0.000385	0.00183	-0.00298				0.00133	0.00200	-0.00331
				(0.00495)	(0.00451)	(0.00434)				(0.00520)	(0.00472)	(0.00442)
Constant	0.425**	0.331**	0.331**	0.424**	0.329**	0.331**	0.111	0.0917	0.176***	0.109	0.0900	0.178***
	(0.150)	(0.149)	(0.134)	(0.149)	(0.148)	(0.136)	(0.0674)	(0.0767)	(0.0394)	(0.0688)	(0.0777)	(0.0389)
Observations	375	401	327	375	401	327	375	401	327	375	401	327
Number of Provinces	12	12	12	12	12	12	12	12	12	12	12	12
Adj. R-squared	0.690	0.714	0.718	0.690	0.715	0.719	0.648	0.677	0.673	0.647	0.676	0.672

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 57: Growth effects of dynamic credit indicators in GEO_{west}, estimated with Fixed Effects and Random Effects.

A.2.3.2 Lagged variables

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0217***	-0.0214***	-0.0266***	-0.0235***	-0.0295***	-0.0241***	-0.0472***	-0.0304***	-0.0295***
	(0.00767)	(0.00801)	(0.00858)	(0.00695)	(0.00778)	(0.00750)	(0.00975)	(0.00799)	(0.00799)
$SCHOOL$	0.0239	0.0190	0.0418	0.00617	0.0170	0.0187	0.0502	0.0114	0.00593
	(0.0606)	(0.0580)	(0.0555)	(0.0578)	(0.0529)	(0.0582)	(0.0571)	(0.0608)	(0.0607)
$log(GOV)$	0.0333***	0.0327***	0.0399***	0.0376***	0.0459***	0.0373***	0.0711***	0.0464***	0.0452***
	(0.0116)	(0.0120)	(0.0126)	(0.0110)	(0.0118)	(0.0118)	(0.0141)	(0.0122)	(0.0117)
$log(OPENNESS)$	-0.00644*	-0.00636*	-0.00758**	-0.00549*	-0.00708**	-0.00547	-0.00803**	-0.00630*	-0.00675*
	(0.00349)	(0.00354)	(0.00364)	(0.00324)	(0.00341)	(0.00337)	(0.00361)	(0.00358)	(0.00372)
$\Delta CREDIT_{tot}$	2.03e-06***								
	(4.97e-07)								
$\Delta CREDIT_{tot(l1)}$		3.21e-06***							
		(5.68e-07)							
$\Delta CREDIT_{tot(l2)}$			2.10e-06***						
			(5.54e-07)						
$\Delta CREDIT_{NFC}$				0.0168*					
				(0.00881)					
$\Delta CREDIT_{NFC(l1)}$					0.0199*				
					(0.0103)				
$\Delta CREDIT_{NFC(l2)}$						0.00127			
						(0.0169)			
ΔINV_{credit}							0.00118		
							(0.00358)		
$\Delta INV_{credit(l1)}$								0.00121	
								(0.00346)	
$\Delta INV_{credit(l2)}$									-0.00302
									(0.00318)
GEO_{east}	0.0219*	0.0196*	0.0248**	0.0128	0.0220*	0.0149	0.0304**	0.0262**	0.0293***
	(0.0114)	(0.0111)	(0.0118)	(0.00986)	(0.0115)	(0.0121)	(0.0121)	(0.0112)	(0.0112)
$\Delta CREDIT_{tot} * GEO_{east}$	0.0127								
	(0.0161)								
$\Delta CREDIT_{tot(l1)} * GEO_{east}$		0.0286***							
		(0.0101)							
$\Delta CREDIT_{tot(l2)} * GEO_{east}$			0.0200**						
			(0.00818)						
$\Delta CREDIT_{NFC} * GEO_{east}$				0.0709***					
				(0.0164)					
$\Delta CREDIT_{NFC(l1)} * GEO_{east}$					0.0323				
					(0.0198)				
$\Delta CREDIT_{NFC(l2)} * GEO_{east}$						0.0534			
						(0.0343)			
$\Delta INV_{credit} * GEO_{east}$							0.00907		
							(0.00594)		
$\Delta INV_{credit(l1)} * GEO_{east}$								0.00514	
								(0.00619)	
$\Delta INV_{credit(l2)} * GEO_{east}$									0.000150
									(0.0102)
Constant	0.104***	0.106***	0.0955**	0.108***	0.0955***	0.116***	0.116***	0.136***	0.136***
	(0.0381)	(0.0378)	(0.0381)	(0.0400)	(0.0328)	(0.0365)	(0.0281)	(0.0297)	(0.0303)
Observations	981	957	931	1,040	1,016	1,009	891	877	863
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.715	0.709	0.702	0.725	0.739	0.731	0.712	0.701	0.696

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 58: Growth effects of dynamic credit indicators and lagged credit indicators with dummy variable for regions, estimated with Random Effects.

					RE				
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0155	-0.0164	-0.0152	-0.0101	-0.0116	-0.00779	-0.0282**	-0.0226*	-0.0219*
	(0.0140)	(0.0141)	(0.0137)	(0.0135)	(0.0139)	(0.0141)	(0.0115)	(0.0120)	(0.0117)
$SCHOOL$	0.00340	0.00655	0.00317	-0.0407	-0.0670	-0.0407	-0.0437	-0.0597	-0.0709
	(0.0678)	(0.0692)	(0.0679)	(0.0647)	(0.0653)	(0.0681)	(0.0673)	(0.0666)	(0.0638)
$log(GOV)$	0.0289	0.0296	0.0276	0.0225	0.0245	0.0175	0.0455***	0.0381**	0.0378**
	(0.0187)	(0.0188)	(0.0182)	(0.0174)	(0.0184)	(0.0187)	(0.0168)	(0.0163)	(0.0157)
$log(OPENNESS)$	-0.00228	-0.00279	-0.00251	-0.000367	-0.00166	0.00151	-0.00278	-0.00160	-0.00131
	(0.00412)	(0.00410)	(0.00401)	(0.00419)	(0.00436)	(0.00434)	(0.00466)	(0.00421)	(0.00409)
$\Delta CREDIT_{tot}$	0.00296								
	(0.00295)								
$\Delta CREDIT_{tot(l1)}$		5.47e-05							
		(0.00196)							
$\Delta CREDIT_{tot(l2)}$			0.00209						
			(0.00357)						
$\Delta CREDIT_{NFC}$				0.00867					
				(0.0201)					
$\Delta CREDIT_{NFC(l1)}$					0.0189				
					(0.0175)				
$\Delta CREDIT_{NFC(l2)}$						0.0492***			
						(0.0167)			
ΔINV_{credit}							0.00113		
							(0.00824)		
$\Delta INV_{credit(l1)}$								-0.000265	
								(0.00819)	
$\Delta INV_{credit(l2)}$									-0.0152
									(0.0126)
GEO_{east}	0.0173	0.0163	0.0227	0.0187*	0.0270**	0.0343**	0.0306**	0.0324***	0.0385***
	(0.0180)	(0.0141)	(0.0147)	(0.0103)	(0.0136)	(0.0144)	(0.0128)	(0.0114)	(0.0111)
$\Delta CREDIT_{tot} * GEO_{east}$	0.0667								
	(0.0707)								
$\Delta CREDIT_{tot(l1)} * GEO_{east}$		0.0833*							
		(0.0485)							
$\Delta CREDIT_{tot(l2)} * GEO_{east}$			0.0476						
			(0.0554)						
$\Delta CREDIT_{NFC} * GEO_{east}$				0.0525**					
				(0.0255)					
$\Delta CREDIT_{NFC(l1)} * GEO_{east}$					0.0195				
					(0.0419)				
$\Delta CREDIT_{NFC(l2)} * GEO_{east}$						-0.0476			
						(0.0556)			
$\Delta INV_{credit} * GEO_{east}$							0.0258		
							(0.0255)		
$\Delta INV_{credit(l1)} * GEO_{east}$								0.0123	
								(0.0276)	
$\Delta INV_{credit(l2)} * GEO_{east}$									-0.0125
									(0.0260)
Constant	0.103***	0.104***	0.108***	0.124***	0.120***	0.137***	0.149***	0.162***	0.165***
	(0.0384)	(0.0386)	(0.0383)	(0.0401)	(0.0343)	(0.0358)	(0.0341)	(0.0311)	(0.0313)
Observations	402	408	413	424	400	393	351	365	381
Number of Provinces	29	31	31	31	31	31	30	30	30
Adj. R-squared	0.700	0.700	0.698	0.704	0.718	0.710	0.708	0.700	0.702

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 59: Growth effects of dynamic credit indicators and lagged credit indicators with dummy variable for regions before 2001, estimated with Random Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0382***	-0.0401***	-0.0404***	-0.0395***	-0.0390***	-0.0404***	-0.0399***	-0.0403***	-0.0422***
	(0.00845)	(0.00881)	(0.00913)	(0.00771)	(0.00798)	(0.00794)	(0.00836)	(0.00872)	(0.00952)
$SCHOOL$	0.0511	0.0394	0.0543	0.0495	0.0562	0.0561	0.0591	0.0675	0.0724
	(0.0563)	(0.0554)	(0.0538)	(0.0515)	(0.0500)	(0.0524)	(0.0540)	(0.0551)	(0.0571)
$log(GOV)$	0.0567***	0.0599***	0.0594***	0.0593***	0.0580***	0.0605***	0.0595***	0.0594***	0.0621***
	(0.0136)	(0.0141)	(0.0144)	(0.0126)	(0.0125)	(0.0132)	(0.0136)	(0.0140)	(0.0150)
$log(OPENNESS)$	-0.00531	-0.00452	-0.00589	-0.00419	-0.00427	-0.00400	-0.00428	-0.00510	-0.00623
	(0.00404)	(0.00427)	(0.00445)	(0.00371)	(0.00382)	(0.00374)	(0.00400)	(0.00423)	(0.00459)
$\Delta CREDIT_{tot}$	1.30e-06***								
	(3.28e-07)								
$\Delta CREDIT_{tot(l1)}$		2.48e-06***							
		(4.26e-07)							
$\Delta CREDIT_{tot(l2)}$			1.40e-06***						
			(4.90e-07)						
$\Delta CREDIT_{NFC}$				0.0178***					
				(0.00666)					
$\Delta CREDIT_{NFC(l1)}$					0.0237**				
					(0.0120)				
$\Delta CREDIT_{NFC(l2)}$						-0.00621			
						(0.0146)			
ΔINV_{credit}							0.00353		
							(0.00334)		
$\Delta INV_{credit(l1)}$								0.00178	
								(0.00260)	
$\Delta INV_{credit(l2)}$									-0.000565
									(0.00433)
GEO_{east}	0.0172	0.0131	0.0167	0.0106	0.0167	0.0110	0.0151	0.0170	0.0188
	(0.0121)	(0.0124)	(0.0133)	(0.00994)	(0.0109)	(0.0114)	(0.0120)	(0.0126)	(0.0133)
$\Delta CREDIT_{tot} * GEO_{east}$	0.00285								
	(0.00482)								
$\Delta CREDIT_{tot(l1)} * GEO_{east}$		0.0204***							
		(0.00208)							
$\Delta CREDIT_{tot(l2)} * GEO_{east}$			0.0150***						
			(0.00192)						
$\Delta CREDIT_{NFC} * GEO_{east}$				0.0392*					
				(0.0227)					
$\Delta CREDIT_{NFC(l1)} * GEO_{east}$					-0.0126				
					(0.0247)				
$\Delta CREDIT_{NFC(l2)} * GEO_{east}$						0.0373			
						(0.0345)			
$\Delta INV_{credit} * GEO_{east}$							-0.00309		
							(0.00647)		
$\Delta INV_{credit(l1)} * GEO_{east}$								-0.00145	
								(0.00427)	
$\Delta INV_{credit(l2)} * GEO_{east}$									0.00410
									(0.00566)
Constant	-0.120*		-0.0719	-0.0906	-0.0885	-0.0916			-0.0770
	(0.0616)		(0.0638)	(0.0568)	(0.0549)	(0.0592)			(0.0646)
Observations	579	549	518	616	616	616	540	512	482
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.690	0.678	0.663	0.712	0.715	0.711	0.657	0.645	0.645

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 60: Growth effects of dynamic credit indicators and lagged credit indicators with dummy variable for regions after 2001, estimated with Random Effects.

	FE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.120***	-0.125***	-0.131***	-0.107***	-0.0983***	-0.104***	-0.107***	-0.116***	-0.125***
	(0.0242)	(0.0241)	(0.0248)	(0.0233)	(0.0209)	(0.0224)	(0.0214)	(0.0216)	(0.0194)
$SCHOOL$	0.106*	0.105*	0.0975	0.0968	0.0777	0.101	0.0851	0.0856	0.0831
	(0.0598)	(0.0606)	(0.0577)	(0.0612)	(0.0618)	(0.0627)	(0.0619)	(0.0627)	(0.0638)
$log(GOV)$	0.118***	0.119***	0.120***	0.109***	0.103***	0.107***	0.114***	0.116***	0.119***
	(0.0220)	(0.0224)	(0.0231)	(0.0201)	(0.0204)	(0.0199)	(0.0194)	(0.0198)	(0.0187)
$log(OPENNESS)$	-0.00771*	-0.00787*	-0.00945*	-0.00875**	-0.0110*	-0.00806*	-0.00985**	-0.00947*	-0.0122**
	(0.00441)	(0.00462)	(0.00486)	(0.00423)	(0.00539)	(0.00410)	(0.00474)	(0.00545)	(0.00497)
$\Delta CREDIT_{tot}$	7.70e-07**								
	(3.43e-07)								
$\Delta CREDIT_{tot(l1)}$		1.62e-06***							
		(4.51e-07)							
$\Delta CREDIT_{tot(l2)}$			5.46e-07						
			(4.25e-07)						
$\Delta CREDIT_{NFC}$				0.0212**					
				(0.00848)					
$\Delta CREDIT_{NFC(l1)}$					0.00678				
					(0.00781)				
$\Delta CREDIT_{NFC(l2)}$						-0.00893			
						(0.0134)			
ΔINV_{credit}							0.00563		
							(0.00403)		
$\Delta INV_{credit(l1)}$								-0.00148	
								(0.00467)	
$\Delta INV_{credit(l2)}$									-0.00948
									(0.00633)
$d10(CREDIT/GDP)$	0.0133	0.0148	0.0116	0.0163**	0.00502	0.00720	0.00976	0.00443	0.00541
	(0.0111)	(0.0112)	(0.00892)	(0.00712)	(0.00907)	(0.00786)	(0.00833)	(0.00953)	(0.00947)
$d10(CREDIT/GDP) * \Delta CREDIT_{tot}$	-0.0134								
	(0.0300)								
$d10(CREDIT/GDP) * \Delta CREDIT_{tot(l1)}$		-0.0206							
		(0.0391)							
$d10(CREDIT/GDP) * \Delta CREDIT_{tot(l2)}$			-0.0241						
			(0.0171)						
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC}$				-0.0292*					
				(0.0160)					
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC(l1)}$					0.0365**				
					(0.0168)				
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC(l2)}$						0.0309			
						(0.0263)			
$d10(CREDIT/GDP) * \Delta INV_{credit}$							-0.00797		
							(0.00475)		
$d10(CREDIT/GDP) * \Delta INV_{credit(l1)}$								0.00550	
								(0.00507)	
$d10(CREDIT/GDP) * \Delta INV_{credit(l2)}$									0.0145*
									(0.00789)
Constant	0.294***	0.320***	0.346***	0.260***	0.237**	0.258***	0.273***	0.316***	0.345***
	(0.0998)	(0.0998)	(0.105)	(0.0902)	(0.0871)	(0.0897)	(0.0991)	(0.104)	(0.0979)
Observations	928	912	892	960	940	935	856	842	829
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.720	0.717	0.715	0.727	0.740	0.731	0.726	0.716	0.712

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 61: Growth effects of dynamic credit indicators and lagged credit indicators with dummy variable for credit to GDP share, estimated with Fixed Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.00927	-0.0267***	-0.0176***	-0.0133**	-0.0156**	-0.00983	-0.0295***	-0.0359***	-0.0174**
	(0.00631)	(0.00747)	(0.00672)	(0.00628)	(0.00624)	(0.00676)	(0.00742)	(0.00851)	(0.00676)
$SCHOOL$	0.0378	0.0809	0.0628	0.0284	0.0222	0.0144	0.0424	0.0611	0.0181
	(0.0616)	(0.0587)	(0.0581)	(0.0628)	(0.0601)	(0.0637)	(0.0624)	(0.0613)	(0.0636)
$log(GOV)$	0.0162*	0.0420***	0.0279***	0.0227**	0.0266***	0.0170	0.0471***	0.0559***	0.0283***
	(0.00958)	(0.0121)	(0.0107)	(0.0102)	(0.0101)	(0.0105)	(0.0117)	(0.0131)	(0.0107)
$log(OPENNESS)$	-2.86e-05	-0.000455	-2.53e-05	-0.000101	-0.000503	0.000419	-0.000361	-0.000458	0.000932
	(0.00222)	(0.00274)	(0.00243)	(0.00228)	(0.00230)	(0.00214)	(0.00239)	(0.00277)	(0.00244)
$\Delta CREDIT_{tot}$	1.73e-06***								
	(4.73e-07)								
$\Delta CREDIT_{tot(l1)}$		2.76e-06***							
		(4.97e-07)							
$\Delta CREDIT_{tot(l2)}$			1.75e-06***						
			(5.26e-07)						
$\Delta CREDIT_{NFC}$				0.0318***					
				(0.0113)					
$\Delta CREDIT_{NFC(l1)}$					0.0135				
					(0.00886)				
$\Delta CREDIT_{NFC(l2)}$						-0.000486			
						(0.0172)			
ΔINV_{credit}							0.00938**		
							(0.00412)		
$\Delta INV_{credit(l1)}$								0.000768	
								(0.00464)	
$\Delta INV_{credit(l2)}$									-0.00771
									(0.00623)
$d10(CREDIT/GDP)$	0.000419	0.00299	-0.000202	0.00892*	-0.00118	-0.000125	0.00359	-0.00231	-0.00377
	(0.00588)	(0.00795)	(0.00515)	(0.00482)	(0.00507)	(0.00566)	(0.00553)	(0.00722)	(0.00615)
$d10(CREDIT/GDP) * \Delta CREDIT_{tot}$	0.0259								
	(0.0207)								
$d10(CREDIT/GDP) * \Delta CREDIT_{tot(l1)}$		0.00600							
		(0.0343)							
$d10(CREDIT/GDP) * \Delta CREDIT_{tot(l2)}$			0.00222						
			(0.0180)						
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC}$				-0.0265					
				(0.0189)					
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC(l1)}$					0.0455***				
					(0.0163)				
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC(l2)}$						0.0420			
						(0.0294)			
$d10(CREDIT/GDP) * \Delta INV_{credit}$							-0.00888*		
							(0.00469)		
$d10(CREDIT/GDP) * \Delta INV_{credit(l1)}$								0.00479	
								(0.00512)	
$d10(CREDIT/GDP) * \Delta INV_{credit(l2)}$									0.0151*
									(0.00782)
Constant	0.126***	0.110***	0.121***	0.122***	0.121***	0.141***	0.145***	0.146***	0.167***
	(0.0342)	(0.0388)	(0.0357)	(0.0388)	(0.0323)	(0.0324)	(0.0292)	(0.0314)	(0.0283)
Observations	928	912	892	960	940	935	856	842	829
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.708	0.704	0.700	0.715	0.729	0.721	0.712	0.701	0.696

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 62: Growth effects of dynamic credit indicators and lagged credit indicators with dummy variable for credit to GDP share, estimated with Random Effects.

	RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)
$log(INITIALGDP)$	-0.0174**	-0.0172**	-0.0219**	-0.0150**	-0.0212***	-0.0149*
	(0.00793)	(0.00843)	(0.00916)	(0.00761)	(0.00821)	(0.00805)
$SCHOOL$	0.0413	0.0441	0.0577	0.0209	0.0175	0.0242
	(0.0556)	(0.0546)	(0.0530)	(0.0539)	(0.0518)	(0.0548)
$log(GOV)$	0.0290**	0.0287**	0.0350***	0.0272**	0.0357***	0.0261**
	(0.0114)	(0.0120)	(0.0128)	(0.0110)	(0.0118)	(0.0117)
$log(OPENNESS)$	-0.00613*	-0.00609*	-0.00712**	-0.00476	-0.00613*	-0.00447
	(0.00334)	(0.00340)	(0.00352)	(0.00332)	(0.00340)	(0.00340)
GEO_{west}	-0.0169	-0.0172	-0.0210*	-0.0141	-0.0186	-0.0131
	(0.0112)	(0.0115)	(0.0124)	(0.0106)	(0.0114)	(0.0109)
$GEO_{centralnorth}$	-0.0269***	-0.0280***	-0.0305***	-0.0241**	-0.0268**	-0.0235**
	(0.0104)	(0.0107)	(0.0111)	(0.0101)	(0.0106)	(0.0104)
$\Delta CREDIT_{tot}$	0.00419					
	(0.00420)					
$\Delta CREDIT_{tot(l1)}$		5.03e-06***				
		(8.00e-07)				
$\Delta CREDIT_{tot(l2)}$			1.54e-06**			
			(6.81e-07)			
$\Delta CREDIT_{NFC}$				0.0203**		
				(0.00943)		
$\Delta CREDIT_{NFC(l1)}$					0.0183*	
					(0.00994)	
$\Delta CREDIT_{NFC(l2)}$						0.00222
						(0.0208)
$year_{>2010}$	-0.180***	-0.150***	-0.139***	-0.190***	-0.196***	-0.186***
	(0.0326)	(0.0334)	(0.0353)	(0.0326)	(0.0316)	(0.0315)
$year_{>2010} * \Delta CREDIT_{tot}$	-0.00419					
	(0.00420)					
$year_{>2010} * \Delta CREDIT_{tot(l1)}$		-3.00e-06***				
		(6.07e-07)				
$year_{>2010} * \Delta CREDIT_{tot(l2)}$			1.87e-06***			
			(5.12e-07)			
$year_{>2010} * \Delta CREDIT_{NFC}$				0.0452**		
				(0.0216)		
$year_{>2010} * \Delta CREDIT_{NFC(l1)}$					0.0243*	
					(0.0131)	
$year_{>2010} * \Delta CREDIT_{NFC(l2)}$						0.0233
						(0.0273)
Constant	0.114***	0.116***	0.112***	0.120***	0.116***	0.128***
	(0.0327)	(0.0326)	(0.0337)	(0.0343)	(0.0293)	(0.0302)
Observations	981	957	931	1,040	1,016	1,009
Number of Provinces	31	31	31	31	31	31
Adj. R-squared	0.715	0.707	0.701	0.725	0.740	0.732

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 63: Growth effects of dynamic credit indicators and lagged credit indicators with time dummy variable for industrial policy (SEI), estimated with Random Effects.

	RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)
$log(INITIALGDP)$	-0.0280**	-0.0287**	-0.0174	-0.0347**	-0.0319**	-0.0261*
	(0.0130)	(0.0140)	(0.0132)	(0.0141)	(0.0153)	(0.0142)
$SCHOOL$	0.125*	0.0818	0.0541	0.135**	0.0843	0.0602
	(0.0639)	(0.0645)	(0.0668)	(0.0650)	(0.0672)	(0.0683)
$log(GOV)$	0.0421**	0.0449**	0.0288	0.0517***	0.0505**	0.0406**
	(0.0178)	(0.0195)	(0.0188)	(0.0190)	(0.0213)	(0.0202)
$log(OPENNESS)$	0.000615	0.000418	-0.00186	0.00226	0.00218	0.000790
	(0.00572)	(0.00524)	(0.00589)	(0.00561)	(0.00517)	(0.00587)
GEO_{west}	-0.000214	0.00106	0.00398	-0.00117	0.00119	0.00390
	(0.0126)	(0.0116)	(0.0119)	(0.0124)	(0.0119)	(0.0121)
$GEO_{centralnorth}$	-0.0182	-0.0165	-0.0128	-0.0177	-0.0156	-0.0116
	(0.0146)	(0.0132)	(0.0133)	(0.0148)	(0.0132)	(0.0136)
$\Delta CREDIT_{priv}$	-0.000366***			-7.45e-05		
	(4.57e-05)			(0.000480)		
$\Delta CREDIT_{state}$	0.00343			0.00161		
	(0.00280)			(0.00327)		
$\Delta CREDIT_{priv(l1)}$		-0.000109***			-0.000150	
		(3.53e-05)			(0.000529)	
$\Delta CREDIT_{state(l1)}$		0.00118			-0.00295*	
		(0.00298)			(0.00165)	
$\Delta CREDIT_{priv(l2)}$			-4.00e-05			-0.000995
			(5.63e-05)			(0.000608)
$\Delta CREDIT_{state(l2)}$			0.00348*			0.00178
			(0.00198)			(0.00162)
$year_{>2010}$				-0.0621**	-0.127***	-0.134***
				(0.0272)	(0.0289)	(0.0279)
$year_{>2010} * \Delta CREDIT_{priv}$				-0.000265		
				(0.000489)		
$year_{>2010} * \Delta CREDIT_{state}$				0.00481		
				(0.00496)		
$year_{>2010} * \Delta CREDIT_{priv(l1)}$					6.26e-05	
					(0.000544)	
$year_{>2010} * \Delta CREDIT_{state(l1)}$					0.0103***	
					(0.00382)	
$year_{>2010} * \Delta CREDIT_{priv(l2)}$						0.000985
						(0.000613)
$year_{>2010} * \Delta CREDIT_{state(l2)}$						0.00338
						(0.00331)
Constant	0.0168	0.0553	0.0563	0.0138	0.0516	0.0620
	(0.0529)	(0.0518)	(0.0592)	(0.0565)	(0.0554)	(0.0610)
Observations	374	373	372	374	373	372
Number of Provinces	29	29	29	29	29	29
Adj. R-squared	0.685	0.692	0.743	0.684	0.695	0.743

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 64: Growth effects of industry credit growth and lagged industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

	RE					
Dependent: ΔINV_{tot}	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta STATECAP_{ind}$	-0.0213**	-0.0177*	-0.0169	-0.0207**	-0.0177*	-0.0177*
	(0.0105)	(0.00980)	(0.0104)	(0.0103)	(0.00968)	(0.0102)
$\Delta FORECAP_{ind}$	-0.00868	-0.00899	0.0111	-0.00831	-0.00841	0.0100
	(0.00717)	(0.00596)	(0.0116)	(0.00741)	(0.00648)	(0.0127)
ΔREV_{ind}	0.304**	0.178	0.150	0.291*	0.175	0.151
	(0.155)	(0.131)	(0.131)	(0.161)	(0.130)	(0.132)
$GEO_{centralnorth}$	0.0204	0.0330*	0.0320*	0.0219	0.0298	0.0303
	(0.0174)	(0.0189)	(0.0192)	(0.0189)	(0.0190)	(0.0194)
GEO_{west}	0.0294**	0.0352***	0.0338***	0.0270**	0.0326***	0.0330***
	(0.0117)	(0.0113)	(0.0116)	(0.0129)	(0.0119)	(0.0121)
$\Delta CREDIT_{priv}$	0.000620			-0.00147		
	(0.000384)			(0.00161)		
$\Delta CREDIT_{state}$	0.00791			0.00198		
	(0.00665)			(0.00529)		
$\Delta CREDIT_{priv(l1)}$		-0.00138			-0.00350*	
		(0.000910)			(0.00184)	
$\Delta CREDIT_{state(l1)}$		0.000697			-0.00869	
		(0.00978)			(0.00622)	
$\Delta CREDIT_{priv(l2)}$			0.00143			-0.000512
			(0.000996)			(0.00259)
$\Delta CREDIT_{state(l2)}$			-0.00144			-0.00520
			(0.0123)			(0.0113)
$year_{>2010}$				-0.111**	-0.148***	-0.216***
				(0.0444)	(0.0503)	(0.0666)
$year_{>2010} * \Delta CREDIT_{priv}$				0.00216		
				(0.00171)		
$year_{>2010} * \Delta CREDIT_{state}$				0.0193		
				(0.0118)		
$year_{>2010} * \Delta CREDIT_{priv(l1)}$					0.00270	
					(0.00194)	
$year_{>2010} * \Delta CREDIT_{state(l1)}$					0.0243***	
					(0.00782)	
$year_{>2010} * \Delta CREDIT_{priv(l2)}$						0.00248
						(0.00302)
$year_{>2010} * \Delta CREDIT_{state(l2)}$						0.0111
						(0.0169)
Constant	0.101***	0.137***	0.219***	0.104***	0.143***	0.223***
	(0.0211)	(0.0250)	(0.0429)	(0.0220)	(0.0259)	(0.0442)
Observations	365	347	330	365	347	330
Number of province1	29	29	28	29	29	28
Adj. R-squared	0.425	0.435	0.446	0.423	0.439	0.445

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 65: Investment effects of industry credit growth and lagged industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent:	ΔINV_{tot}	ΔINV_{tot}	ΔINV_{tot}	ΔINV_{auto}	ΔINV_{auto}	ΔINV_{auto}	ΔINV_{energy}	ΔINV_{energy}	ΔINV_{energy}
ΔREV_{ind}	0.302**	0.270*	0.269*	0.834	0.0867	0.0254	-10.72	-10.81	-10.73
	(0.151)	(0.156)	(0.160)	(0.645)	(0.427)	(0.411)	(9.862)	(10.10)	(10.12)
$\Delta CREDIT_{firm}$	0.00436			0.557***			-0.101		
	(0.00763)			(0.163)			(0.199)		
$\Delta CREDIT_{firm(l1)}$		0.000654			-0.159**			0.140	
		(0.00886)			(0.0641)			(0.262)	
$\Delta CREDIT_{firm(l2)}$			-0.00460			0.0567			-0.104
			(0.0121)			(0.0524)			(0.218)
$\Delta STATECAP_{ind}$	-0.00370	-0.0165*	-0.0167*	-0.267***	-0.175*	-0.153*	0.270	0.358	0.304
	(0.0111)	(0.00886)	(0.00897)	(0.0901)	(0.0968)	(0.0865)	(0.456)	(0.605)	(0.577)
$\Delta FORECAP_{ind}$	-0.00736	-0.0120*	-0.0119*	-0.0314	-0.0165	-0.0611	0.227	0.196	0.218
	(0.00917)	(0.00624)	(0.00646)	(0.103)	(0.0881)	(0.0903)	(0.371)	(0.420)	(0.414)
$GEO_{centralnorth}$	0.0228*	0.0198	0.0178	-0.0756	-0.0499	-0.0489	1.084	1.120	1.157
	(0.0138)	(0.0128)	(0.0134)	(0.0565)	(0.0440)	(0.0502)	(1.126)	(1.165)	(1.212)
GEO_{west}	0.0344***	0.0310***	0.0290***	-0.0651	-0.00542	0.0397	2.485	2.599	2.658
	(0.0117)	(0.0104)	(0.0109)	(0.132)	(0.108)	(0.103)	(2.202)	(2.381)	(2.475)
Constant	0.0914***	0.0977***	0.115***	0.154	0.0773	2.483***	0.0711	0.0706	0.562
	(0.0184)	(0.0180)	(0.0254)	(0.514)	(0.469)	(0.142)	(0.337)	(0.378)	(0.539)
Observations	501	480	452	128	123	121	390	372	362
Number of Provinces	30	30	29	22	21	21	29	29	28
Adj. R-squared	0.432	0.426	0.424	0.540	0.710	0.694	0.044	0.055	0.064

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 66: Investment effects of industry credit growth and lagged industry credit growth by industrial sector, estimated with Random Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0252***	-0.0256***	-0.0237***	1.09e-05	-0.0256***	-0.0237***	-0.0379***	-0.0256***	-0.0237***
	(0.00847)	(0.00833)	(0.00834)	(0.0301)	(0.00833)	(0.00834)	(0.0118)	(0.00833)	(0.00834)
$SCHOOL$	0.0502	0.0348	0.0353	0.186	0.0348	0.0353	0.0865	0.0348	0.0353
	(0.0486)	(0.0483)	(0.0505)	(0.153)	(0.0483)	(0.0505)	(0.0590)	(0.0483)	(0.0505)
$log(GOV)$	0.0405***	0.0404***	0.0370***	0.0278	0.0404***	0.0370***	0.0523***	0.0404***	0.0370***
	(0.0123)	(0.0119)	(0.0119)	(0.0404)	(0.0119)	(0.0119)	(0.0163)	(0.0119)	(0.0119)
$log(OPENNESS)$	-0.00463	-0.00533*	-0.00508	-0.000954	-0.00533*	-0.00508	-0.00491	-0.00533*	-0.00508
	(0.00307)	(0.00316)	(0.00317)	(0.00553)	(0.00316)	(0.00317)	(0.00416)	(0.00316)	(0.00317)
ΔINV_{tot}	0.118***								
	(0.0213)								
$\Delta INV_{tot(l1)}$		0.0909***							
		(0.0139)							
$\Delta INV_{tot(l2)}$			0.0618***						
			(0.0115)						
ΔINV_{auto}				0.0119					
				(0.00728)					
$\Delta INV_{auto(l1)}$					0.0909***				
					(0.0139)				
$\Delta INV_{auto(l2)}$						0.0618***			
						(0.0115)			
ΔINV_{energy}							-0.000112**		
							(4.64e-05)		
$\Delta INV_{energy(l1)}$								0.0909***	
								(0.0139)	
$\Delta INV_{energy(l2)}$									0.0618***
									(0.0115)
$GEO_{centralnorth}$	-0.0267***	-0.0282***	-0.0270***	-0.0193	-0.0282***	-0.0270***	-0.0243*	-0.0282***	-0.0270***
	(0.00966)	(0.0102)	(0.0102)	(0.0214)	(0.0102)	(0.0102)	(0.0132)	(0.0102)	(0.0102)
GEO_{west}	-0.0207*	-0.0216*	-0.0188*	0.0167	-0.0216*	-0.0188*	-0.0128	-0.0216*	-0.0188*
	(0.0112)	(0.0113)	(0.0111)	(0.0258)	(0.0113)	(0.0111)	(0.0139)	(0.0113)	(0.0111)
Constant	0.113***	0.116***	0.159***	0.00965	0.116***	0.159***	0.117***	0.116***	0.159***
	(0.0299)	(0.0265)	(0.0245)	(0.0867)	(0.0265)	(0.0245)	(0.0379)	(0.0265)	(0.0245)
Observations	995	998	997	156	998	997	521	998	997
Number of Provinces	31	31	31	22	31	31	30	31	31
Adj. R-squared	0.719	0.726	0.735	0.756	0.726	0.735	0.744	0.726	0.735

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 67: Growth effects of investment and lagged investment by industrial sector, estimated with Random Effects.

A.2.3.3 Logarithmic growth rates

	FE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.117***	-0.124***	-0.132***	-0.101***	-0.0973***	-0.0985***	-0.109***	-0.118***	-0.127***
	(0.0239)	(0.0238)	(0.0236)	(0.0232)	(0.0195)	(0.0231)	(0.0214)	(0.0211)	(0.0187)
$SCHOOL$	0.0890	0.0861	0.0797	0.0808	0.0728	0.0894	0.0751	0.0734	0.0700
	(0.0566)	(0.0567)	(0.0561)	(0.0579)	(0.0554)	(0.0583)	(0.0609)	(0.0610)	(0.0617)
$log(GOV)$	0.118***	0.120***	0.122***	0.108***	0.104***	0.106***	0.114***	0.118***	0.122***
	(0.0219)	(0.0222)	(0.0218)	(0.0204)	(0.0188)	(0.0204)	(0.0194)	(0.0195)	(0.0182)
$log(OPENNESS)$	-0.00907**	-0.00927**	-0.0106**	-0.00832*	-0.00990*	-0.00722*	-0.00967**	-0.00970*	-0.0121**
	(0.00408)	(0.00434)	(0.00459)	(0.00412)	(0.00503)	(0.00375)	(0.00469)	(0.00525)	(0.00501)
$\Delta log(CREDIT_{tot})$	0.0221								
	(0.0182)								
$\Delta log(CREDIT_{tot(l1)})$		0.0125							
		(0.0129)							
$\Delta log(CREDIT_{tot(l2)})$			-0.00876						
			(0.0240)						
$\Delta log(CREDIT_{NFC})$				0.0890*					
				(0.0464)					
$\Delta log(CREDIT_{NFC(l1)})$					0.105*				
					(0.0547)				
$\Delta log(CREDIT_{NFC(l2)})$						0.0539			
						(0.0916)			
$\Delta log(INV_{credit})$							0.0403		
							(0.0247)		
$\Delta log(INV_{credit(l1)})$								-0.0545	
								(0.0547)	
$\Delta log(INV_{credit(l2)})$									-0.121**
									(0.0464)
Constant	0.279***	0.311***	0.340***	0.244**	0.234**	0.243**	0.288***	0.326***	0.351***
	(0.0966)	(0.0966)	(0.101)	(0.0890)	(0.0880)	(0.0908)	(0.0972)	(0.100)	(0.0969)
Observations	981	957	931	1,040	1,016	1,009	891	877	863
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.727	0.719	0.714	0.736	0.749	0.742	0.726	0.716	0.713

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 68: Growth effects of dynamic credit indicators and lagged credit indicators, estimated with Fixed Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0108*	-0.0139**	-0.0218***	-0.0115**	-0.0147***	-0.0115*	-0.0290***	-0.0206***	-0.0160***
	(0.00557)	(0.00556)	(0.00586)	(0.00555)	(0.00539)	(0.00601)	(0.00665)	(0.00615)	(0.00597)
$SCHOOL$	0.00782	0.0205	0.0469	-0.0141	-0.0141	-0.0105	0.0235	-0.00444	-0.0249
	(0.0614)	(0.0607)	(0.0584)	(0.0638)	(0.0609)	(0.0635)	(0.0639)	(0.0652)	(0.0653)
$log(GOV)$	0.0191**	0.0235***	0.0350***	0.0214**	0.0263***	0.0203**	0.0465***	0.0336***	0.0272***
	(0.00870)	(0.00905)	(0.00977)	(0.00913)	(0.00911)	(0.00982)	(0.0108)	(0.0102)	(0.00961)
$log(OPENNESS)$	0.000517	0.000604	9.54e-05	0.000880	0.000247	0.000912	0.000309	0.00119	0.00175
	(0.00218)	(0.00226)	(0.00254)	(0.00214)	(0.00227)	(0.00216)	(0.00243)	(0.00242)	(0.00241)
$\Delta log(CREDIT_{tot})$	0.0406								
	(0.0293)								
$\Delta log(CREDIT_{tot(l1)})$		0.0249							
		(0.0157)							
$\Delta log(CREDIT_{tot(l2)})$			-0.00484						
			(0.0331)						
$\Delta log(CREDIT_{NFC})$				0.167***					
				(0.0532)					
$\Delta log(CREDIT_{NFC(l1)})$					0.169***				
					(0.0500)				
$\Delta log(CREDIT_{NFC(l2)})$						0.123			
						(0.0826)			
$\Delta log(INV_{credit})$							0.0620		
							(0.0424)		
$\Delta log(INV_{credit(l1)})$								-0.0384	
								(0.0756)	
$\Delta log(INV_{credit(l2)})$									-0.129**
									(0.0641)
Constant	0.135***	0.134***	0.125***	0.137***	0.129***	0.148***	0.155***	0.173***	0.179***
	(0.0332)	(0.0339)	(0.0350)	(0.0350)	(0.0301)	(0.0335)	(0.0285)	(0.0287)	(0.0286)
Observations	981	957	931	1,040	1,016	1,009	891	877	863
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.716	0.707	0.701	0.724	0.740	0.732	0.713	0.701	0.698

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 69: Growth effects of dynamic credit indicators and lagged credit indicators, estimated with Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
log(INITIAL GDP)	-0.133***	-0.115***	-0.161***	-0.136***	-0.115***	-0.162***	-0.0417	-0.0346	-0.0462	-0.0422	-0.0345	-0.0465
	(0.0384)	(0.0345)	(0.0304)	(0.0376)	(0.0344)	(0.0293)	(0.0287)	(0.0263)	(0.0299)	(0.0280)	(0.0261)	(0.0299)
SCHOOL	0.0877	0.0972**	0.113**	0.0852	0.0970**	0.113**	0.0161	-0.0111	0.0261	0.0140	-0.0111	0.0262
	(0.0529)	(0.0413)	(0.0410)	(0.0536)	(0.0410)	(0.0408)	(0.0529)	(0.0521)	(0.0498)	(0.0528)	(0.0520)	(0.0499)
log(GOV)	0.124***	0.103***	0.122***	0.124***	0.103***	0.122***	0.0586	0.0516	0.0659*	0.0595*	0.0515	0.0663*
	(0.0321)	(0.0316)	(0.0371)	(0.0315)	(0.0314)	(0.0370)	(0.0363)	(0.0329)	(0.0384)	(0.0354)	(0.0327)	(0.0384)
log(OPENNESS)	-0.00709	-0.00539	-0.00735	-0.00633	-0.00528	-0.00702	-0.00509	-0.00285	-0.00474	-0.00504	-0.00281	-0.00474
	(0.00796)	(0.00931)	(0.00985)	(0.00808)	(0.00923)	(0.00960)	(0.00614)	(0.00575)	(0.00683)	(0.00602)	(0.00573)	(0.00677)
$\Delta log(CREDIT_{tot})$	0.242			0.255			0.355			0.367		
	(0.292)			(0.302)			(0.368)			(0.379)		
$\Delta log(CREDIT_{NFC})$		0.181			0.182			0.458***			0.458***	
		(0.136)			(0.136)			(0.131)			(0.130)	
$\Delta log(INV_{credit})$			-0.0257			-0.0239			-0.0174			-0.0155
			(0.0199)			(0.0203)			(0.0330)			(0.0337)
$year_{>2001}$				-0.00460*	-0.000825	-0.00213				-0.00453	-0.00152	-0.00209
				(0.00208)	(0.00198)	(0.00343)				(0.00283)	(0.00267)	(0.00415)
Constant	0.410*	0.396	0.569**	0.432*	0.398*	0.578**	0.161***	0.159***	0.167***	0.163***	0.160***	0.169***
	(0.213)	(0.217)	(0.201)	(0.210)	(0.215)	(0.189)	(0.0271)	(0.0191)	(0.0254)	(0.0279)	(0.0192)	(0.0276)
Observations	315	334	291	315	334	291	315	334	291	315	334	291
Number of Provinces	10	10	10	10	10	10	10	10	10	10	10	10
Adj. R-squared	0.817	0.824	0.822	0.818	0.824	0.822	0.790	0.800	0.795	0.790	0.799	0.794

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 70: Growth effects of dynamic credit indicators in GEO_{east}, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
log(INITIAL GDP)	-0.0889	-0.0654	-0.0770	-0.0865	-0.0636	-0.0756	-0.0378	-0.0206	-0.0287	-0.0375	-0.0205	-0.0290
	(0.0552)	(0.0445)	(0.0504)	(0.0556)	(0.0452)	(0.0502)	(0.0304)	(0.0251)	(0.0306)	(0.0306)	(0.0255)	(0.0308)
SCHOOL	-0.0891	-0.0884	-0.0719	-0.0860	-0.0830	-0.0682	-0.280	-0.259*	-0.256	-0.278	-0.256	-0.255
	(0.201)	(0.190)	(0.208)	(0.204)	(0.193)	(0.211)	(0.177)	(0.157)	(0.179)	(0.177)	(0.158)	(0.180)
log(GOV)	0.131**	0.111**	0.126**	0.130**	0.110**	0.125**	0.0580	0.0341	0.0493	0.0579	0.0346	0.0499
	(0.0443)	(0.0425)	(0.0411)	(0.0460)	(0.0446)	(0.0423)	(0.0394)	(0.0342)	(0.0389)	(0.0399)	(0.0349)	(0.0394)
log(OPENNESS)	-0.00860	-0.0143	-0.00932	-0.00832	-0.0138	-0.00886	-0.0186***	-0.0151***	-0.0174***	-0.0185***	-0.0150***	-0.0172***
	(0.00755)	(0.00781)	(0.00740)	(0.00818)	(0.00830)	(0.00817)	(0.00369)	(0.00325)	(0.00367)	(0.00375)	(0.00338)	(0.00385)
$\Delta log(CREDIT_{tot})$	0.0186			0.0211			0.0323			0.0348*		
	(0.0167)			(0.0157)			(0.0213)			(0.0201)		
$\Delta log(CREDIT_{NFC})$		0.176			0.181			0.228*			0.232*	
		(0.128)			(0.126)			(0.137)			(0.138)	
$\Delta log(INV_{credit})$			0.213			0.212			0.281			0.279
			(0.301)			(0.292)			(0.294)			(0.284)
$year_{>2001}$				0.00641	0.00678	0.00606				0.00680	0.00670	0.00625
				(0.00603)	(0.00543)	(0.00548)				(0.00630)	(0.00585)	(0.00575)
Constant	0.117	0.0673	0.108	0.104	0.0523	0.0983	0.134	0.155**	0.151*	0.127	0.147*	0.146*
	(0.222)	(0.170)	(0.212)	(0.225)	(0.175)	(0.213)	(0.0822)	(0.0771)	(0.0872)	(0.0810)	(0.0772)	(0.0868)
Observations	291	305	273	291	305	273	291	305	273	291	305	273
Number of Provinces	9	9	9	9	9	9	9	9	9	9	9	9
Adj. R-squared	0.787	0.780	0.774	0.789	0.781	0.775	0.754	0.747	0.735	0.755	0.747	0.735

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 71: Growth effects of dynamic credit indicators in $GEO_{centralnorth}$, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
log(INITIAL GDP)	-0.128**	-0.111**	-0.0877***	-0.128**	-0.111**	-0.0877***	-0.0120	-0.0145	-0.0206**	-0.0120	-0.0145	-0.0210**
	(0.0465)	(0.0423)	(0.0212)	(0.0466)	(0.0422)	(0.0216)	(0.0105)	(0.0111)	(0.00935)	(0.0106)	(0.0111)	(0.00939)
SCHOOL	0.118	0.141	0.0981	0.118	0.141	0.0993	0.0590	0.0729	0.0525	0.0591	0.0726	0.0535
	(0.134)	(0.135)	(0.176)	(0.134)	(0.135)	(0.176)	(0.0628)	(0.0715)	(0.0998)	(0.0629)	(0.0716)	(0.100)
log(GOV)	0.0743*	0.0747*	0.0622*	0.0743*	0.0746*	0.0624*	0.0221	0.0253	0.0308*	0.0220	0.0252	0.0312*
	(0.0360)	(0.0372)	(0.0290)	(0.0361)	(0.0373)	(0.0290)	(0.0172)	(0.0181)	(0.0159)	(0.0173)	(0.0181)	(0.0159)
log(OPENNESS)	-0.00667	-0.00735	-0.00828	-0.00669	-0.00741	-0.00830	0.00304	0.000961	0.00311	0.00295	0.000891	0.00312
	(0.00811)	(0.00724)	(0.00896)	(0.00812)	(0.00724)	(0.00905)	(0.00554)	(0.00414)	(0.00505)	(0.00562)	(0.00416)	(0.00506)
$\Delta log(CREDIT_{tot})$	0.0320			0.0319			0.0324			0.0322		
	(0.0444)			(0.0448)			(0.0489)			(0.0502)		
$\Delta log(CREDIT_{NFC})$		0.0642			0.0672			0.0764			0.0796	
		(0.0440)			(0.0435)			(0.0497)			(0.0496)	
$\Delta log(INV_{credit})$			0.0473			0.0451			0.0910**			0.0884**
			(0.0503)			(0.0496)			(0.0460)			(0.0450)
$year_{>2001}$				0.000441	0.00203	-0.00296				0.00136	0.00223	-0.00327
				(0.00494)	(0.00453)	(0.00436)				(0.00524)	(0.00470)	(0.00443)
Constant	0.424**	0.328**	0.329**	0.423**	0.325**	0.330**	0.108	0.0900	0.176***	0.106	0.0881	0.178***
	(0.148)	(0.148)	(0.134)	(0.147)	(0.147)	(0.136)	(0.0700)	(0.0747)	(0.0397)	(0.0716)	(0.0759)	(0.0391)
Observations	375	401	327	375	401	327	375	401	327	375	401	327
Number of Provinces	12	12	12	12	12	12	12	12	12	12	12	12
Adj. R-squared	0.690	0.715	0.718	0.690	0.715	0.719	0.649	0.678	0.673	0.648	0.677	0.672

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 72: Growth effects of dynamic credit indicators in GEO_{west}, estimated with Fixed Effects and Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					$year < 2001$			$year >= 2001$	
$log(INITIALGDP)$	-0.0170**	-0.0184**	-0.0433***	-0.0125	-0.00687	-0.0280**	-0.0310***	-0.0346***	-0.0364***
	(0.00797)	(0.00754)	(0.0101)	(0.0147)	(0.0133)	(0.0124)	(0.00895)	(0.00843)	(0.00912)
$SCHOOL$	0.0429	0.0253	0.0534	0.00507	-0.0279	-0.0418	0.0580	0.0598	0.0624
	(0.0551)	(0.0560)	(0.0574)	(0.0699)	(0.0642)	(0.0699)	(0.0531)	(0.0491)	(0.0520)
$log(GOV)$	0.0288**	0.0322***	0.0661***	0.0270	0.0205	0.0455***	0.0484***	0.0536***	0.0563***
	(0.0114)	(0.0112)	(0.0141)	(0.0187)	(0.0167)	(0.0177)	(0.0138)	(0.0129)	(0.0140)
$log(OPENNESS)$	-0.00610*	-0.00523	-0.00773**	-0.00144	0.000340	-0.00257	-0.00501	-0.00425	-0.00408
	(0.00334)	(0.00339)	(0.00365)	(0.00445)	(0.00415)	(0.00480)	(0.00383)	(0.00369)	(0.00383)
$\Delta log(CREDIT_{tot})$	0.0397			0.110			0.0175*		
	(0.0260)			(0.0831)			(0.00950)		
$\Delta log(CREDIT_{NFC})$		0.161***			0.141**			0.207***	
		(0.0486)			(0.0617)			(0.0622)	
$\Delta log(INV_{credit})$			0.0567*			0.0566			0.0503
			(0.0335)			(0.0480)			(0.0769)
$GEO_{centralnorth}$	-0.0268***	-0.0253**	-0.0328***	-0.0314***	-0.0293***	-0.0371***	-0.0203	-0.0180	-0.0172
	(0.0103)	(0.0103)	(0.0124)	(0.0101)	(0.00973)	(0.0125)	(0.0124)	(0.0118)	(0.0127)
GEO_{west}	-0.0167	-0.0159	-0.0285**	-0.0261*	-0.0221*	-0.0357**	-0.00859	-0.00910	-0.00847
	(0.0112)	(0.0110)	(0.0133)	(0.0140)	(0.0127)	(0.0148)	(0.0115)	(0.0111)	(0.0119)
Constant	0.112***	0.115***	0.144***	0.123***	0.136***	0.184***	-0.107**	-0.0815	-0.0536
	(0.0327)	(0.0336)	(0.0250)	(0.0376)	(0.0364)	(0.0292)	(0.0540)	(0.0498)	(0.0650)
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.716	0.724	0.713	0.701	0.705	0.708	0.691	0.713	0.658

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 73: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.0168**	-0.0194**	-0.0505***	-0.0150	-0.00827	-0.0280**	-0.0236**	-0.0315***	-0.0311***
	(0.00805)	(0.00759)	(0.0113)	(0.0144)	(0.0135)	(0.0123)	(0.00995)	(0.00793)	(0.00863)
$SCHOOL$	0.0300	0.0200	0.0617	0.0326	-0.0190	-0.0396	0.0603	0.0477	0.0582
	(0.0561)	(0.0528)	(0.0572)	(0.0656)	(0.0635)	(0.0700)	(0.0561)	(0.0523)	(0.0547)
$log(GOV)$	0.0293**	0.0348***	0.0757***	0.0311*	0.0231	0.0454**	0.0399***	0.0495***	0.0486***
	(0.0114)	(0.0114)	(0.0153)	(0.0186)	(0.0168)	(0.0176)	(0.0145)	(0.0126)	(0.0136)
$log(OPENNESS)$	-0.00567*	-0.00493	-0.00849**	-0.00237	-0.000358	-0.00271	-0.00507	-0.00415	-0.00449
	(0.00321)	(0.00309)	(0.00366)	(0.00406)	(0.00412)	(0.00479)	(0.00376)	(0.00350)	(0.00374)
$\Delta log(CREDIT_{tot})$	0.535			0.767*			0.155		
	(0.418)			(0.425)			(0.189)		
$\Delta log(CREDIT_{NFC})$		0.757***			0.541***			0.546**	
		(0.159)			(0.164)			(0.235)	
$\Delta log(INV_{credit})$			0.0763			0.0673			0.0532
			(0.0554)			(0.0673)			(0.175)
$GEO_{centralnorth}$	-0.0155	-0.0147	-0.0346***	-0.0243	-0.0202**	-0.0384***	-0.0164	-0.0128	-0.0153
	(0.0142)	(0.00995)	(0.0131)	(0.0149)	(0.0101)	(0.0131)	(0.0131)	(0.0106)	(0.0131)
GEO_{west}	-0.00405	-0.00244	-0.0320**	-0.00406	-0.00991	-0.0347**	-0.0149	-0.00278	-0.00750
	(0.0144)	(0.0104)	(0.0139)	(0.0173)	(0.0117)	(0.0147)	(0.0122)	(0.00986)	(0.0119)
$\Delta log(CREDIT_{tot}) * GEO_{centralnorth}$	-0.502			-0.256			-0.143		
	(0.417)			(0.409)			(0.189)		
$\Delta log(CREDIT_{tot}) * GEO_{west}$	-0.545			-0.761*			0.521*		
	(0.409)			(0.420)			(0.277)		
$\Delta log(CREDIT_{NFC}) * GEO_{centralnorth}$		-0.557***			-0.401*			-0.326	
		(0.167)			(0.223)			(0.256)	
$\Delta log(CREDIT_{NFC}) * GEO_{west}$		-0.700***			-0.480***			-0.365	
		(0.148)			(0.158)			(0.249)	
$\Delta log(INV_{credit}) * GEO_{centralnorth}$			-0.0648			0.0883			-0.178
			(0.183)			(0.318)			(0.244)
$\Delta log(INV_{credit}) * GEO_{west}$			-0.0714			-0.0791			0.0585
			(0.0947)			(0.149)			(0.204)
Constant	0.0997***	0.0996***	0.144***	0.0875**	0.118***	0.182***		-0.0770	
	(0.0347)	(0.0363)	(0.0263)	(0.0394)	(0.0407)	(0.0286)		(0.0491)	
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.717	0.726	0.712	0.704	0.705	0.707	0.692	0.712	0.659

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 74: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.0212***	-0.0221***	-0.0456***	-0.0163	-0.0106	-0.0287**	-0.0377***	-0.0392***	-0.0397***
	(0.00776)	(0.00696)	(0.00940)	(0.0143)	(0.0138)	(0.0121)	(0.00845)	(0.00767)	(0.00823)
$SCHOOL$	0.0155	-0.000332	0.0513	0.0153	-0.0352	-0.0426	0.0472	0.0485	0.0577
	(0.0605)	(0.0577)	(0.0581)	(0.0677)	(0.0654)	(0.0690)	(0.0578)	(0.0520)	(0.0550)
$log(GOV)$	0.0336***	0.0367***	0.0685***	0.0315	0.0246	0.0460***	0.0561***	0.0590***	0.0592***
	(0.0116)	(0.0112)	(0.0137)	(0.0192)	(0.0179)	(0.0175)	(0.0135)	(0.0125)	(0.0135)
$log(OPENNESS)$	-0.00608*	-0.00511	-0.00806**	-0.00254	-0.000534	-0.00271	-0.00525	-0.00413	-0.00445
	(0.00340)	(0.00324)	(0.00367)	(0.00409)	(0.00419)	(0.00477)	(0.00402)	(0.00373)	(0.00396)
$\Delta log(CREDIT_{tot})$	0.0257			0.0784			0.0142**		
	(0.0188)			(0.0749)			(0.00724)		
$\Delta log(CREDIT_{NFC})$		0.101**			0.0789			0.188***	
		(0.0475)			(0.0504)			(0.0655)	
$\Delta log(INV_{credit})$			0.0114			0.0232			0.0500
			(0.0707)			(0.120)			(0.0838)
GEO_{east}	0.0127	0.00986	0.0315**	0.0128	0.0165*	0.0365***	0.0156	0.0109	0.0149
	(0.0144)	(0.00998)	(0.0123)	(0.0157)	(0.0100)	(0.0128)	(0.0126)	(0.0101)	(0.0121)
$\Delta log(CREDIT_{tot}) * GEO_{east}$	0.506			0.646			0.108		
	(0.408)			(0.420)			(0.169)		
$\Delta log(CREDIT_{NFC}) * GEO_{east}$		0.654***			0.447***			0.312	
		(0.154)			(0.159)			(0.247)	
$\Delta log(INV_{credit}) * GEO_{east}$			0.0660			0.0414			-0.00261
			(0.0933)			(0.151)			(0.197)
Constant	0.0986***	0.103***	0.117***	0.0886**	0.114***	0.149***	-0.118*		-0.0581
	(0.0372)	(0.0394)	(0.0283)	(0.0393)	(0.0405)	(0.0342)	(0.0615)		(0.0691)
Observations	981	1,040	891	402	424	351	579	616	540
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.717	0.726	0.713	0.701	0.705	0.707	0.690	0.713	0.657

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 75: Growth effects of dynamic credit indicators with dummy variable for regions, estimated with Random Effects.

	FE						RE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent: ΔGDP_{real}				$d(CREDIT/GDP) \leq 9$						$d(CREDIT/GDP) \leq 9$		
log(INITIAL GDP)	-0.121***	-0.108***	-0.108***	-0.135***	-0.119***	-0.113***	-0.0149**	-0.0110*	-0.0153**	-0.00600	-0.00727	-0.0142*
	(0.0245)	(0.0233)	(0.0216)	(0.0246)	(0.0237)	(0.0209)	(0.00660)	(0.00619)	(0.00709)	(0.00773)	(0.00765)	(0.00851)
SCHOOL	0.111*	0.0949	0.0878	0.0874	0.0688	0.0865	0.0509	0.0229	-0.0148	0.0184	0.00757	-0.0170
	(0.0580)	(0.0609)	(0.0624)	(0.0722)	(0.0774)	(0.0711)	(0.0617)	(0.0640)	(0.0671)	(0.0634)	(0.0638)	(0.0706)
log(GOV)	0.120***	0.111***	0.114***	0.140***	0.129***	0.135***	0.0242**	0.0204**	0.0254**	0.0114	0.0143	0.0233*
	(0.0220)	(0.0203)	(0.0194)	(0.0202)	(0.0186)	(0.0171)	(0.0103)	(0.00996)	(0.0109)	(0.0110)	(0.0111)	(0.0123)
log(OPENNESS)	-0.00694	-0.00869**	-0.0101**	-0.00807*	-0.00940*	-0.0140**	-0.000226	-1.34e-05	0.00102	0.00119	0.00107	0.00146
	(0.00415)	(0.00414)	(0.00482)	(0.00464)	(0.00467)	(0.00547)	(0.00243)	(0.00224)	(0.00201)	(0.00224)	(0.00210)	(0.00204)
$\Delta log(CREDIT_{tot})$	0.0277			0.0265			0.0440			0.0476		
	(0.0238)			(0.0222)			(0.0334)			(0.0345)		
$\Delta log(CREDIT_{NFC})$		0.173***			0.164**			0.240***			0.239***	
		(0.0623)			(0.0604)			(0.0678)			(0.0646)	
$\Delta log(INV_{credit})$			0.0564			0.0483			0.0744			0.0688
			(0.0362)			(0.0317)			(0.0598)			(0.0554)
$d10(CREDIT/GDP)$	0.0213**	0.0167**	0.00961				0.0113**	0.00976**	0.00260			
	(0.00852)	(0.00668)	(0.00836)				(0.00484)	(0.00455)	(0.00449)			
$d10(CREDIT/GDP) * \Delta log(CREDIT_{tot})$	-0.510***						-0.345***					
	(0.140)						(0.0922)					
$d10(CREDIT/GDP) * \Delta log(CREDIT_{NFC})$		-0.256***						-0.258***				
		(0.0837)						(0.0896)				
$d10(CREDIT/GDP) * \Delta log(INV_{credit})$			-0.154						-0.0494			
			(0.102)						(0.133)			
Constant	0.295***	0.255***	0.275***	0.300**	0.258**	0.210**	0.120***	0.118***	0.169***	0.134***	0.128***	0.173***
	(0.101)	(0.0899)	(0.0999)	(0.114)	(0.105)	(0.0996)	(0.0348)	(0.0373)	(0.0270)	(0.0312)	(0.0339)	(0.0274)
Observations	928	960	856	834	858	771	928	960	856	834	858	771
Number of Provinces	31	31	31	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.722	0.727	0.726	0.723	0.727	0.725	0.710	0.715	0.712	0.713	0.715	0.712

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 76: Growth effects of dynamic credit indicators with dummy variable for credit to GDP share, estimated with Fixed Effects and Random Effects.

	RE			
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)
$log(INITIALGDP)$	-0.0170**	-0.0169**	-0.0184**	-0.0146*
	(0.00797)	(0.00798)	(0.00754)	(0.00757)
$SCHOOL$	0.0429	0.0436	0.0253	0.0209
	(0.0551)	(0.0550)	(0.0560)	(0.0543)
$log(GOV)$	0.0288**	0.0288**	0.0322***	0.0273**
	(0.0114)	(0.0114)	(0.0112)	(0.0110)
$log(OPENNESS)$	-0.00610*	-0.00612*	-0.00523	-0.00463
	(0.00334)	(0.00334)	(0.00339)	(0.00339)
GEO_{west}	-0.0167	-0.0167	-0.0159	-0.0140
	(0.0112)	(0.0112)	(0.0110)	(0.0109)
$GEO_{centralnorth}$	-0.0268***	-0.0266***	-0.0253**	-0.0238**
	(0.0103)	(0.0103)	(0.0103)	(0.0102)
$\Delta log(CREDIT_{tot})$	0.0397	0.0996		
	(0.0260)	(0.0761)		
$\Delta log(CREDIT_{NFC})$			0.161***	0.121**
			(0.0486)	(0.0554)
$year_{>2010}$		-0.179***		-0.191***
		(0.0325)		(0.0322)
$year_{>2010} * \Delta log(CREDIT_{tot})$		-0.0770		
		(0.0761)		
$year_{>2010} * \Delta log(CREDIT_{NFC})$				0.487***
				(0.151)
Constant	0.112***	0.108***	0.115***	0.117***
	(0.0327)	(0.0322)	(0.0336)	(0.0331)
Observations	981	981	1,040	1,040
Number of Provinces	31	31	31	31
Adj. R-squared	0.716	0.716	0.724	0.725

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 77: Growth effects of dynamic credit indicators with time dummy variable for industrial policy (SEI), estimated with Random Effects.

	RE	
Dependent: ΔGDP_{real}	(1)	(2)
$log(INITIALGDP)$	-0.0230*	-0.0257*
	(0.0130)	(0.0144)
$SCHOOL$	0.115*	0.126**
	(0.0640)	(0.0634)
$log(GOV)$	0.0349**	0.0395**
	(0.0176)	(0.0194)
$log(OPENNESS)$	-1.97e-05	0.000901
	(0.00588)	(0.00576)
GEO_{west}	0.00108	0.000750
	(0.0130)	(0.0129)
$GEO_{centralnorth}$	-0.0181	-0.0176
	(0.0148)	(0.0147)
$\Delta log(CREDIT_{priv})$	-0.00707***	-0.00125
	(0.00125)	(0.00734)
$\Delta log(CREDIT_{state})$	0.0267	0.00445
	(0.0242)	(0.0322)
$year_{>2010}$		-0.0478*
		(0.0275)
$year_{>2010} * \Delta log(CREDIT_{priv})$		-0.00585
		(0.00757)
$year_{>2010} * \Delta log(CREDIT_{state})$		0.0640
		(0.0538)
Constant	0.0213	0.0136
	(0.0517)	(0.0535)
Observations	374	374
Number of Provinces	29	29
Adj. R-squared	0.682	0.683

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 78: Growth effects of industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

	RE	
Dependent: $\Delta log(INV_{tot})$	(1)	(2)
$\Delta log(STATECAP_{ind})$	-0.00912*	-0.0103*
	(0.00544)	(0.00544)
$\Delta log(FORECAP_{ind})$	0.000985***	0.000862***
	(0.000312)	(0.000327)
$\Delta log(REV_{ind})$	0.136	0.136
	(0.0965)	(0.0982)
$GEO_{centralnorth}$	0.000525	0.000370
	(0.000981)	(0.000974)
GEO_{west}	0.00146**	0.00140**
	(0.000734)	(0.000695)
$\Delta log(CREDIT_{priv})$	0.000347	-0.00184*
	(0.000663)	(0.000956)
$\Delta log(CREDIT_{state})$	0.00310	-0.000602
	(0.00419)	(0.00380)
$year_{>2010}$		-0.00704**
		(0.00279)
$year_{>2010} * \Delta log(CREDIT_{priv})$		0.00271**
		(0.00124)
$year_{>2010} * \Delta log(CREDIT_{state})$		0.00941
		(0.00820)
Constant	0.00598***	0.00627***
	(0.00132)	(0.00139)
Observations	365	365
Number of Provinces	29	29
Adj. R-squared	0.388	0.389

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 79: Investment effects of industry credit growth with time dummy variable for industrial policy (SEI) by ownership, estimated with Random Effects.

	RE		
	(1)	(2)	(3)
Dependent:	$\Delta log(INV_{tot})$	$\Delta log(INV_{auto})$	$\Delta log(INV_{energy})$
$\Delta log(REV_{ind})$	0.139	0.440	-0.163
	(0.0964)	(0.388)	(0.310)
$\Delta log(CREDIT_{firm})$	0.00239	0.155***	-0.0142
	(0.00351)	(0.0552)	(0.0223)
$\Delta log(STATECAP_{ind})$	-0.00194	-0.136***	-0.00762
	(0.00337)	(0.0456)	(0.0231)
$\Delta log(FORECAP_{ind})$	0.00120***	0.0231	0.0365*
	(0.000331)	(0.0621)	(0.0190)
$GEO_{centralnorth}$	0.000775	-0.00638*	-8.30e-05
	(0.000860)	(0.00351)	(0.00246)
GEO_{west}	0.00167**	-0.00827	0.00227
	(0.000719)	(0.00731)	(0.00370)
Constant	0.00540***	-0.0195	-0.0101
	(0.00120)	(0.0596)	(0.00768)
Observations	501	128	390
Number of Provinces	30	22	29
Adj. R-squared	0.407	0.373	0.012

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 80: Investment effects of industry credit growth by industrial sector, estimated with Random Effects.

	RE		
Dependent: ΔGDP_{real}	(1)	(2)	(3)
$log(INITIALGDP)$	-0.0227***	-0.000514	-0.0365***
	(0.00838)	(0.0300)	(0.0116)
$SCHOOL$	0.0518	0.172	0.0863
	(0.0505)	(0.153)	(0.0601)
$log(GOV)$	0.0384***	0.0281	0.0503***
	(0.0121)	(0.0405)	(0.0161)
$log(OPENNESS)$	-0.00470	-0.00108	-0.0049
	(0.00312)	(0.00549)	(0.0041)
$\Delta\, log(INV_{tot})$	2.025***		
	(0.430)		
$\Delta\, log(INV_{auto})$		0.174*	
		(0.0945)	
$\Delta\, log(INV_{energy})$			0.0115
			(0.0231)
$GEO_{centralnorth}$	-0.0262***	-0.0185	-0.0240*
	(0.00960)	(0.0212)	(0.0130)
GEO_{west}	-0.0201*	0.0182	-0.0122
	(0.0110)	(0.0255)	(0.0136
Constant	0.104***	0.0173	0.1166***
	(0.0297)	(0.0883)	(0.0368)
Observations	995	156	521
Number of Provinces	31	22	30
Adj. R-squared	0.717	0.756	0.744

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 81: Growth effects of investment by industrial sector, estimated with Random Effects.

A.2.3.4 3- and 5-year averages

	FE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0933***	-0.0834***	-0.0800***	-0.0801***	-0.0785***	-0.0772***	-0.1000***	-0.0931***	-0.0861***
	(0.0220)	(0.0221)	(0.0230)	(0.0213)	(0.0214)	(0.0218)	(0.0223)	(0.0249)	(0.0258)
$SCHOOL$	0.0798	0.0807	0.0901	0.0638	0.0680	0.0789	0.0702	0.0642	0.0674
	(0.0593)	(0.0607)	(0.0616)	(0.0589)	(0.0591)	(0.0603)	(0.0647)	(0.0651)	(0.0658)
$log(GOV)$	0.109***	0.101***	0.0972***	0.0970***	0.0930***	0.0915***	0.109***	0.0981***	0.0880***
	(0.0241)	(0.0232)	(0.0241)	(0.0209)	(0.0209)	(0.0220)	(0.0194)	(0.0202)	(0.0210)
$log(OPENNESS)$	-0.00880	-0.00818	-0.00769	-0.00816	-0.00839	-0.00859	-0.00757	-0.00545	-0.00463
	(0.00526)	(0.00535)	(0.00517)	(0.00483)	(0.00520)	(0.00518)	(0.00596)	(0.00606)	(0.00557)
$\Delta CREDIT_{tot}$	3.42e-06***								
	(1.01e-06)								
$\Delta CREDIT_{tot(l1)}$		2.18e-06**							
		(9.72e-07)							
$\Delta CREDIT_{tot(l2)}$			6.64e-07						
			(9.47e-07)						
$\Delta CREDIT_{NFC}$				0.0215*					
				(0.0116)					
$\Delta CREDIT_{NFC(l1)}$					0.0184				
					(0.0131)				
$\Delta CREDIT_{NFC(l2)}$						0.00956			
						(0.0133)			
ΔINV_{credit}							0.00840		
							(0.00553)		
$\Delta INV_{credit(l1)}$								0.0192***	
								(0.00641)	
$\Delta INV_{credit(l2)}$									0.0243***
									(0.00580)
Constant	0.193**	0.177*	0.221**	0.170*	0.180*	0.231**	0.248**	0.258*	0.303**
	(0.0835)	(0.0879)	(0.0906)	(0.0871)	(0.0930)	(0.0955)	(0.110)	(0.127)	(0.133)
Observations	915	909	896	978	954	925	818	817	813
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.797	0.803	0.809	0.805	0.811	0.815	0.807	0.824	0.835

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 82: Growth effects of dynamic credit indicators and lagged credit indicators, 3-year moving averages, estimated with Fixed Effects.

	FE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0951***	-0.0850***	-0.0785***	-0.0756***	-0.0753***	-0.0736***	-0.100***	-0.0901***	-0.0770***
	(0.0217)	(0.0233)	(0.0246)	(0.0210)	(0.0219)	(0.0222)	(0.0224)	(0.0246)	(0.0252)
$SCHOOL$	0.0841	0.0961	0.108	0.0663	0.0791	0.0905	0.0745	0.0655	0.0621
	(0.0627)	(0.0645)	(0.0648)	(0.0632)	(0.0629)	(0.0629)	(0.0691)	(0.0685)	(0.0669)
$log(GOV)$	0.112***	0.105***	0.101***	0.0955***	0.0947***	0.0971***	0.110***	0.0987***	0.0871***
	(0.0260)	(0.0256)	(0.0265)	(0.0215)	(0.0219)	(0.0230)	(0.0201)	(0.0205)	(0.0217)
$log(OPENNESS)$	-0.00899	-0.00901	-0.00925	-0.00948	-0.00870	-0.00852	-0.0101	-0.00709	-0.00500
	(0.00602)	(0.00618)	(0.00592)	(0.00559)	(0.00575)	(0.00561)	(0.00632)	(0.00666)	(0.00656)
$\Delta CREDIT_{tot}$	3.11e-06**								
	(1.24e-06)								
$\Delta CREDIT_{tot(l1)}$		2.56e-06**							
		(1.19e-06)							
$\Delta CREDIT_{tot(l2)}$			2.49e-06**						
			(1.18e-06)						
$\Delta CREDIT_{NFC}$				0.0313*					
				(0.0158)					
$\Delta CREDIT_{NFC(l1)}$					0.0205				
					(0.0161)				
$\Delta CREDIT_{NFC(l2)}$						0.00467			
						(0.0164)			
ΔINV_{credit}							0.0210**		
							(0.00950)		
$\Delta INV_{credit(l1)}$								0.0305***	
								(0.00899)	
$\Delta INV_{credit(l2)}$									0.0346***
									(0.00810)
Constant	0.224***	0.184**	0.166*	0.180*	0.177*	0.165	0.260**	0.249*	0.234*
	(0.0811)	(0.0898)	(0.0948)	(0.0910)	(0.0975)	(0.0980)	(0.116)	(0.130)	(0.128)
Observations	850	844	831	916	892	863	750	749	745
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.821	0.824	0.834	0.833	0.835	0.841	0.838	0.849	0.858

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 83: Growth effects of dynamic credit indicators and lagged credit indicators, 5-year moving averages, estimated with Fixed Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0185***	-0.0192***	-0.0231***	-0.0227***	-0.0243***	-0.0239***	-0.0373***	-0.0394***	-0.0401***
	(0.00632)	(0.00634)	(0.00697)	(0.00656)	(0.00703)	(0.00735)	(0.00821)	(0.00915)	(0.01000)
$SCHOOL$	0.0357	0.0364	0.0545	0.0254	0.0320	0.0402	0.0482	0.0508	0.0584
	(0.0598)	(0.0611)	(0.0610)	(0.0577)	(0.0571)	(0.0581)	(0.0633)	(0.0624)	(0.0615)
$log(GOV)$	0.0302***	0.0309***	0.0364***	0.0381***	0.0401***	0.0389***	0.0594***	0.0619***	0.0619***
	(0.0104)	(0.0103)	(0.0113)	(0.0112)	(0.0116)	(0.0120)	(0.0133)	(0.0150)	(0.0164)
$log(OPENNESS)$	-0.000284	-0.000592	-0.00108	-0.000425	-0.000689	-0.000813	-0.000340	-0.000255	-0.000510
	(0.00255)	(0.00253)	(0.00265)	(0.00259)	(0.00268)	(0.00264)	(0.00282)	(0.00292)	(0.00298)
$\Delta CREDIT_{tot}$	5.64e-06***								
	(1.19e-06)								
$\Delta CREDIT_{tot(l1)}$		4.12e-06***							
		(1.15e-06)							
$\Delta CREDIT_{tot(l2)}$			2.21e-06**						
			(1.08e-06)						
$\Delta CREDIT_{NFC}$				0.0356***					
				(0.0133)					
$\Delta CREDIT_{NFC(l1)}$					0.0308**				
					(0.0131)				
$\Delta CREDIT_{NFC(l2)}$						0.0223*			
						(0.0128)			
ΔINV_{credit}							0.0149**		
							(0.00636)		
$\Delta INV_{credit(l1)}$								0.0240***	
								(0.00743)	
$\Delta INV_{credit(l2)}$									0.0270***
									(0.00654)
Constant	0.124***	0.125***	0.168***	0.112***	0.115***	0.168***	0.120***	0.116***	0.156***
	(0.0312)	(0.0297)	(0.0315)	(0.0336)	(0.0321)	(0.0314)	(0.0292)	(0.0323)	(0.0340)
Observations	915	909	896	978	954	925	818	817	813
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.793	0.780	0.807	0.801	0.808	0.812	0.802	0.820	0.832

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 84: Growth effects of dynamic credit indicators and lagged credit indicators, 3-year moving averages, estimated with Random Effects.

	RE								
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$log(INITIALGDP)$	-0.0232***	-0.0222***	-0.0265***	-0.0279***	-0.0289***	-0.0307***	-0.0435***	-0.0436***	-0.0420***
	(0.00719)	(0.00717)	(0.00800)	(0.00784)	(0.00817)	(0.00859)	(0.00971)	(0.0104)	(0.0112)
$SCHOOL$	0.0584	0.0652	0.0870	0.0452	0.0568	0.0709	0.0670	0.0590	0.0572
	(0.0611)	(0.0626)	(0.0622)	(0.0593)	(0.0593)	(0.0595)	(0.0672)	(0.0655)	(0.0631)
$log(GOV)$	0.0372***	0.0352***	0.0420***	0.0464***	0.0472***	0.0495***	0.0690***	0.0689***	0.0661***
	(0.0120)	(0.0118)	(0.0131)	(0.0133)	(0.0136)	(0.0142)	(0.0158)	(0.0168)	(0.0181)
$log(OPENNESS)$	-0.000878	-0.00108	-0.00178	-0.00156	-0.00147	-0.00158	-0.00165	-0.00129	-0.00122
	(0.00280)	(0.00275)	(0.00286)	(0.00276)	(0.00289)	(0.00291)	(0.00295)	(0.00319)	(0.00337)
$\Delta CREDIT_{tot}$	5.60e-06***								
	(1.32e-06)								
$\Delta CREDIT_{tot(l1)}$		4.71e-06***							
		(1.31e-06)							
$\Delta CREDIT_{tot(l2)}$			4.09e-06***						
			(1.25e-06)						
$\Delta CREDIT_{NFC}$				0.0469***					
				(0.0165)					
$\Delta CREDIT_{NFC(l1)}$					0.0363**				
					(0.0148)				
$\Delta CREDIT_{NFC(l2)}$						0.0215			
						(0.0141)			
ΔINV_{credit}							0.0288***		
							(0.00869)		
$\Delta INV_{credit(l1)}$								0.0370***	
								(0.00826)	
$\Delta INV_{credit(l2)}$									0.0391***
									(0.00736)
Constant	0.148***	0.137***	0.132***	0.131***	0.127***	0.131***	0.127***	0.119***	0.127***
	(0.0312)	(0.0307)	(0.0333)	(0.0321)	(0.0327)	(0.0339)	(0.0309)	(0.0338)	(0.0339)
Observations	850	844	831	916	892	863	750	749	745
Number of Provinces	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.820	0.825	0.836	0.832	0.835	0.841	0.837	0.848	0.859

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 85: Growth effects of dynamic credit indicators and lagged credit indicators, 5-year moving averages, estimated with Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.126***	-0.101***	-0.157***	-0.127***	-0.100***	-0.159***	-0.0336	-0.0282	-0.0391	-0.0339	-0.0282	-0.0398
	(0.0324)	(0.0299)	(0.0294)	(0.0320)	(0.0298)	(0.0287)	(0.0278)	(0.0210)	(0.0267)	(0.0277)	(0.0211)	(0.0263)
$SCHOOL$	0.0737	0.0803	0.121**	0.0724	0.0817	0.120**	-0.00969	-0.0656	0.0418	-0.0105	-0.0653	0.0406
	(0.0446)	(0.0544)	(0.0424)	(0.0445)	(0.0542)	(0.0416)	(0.0575)	(0.0514)	(0.0526)	(0.0569)	(0.0514)	(0.0518)
$log(GOV)$	0.122***	0.0961***	0.122***	0.122***	0.0960**	0.122***	0.0472	0.0434	0.0582	0.0477	0.0433	0.0594*
	(0.0349)	(0.0294)	(0.0313)	(0.0349)	(0.0296)	(0.0314)	(0.0359)	(0.0270)	(0.0354)	(0.0357)	(0.0271)	(0.0347)
$log(OPENNESS)$	-0.00376	-0.00317	-0.0124	-0.00362	-0.00326	-0.0121	-0.00355	-0.000988	-0.00479	-0.00357	-0.00100	-0.00485
	(0.0113)	(0.0130)	(0.0101)	(0.0113)	(0.0130)	(0.01000)	(0.00594)	(0.00467)	(0.00687)	(0.00589)	(0.00469)	(0.00676)
$\Delta CREDIT_{tot}$	0.0235			0.0236			0.0355			0.0355		
	(0.0192)			(0.0192)			(0.0288)			(0.0289)		
$\Delta CREDIT_{NFC}$		0.0472			0.0477			0.135***			0.136***	
		(0.0375)			(0.0376)			(0.0319)			(0.0318)	
ΔINV_{credit}			-0.000914			-0.00102			0.0147			0.0147
			(0.00703)			(0.00692)			(0.0111)			(0.0110)
$year_{>2001}$				-0.00146	0.00171	-0.00282				-0.00182	0.00116	-0.00397*
				(0.00169)	(0.00145)	(0.00164)				(0.00153)	(0.00214)	(0.00215)
Constant	0.395*	0.341	0.536**	0.401*	0.336	0.548**	0.168***	0.154***	0.152***	0.169***	0.153***	0.154***
	(0.191)	(0.216)	(0.190)	(0.189)	(0.214)	(0.186)	(0.0220)	(0.0174)	(0.0256)	(0.0221)	(0.0175)	(0.0262)
Observations	295	314	264	295	314	264	295	314	264	295	314	264
Number of Provinces	10	10	10	10	10	10	10	10	10	10	10	10
Adj. R-squared	0.873	0.875	0.889	0.873	0.875	0.890	0.855	0.858	0.875	0.855	0.858	0.875

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 86: Growth effects of dynamic credit indicators in GEO_{east}, 3-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.120***	-0.0875***	-0.160***	-0.121***	-0.0867***	-0.161***	-0.0228	-0.0228	-0.0334	-0.0228	-0.0227	-0.0341
	(0.0292)	(0.0247)	(0.0259)	(0.0285)	(0.0243)	(0.0255)	(0.0257)	(0.0179)	(0.0243)	(0.0256)	(0.0180)	(0.0237)
$SCHOOL$	0.0831	0.0848	0.133**	0.0827	0.0861	0.132**	-0.00388	-0.0718	0.0778	-0.00389	-0.0715	0.0762
	(0.0463)	(0.0704)	(0.0447)	(0.0456)	(0.0711)	(0.0443)	(0.0622)	(0.0560)	(0.0571)	(0.0618)	(0.0560)	(0.0566)
$log(GOV)$	0.113**	0.0872***	0.122***	0.113**	0.0870***	0.122***	0.0327	0.0374	0.0509	0.0327	0.0373	0.0521
	(0.0366)	(0.0246)	(0.0246)	(0.0367)	(0.0248)	(0.0246)	(0.0338)	(0.0237)	(0.0326)	(0.0336)	(0.0239)	(0.0317)
$log(OPENNESS)$	-0.00218	-0.00502	-0.0191*	-0.00214	-0.00524	-0.0190*	-0.00257	-0.000581	-0.00464	-0.00257	-0.000595	-0.00477
	(0.0125)	(0.0146)	(0.00962)	(0.0124)	(0.0147)	(0.00944)	(0.00559)	(0.00404)	(0.00666)	(0.00559)	(0.00407)	(0.00653)
$\Delta CREDIT_{tot}$	0.0368			0.0368			0.0591			0.0591		
	(0.0281)			(0.0283)			(0.0408)			(0.0412)		
$\Delta CREDIT_{NFC}$		0.0785			0.0795			0.178***			0.178***	
		(0.0519)			(0.0521)			(0.0424)			(0.0426)	
ΔINV_{credit}			0.000966			0.000622			0.0284*			0.0279*
			(0.00974)			(0.00967)			(0.0148)			(0.0149)
$year_{>2001}$				-0.000376	0.00164	-0.00148				-2.94e-05	0.00130	-0.00380
				(0.00249)	(0.00173)	(0.00194)				(0.00276)	(0.00250)	(0.00297)
Constant	0.419**	0.314	0.571***	0.421**	0.307	0.579***	0.175***	0.160***	0.156***	0.175***	0.159***	0.159***
	(0.182)	(0.211)	(0.129)	(0.175)	(0.209)	(0.124)	(0.0272)	(0.0217)	(0.0399)	(0.0274)	(0.0216)	(0.0397)
Observations	275	294	240	275	294	240	275	294	240	275	294	240
Number of Provinces	10	10	10	10	10	10	10	10	10	10	10	10
Adj. R-squared	0.897	0.900	0.928	0.897	0.901	0.928	0.885	0.888	0.921	0.884	0.888	0.920

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 87: Growth effects of dynamic credit indicators in GEO_{east}, 5-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.0169	0.00143	-0.0143	-0.0165	0.00170	-0.0137	-0.00107	0.0153	-0.000923	-0.000726	0.0155	-0.000702
	(0.0542)	(0.0438)	(0.0519)	(0.0539)	(0.0438)	(0.0523)	(0.0332)	(0.0244)	(0.0317)	(0.0332)	(0.0245)	(0.0318)
$SCHOOL$	-0.0363	-0.0433	0.00135	-0.0366	-0.0432	0.00132	-0.241	-0.227	-0.208	-0.241	-0.226	-0.207
	(0.189)	(0.178)	(0.181)	(0.190)	(0.178)	(0.182)	(0.154)	(0.139)	(0.154)	(0.154)	(0.139)	(0.154)
$log(GOV)$	0.0653	0.0460	0.0733*	0.0648	0.0458	0.0728	0.00523	-0.0171	0.00801	0.00477	-0.0172	0.00781
	(0.0420)	(0.0396)	(0.0391)	(0.0417)	(0.0396)	(0.0393)	(0.0429)	(0.0325)	(0.0417)	(0.0430)	(0.0326)	(0.0418)
$log(OPENNESS)$	-0.000499	-0.00774	-0.00162	-0.000477	-0.00775	-0.00160	-0.0148***	-0.0116***	-0.0139***	-0.0148***	-0.0116***	-0.0138***
	(0.00839)	(0.00845)	(0.00873)	(0.00845)	(0.00853)	(0.00877)	(0.00419)	(0.00369)	(0.00408)	(0.00420)	(0.00372)	(0.00419)
$\Delta CREDIT_{tot}$	4.51e-06			4.60e-06			8.25e-06***			8.36e-06***		
	(2.81e-06)			(2.97e-06)			(2.01e-06)			(2.15e-06)		
$\Delta CREDIT_{NFC}$		0.0163			0.0166			0.0251			0.0255	
		(0.0146)			(0.0148)			(0.0177)			(0.0178)	
ΔINV_{credit}			0.0142			0.0144			0.0232			0.0233
			(0.0314)			(0.0313)			(0.0311)			(0.0310)
$year_{>2001}$				0.000691	0.000714	0.000786				0.00149	0.00108	0.00178
				(0.00216)	(0.00244)	(0.00260)				(0.00238)	(0.00238)	(0.00248)
Constant	-0.0209	-0.0688	-0.0672	-0.0210	-0.0698	-0.0690	0.134*	0.140**	0.130*	0.133*	0.139**	0.130*
	(0.218)	(0.180)	(0.204)	(0.218)	(0.181)	(0.206)	(0.0769)	(0.0696)	(0.0736)	(0.0766)	(0.0691)	(0.0729)
Observations	273	287	253	273	287	253	273	287	253	273	287	253
Number of Provinces	9	9	9	9	9	9	9	9	9	9	9	9
Adj. R-squared	0.874	0.875	0.860	0.874	0.875	0.860	0.857	0.860	0.838	0.856	0.859	0.837

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 88: Growth effects of dynamic credit indicators in $GEO_{centralnorth}$, 3-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.00264	0.0302	-0.0126	-0.00289	0.0302	-0.0131	0.0116	0.0299	0.00786	0.0117	0.0299	0.00791
	(0.0594)	(0.0455)	(0.0602)	(0.0596)	(0.0455)	(0.0608)	(0.0379)	(0.0241)	(0.0372)	(0.0382)	(0.0242)	(0.0374)
$SCHOOL$	-0.0257	-0.0170	0.0355	-0.0255	-0.0170	0.0359	-0.227	-0.205	-0.176	-0.227	-0.205	-0.176
	(0.197)	(0.166)	(0.180)	(0.197)	(0.166)	(0.180)	(0.155)	(0.128)	(0.150)	(0.155)	(0.129)	(0.150)
$log(GOV)$	0.0490	0.0152	0.0812	0.0493	0.0152	0.0818	-0.0150	-0.0394	-0.00642	-0.0151	-0.0394	-0.00645
	(0.0511)	(0.0414)	(0.0542)	(0.0508)	(0.0414)	(0.0546)	(0.0506)	(0.0328)	(0.0512)	(0.0510)	(0.0329)	(0.0513)
$log(OPENNESS)$	-0.000608	-0.00857	-0.00550	-0.000580	-0.00858	-0.00555	-0.0145***	-0.0107***	-0.0134***	-0.0145***	-0.0107***	-0.0134***
	(0.0103)	(0.00867)	(0.0115)	(0.0104)	(0.00871)	(0.0114)	(0.00444)	(0.00402)	(0.00451)	(0.00449)	(0.00401)	(0.00454)
$\Delta CREDIT_{tot}$	4.83e-06			4.81e-06			8.76e-06***			8.77e-06***		
	(3.50e-06)			(3.46e-06)			(2.14e-06)			(2.15e-06)		
$\Delta CREDIT_{NFC}$		0.0368*			0.0368*			0.0478**			0.0479**	
		(0.0184)			(0.0185)			(0.0216)			(0.0218)	
ΔINV_{credit}			0.0273			0.0274			0.0350			0.0349
			(0.0333)			(0.0333)			(0.0304)			(0.0305)
$year_{>2001}$				-0.000411	7.41e-05	-0.000830				0.000313	0.000345	0.000488
				(0.00197)	(0.00168)	(0.00197)				(0.00186)	(0.00149)	(0.00156)
Constant	-0.0118	-0.109	-0.124	-0.0112	-0.109	-0.123	0.172**	0.164**	0.149**	0.171**	0.163**	0.149**
	(0.238)	(0.187)	(0.214)	(0.239)	(0.187)	(0.215)	(0.0752)	(0.0653)	(0.0742)	(0.0751)	(0.0647)	(0.0737)
Observations	255	269	235	255	269	235	255	269	235	255	269	235
Number of Provinces	9	9	9	9	9	9	9	9	9	9	9	9
Adj. R-squared	0.914	0.921	0.898	0.914	0.921	0.898	0.905	0.913	0.883	0.904	0.913	0.882

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 89: Growth effects of dynamic credit indicators in $GEO_{centralnorth}$, 5-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.0807*	-0.0674*	-0.0650**	-0.0801*	-0.0670*	-0.0647**	-0.00462	-0.00700	-0.0171*	-0.00439	-0.00831	-0.0172*
	(0.0390)	(0.0314)	(0.0218)	(0.0382)	(0.0311)	(0.0220)	(0.0120)	(0.0109)	(0.00898)	(0.0120)	(0.0114)	(0.00895)
$SCHOOL$	0.0802	0.0906	0.0812	0.0807	0.0907	0.0825	0.0146	0.0212	0.0506	0.0140	0.0281	0.0511
	(0.148)	(0.145)	(0.192)	(0.149)	(0.146)	(0.192)	(0.0748)	(0.0729)	(0.101)	(0.0745)	(0.0771)	(0.101)
$log(GOV)$	0.0565	0.0558	0.0589*	0.0564	0.0557	0.0588*	0.0105	0.0140	0.0247	0.0101	0.0160	0.0247
	(0.0379)	(0.0356)	(0.0308)	(0.0378)	(0.0356)	(0.0309)	(0.0183)	(0.0169)	(0.0153)	(0.0182)	(0.0176)	(0.0153)
$log(OPENNESS)$	-0.00739	-0.00712	-0.00218	-0.00737	-0.00713	-0.00232	0.00248	0.000631	0.00580	0.00242	0.000273	0.00575
	(0.00910)	(0.00704)	(0.0116)	(0.00911)	(0.00703)	(0.0118)	(0.00591)	(0.00459)	(0.00635)	(0.00590)	(0.00468)	(0.00640)
$\Delta CREDIT_{tot}$	0.00890*			0.00869			0.00682			0.00638		
	(0.00449)			(0.00495)			(0.00507)			(0.00546)		
$\Delta CREDIT_{NFC}$		0.0155			0.0153			0.0171			0.0171	
		(0.0220)			(0.0217)			(0.0235)			(0.0227)	
ΔINV_{credit}			0.00809			0.00789			0.0135***			0.0134***
			(0.00490)			(0.00482)			(0.00483)			(0.00462)
$year_{>2001}$				0.000973	0.00115	-0.00190				0.00212	0.00177	-0.00168
				(0.00340)	(0.00273)	(0.00342)				(0.00396)	(0.00294)	(0.00316)
Constant	0.277*	0.209	0.227	0.274*	0.207	0.226	0.126**	0.111**	0.150***	0.125**	0.106*	0.151***
	(0.130)	(0.135)	(0.141)	(0.128)	(0.134)	(0.143)	(0.0504)	(0.0539)	(0.0512)	(0.0516)	(0.0554)	(0.0507)
Observations	347	377	301	347	377	301	347	377	301	347	377	301
Number of Provinces	12	12	12	12	12	12	12	12	12	12	12	12
Adj. R-squared	0.739	0.758	0.772	0.739	0.758	0.773	0.704	0.731	0.736	0.703	0.730	0.735

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 90: Growth effects of dynamic credit indicators in GEO_{west}, 3-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
Dependent: ΔGDP_{real}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$log(INITIALGDP)$	-0.0753*	-0.0550*	-0.0579*	-0.0758*	-0.0548*	-0.0579*	-0.00774	-0.0107	-0.0156*	-0.00210	-0.0142	-0.0156*
	(0.0376)	(0.0278)	(0.0294)	(0.0374)	(0.0277)	(0.0295)	(0.0138)	(0.0121)	(0.00878)	(0.0118)	(0.0132)	(0.00879)
$SCHOOL$	0.0611	0.0980	0.0523	0.0608	0.0977	0.0520	0.0264	0.0459	0.0521	0.000668	0.0607	0.0519
	(0.154)	(0.154)	(0.202)	(0.154)	(0.154)	(0.202)	(0.0930)	(0.0901)	(0.102)	(0.0782)	(0.101)	(0.102)
$log(GOV)$	0.0619	0.0571	0.0583*	0.0619	0.0571	0.0583*	0.0153	0.0192	0.0232	0.00660	0.0247	0.0232
	(0.0382)	(0.0344)	(0.0309)	(0.0383)	(0.0344)	(0.0311)	(0.0207)	(0.0185)	(0.0147)	(0.0175)	(0.0204)	(0.0147)
$log(OPENNESS)$	-0.00779	-0.00631	-0.00195	-0.00784	-0.00633	-0.00194	0.00243	-0.000295	0.00544	0.00353	-0.00117	0.00544
	(0.0110)	(0.00831)	(0.0145)	(0.0110)	(0.00831)	(0.0145)	(0.00725)	(0.00592)	(0.00713)	(0.00633)	(0.00630)	(0.00714)
$\Delta CREDIT_{tot}$	0.0188**			0.0190**			0.0161**			0.0155**		
	(0.00680)			(0.00710)			(0.00738)			(0.00787)		
$\Delta CREDIT_{NFC}$		0.0123			0.0123			0.0185			0.0180	
		(0.0285)			(0.0285)			(0.0294)			(0.0288)	
ΔINV_{credit}			0.0222**			0.0222**			0.0288***			0.0289***
			(0.00998)			(0.0101)			(0.00902)			(0.00910)
$year_{>2001}$				-0.000974	0.000779	0.000203				-0.000518	0.00113	0.000534
				(0.00172)	(0.00150)	(0.00202)				(0.00193)	(0.00148)	(0.00200)
Constant	0.286*	0.202	0.226	0.289**	0.200	0.226	0.166***	0.151***	0.166***	0.180***	0.141***	0.165***
	(0.131)	(0.137)	(0.165)	(0.131)	(0.137)	(0.165)	(0.0522)	(0.0485)	(0.0540)	(0.0455)	(0.0517)	(0.0541)
Observations	320	353	275	320	353	275	320	353	275	320	353	275
Number of Provinces	12	12	12	12	12	12	12	12	12	12	12	12
Adj. R-squared	0.738	0.763	0.765	0.738	0.763	0.765	0.703	0.740	0.726	0.702	0.739	0.725

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 91: Growth effects of dynamic credit indicators in GEO_{west}, 5-year moving averages, estimated with Fixed Effects and Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.0262**	-0.0294***	-0.0518***	-0.0144	-0.00290	-0.0314*	-0.0342***	-0.0364***	-0.0398***
	(0.0106)	(0.00992)	(0.0121)	(0.0208)	(0.0180)	(0.0162)	(0.0109)	(0.0108)	(0.0121)
$SCHOOL$	0.0592	0.0405	0.0605	-0.0452	-0.0952	-0.0515	0.0759	0.0616	0.0700
	(0.0546)	(0.0529)	(0.0603)	(0.0970)	(0.0834)	(0.0979)	(0.0539)	(0.0498)	(0.0542)
$log(GOV)$	0.0415***	0.0476***	0.0776***	0.0277	0.0134	0.0504**	0.0526***	0.0573***	0.0615***
	(0.0151)	(0.0141)	(0.0169)	(0.0275)	(0.0235)	(0.0238)	(0.0166)	(0.0162)	(0.0179)
$log(OPENNESS)$	-0.00773**	-0.00711**	-0.00772*	-0.00279	0.000386	-0.00496	-0.00304	-0.00186	-0.000741
	(0.00366)	(0.00354)	(0.00439)	(0.00636)	(0.00564)	(0.00618)	(0.00453)	(0.00427)	(0.00494)
$\Delta CREDIT_{tot}$	6.85e-06***			0.0175			5.66e-06***		
	(1.31e-06)			(0.0133)			(1.05e-06)		
$\Delta CREDIT_{NFC}$		0.0353***			0.0210			0.0325**	
		(0.0120)			(0.0405)			(0.0132)	
ΔINV_{credit}			0.0111*			0.0273			0.00881
			(0.00600)			(0.0324)			(0.00570)
$GEO_{centralnorth}$	-0.0317***	-0.0300***	-0.0331**	-0.0347***	-0.0292**	-0.0392**	-0.0187	-0.0148	-0.0121
	(0.0115)	(0.0112)	(0.0137)	(0.0129)	(0.0118)	(0.0155)	(0.0130)	(0.0121)	(0.0137)
GEO_{west}	-0.0220*	-0.0224*	-0.0315**	-0.0331*	-0.0255*	-0.0436**	-0.00584	-0.00431	-0.00294
	(0.0134)	(0.0127)	(0.0154)	(0.0175)	(0.0150)	(0.0182)	(0.0124)	(0.0117)	(0.0137)
Constant	0.107***	0.103***	0.125***	0.143***	0.154***	0.159***			-0.0806
	(0.0301)	(0.0321)	(0.0267)	(0.0390)	(0.0374)	(0.0480)			(0.0589)
Observations	915	978	818	343	362	284	572	616	534
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.792	0.801	0.802	0.736	0.748	0.779	0.791	0.801	0.774

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 92: Growth effects of dynamic credit indicators with dummy variable for regions, 3-year moving averages, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.0315***	-0.0352***	-0.0579***	-0.0157	0.00328	-0.0383	-0.0349***	-0.0310**	-0.0383***
	(0.0118)	(0.0111)	(0.0132)	(0.0244)	(0.0193)	(0.0235)	(0.0133)	(0.0121)	(0.0139)
$SCHOOL$	0.0758	0.0523	0.0711	-0.0225	-0.102	0.00900	0.0866	0.0576	0.0771
	(0.0568)	(0.0561)	(0.0650)	(0.121)	(0.0981)	(0.124)	(0.0615)	(0.0591)	(0.0640)
$log(GOV)$	0.0489***	0.0561***	0.0858***	0.0288	0.00529	0.0585*	0.0519**	0.0487***	0.0579***
	(0.0168)	(0.0160)	(0.0186)	(0.0325)	(0.0258)	(0.0316)	(0.0203)	(0.0181)	(0.0207)
$log(OPENNESS)$	-0.00867**	-0.00863**	-0.00925*	-0.00375	0.000364	-0.0101	-0.00191	-0.000368	0.00124
	(0.00395)	(0.00381)	(0.00475)	(0.00814)	(0.00708)	(0.00685)	(0.00539)	(0.00486)	(0.00581)
$\Delta CREDIT_{tot}$	6.70e-06***			0.0297			5.86e-06***		
	(1.42e-06)			(0.0243)			(1.27e-06)		
$\Delta CREDIT_{NFC}$		0.0466***			0.0315			0.0482***	
		(0.0153)			(0.0641)			(0.0149)	
ΔINV_{credit}			0.0246***			0.105***			0.0172*
			(0.00895)			(0.0324)			(0.00989)
$GEO_{centralnorth}$	-0.0338***	-0.0332***	-0.0357**	-0.0375**	-0.0298**	-0.0489***	-0.0167	-0.0110	-0.00780
	(0.0123)	(0.0119)	(0.0145)	(0.0154)	(0.0139)	(0.0179)	(0.0139)	(0.0125)	(0.0144)
GEO_{west}	-0.0246*	-0.0267*	-0.0359**	-0.0357*	-0.0268	-0.0594**	-0.00400	0.000885	0.00249
	(0.0144)	(0.0137)	(0.0165)	(0.0195)	(0.0165)	(0.0236)	(0.0137)	(0.0122)	(0.0141)
Constant	0.135***	0.128***	0.141***	0.167***	0.184***	0.148***			
	(0.0297)	(0.0306)	(0.0306)	(0.0457)	(0.0432)	(0.0526)			
Observations	850	916	750	285	300	223	565	616	527
Number of Provinces	31	31	31	29	31	29	31	31	31
Adj. R-squared	0.820	0.832	0.837	0.685	0.707	0.830	0.806	0.824	0.787

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 93: Growth effects of dynamic credit indicators with dummy variable for regions, 5-year moving averages, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.00996	-0.0265***	-0.0553***	-0.0175	0.00119	-0.0258*	-0.0269***	-0.0352***	-0.0360***
	(0.00862)	(0.00924)	(0.0123)	(0.0215)	(0.0163)	(0.0147)	(0.00980)	(0.0102)	(0.0115)
$SCHOOL$	0.00880	0.0213	0.0588	0.00139	-0.0809	-0.0555	0.0565	0.0509	0.0744
	(0.0568)	(0.0551)	(0.0596)	(0.0903)	(0.0807)	(0.0858)	(0.0556)	(0.0581)	(0.0533)
$log(GOV)$	0.0183	0.0444***	0.0827***	0.0330	0.00924	0.0436**	0.0419***	0.0560***	0.0553***
	(0.0123)	(0.0136)	(0.0172)	(0.0286)	(0.0214)	(0.0200)	(0.0151)	(0.0158)	(0.0174)
$log(OPENNESS)$	-0.00539*	-0.00641**	-0.00820*	-0.00481	0.000976	-0.00349	-0.00378	-0.00174	-0.00122
	(0.00327)	(0.00317)	(0.00434)	(0.00568)	(0.00527)	(0.00555)	(0.00401)	(0.00418)	(0.00486)
$\Delta CREDIT_{tot}$	0.0488			0.191			0.0192**		
	(0.0350)			(0.148)			(0.00761)		
$\Delta CREDIT_{NFC}$		0.140***			0.140**			0.0636	
		(0.0289)			(0.0642)			(0.0421)	
ΔINV_{credit}			0.0277***			0.0620			0.00335
			(0.0107)			(0.0423)			(0.00756)
$GEO_{centralnorth}$	-0.0154	-0.0128	-0.0312**	-0.0140	-0.00641	-0.0276	-0.0151	-0.00978	-0.0150
	(0.0126)	(0.0103)	(0.0145)	(0.0333)	(0.0119)	(0.0177)	(0.0123)	(0.0120)	(0.0133)
GEO_{west}	-0.00469	-0.00213	-0.0276*	0.00743	0.0113	-0.0224	-0.00303	0.000127	-0.00395
	(0.0129)	(0.0107)	(0.0154)	(0.0368)	(0.0169)	(0.0182)	(0.0117)	(0.0104)	(0.0132)
$\Delta CREDIT_{tot} * GEO_{centralnorth}$	-0.0488			-0.106			-0.0192**		
	(0.0350)			(0.135)			(0.00761)		
$\Delta CREDIT_{tot} * GEO_{west}$	-0.0446			-0.192			-0.0107		
	(0.0342)			(0.150)			(0.00802)		
$\Delta CREDIT_{NFC} * GEO_{centralnorth}$		-0.109***			-0.118**			-0.0382	
		(0.0295)			(0.0586)			(0.0459)	
$\Delta CREDIT_{NFC} * GEO_{west}$		-0.128***			-0.181**			-0.0310	
		(0.0272)			(0.0887)			(0.0403)	
$\Delta INV_{credit} * GEO_{centralnorth}$			-0.0158			-0.0473			0.0157
			(0.0211)			(0.0427)			(0.0286)
$\Delta INV_{credit} * GEO_{west}$			-0.0286***			-0.0725			0.00782
			(0.0106)			(0.0452)			(0.00937)
Constant	0.113***	0.0902***	0.122***	0.0832*	0.123***	0.153***	-0.0621	-0.0961*	
	(0.0248)	(0.0315)	(0.0277)	(0.0429)	(0.0415)	(0.0476)	(0.0513)	(0.0556)	
Observations	915	978	818	343	362	284	572	616	534
Number of Provinces	31	31	31	29	31	30	31	31	31
Adj. R-squared	0.794	0.803	0.803	0.745	0.750	0.789	0.791	0.801	0.774

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 94: Growth effects of dynamic credit indicators with dummy variable for regions, 3-year moving averages, estimated with Random Effects.

	RE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: ΔGDP_{real}					year<2001			year>=2001	
$log(INITIALGDP)$	-0.00947	-0.0306***	-0.0611***	-0.0240	0.00728	-0.0416*	-0.0256**	-0.0294***	-0.0363***
	(0.00895)	(0.0100)	(0.0132)	(0.0269)	(0.0186)	(0.0218)	(0.0111)	(0.0113)	(0.0134)
$SCHOOL$	0.0104	0.0330	0.0704	0.0539	-0.0795	0.0320	0.0579	0.0517	0.0854
	(0.0595)	(0.0607)	(0.0647)	(0.120)	(0.103)	(0.113)	(0.0634)	(0.0692)	(0.0618)
$log(GOV)$	0.0175	0.0507***	0.0902***	0.0411	0.00207	0.0612**	0.0386**	0.0469***	0.0541***
	(0.0128)	(0.0150)	(0.0185)	(0.0360)	(0.0251)	(0.0294)	(0.0171)	(0.0177)	(0.0202)
$log(OPENNESS)$	-0.00580*	-0.00808**	-0.00983**	-0.00866	0.00115	-0.0101	-0.00326	-0.000473	0.000295
	(0.00339)	(0.00351)	(0.00473)	(0.00718)	(0.00680)	(0.00714)	(0.00429)	(0.00476)	(0.00555)
$\Delta CREDIT_{tot}$	0.0764			0.244			0.0340***		
	(0.0483)			(0.198)			(0.0129)		
$\Delta CREDIT_{NFC}$		0.175***			0.272**			0.0922*	
		(0.0345)			(0.112)			(0.0511)	
ΔINV_{credit}			0.0401*			0.144***			0.0107
			(0.0216)			(0.0375)			(0.0112)
$GEO_{centralnorth}$	-0.0103	-0.0135	-0.0351**	-0.00286	0.0230	-0.0263	-0.0112	-0.00613	-0.0162
	(0.0147)	(0.0108)	(0.0159)	(0.0457)	(0.0246)	(0.0222)	(0.0126)	(0.0125)	(0.0140)
GEO_{west}	-0.00128	-0.000775	-0.0313*	0.0125	0.0431	-0.0412*	-0.00103	0.00830	9.05e-05
	(0.0147)	(0.0110)	(0.0168)	(0.0496)	(0.0305)	(0.0226)	(0.0121)	(0.0104)	(0.0138)
$\Delta CREDIT_{tot} * GEO_{centralnorth}$	-0.0764			-0.193			-0.0340***		
	(0.0483)			(0.184)			(0.0129)		
$\Delta CREDIT_{tot} * GEO_{west}$	-0.0633			-0.241			-0.0169		
	(0.0469)			(0.200)			(0.0123)		
$\Delta CREDIT_{NFC} * GEO_{centralnorth}$		-0.125***			-0.277**			-0.0378	
		(0.0349)			(0.118)			(0.0558)	
$\Delta CREDIT_{NFC} * GEO_{west}$		-0.164***			-0.347**			-0.0579	
		(0.0322)			(0.160)			(0.0467)	
$\Delta INV_{credit} * GEO_{centralnorth}$			-0.01000			-0.108***			0.0415
			(0.0290)			(0.0390)			(0.0384)
$\Delta INV_{credit} * GEO_{west}$			-0.0328			-0.0841*			0.00597
			(0.0214)			(0.0502)			(0.0138)
Constant	0.139***	0.110***	0.139***	0.0856	0.126***	0.143***	-0.0356	-0.0647	
	(0.0220)	(0.0289)	(0.0313)	(0.0544)	(0.0477)	(0.0463)	(0.0515)	(0.0591)	
Observations	850	916	750	285	300	223	565	616	527
Number of Provinces	31	31	31	29	31	29	31	31	31
Adj. R-squared	0.825	0.838	0.838	0.708	0.721	0.841	0.809	0.824	0.788

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 95: Growth effects of dynamic credit indicators with dummy variable for regions, 5-year moving averages, estimated with Random Effects.

	FE						RE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent: ΔGDP_{real}					$d(CREDIT/GDP) \leq 9$						$d(CREDIT/GDP) \leq 9$	
$log(INITIALGDP)$	-0.0939***	-0.0854***	-0.100***	-0.110***	-0.0943***	-0.106***	-0.0174**	-0.0194***	-0.0412***	-0.00159	-0.00353	-0.0380***
	(0.0234)	(0.0220)	(0.0232)	(0.0231)	(0.0214)	(0.0202)	(0.00780)	(0.00737)	(0.00976)	(0.00830)	(0.00831)	(0.0103)
$SCHOOL$	0.0875	0.0807	0.0783	0.0770	0.0619	0.0867	0.0584	0.0436	0.0616	-0.000173	-0.0226	0.0564
	(0.0677)	(0.0652)	(0.0670)	(0.0758)	(0.0780)	(0.0736)	(0.0617)	(0.0600)	(0.0645)	(0.0650)	(0.0633)	(0.0717)
$log(GOV)$	0.105***	0.0987***	0.109***	0.133***	0.121***	0.137***	0.0287**	0.0324***	0.0646***	0.00429	0.00796	0.0576***
	(0.0248)	(0.0214)	(0.0204)	(0.0236)	(0.0206)	(0.0151)	(0.0122)	(0.0123)	(0.0157)	(0.0119)	(0.0122)	(0.0157)
$log(OPENNESS)$	-0.00740	-0.00789	-0.00757	-0.00827	-0.00926	-0.0119*	-0.000547	-0.000536	-0.000759	0.00160	0.00159	-0.000273
	(0.00604)	(0.00567)	(0.00623)	(0.00644)	(0.00607)	(0.00623)	(0.00261)	(0.00263)	(0.00294)	(0.00220)	(0.00201)	(0.00270)
$\Delta CREDIT_{tot}$	3.75e-06***			2.91e-06**			5.98e-06***			5.90e-06***		
	(1.18e-06)			(1.39e-06)			(1.29e-06)			(1.56e-06)		
$\Delta CREDIT_{NFC}$		0.0206			0.0165			0.0362**			0.0453**	
		(0.0151)			(0.0145)			(0.0182)			(0.0212)	
ΔINV_{credit}			0.0154*			0.00853			0.0217***			0.0186*
			(0.00827)			(0.0102)			(0.00819)			(0.00990)
$d10(CREDIT/GDP)$	0.00150	0.0108	0.00704				-0.0110	0.00511	0.00236			
	(0.0118)	(0.00765)	(0.00975)				(0.00678)	(0.00562)	(0.00825)			
$d10(CREDIT/GDP) * \Delta CREDIT_{tot}$	0.0416						0.0854***					
	(0.0393)						(0.0264)					
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC}$		-0.000952						-0.000270				
		(0.0315)						(0.0320)				
$d10(CREDIT/GDP) * \Delta INV_{credit}$			-0.0179						-0.0202*			
			(0.0126)						(0.0115)			
Constant	0.212**	0.188**	0.246**	0.200**	0.157*	0.158	0.112***	0.106***	0.117***	0.142***	0.133***	0.129***
	(0.0899)	(0.0850)	(0.113)	(0.0976)	(0.0925)	(0.100)	(0.0313)	(0.0329)	(0.0320)	(0.0261)	(0.0269)	(0.0335)
Observations	870	910	795	776	808	712	870	910	795	776	808	712
Number of Provinces	31	31	31	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.796	0.799	0.807	0.799	0.802	0.817	0.792	0.796	0.802	0.798	0.800	0.816

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 96: Growth effects of dynamic credit indicators with dummy variable for credit to GDP share, 3-year moving averages, estimated with Fixed Effects and Random Effects.

	FE						RE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent: ΔGDP_{real}				$d(CREDIT/GDP) \leq 9$						$d(CREDIT/GDP) \leq 9$		
$log(INITIALGDP)$	-0.0990***	-0.0871***	-0.104***	-0.119***	-0.0994***	-0.114***	-0.0268***	-0.0326***	-0.0447***	-0.0262**	-0.00363	-0.0523***
	(0.0231)	(0.0212)	(0.0229)	(0.0234)	(0.0207)	(0.0203)	(0.00927)	(0.00927)	(0.00997)	(0.0108)	(0.00847)	(0.0108)
$SCHOOL$	0.0903	0.0849	0.0804	0.0869	0.0761	0.0991	0.0800	0.0756	0.0702	0.0754	-0.0295	0.0863
	(0.0727)	(0.0691)	(0.0722)	(0.0797)	(0.0817)	(0.0750)	(0.0659)	(0.0625)	(0.0687)	(0.0739)	(0.0638)	(0.0730)
$log(GOV)$	0.110***	0.0993***	0.112***	0.144***	0.125***	0.144***	0.0428***	0.0525***	0.0703***	0.0411**	0.00905	0.0790***
	(0.0254)	(0.0209)	(0.0197)	(0.0258)	(0.0211)	(0.0150)	(0.0146)	(0.0152)	(0.0162)	(0.0162)	(0.0125)	(0.0164)
$log(OPENNESS)$	-0.00753	-0.00928	-0.0104	-0.00803	-0.00975	-0.0137*	-0.00127	-0.00203	-0.00170	-0.000121	0.00145	-0.00162
	(0.00687)	(0.00651)	(0.00651)	(0.00746)	(0.00716)	(0.00690)	(0.00304)	(0.00313)	(0.00295)	(0.00317)	(0.00203)	(0.00298)
$\Delta CREDIT_{tot}$	3.61e-06**			2.43e-06			5.88e-06***			5.85e-06***		
	(1.45e-06)			(1.71e-06)			(1.50e-06)			(1.69e-06)		
$\Delta CREDIT_{NFC}$		0.0330			0.0267			0.0449*			0.0698***	
		(0.0219)			(0.0215)			(0.0230)			(0.0268)	
ΔINV_{credit}			0.0296*			0.0211			0.0379***			0.0316**
			(0.0158)			(0.0144)			(0.0145)			(0.0137)
$d10(CREDIT/GDP)$	0.00145	0.0106*	0.00733				-0.00989*	0.00659	0.00277			
	(0.00887)	(0.00605)	(0.00888)				(0.00550)	(0.00492)	(0.00756)			
$d10(CREDIT/GDP) * \Delta CREDIT_{tot}$	0.0429						0.0815***					
	(0.0357)						(0.0251)					
$d10(CREDIT/GDP) * \Delta CREDIT_{NFC}$		-0.00966						-0.00871				
		(0.0324)						(0.0313)				
$d10(CREDIT/GDP) * \Delta INV_{credit}$			-0.0279*						-0.0308**			
			(0.0164)						(0.0148)			
Constant	0.254***	0.220**	0.264**	0.239**	0.197*	0.186	0.132***	0.119***	0.126***	0.141***	0.157***	0.132***
	(0.0898)	(0.0910)	(0.118)	(0.0991)	(0.100)	(0.113)	(0.0329)	(0.0344)	(0.0318)	(0.0351)	(0.0243)	(0.0344)
Observations	813	857	736	719	756	657	813	857	736	719	756	657
Number of Provinces	31	31	31	31	31	31	31	31	31	31	31	31
Adj. R-squared	0.820	0.825	0.836	0.824	0.827	0.850	0.821	0.826	0.836	0.830	0.832	0.855

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 97: Growth effects of dynamic credit indicators with dummy variable for credit to GDP share, 5-year moving averages, estimated with Fixed Effects and Random Effects.

	RE		
	(1)	(2)	(3)
Dependent:	ΔINV_{tot}	ΔINV_{auto}	ΔINV_{energy}
ΔREV_{ind}	0.599***	1.482**	-10.21
	(0.151)	(0.683)	(10.40)
$\Delta CREDIT_{firm}$	0.00502	0.889***	-1.912
	(0.0155)	(0.150)	(2.047)
$\Delta STATECAP_{ind}$	0.0614	-0.278	-1.943
	(0.0377)	(0.230)	(2.417)
$\Delta FORECAP_{ind}$	-0.0404***	-0.186	-3.440
	(0.0131)	(0.203)	(3.512)
$GEO_{centralnorth}$	0.0167	-0.0845	0.995
	(0.0111)	(0.0681)	(1.122)
GEO_{west}	0.0249**	-0.110	2.824
	(0.0103)	(0.236)	(2.560)
Constant	0.0797***	0.165	9.652
	(0.0275)	(0.216)	(9.215)
Observations	437	81	326
Number of Provinces	30	21	29
Adj. R-squared	0.568	0.868	0.185

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 98: Investment effects of industry credit growth by industrial sector, 3-year moving averages, estimated with Random Effects.

	RE		
	(1)	(2)	(3)
Dependent:	ΔINV_{tot}	ΔINV_{auto}	ΔINV_{energy}
ΔREV_{ind}	0.670***	1.121*	-3.272
	(0.160)	(0.673)	(6.370)
$\Delta CREDIT_{firm}$	0.00844	0.899***	-1.028
	(0.0238)	(0.188)	(1.214)
$\Delta STATECAP_{ind}$	0.116**	0.612	0.00924
	(0.0570)	(0.907)	(1.605)
$\Delta FORECAP_{ind}$	-0.0609***	0.470	-5.028
	(0.0106)	(0.757)	(5.190)
$GEO_{centralnorth}$	0.0222*	-0.0810	0.640
	(0.0126)	(0.0980)	(0.781)
GEO_{west}	0.0245*	-0.227	1.796
	(0.0129)	(0.290)	(1.674)
Constant	0.0622*	0.303	7.144
	(0.0359)	(0.246)	(6.651)
Observations	376	40	266
Number of Provinces	29	19	28
Adj. R-squared	0.653	0.972	0.195

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 99: Investment effects of industry credit growth by industrial sector, 5-year moving averages, estimated with Random Effects.

	RE		
Dependent: ΔGDP_{real}	(1)	(2)	(3)
$log(INITIALGDP)$	-0.0310***	0.00447	-0.0430***
	(0.0101)	(0.0363)	(0.0137)
$SCHOOL$	0.0501	0.199**	0.119**
	(0.0454)	(0.0963)	(0.0528)
$log(GOV)$	0.0488***	0.0285	0.0600***
	(0.0147)	(0.0517)	(0.0183)
$log(OPENNESS)$	-0.00511	0.00468	-0.00532
	(0.00327)	(0.00583)	(0.00464)
ΔINV_{tot}	0.173***		
	(0.0277)		
ΔINV_{auto}		0.0317***	
		(0.00915)	
ΔINV_{energy}			-0.000360***
			(6.55e-05)
$GEO_{centralnorth}$	-0.0292***	-0.0115	-0.0262*
	(0.0101)	(0.0204)	(0.0142)
GEO_{west}	-0.0245**	0.0269	-0.0157
	(0.0122)	(0.0275)	(0.0161)
Constant	0.0920***	0.0330	0.195***
	(0.0284)	(0.0989)	(0.0448)
Observations	932	108	454
Number of Provinces	31	22	30
Adj. R-squared	0.820	0.944	0.826

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 100: Growth effects of investment by industrial sector, 3-year moving averages, estimated with Random Effects.

	RE		
Dependent: ΔGDP_{real}	(1)	(2)	(3)
$log(INITIALGDP)$	-0.0361***	0.0295	-0.0444***
	(0.0105)	(0.0479)	(0.0155)
$SCHOOL$	0.0641	0.310***	0.183***
	(0.0464)	(0.0807)	(0.0544)
$log(GOV)$	0.0564***	-0.00209	0.0599***
	(0.0157)	(0.0677)	(0.0216)
$log(OPENNESS)$	-0.00579	0.00190	-0.00658
	(0.00366)	(0.00683)	(0.00509)
ΔINV_{tot}	0.196***		
	(0.0287)		
$GEO_{centralnorth}$	-0.0316***	-0.0136	-0.0278*
	(0.0109)	(0.0256)	(0.0154)
GEO_{west}	-0.0270**	0.0384	-0.0175
	(0.0128)	(0.0396)	(0.0179)
ΔINV_{auto}		0.0449***	
		(0.00220)	
ΔINV_{energy}			-0.000492***
			(0.000130)
Constant	0.127***	-0.0927	0.181***
	(0.0290)	(0.102)	(0.0639)
Observations	870	60	389
Number of Provinces	31	21	30
Adj. R-squared	0.853	0.966	0.838

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table 101: Growth effects of investment by industrial sector, 5-year moving averages, estimated with Random Effects.

A.3 Appendix C: Lending for Equality? A Machine Learning Approach to the Finance-Inequality Nexus

A.3.1 Data set

Argentina	Hong Kong SAR	Poland
Australia	Hungary	Portugal
Austria	India	Russia
Belgium	Indonesia	Saudi Arabia
Brazil	Ireland	Singapore
Canada	Israel	South Africa
Chile	Italy	Spain
China	Japan	Sweden
Colombia	Korea	Switzerland
Czechia	Luxembourg	Thailand
Denmark	Malaysia	Turkey
Finland	Mexico	United Kingdom
France	Netherlands	United States
Germany	New Zealand	
Greece	Norway	

Table 102: Countries covered in the data set (finance-wealth inequality-nexus).

Target features

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$gini_{wea}$	Wealth Gini coefficient	Gini of net personal wealth (equal-split; adults)	World Inequality Database (WID)	x	x
wea_{top1}	99% percentile of wealth	Share of net personal wealth that is held by the wealthiest 1% of the total population (share; equal-split; adults)	World Inequality Database (WID)	x	x
wea_{top10}	90% percentile of wealth	Share of net personal wealth that is held by the wealthiest 10% of the total population (share; equal-split; adults)	World Inequality Database (WID)	x	x
wea_{p3070}	Middle 50% percentile of wealth	30-70 percent percentile of net personal wealth (share; equal-split; adults)	World Inequality Database (WID)	x	x
wea_{bot50}	50% percentile of wealth	Bottom 50% (median) of net personal wealth (share; equal-split; adults)	World Inequality Database (WID)	x	x
wea_{bot20}	20% percentile of wealth	Bottom 20 percent percentile of net personal wealth (share; equal-split; adults)	World Inequality Database (WID)	x	x

Table 103: Target feature variables, definitions and data sources (finance-inequality-nexus).

Descriptive features

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
id	Country ID	43 developed and developing countries worldwide (see table 1)	-	x	x
time	Time ID	Time period from 1945 to 2021	-	x	x
wbdev	Development level	Development level according to the World Bank (lower-middle-income; upper-middle income; developed)	World Bank	x	x
undev	Development level	Development level according to the UN (developing; developed)	UN	x	x
bankcrisis	Bank crisis dummy	Dummy for the presence of bank crisis (0;1)	div.*	x	x
$gini_{mkt}$	Gross Gini coefficient	Gini coefficient for market income	SWIID	x	
$gini_{disp}$	Net Gini coefficient	Gini coefficient for disposable income (after taxes and transfers)	SWIID	x	
redist	Redistribution	Difference between market and disposable Gini coefficient	SWIID	x	
palma	Palma ratio	Ratio between the income share of the top decile and that of the bottom four deciles, total population	OECD	x	
povrate	Poverty ratio	Poverty rate after taxes and transfers, poverty line 50%, total population	OECD	x	
inc_{top1}	99% percentile of income	Share of national income that is held by the wealthiest 1% of the total population (share; pre-tax; equal-split; adults)	WID	x	
inc_{top10}	90% percentile of income	Share of national income that is held by the wealthiest 10% of the total population (share; pre-tax; equal-split; adults)	WID	x	
inc_{bot50}	50% percentile of income	50 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	
inc_{mid40}	Middle 40% percentile of income	50-90 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	
inc_{p010}	10% percentile of income	10 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	
inc_{p1020}	10-20% percentile of income	10-20 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	
inc_{p3070}	Middle 50% percentile of income	30-70 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	

* World Bank; Jordà-Schularick-Taylor Macrohistory Database; Laeven and Valencia (2018); Reinhart, Rogoff, Trebesch & Reinhart (Global Crises Data by Country).

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
inc_{p8090}	80-90% percentile of income	80-90 percent percentile of national income (share; pre-tax; equal split; adults)	WID	x	
inc_{t10b50}	90/50 percentile of income ratio	Ratio of top 10% to bottom 50% percentiles of national income (pre-tax; equal-split; adults)	WID	x	
$inc_{top1,\ net}$	99% percentile of net income	Share of net national income that is held by the wealthiest 1% of the total population (share; post-tax; equal-split; adults)	WID	x	
$inc_{top10,\ net}$	90% percentile of net income	Share of net national income that is held by the wealthiest 10% of the total population (share; post-tax; equal-split; adults)	WID	x	
$inc_{bot50,\ net}$	50% percentile of net income	50 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{mid40,\ net}$	Middle 40% percentile of net income	50-90 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{p010,\ net}$	10% percentile of net income	10 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{p1020,\ net}$	10-20% percentile of net income	10-20 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{p3070,\ net}$	Middle 50% percentile of net income	30-70 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{p8090,\ net}$	80-90% percentile of net income	80-90 percent percentile of net national income (share; post-tax; equal split; adults)	WID	x	
$inc_{t10b50,\ net}$	90/50 percentile of net income ratio	Ratio of top 10% to bottom 50% percentiles of net national income (post-tax; equal-split; adults)	WID	x	
wea_{mid40}	Middle 40% percentile of wealth	50-90 percent percentile of net personal wealth (share; equal split; adults)	WID	x	
wea_{p010}	10% percentile of wealth	10 percent percentile of net personal wealth (share; equal split; adults)	WID	x	
wea_{p1020}	10-20% percentile of wealth	10-20 percent percentile of net personal wealth (share; equal split; adults)	WID	x	
wea_{p8090}	80-90% percentile of wealth	80-90 percent percentile of net personal wealth (share; equal split; adults)	WID	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
wea_{t10b50}	90/50 percentile of wealth ratio	Ratio of top 10% to bottom 50% percentiles of net personal wealth (equal-split; adults)	WID	x	
$hhcred_{usd}$	Household credit	Credit by all institutions to households and NPISHs; in billion US dollar; adjusted for breaks	BIS	x	
$nfccred_{usd}$	Non-financial priv. corporations credit	Credit by all institutions to non-financial private corporations; in billion US dollar; adjusted for breaks	BIS	x	
hhcredfl	Household credit flow	Absolute difference between hhcred_usd in t and t-1	BIS	x	
$hhcredfl_{gdp}$	Household credit flow to GDP	Difference between hhcred_usd in t and t-1, relative to GDP	BIS	x	
$privnfcred_{usd}$	Non-financial priv. sector credit	Credit by all institutions to non-financial private sector; in billion US dollar; adjusted for breaks	BIS	x	
$privnfcred_{bank,usd}$	Non-financial priv. sector bank credit	Credit by banks to non-financial private sector; in billion US dollar; adjusted for breaks	BIS	x	
$privnfcred_{gdp}$	Non-financial priv. sector credit (GDP)	Credit by all institutions to non-financial private sector; in percentage of GDP; adjusted for breaks	BIS	x	
$privnfcred_{bank,gdp}$	Non-financial priv. sector bank credit (GDP)	Credit by banks to non-financial private sector; in percentage of GDP; adjusted for breaks	BIS	x	
$hhcred_{gdp}$	Household credit (GDP)	Credit by all institutions to households and NPISHs; in percentage of GDP; adjusted for breaks	BIS, IMF	x	
$nfccred_{gdp}$	Non-financial priv. corporations credit (GDP)	Credit by all institutions to non-financial private corporations; in percentage of GDP, adjusted for breaks	BIS, IMF	x	
$privcr_{gdp}$	Domestic private credit (GDP)	Domestic credit to private sector (in percentage of GDP)	World Bank	x	
$bcredit_{priv}$	Domestic private bank credit (GDP)	Domestic credit to private sector by banks (in percentage of GDP)	World Bank	x	
$fscredit_{priv}$	Domestic fin. sector credit (GDP)	Domestic credit provided by financial sector (in percentage of GDP)	World Bank	x	
$credit_{priv}$	Net dom. credit	Net domestic credit (current local currency units)	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$tloans_{jst}$	Non-financial private sector loans	Total loans to non-financial private sector (nominal, local currency)	JST	x	
$tmort_{jst}$	Non-financial private sector mortg. loans	Mortgage loans to non-financial private sector (nominal, local currency)	JST	x	
thh_{jst}	Household loans	Total loans to households (nominal, local currency)	JST	x	x
$tbus_{jst}$	Business loans	Total loans to business (nominal, local currency)	JST	x	x
$privcred_{fi,gdp}$	Private bank and financial inst. credit (GDP)	Private credit by deposit money banks and other financial institutions to GDP	World Bank	x	
$gov_{cred,gdp}$	Government and SOE credit (GDP)	Credit to government and state owned enterprises to GDP	World Bank	x	
$privclaims_{banks}$	Private sector claims of banks	Banking institutions claims on private sector (non-standardized), domestic currency	IMF	x	
$prdebt_{loans,gdp}$	Private loans / debt securities (GDP)	Private debt, loans and debt securities (percentage of GDP)	IMF	x	
$prdebt_{gdp}$	Private debt (GDP)	Private debt, all instruments (percentage of GDP)	IMF	x	
$hhdebt_{gdp}$	Household debt (GDP)	Household debt, all instruments (percentage of GDP)	IMF	x	
$nfcorpdebt_{gdp}$	Non-financial corporate debt (GDP)	Nonfinancial corporate debt, all instruments (percentage of GDP)	IMF	x	
gdp	GDP	GDP, current prices, million USD	IMF, JST, World Bank, OECD	x	
gdp_{imf}	GDP	GDP, current prices (billions of USD)	IMF	x	
$gdp_{current,mio}$	GDP	GDP (current USD), in millions	World Bank	x	x
$gdp_{jst,usd}$	GDP	GDP (nominal, USD), in millions	JST	x	
gdp_{oecd}	GDP	GDP, current prices, current exchange rates (output approach)	OECD	x	
gdpgr	Annual GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency	World Bank	x	x
rgdpgr	Real GDP growth	Real GDP growth (Annual percent change)	IMF	x	x

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$gdp_{deflator}$	GDP deflator	GDP, deflator, index	IMF	x	
$rgdp_{imf}$	Real GDP	GDP, real, domestic currency	IMF	x	x
gdppc	GDP per capita	GDP per capita (current USD)	World Bank	x	x
$gdppc_{imf}$	GDP per capita	GDP per capita, current prices, USD	IMF	x	
$rgdpmad_{jst}$	Real GDP per capita	Real GDP per capita (PPP, 1990 Int$, Maddison)	JST	x	
$rgdpbarro_{jst}$	Real GDP per capita	Real GDP per capita (index, 2005=100)	JST	x	
i_{dep}	Deposit interest rate	Deposit interest rate (percent p.a.)	World Bank, IMF	x	
i_{spread}	Interest rate spread	Interest rate spread (lending rate minus deposit rate, percent p.a.)	World Bank	x	
i_{lend}	Lending interest rate	Lending interest rate (percent p.a.)	World Bank, IMF	x	x
i_{long}	Long-term interest rate	Long-term interest rate (nominal, percent p.a.)	JST, OECD	x	
i_{short}	Short-term interest rate	Short-term interest rate (nominal, percent p.a.)	JST, OECD	x	
i_r	Real interest rate	Real interest rate (percent), as lending interest rate adjusted for inlation as measured by the GDP deflator	World Bank	x	x
$billrate_{jst}$	Bill rate	Bill rate, nominal. r[t] = coupon[t] / p[t-1]	JST	x	
$rgovbond_{yield}$	Real long-term government bond yield	Real long term government bond yield, percent	IMF	x	x
$ir_{govbond,short}$	Short/Medium term gov. bond yield	Government bond yields, short- to medium-term, percent p.a.	IMF	x	
ir_{monpol}	Monetary policy rate	Monetary policy-related interest rate, percent p.a.	IMF	x	
$ir_{monmark}$	Money market rate	Money market interest rate, percent p.a.	IMF	x	
$ir_{interbank}$	Interbank rate	Interbank rate, percent p.a.	OECD	x	
ltgovbond	Long-term gov. bond yields	Long-term government bond yields, 10 years	EIKON	x	
infl	Inflation	Inflation, consumer prices (annual percentage change)	World Bank, OECD, IMF	x	x

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
cpi_{jst}	CPI	Consumer prices (index, 1990 = 100)	JST	x	
cpi	CPI	Consumer price index (2010 = 100)	World Bank	x	
deflator	GDP deflator	Inflation, GDP deflator (annual percent)	World Bank	x	
pop_{av}	Population	Total population, all age groups	World Bank, IMF, JST, OECD	x	
pop_{gr}	Population growth	Annual population growth rate	World Bank	x	
pop65y	Population over 65 years	Population being 65 yeras old and over, in percent of total population	OECD	x	x
$school_{prim,net}$	Primary net enrollment rate	Adjusted net enrollment rate, primary (percentage of primary school age children)	World Bank	x	
$educ_{comp}$	Duration of compulsory education	Compulsory education, duration (years)	World Bank	x	
$educ_{bach}$	Education (Bachelor and above)	Educational attainment, at least Bachelor's or equivalent, population 25+, total (in percent) (cumulative)	World Bank	x	
$educ_{lowsec}$	Education (Lower secondary and above)	Educational attainment, at least completed lower secondary, population 25+, total (in percent) (cumulative)	World Bank	x	
$educ_{postsec}$	Education (Post-secondary and above)	Educational attainment, at least completed post-secondary, population 25+, total (in percent) (cumulative)	World Bank	x	
$educ_{prim}$	Education (Primary and above)	Educational attainment, at least completed primary, population 25+ years, total (in percent) (cumulative)	World Bank	x	
$educ_{tert}$	Education (Tertiary and above)	Educational attainment, at least completed short-cycle tertiary, population 25+, total (in percent) (cumulative)	World Bank	x	
$educ_{upsec}$	Education (Upper secondary and above)	Educational attainment, at least completed upper secondary, population 25+ years, total (in percent) (cumulative)	World Bank	x	
$educ_{master}$	Education (Master and above)	Educational attainment, at least Master's or equivalent, population 25+, total (in percent) (cumulative)	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$educ_{doc}$	Education (Doctoral)	Educational attainment, Doctoral or equivalent, population 25+ years, total (in percent) (cumulative)	World Bank	x	
$educ_{prim,years}$	Duration of primary education	Primary education, duration (years)	World Bank	x	
$schoolenr_{preprim}$	Preprimary schooling	Ratio of total school enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education (preprimary), percent	World Bank	x	
$schoolenr_{prim,gr}$	Primary schooling (gross ratio)	Ratio of total school enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education (primary), percent	World Bank	x	
$schoolenr_{prim,net}$	Primary schooling (net ratio)	Ratio of children of official school age who are enrolled in school to the population of the corresponding official school age (primary), percent	World Bank	x	
$schoolenr_{sec,gr}$	Secondary schooling (gross ratio)	Ratio of total school enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education (secondary), percent	World Bank	x	x
$schoolenr_{sec,net}$	Secondary schooling (net ratio)	Ratio of children of official school age who are enrolled in school to the population of the corresponding official school age (secondary), percent	World Bank	x	
$schoolenr_{tert,gr}$	Tertiary schooling (gross ratio)	Ratio of total school enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education (tertiary), percent	World Bank	x	
$educ_{sec,years}$	Duration of secondary education	Secondary education, duration (years)	World Bank	x	
school	Average years of schooling	Average years of schooling, total	BL	x	
pschool	Average years of primary schooling	Average years of primary schooling	BL	x	
sschool	Average years of secondary schooling	Average years of secondary schooling	BL	x	x

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
trade	Trade volume	Sum of exports and imports, divided by GDP	World Bank, JST, OECD	x	x
exp	Exports	Exports of goods and services (constant 2015 USD)	World Bank	x	
imp	Imports	Imports of goods and services (constant 2015 USD)	World Bank	x	
fdi	Foreign direct invesment	Foreign direct investment, net (Balance of Payments, current USD)	World Bank	x	x
exr	Exchange rate	USD exchange rate (local currency / USD), period average	World Bank, JST, IMF	x	x
gfcap	Gross fixed capital formation	Gross fixed capital formation (current USD, in millions)	World Bank, OECD	x	x
$inv_{bankfin}$	Investment financed by banks	Investments financed by banks (percent)	World Bank	x	
iy_{jst}	Investment (GDP)	Investment-to-GDP ratio	JST	x	x
$govdebt_{gdp}$	Government debt (GDP)	General government gross debt (percent of GDP)	JST, IMF	x	
govdebt	Government debt	Central government debt, total (current local currency unit)	World Bank	x	
gov_{cexp}	Government consumption	General government final consumption expenditure	World Bank	x	
$fconsex_{gov,oecd}$	Final government consumption	Final government consumption expenditure, current prices, current exchange rates	OECD	x	x
$centgovdebt_{gdp}$	Central government debt (GDP)	Central government debt (GDP)	IMF	x	x
$ndebt_{gdp}$	Net debt (GDP)	Net debt (in percentage of GDP), as gross debt minus financial assets corresponding to debt instruments	IMF	x	
$revenue_{jst}$	Government revenue	Government revenue (nominal, local currency)	JST	x	
$gov_{rev,gdp}$	Government revenue (GDP)	Government revenue, percent of GDP	IMF	x	
$bond_{tr,jst}$	Government bond return	Government bond total return, nominal. r[t] = [[p[t] + coupon[t]] / p[t-1]] - 1	JST	x	
$bond_{rate,jst}$	Government bond rate	Gov. bond rate, rate[t] = coupon[t] / p[t-1], or yield to maturity at t	JST	x	
$expenditure_{jst}$	Government expenditure	Government expenditure (nominal, local currency)	JST	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$gov_{primexp,gdp}$	Government primary expenditure	Government primary expenditure, percent of GDP	IMF	x	
$gov_{exp,gdp}$	Government expenditure (GDP)	Government expenditure, percent of GDP	IMF	x	x
$gov_{primexp,socben}$	General government social expenditure	General government expense, social benefits, domestic currency	IMF	x	
$pgov_{lmp,gdp}$	Public labor market policy spending (GDP)	Public expenditure on labor market policies as percentage of GDP (total programmes)	OECD	x	
$soc_{pexp,gdp}$	Social public expenditure (GDP)	Social public expenditure, all branches, all programmes, in percentage of GDP	OECD	x	
homeowner	Home ownership ratio	Home owner, percentage of total population, percent	FRED, Eurostat, nat. offices	x	x
$hpnom_{jst}$	House prices	House prices (nominal index, 1990=100)	JST	x	
$housing_{tr,jst}$	Housing return	Housing total return, nominal. r[t] = [[p[t] + d[t]] / p[t-1]] - 1	JST	x	
$housing_{capgain,jst}$	Housing capital gain	Housing capital gain, nominal. cg[t] = [p[t] / p[t-1]] - 1	JST	x	
$housing_{rentrtn,jst}$	Housing rental return	Housing rental return. dp_rtn[t] = rent[t]/p[t-1]	JST	x	
$housing_{rentyd,jst}$	Housing rental yield	Housing rental yield. dp[t] = rent[t]/p[t]	JST	x	
rhousepr	Real house prices	Real house price index, seasonally adjusted, 2015 = 100	OECD	x	
nhousepr	Nominal house prices	Nominal house price index, seasonally adjusted, 2015 = 100	OECD	x	x
rentpr	Rent prices	Rent prices index, seasonally adjusted, 2015 = 100	OECD	x	
pr_rent_ratio	Price-rent-ratio	Price to rent ratio, index, 2015 = 100	OECD	x	
pr_inc_ratio	Price-income-ratio	Price to income ratio, index, 2015 = 100	OECD	x	x
labforce	Labor force	Annual labor force, total, in thousands	World Bank, OECD	x	
emp	Employment ratio	Employment to population ratio (15+, total, in percent)	World Bank, ILO	x	

Symbol	**Variable**	**Definition**	**Data source**	**Imputation data set**	**Reduced data set**
unemprate	Unemployment rate	Unemployment to total labor force (total, in percent)	World Bank, ILO, JST, IMF, OECD	x	x
$labforce_{rate}$	Labor force participation	Labor force participation rate, total (in percent of total population ages 15-64)	World Bank	x	
$emp_{parttime}$	Part-time employment	Part-time employment, all persons 25 to 54 years old, thousands	World Bank	x	x
$wage_{jst}$	Wages	Wages (index, 1990=100)	JST	x	
$wages_{annual,oecd}$	Wages	Average annual wages, 2021 constant prices at 2021 USD PPPs (in USD)	OECD	x	x
$emp_{tsd,oecd}$	Employment	Annual employment, persons, thousands	OECD	x	
$parttime_{oecd}$	Part-time employment	Part-time employment, all persons 25 to 54 years old, thousands	OECD	x	
$fulltime_{oecd}$	Full-time employment	Full-time employment, all persons 25 to 54 years old, thousands	OECD	x	
$workhour_{av}$	Annual hours worked	Average annual hours actually worked per worker	OECD	x	x
sip	Social insurance coverage	Coverage of social insurance programs (in percent of population)	World Bank	x	x
ssn	Social safety net coverage	Coverage of social safety net programs (in percent of population)	World Bank	x	
$unemp_{benefits}$	Unemployment benef. coverage	Coverage of unemployment benefits and active labor market programs (in percent of population)	World Bank	x	x
fert	Fertility rate	Fertility rate, total (births per woman)	World Bank	x	
$health_{oop}$	Out-of-pocket health exp.	Out-of-pocket health expenditure per capita, PPP (current international$)	World Bank	x	
$health_{oop,usd}$	Out-of-pocket health exp.	Out-of-pocket health expenditure per capita, PPP (current USD)	World Bank	x	
$health_{exp,pc}$	Out-of-pocket health exp. per capita	Current expenditure on health (total), per capita, current prices	OECD	x	x
$life_{exp}$	Life expectancy	Life expectancy, total population, at birth (years)	OECD	x	x
$found_{cost}$	Cost of starting a business	Cost of business start-up procedures (in percent of gross national income per capita)	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
edb_{rank}	Ease of doing business rank	Ease of doing business rank (1=most business-friendly regulations)	World Bank	x	
edb_{score}	Ease of doing business score	Ease of doing business score (0 = lowest performance to 100 = best performance)	World Bank	x	
$ecofree_{index}$	Economic freedom	Economic Freedom Summary Index (see subindices below)	Fraser institute	x	
propertyrights	Property rights	Score for protection of property rights	Fraser institute	x	
$contracts_{enforce}$	Enforcement of contracts	Score for legal enforcement of contracts	Fraser institute	x	
$legsys\_propr_{index}$	Legal system	Score for legal system and property rights	Fraser institute	x	
$tariffs_{index}$	Tariffs	Score for tariffs	Fraser institute	x	
$regtradebarr_{index}$	Regulatory trade barriers	Score for regulatory trade barriers	Fraser institute	x	
$finopen_{index}$	Financial openness	Score for financial openness	Fraser institute	x	
$capcontr_{index}$	Capital controls	Score for capital controls	Fraser institute	x	
$creditmarketreg_{index}$	Credit markt regulations	Score for credit market regulations	Fraser institute	x	x
hirereg_minwage	Hiring regulations	Score for hiring regulations and minimum wage	Fraser institute	x	x
hirefire_reg	Hiring and firing regul.	Score for hiring and firing regulations	Fraser institute	x	
centrcollbarg	Centralized collective bargaining	Score for centralized collective bargaining	Fraser institute	x	x
labmarket_reg	Labor market regulations	Score for labor market regulations	Fraser institute	x	
$admrequ_{index}$	Administrative requirements	Score for administrative requirements	Fraser institute	x	
$regburden_{index}$	Regulatory burden	Score for regulatory burden	Fraser institute	x	
$starbus_{index}$	Starting a business	Score for starting a business	Fraser institute	x	
$busreg_{index}$	Business regulations	Score for business regulations	Fraser institute	x	
rd_{gdp}	Research and development expenditure	Gross domestic expenditure on research and development, in percentage of GDP	World Bank, OECD	x	
$patent_{ges}$	Total patent applications	Patent applications, residents and non-residents	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
patent	Total patent applications	Number of patent applications filed under the Patent Cooperation Treaty (priority year), number	OECD	x	x
$berd_{gdp}$	Business research and development expenditure	Business expenditure on research and development, in percentage of GDP	OECD	x	
gsav	Gross domestic saving	Gross domestic saving (current USD)	World Bank	x	
sav_{fi}	Saves at financial institution	Saved at a financial institution (in percent, population of age 15+)	World Bank	x	
sav_{share}	Saves any money	Saved any money (in percent, population of age 15+)	World Bank	x	
$nsav_{oecd}$	Net saving	Saving, net, current prices, current exchange rates	OECD	x	
nhh	Household net saving rate	Household net saving to household disposable income, in percent	div.**	x	
gtot	Domestic gross saving rate	Gross domestic saving to gross national income, in percent	div.**	x	
ntot	Domestic net saving rate	Net domestic saving to gross national income, in percent	div.**	x	
ghh	Household gross saving rate	Household gross saving to household disposable income, in percent	div.**	x	x
gdsgdp	Gross domestic saving (GDP)	Gross domestic saving, in percentage of GDP	World Bank	x	x
$gnatdispinc_{oecd}$	Gross national disposable income	Gross national disposable income, current prices, current exchange rates	OECD	x	
$nnatdispinc_{oecd}$	Net national disposable income	Net national disposable income, current prices, current exchange rates	OECD	x	
cap_inc_{hh}	Capital income	Capital income (current prices), total population, domestic currency	OECD	x	x
$mdisp\_inc_{hh}$	Mean disposable income	Mean disposable income (current prices), total population, domestic currency	OECD	x	x
$meddisp\_inc_{hh}$	Median disposable income	Median disposable income (current prices), total population, domestic currency	OECD	x	
$cons_{hh}$	Household final con- sumption expenditure	Household and NPISHs final consumption expenditure (current USD)	World Bank	x	

** United Nations, AMECO, OECD, own calculations based on national statistcs agenies.

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$cons_{gdp}$	Final consumption expenditure	Final consumption expenditure (in percentage of GDP)	World Bank	x	x
cons	Final consumption expenditure	Final consumption expenditure (constant 2015 USD)	World Bank	x	
$rconsbarro_{jst}$	Real per capita consumption	Real consumption per capita (index, 2006=100)	JST	x	
cabalance	Current account balance	Current account balance (balance of Payments, current USD, in millions)	World Bank, JST, IMF, OECD	x	
$cabalance_{gdp}$	Current account balance	Current account balance, percent of GDP	IMF	x	x
FD	Financial development	Index of financial development, aggregate of financial institutions and financial markets index	IMF	x	x
FI	Financial institutions development	Relative ranking of countries on the depth, access, and efficiency of their financial institutions	IMF	x	x
FM	Financial markets development	Relative ranking of countries on the depth, access, and efficiency of their financial markets	IMF	x	x
FID	Financial institutions, depth	Compiles data on bank credit to the private sector in percent of GDP, pension fund assets to GDP, mutual fund as GDP, and insurance premiums, life and non-life to GDP	IMF	x	x
FIA	Financial institutions, access	Compiles data on bank branches per 100,000 adults and ATMs per 100,000 adults	IMF	x	x
FIE	Financial institutions, efficiency	Compiles data on banking sector net interest margin, lending-deposits spread, non-interest income to total in overhead costs to total assets, return on assets, and return on equity	IMF	x	x
FMD	Financial markets, depth	Compiles data on stock market capitalization to GDP, stocks traded to GDP, international debt securities of government to GDP, and total debt securities of financial and nonfinancial corporations to GDP	IMF	x	x

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
FMA	Financial markets, access	Compiles data on percent of market capitalization outside of top 10 largest companies and total number of issuers (domestic and external, nonfinancial and financial corporations) per 100,000 adults.	IMF	x	x
FME	Financial markets, efficiency	Compiles data on stock market turnover ratio (stocks traded to capitalization).	IMF	x	x
npl_{share}	Non-performing loans	Bank non-performing loans to total gross loans (in percent)	World Bank	x	
bcapassetratio	Bank capital to assets	Bank capital to total assets ratio (in percent)	World Bank, JST	x	
$pop_{finaccount}$	Financial account ownership	Account ownership at a financial institution or with a mobile-money-service provider (in percent of population ages 15+)	World Bank	x	
atm	ATMs	Automated teller machines (ATMs) (per 100,000 adults)	World Bank	x	
borrowers	Borrowers	Borrowers from commercial banks (per 1,000 adults)	World Bank	x	
lending	Commercial bank lending	Commercial banks and other lending (public and publicly guaranteed and private nonguaranteed) (net, current USD)	World Bank	x	
i_{paym}	Interest payment	Interest payments (current local currency unit)	World Bank	x	
bonds	Bond investment	Portfolio investment, bonds (public and publicly guaranteed and private nonguaranteed) (net, current USD)	World Bank	x	
$stocks_{gdp}$	Stocks traded	Stocks traded, total value (in percent of GDP)	World Bank	x	x
$stocks_{tor}$	Stocks turnover ratio	Stocks traded, turnover ratio of domestic shares, in percent	World Bank	x	
$bdebt_{jst}$	Corporate debt	Corporate debt (nominal, local currency)	JST	x	
ltd_{jst}	Loans-to-deposits ratio	Banks, loans-to-deposits ratio, in percent	JST	x	
$noncore_{jst}$	Noncore funding	Banks, noncore funding ratio, in percent	JST	x	
eq_tr_{jst}	Equity total return	Equity total return, nominal. r[t] = [[p[t] + d[t]] / p[t-1]] - 1	JST	x	
$eq\_capgain_{jst}$	Equity capital gain	Equity capital gain, nominal. cg[t] = [p[t] / p[t-1]] - 1	JST	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$eq\_div\_yd_{jst}$	Equity dividend yield	Equity dividend yield. dp[t] = dividend[t]/p[t]	JST	x	
$eq\_div\_rtn_{jst}$	Equity dividend return	Equity dividend return. dp_rtn[t] = dividend[t]/p[t-1]	JST	x	
$capital\_tr_{jst}$	Total return on wealth	Total return on wealth, nominal. Weighted average of housing, equity, bonds and bills	JST	x	
$risky\_tr_{jst}$	Total return on risky assets	Total return on risky assets, nominal. Weighted average of housing and equity	JST	x	
$safe\_tr_{jst}$	Total return on safe assets	Total return on safe assets, nominal. Equally weighted average of bonds and bills	JST	x	
baccount	Bank accounts	Bank accounts per 1,000 adults	World Bank	x	
bbranch	Bank branches	Bank branches per 100,000 adults	World Bank	x	
$firmshare_{cred}$	Firms with loan	Firms with a bank loan or line of credit, in percent	World Bank	x	
$smfirmshare_{cred}$	Small firms with loan	Small firms with a bank loan or line of credit, in percent	World Bank	x	
fiaccount	Financial institution account	Financial institution account, in percent of population with age 15+	World Bank	x	
$borr_{fi}$	Formal fin. institution borrowing	Borrowed from a formal financial institution, in percent of population with age 15+	World Bank	x	
$borr_{business}$	Borrowing for business	Borrowed to start, operate, or expand a farm or business, in percent of population with age 15+	World Bank	x	
govtransf	Government transfer on fi. account	Received government transfer into a financial institution account, in percent of population with age 15+	World Bank	x	
domremitt	Domestic remittances on fi. account	Received domestic remittances into an account, in percent of population with age 15+	World Bank	x	
$wage_{fiacc}$	Wages on fi. account	Received wages into a financial institution account, in percent of population with age 15+	World Bank	x	
$borr_{share}$	Borrowed money	Borrowed any money, in percent of population with age 15+	World Bank	x	
$loan_{privlend}$	Private lender credit	Loan from a private lender in the past year, in percent of population with age 15+	World Bank	x	
$loan_{employer}$	Employer credit	Loan from an employer in the past year, in percent of population with age 15+	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
buy_{credit}	Consumer credit	Borrowed from a store by buying on credit, in percent of population with age 15+	World Bank	x	
fam_{credit}	Family credit	Borrowed from family or friends, in percent of population with age 15+	World Bank	x	
$checks_{paym}$	Checks for payment	Used checks to make payments, in percent of population with age 15+	World Bank	x	
creditcard	Credit card ownership	Owns a credit card, in percent of population with age 15+	World Bank	x	
debitcard	Debit card ownership	Owns a debit card, in percent of population with age 15+	World Bank	x	
digitalpay	Digital payment	Made a digital payment, in percent of population with age 15+	World Bank	x	
$banks_{invfin}$	Firm investment through banks	Firms using banks to finance investments, in percent	World Bank	x	
$banks_{wcfin}$	Working cap. finance through banks	Firms using banks to finance working capital, in percent	World Bank	x	
$need_{collateral}$	Collateral for loan	Loans requiring collateral, in percent	World Bank	x	
$value_{collateral}$	Value of collateral for loan	Value of collateral needed for a loan, in percent of loan amount	World Bank	x	x
$firms_{loanrej}$	Loan application rejected	Firms whose recent loan application was rejected, in percent	World Bank	x	
$wc_{bankfin}$	Working cap. finance through banks	Working capital financed by banks, in percent	World Bank	x	
$fin_{constraint}$	Finance constraint	Firms identifying access to finance as a major constraint, in percent	World Bank	x	x
$valuetraded_{tot,excl10}$	Value traded	Value traded excluding top 10 traded companies to total value traded, in percent	World Bank	x	
$marketcap_{tot,excl10}$	Market capitalization	Market capitalization excluding top 10 companies to total market capitalization, in percent	World Bank	x	
$nfcorpbonds_{tot}$	Nonfinanc. corporate bonds	Nonfinancial corporate bonds to total bonds and notes outstanding, in percent	World Bank	x	
$privcred_{depbanks,gdp}$	Deposit money bank credit	Private credit by deposit money banks to GDP, in percent	World Bank	x	

Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$assets_{depbanks,gdp}$	Deposit money bank assets	Deposit money banks' assets to GDP, in percent	World Bank	x	
$assets_{nfinst,gdp}$	Nonbank fin. inst. assets	Nonbank financial institutions' assets to GDP, in percent	World Bank	x	
$lliab_{gdp}$	Liquid liabilities	Liquid liabilities to GDP, in percent	World Bank	x	
$assets_{cb,gdp}$	Central bank assets	Central bank assets to GDP, in percent	World Bank	x	
$deposits_{finsys,gdp}$	Financial system deposits	Financial system deposits to GDP, in percent	World Bank	x	
$assets_{pensfund,gdp}$	Pension fund assets	Pension fund assets to GDP, in percent	World Bank	x	
$stockmarketcap_{gdp}$	Stock market capitalization	Stock market capitalization to GDP, in percent	World Bank	x	x
$corpbond_{gdp}$	Corporate bond issuance	Corporate bond issuance volume to GDP, in percent	World Bank	x	
$corpbond_{matur}$	Corporate bond maturity	Corporate bond average maturity (years)	World Bank	x	
$bank_{margin}$	Net interest margin	Bank net interest margin, in percent	World Bank	x	
$bank\_inc_{nonint}$	Noninterest income of banks	Bank noninterest income to total income, in percent	World Bank	x	
$bank_{roa}$	Return on assets of banks	Bank return on assets, in percent, after tax	World Bank	x	
$bank_{roe}$	Return on equity of banks	Bank return on equity, in percent, after tax	World Bank	x	
$bank_{cost,income}$	Cost to income ratio of banks	Bank cost to income ratio, in percent	World Bank	x	
$bank_{roa,gross}$	Return on assets of banks	Bank return on assets, in percent, before tax	World Bank	x	
$bank_{roe,gross}$	Return on equity of banks	Bank return on equity, in percent, before tax	World Bank	x	
$bank_{zscore}$	Bank Z-score	Bank Z-score	World Bank	x	
$bank_{creditdeposit}$	Credit to bank deposits	Bank credit to bank deposits, in percent	World Bank	x	
$stock_{pricevolat}$	Stock price volatility	Stock price volatility	World Bank	x	x
$bank_{concentr}$	Bank concentration	Bank concentration, in percent	World Bank	x	x

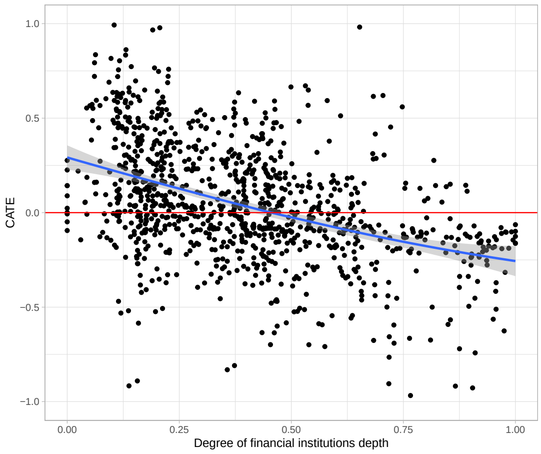
Symbol	Variable	Definition	Data source	Imputation data set	Reduced data set
$bank\_dep_{gdp}$	Bank deposits	Bank deposits to GDP, in percent	World Bank	x	
liquliab	Liquid liabilities	Liquid liabilities in millions USD, 2010 constant	World Bank	x	
listcomp	Listed companies	Number of listed companies per 1,000,000 people	World Bank	x	
$return_{stockmarket}$	Stock market return	Stock market return, in percent, year-on-year	World Bank	x	x
$deposits_{banks}$	Banking inst. deposits	Deposits of banking institutions, non-standardized, domestic currency	IMF	x	
$assets_{banks}$	Assets of banking institutions	Total assets of banking institutions, non-standardized, domestic currency	IMF	x	
share_prices	Share prices	Share prices (end of month)	IMF	x	
$share\_prices_{oecd}$	Share prices	Share prices, index, 2015 = 100	OECD	x	x
portfinv	Portfolio investment	Portfolio investment, net (balance of payments, current USD)	World Bank	x	
brmoney	Broad money	Broad money (current local currency units, in millions)	World Bank	x	
$money_{jst}$	Narrow money	Narrow money (nominal, local currency)	JST	x	
$broadmoney_{dom}$	Broad money	Broad money (nominal, local currency)	IMF	x	
$m3_{oecd}$	Base money	Base money, domestic currency	OECD	x	
$narrowm_{jst}$	Broad money	Broad money, domestic currency	JST	x	
$basemoney_{dom}$	Narrow money	Narrow money (M1), seasonally adjusted, index, 2015 = 100	IMF	x	
$m1_{oecd}$	Broad money	Broad money (M3), seasonally adjusted, index, 2015 = 100	OECD	x	
m1	Money supply M1	Money Supply M2, standardized, current prices, seasonally adjusted, in USD	EIKON	x	
m2	Money supply M1	Money Supply M1, standardized, current prices, seasonally adjusted, in USD	EIKON	x	
m3	Money supply M2	Money Supply M3, standardized, current prices, seasonally adjusted, in USD	EIKON	x	

Table 104: Descriptive feature variables, definitions and data sources.

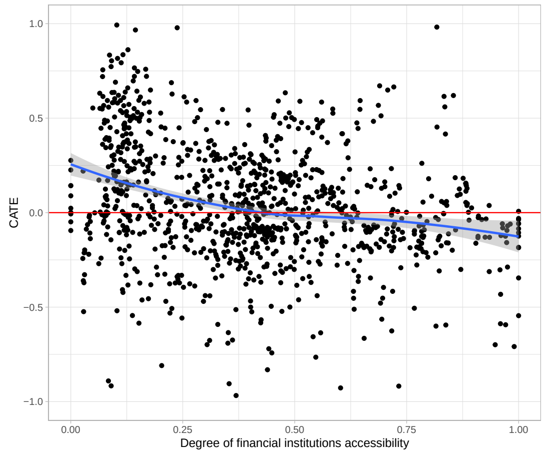
Database abbreviations: Bank for International Settlements (**BIS**), Barro-Lee Educational Attainment Data (**BL**), Eikon Financial Analysis & Trading Software (**EIKON**), European Statistical Office (**Eurostat**), Federal Reserve Economic Data (**FRED**), International Labour Organization (**ILO**), International Monetary Fund (**IMF**), Jordà-Schularick-Taylor Macrohistory Database (**JST**), Organisation for Economic Co-operation and Development (**OECD**), Standardized World Income Inequality Database (**SWIID**), United Nations (**UN**), World Inequality Database (**WID**).

A.3.2 Conditional average treatment effects

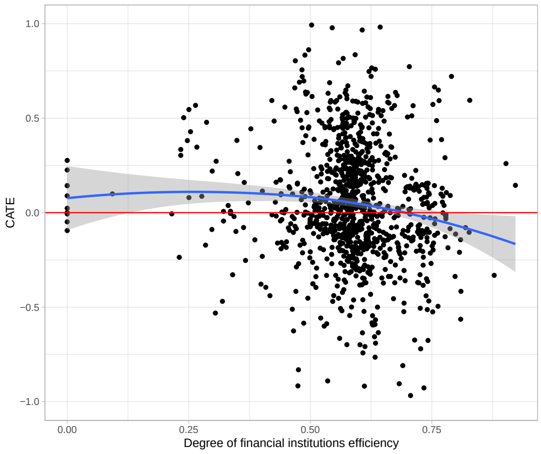
A.3.2.1 Financial institutions and financial markets development



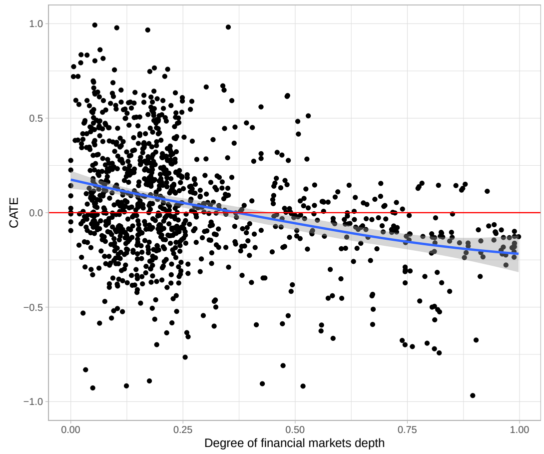
(a) CATE by financial institutions depth.



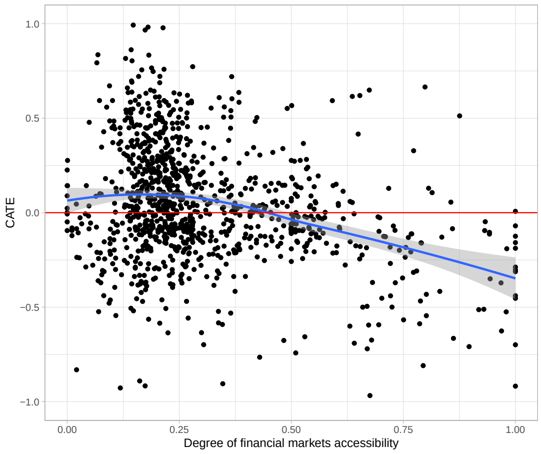
(b) CATE by financial institutions accessibility.



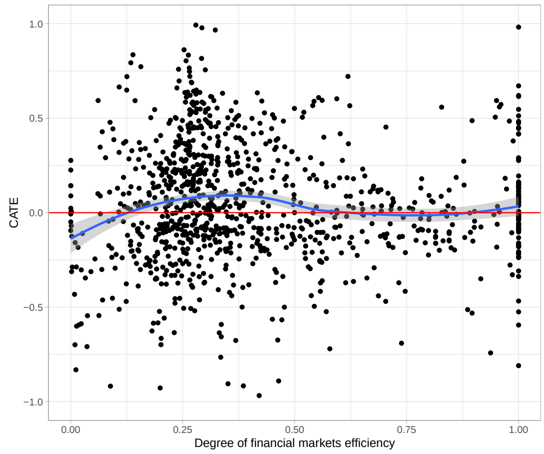
(c) CATE by financial institutions efficiency.



(d) CATE by financial markets depth.



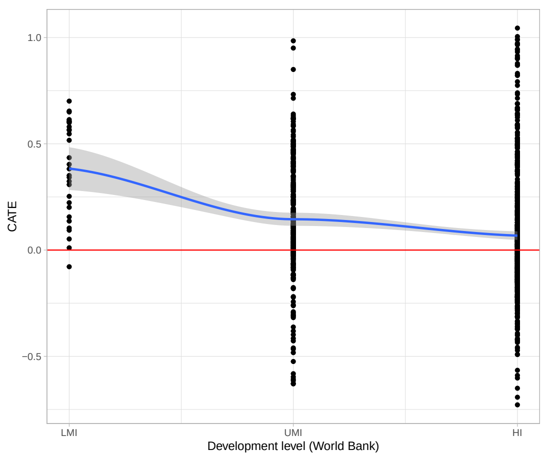
(e) CATE by financial markets accessibility.



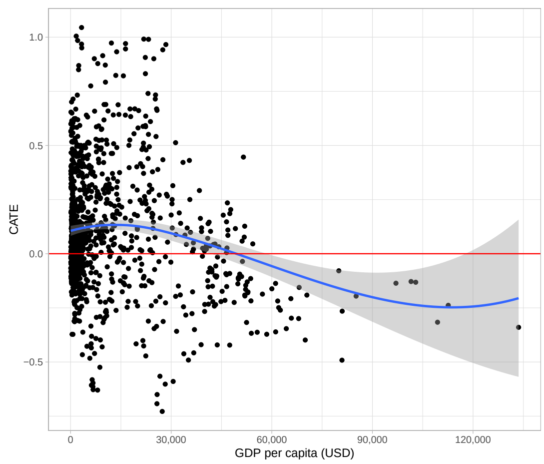
(f) CATE by financial markets efficiency.

Figure 50: Conditional average treatment effects (CATE) by financial development of financial institutions and financial markets, by sub-indices, based on *causalForest*.

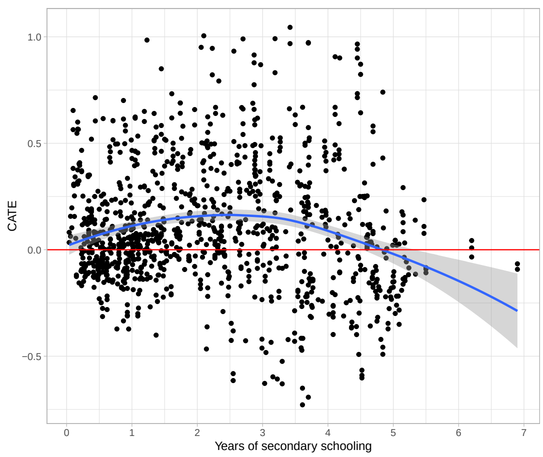
A.3.2.2 Robustness check: Effect of household credit to GDP on wealth inequality (CATEs)



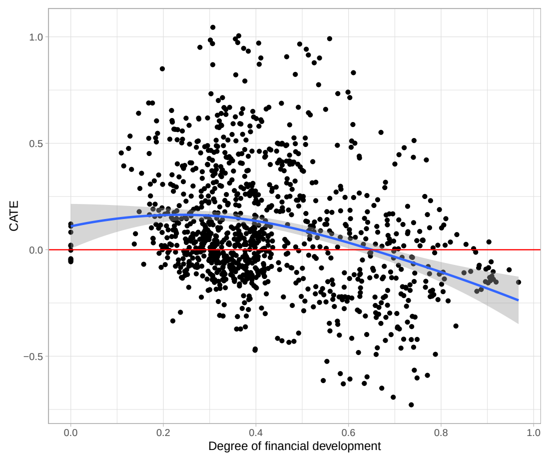
(a) CATE by development level.



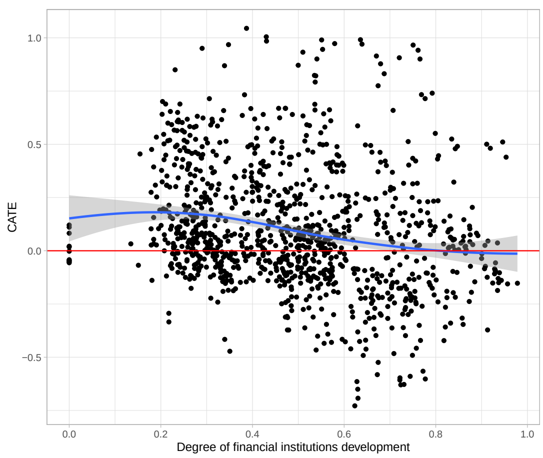
(b) CATE by GDP per capita.



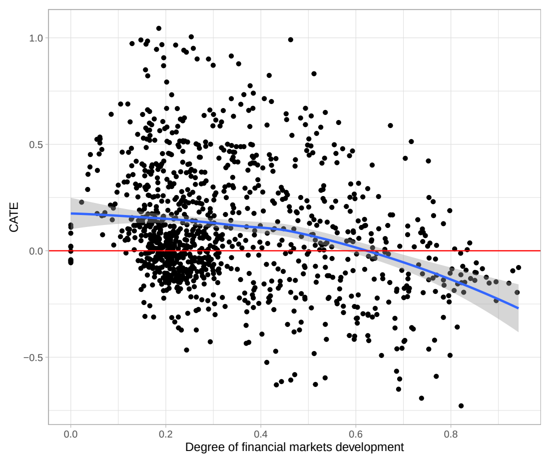
(c) CATE by years of secondary schooling.



(d) CATE by degree of fin. development.

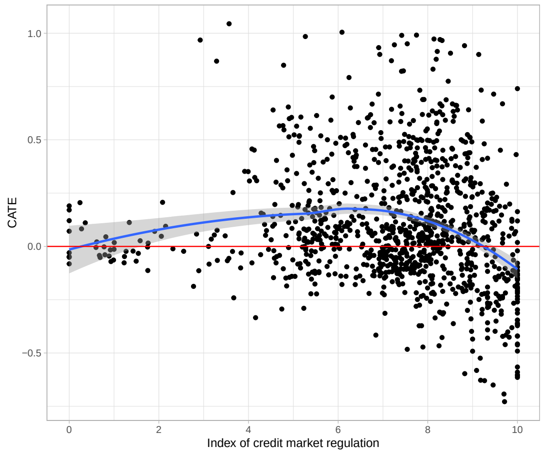


(e) CATE by fin. institutions development.

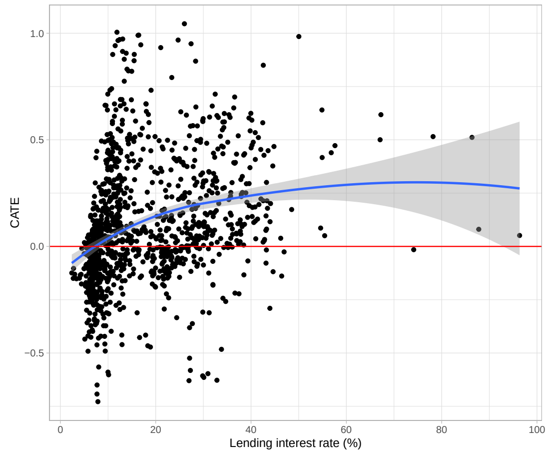


(f) CATE by fin. markets development.

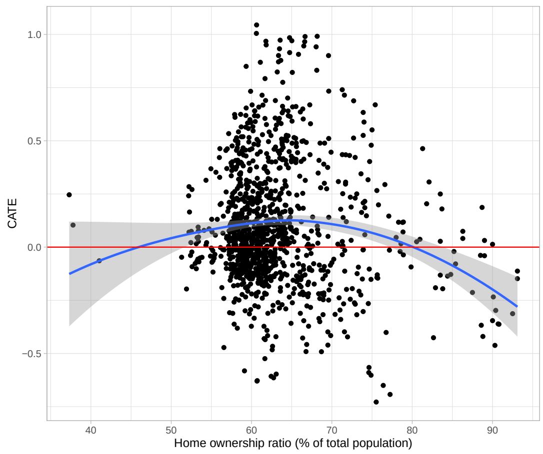
Figure 51: Conditional average treatment effects (CATE) for the relationship between household credit to GDP and the Gini coefficient of wealth, based on *causalForest*.



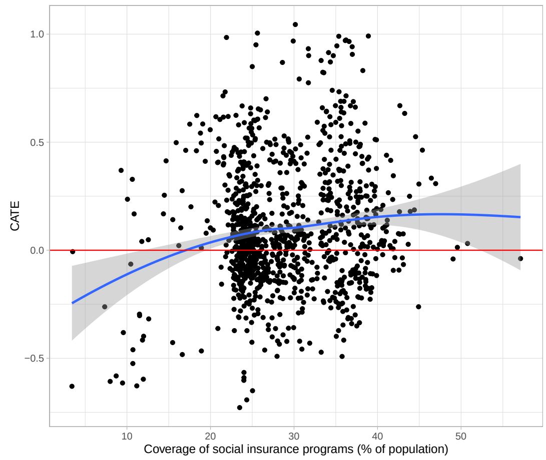
(g) CATE by index of credit market regulation.



(h) CATE by lending interest rate.



(i) CATE by home ownership ratio.



(j) CATE by coverage of social insurance programs.

Figure 51: Conditional average treatment effects (CATE) for the relationship between household credit to GDP and the Gini coefficient of wealth, based on *causalForest*.