Capital Flows and Financial Stability in Emerging Markets: the Role of U.S. Monetary Policy

DISSERTATION

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Zusammenfassung

Die vorliegende Dissertation beschäftigt sich mit den Triebkräften der internationalen Kapitalströme in Schwellenländer sowie den Determinanten von Krisen in Schwellenländern. Besonderes Augenmerk liegt dabei auf der Rolle der Geldpolitik in den USA.

Kapitel 1 nimmt eine Bestandsaufnahme der umfangreichen empirischen Literatur zu den Triebkräften von Kapitalströmen in Schwellenländer vor. Die empirische Evidenz hinsichtlich dieser Triebkräfte ist entlang mehrer Dimensionen strukturiert. So werden die Triebkräfte entsprechend des etablierten Paradigmas eingeordnet, nachdem zwischen externen Faktoren (z.B. US-Geldpolitik) und internen Faktoren (z.B. Wachstum in Schwellenländern) unterschieden wird (Calvo et al. 1993). Eine umfassende Auswertung der empirischen Literatur zeigt, dass externe Faktoren Portfolioinvestitionen am meisten beeinflussen, gefolgt von Zuflüssen von Banken. Für Direktinvestitionen hingegen ist die empirische Evidenz hinsichtlich einer Reihe externer Faktoren nicht eindeutig. Interne Faktoren sind für alle drei Arten von Kapitalströmen von erheblicher Bedeutung, insbesondere für Zuflüsse von Banken. Darüber hinaus unterscheidet die vorliegende Studie zwischen zyklischen und strukturellen Faktoren, die Kapitalströme beeinflussen. Eine historische Analyse deutet darauf hin, dass die Literatur die Bedeutung von zyklischen Faktoren zulasten längerfristiger struktureller Trends überbewertet hat.

Kapitel 2 nimmt eine empirische Analyse der Triebkräfte von Portfolioinvestitionen in Schwellenländern vor, mit besonderem Fokus auf die Rolle der Geldpolitik der US-Zentralbank. Dabei werden zwei unterschiedliche Datensätze zu hochfrequenten Portfolioinvestitionen mit Hilfe eines Zeitreihenmodells analysiert. Die empirische Analyse zeigt, dass Portfolioinvestitionen erheblich vom Überraschungsmoment der US-Geldpolitik getrieben werden. Wenn Marktteilnehmer ihre Erwartungen bezüglich des künftigen Pfades der Leitzinsen verändern, dann hat dies direkte Auswirkungen auf das Verhalten von Portfolio-Kapitalströmen. Eine Verschiebung der erwarteten Leitzinsen nach unten [nach oben] erhöht [vermindert] die Portfoliozuflüsse in Schwellenländer. Dieses Ergebnis legt eine neue Interpretation der Rolle der US-Geldpolitik nahe. In der gegenwärtigen Literatur besteht die zentrale Überzeugung hinsichtlich der Rolle der US-Geldpolitik darin, dass sich eine Erhöhung der Leitzinsen negativ auf Kapitalflüsse in Schwellenländer auswirkt, unabhängig davon wie schnell die Leitzinsen erhöht werden (z.B. Fernandez-Arias 1996). Die Ergebnisse der vorliegenden Arbeit hingegen deuten darauf hin, dass eine Straffung der US-Geldpolitik sich nicht notwendigerweise negativ auf Portfolioinvestitionen auswirkt. Negative Effekte bleiben insbesondere

dann aus, wenn eine Zinserhöhung von den Marktteilnehmern bereits erwartetet und somit eingepreist war. Eine Erhöhung der Leitzinsen kann sogar mit positiven Effekten auf Kapitalströme einhergehen, nämlich dann, wenn sie von einer Abwärtsbewegung im erwarteten Pfad der Leitzinsen begleitet ist (zum Beispiel weil die Zentralbank signalisiert, dass weitere Zinserhöhungen nicht zu erwarten sind). Umgekehrt kann die US-Geldpolitik Portfolioinvestitionen auch ohne eine Erhöhung der Leitzinsen beeinträchtigen, nämlich dann, wenn Marktteilnehmer ihre Erwartungen hinsichtlich der künftigen Leitzinsen nach oben revidieren.

Kapitel 3 untersucht die Rolle der US-Geldpolitik hinsichtlich ihres Einflusses auf das Auftreten von Krisen in Schwellenländern. Es werden ein negativ-binomisches Zählmodell und ein Panel-Logitmodell ökonometrisch geschätzt, um die Determinanten von Währungskrisen, Bankenkrisen und Staatsbankrotten in 27 Schwellenländern zu analysieren. Die Schätzergebnisse deuten darauf hin, dass die Wahrscheinlichkeit von Krisen wesentlich höher ist, (1) wenn die US-Leitzinsen über ihrem natürlichen Niveau liegen, (2) während Zinsanhebungszyklen, und (3) wenn Marktteilnehmer von Signalen überrascht werden, dass die US-Zentralbank die Leitzinsen schneller als erwartet anheben wird. Diese Ergebnisse stehen im Gegensatz zur bestehenden Literatur, die interne Faktoren in Schwellenländern als die dominante Ursache von Krisen ansieht (z.B. Gourinchas und Obstfeld 2012). Die Ergebnisse dieser Studie weisen auch auf ein erhöhtes Risiko von Krisen in Schwellenländern in den kommenden Jahren hin, wenn die US-Zentralbank wie erwartet die Leitzinsen weiterhin graduell anheben wird.

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Contents

List of Figures

List of Tables

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Introduction and Summary

The past three decades have witnessed the unprecedented rise of emerging markets (EMs) in the global economy. Remarkable improvements in standards of living in many EMs have been supported by the deepening of local capital markets and greater openness to international capital flows, resulting in the growing integration of EMs into global financial markets (Kose et al. 2009). But financial integration has not been without costs. Increased reliance on global capital markets has also exposed emerging market economies to reversals of foreign capital flows and has made EMs more vulnerable to periods of financial instability and crises (Prasad et al. 2005).

This dissertation contributes to two separate but related strands in the literature on international finance in emerging markets: first, the literature on the determinants of capital flows to emerging markets, and second, the literature on the determinants of emerging market crises. In both strands, the determinants can be classified into two broad categories, namely domestic and external factors (see, for example, Calvo et al. (1993) for capital flows and Eichengreen and Rose (1998) for crises). Domestic determinants include factors such as macroeconomic fundamentals, country risk, and the quality of institutions, while external determinants relate to factors like monetary policy in advanced economies and risk appetite among global investors. This dissertation focuses particularly on an external factor: the role of U.S. monetary policy.

One contribution of this dissertation is to reappraise the importance of U.S. monetary policy in affecting capital flows and financial stability in emerging markets. In the capital flows literature, the role of external factors, including U.S. monetary policy, is well-recognized (e.g., Lopez-Mejia 1999), but in the crisis literature external factors play only a secondary role, as domestic vulnerabilities are generally viewed to be the dominant source of financial instability in EMs (e.g., Gourinchas and Obstfeld 2012). This contrast is surprising, given that capital flows dynamics and the incidence of crises are closely linked, as emphasized in recent studies such as Ghosh et al. (2016). Indeed, the empirical results presented in this dissertation suggest that U.S. monetary policy plays an important role in determining both capital flows and the incidence of crises in emerging markets. The findings suggest that the crisis literature neglects the role of external factors when attempting to explain the causes of financial instability in emerging markets.

This dissertation also contributes to the literature by providing empirical evidence on the specific aspects of U.S. monetary policy that matter for capital flows and financial stability in emerging markets. One guiding theme is the role of investor expectations about the future path of monetary policy. Recent advances in the literature on monetary policy transmission to the domestic economy

highlight the forward-looking nature of monetary policy in general and the role of shifts in investor expectations of future policy interest rates in particular. A number of recent studies emphasize that changes in expectations for future policy settings impact asset markets today and thus facilitate the transmission of monetary policy to the real economy (e.g., Hamilton 2008; Gertler and Karadi 2014). One contribution of this dissertation is to bring the monetary policy expectations framework to the literatures on the determinants of EM capital flows and crises. The empirical findings provide strong support for the notion that monetary policy surprises have a major influence on both capital flows and the incidence of crises in emerging markets.

The pivotal role of U.S. monetary policy is particularly relevant at the current juncture where the Federal Reserve is expected to continue raising interest rates gradually in the years ahead, which may make external financing conditions more challenging in emerging markets. From a policy perspective, the findings of this study highlight the need for policymakers in emerging markets to monitor and respond to changing conditions in the external environment. Policymakers need to be ready to lean against the wind in the face of external shocks, making use of prudent monetary, fiscal and exchange rate policies to safeguard domestic financial stability. For example, EM central banks should maintain ample reserve buffers to stabilize the exchange rate if needed, and governments should avoid excessive borrowing from foreign creditors, particularly in foreign currency. Moreover, the findings of this dissertation serve to highlight the importance of effective Fed communication regarding its policy intentions. Clear signaling by the Fed regarding the likely course of monetary policy can serve as an anchor for investor expectations about the path for short-term interest rates, helping to avoid excessive volatility and stress on financial markets.

The dissertation consists of three chapters, each of which is self-contained and can be read independently without any loss of context. As a result, there is some overlap between the chapters in terms of explanations of important key concepts and related literature.

Chapter 1 is a survey of the voluminous empirical literature on the drivers of capital flows to emerging markets. The contribution of the survey is to provide a comprehensive assessment of what we can say with relative confidence about the empirical drivers of EM capital flows. The evidence is structured based on the recognition that the drivers of capital flows vary over time and across different types of capital flows. The drivers are classified using the traditional framework for external and domestic factors (often referred to as "push versus pull" drivers), which is augmented by a distinction between cyclical and structural factors. Push factors are found to matter most for portfolio flows, somewhat less for banking flows, and least for foreign direct investment (FDI). Pull factors matter for all three components, but most for banking flows. A historical perspective suggests that

the recent literature may have overemphasized the importance of cyclical factors at the expense of longer-term structural trends.

Chapter 2 undertakes an empirical analysis of the drivers of portfolio flows to emerging markets, focusing on the role of Fed policy. A time series model is estimated to analyze two different concepts of high-frequency portfolio flows, including monthly data on flows into investment funds and a novel dataset on monthly portfolio flows obtained from individual national sources. The evidence presented in this chapter suggests a more nuanced interpretation of the role of U.S. monetary policy. In the existing literature, it is traditionally argued that Fed policy tightening is unambiguously negative for capital flows to emerging markets. By contrast, the findings presented in this dissertation suggest that it is the surprise element of monetary policy that affects EM portfolio inflows. A shift in market expectations towards easier future U.S. monetary policy leads to greater foreign portfolio inflows and vice versa. Given current market expectations of sustained increases in the federal funds rate in coming years, EM portfolio flows could be boosted by a slower pace of Fed tightening than currently expected or could be reduced by a faster pace of Fed tightening.

Chapter 3 examines the role of U.S. monetary policy in determining the incidence of emerging market crises. A negative binomial count model and a panel logit model are estimated to analyze the determinants of currency crises, banking crises, and sovereign defaults in a group of 27 emerging economies. The estimation results suggest that the probability of crises is substantially higher (1) when the federal funds rate is above its natural level, (2) during Fed policy tightening cycles, and (3) when market participants are surprised by signals that the Fed will tighten policy faster than previously expected. These findings contrast with the existing literature, which generally views domestic factors as the dominant determinants of emerging market crises. The findings also point to a heightened risk of emerging market crises in the coming years if the Fed continues to tighten monetary policy.

Chapter 1

What Drives Capital Flows to Emerging Markets? A Survey of the Empirical Literature[1]

1.1. Introduction

International capital flows play a central role in the global economy. They are closely tied to countries' economic and financial conditions, impact macroeconomic policymaking, and bring a range of benefits and risks to recipient countries. While in absolute terms, most capital flows are between advanced economies, their importance for financial stability is greatest for emerging markets (EMs), which are particularly exposed to swings in the availability of foreign capital (Obstfeld 2012). Understanding the drivers of capital flows to EMs thus is important for the purpose of macroeconomic policy making, which is reflected in the significant scholarly interest the topic has attracted over time.

The seminal work by Calvo, Leiderman and Reinhart (1993) and Fernandez-Arias (1996) introduced the distinction between country-specific "pull" factors and external "push" factors, providing the analytical framework for much of the empirical analysis since the early 1990s. The push-pull framework has also proven useful for explaining the behavior of capital flows during and after the global financial crisis, which began in the United States, but quickly saw extensive spillovers to emerging markets, reviving the academic debate on the importance of external developments for EM capital inflows. The recent literature interprets the sharp retrenchment in foreign capital flows during the crisis primarily as the result of a powerful "push shock" in global risk aversion that prompted global investors to unwind their EM positions (Milesi-Ferretti and Tille 2011). After the crisis, the focus in the literature shifted to another external factor, namely the impact of expansionary monetary policies in mature economies on EM capital flows – the very issue that was at the heart of Calvo, Leiderman and Reinhart's 1993 paper.

This survey takes stock of the empirical evidence on the drivers of capital flows to emerging markets by reviewing the sprawling research produced since the global financial crisis while also considering the extensive findings of the earlier literature. The contribution of this survey is to provide a comprehensive assessment of what we can say with relative confidence about the empirical drivers

[1] This chapter was published as Koepke (2015a).

of EM capital flows. The literature makes use of a wide variety of concepts to measure and analyze capital flows, which means that it is critical to structure the wealth of empirical findings systematically. In this survey, the empirical evidence is organized along three dimensions: the time dimension (reviewing the historical evolution of the literature), the dependent variables (providing a taxonomy for the different types of capital flows), and the independent variables (evaluating the prevailing framework for the drivers of capital flows). Building on this structure, a qualitative meta-analysis is conducted for the key push and pull drivers of each of the major capital flows components.

First, the historical overview sheds light on how evolving economic conditions have shaped the focus of the literature over time. For example, external factors have tended to receive particular attention during the early part of U.S. economic expansions, when interest rates are typically low and concerns about spillovers from Fed tightening are greatest (notably in the early 1990s, the early 2000s, and the extended low-interest period since 2009). By contrast, in the later stage of U.S. economic expansions, the focus has tended to shift to EM country-specific factors that attract capital flows and structural forces affecting EM capital flows. A pertinent example is the period of the late 1990s, when secular forces like the rise of institutional investors and innovations in information and communication technology received significant attention (e.g., World Bank 1997; Lopez-Mejia 1999). Since cyclical and structural forces are typically analyzed separately rather than in an integrated framework, there is a risk that the importance of structural forces for capital flows may be understated during periods like the present time, when U.S. interest rates are low and policy concerns are dominated by near-term cyclical developments.

Second, the empirical evidence is structured according to the different concepts and measures of capital flows that are used in the literature. This distinction is important because the drivers of capital flows differ crucially depending on the specific concepts and data that are analyzed. For example, it is important to differentiate between capital inflows to an emerging market by non-residents and outward investment by the residents of an emerging market. For the most part, this survey focuses on non-resident capital flows to emerging markets (see pages 16-18). The drivers of capital flows also vary across components (like portfolio flows, FDI, and banking flows), differ between institutional and retail investors, and depend on the currency denomination and maturity of instruments, among other factors. Moreover, it is important to distinguish between data that directly measure international capital flows as defined in the standard balance of payments (BoP) framework from data that serve as an approximation to BoP capital flows, such as data on flows into investment funds and BIS data on cross-border bank claims.

Third, this survey discusses the explanatory power of the prevailing "push vs. pull" framework, which distinguishes between external and domestic factors driving capital flows to emerging markets. The push-pull dichotomy provides a simple and intuitive classification of capital flows drivers, but it certainly has its limitations. For example, contagion effects and other forces related to investor behavior are difficult to classify as being either country-specific or external in nature. In addition, some studies have challenged the push-pull framework by asserting that rather than looking at emerging and advanced economy developments separately, the focus should be on differentials between EM and advanced economy variables (such as interest rate differentials and growth differentials; see, for example, Ahmed and Zlate 2013; Herrmann and Mihaljek 2013). A comprehensive review of the literature suggests otherwise, however. Most empirical research concludes that emerging and advanced economy effects on EM capital inflows differ in magnitude and statistical significance, and sometimes even work in the same direction (as in the case of real GDP growth in mature economies, for which there is evidence that faster growth tends to support certain types of EM capital inflows). Therefore, it would be misleading to focus on differentials between emerging and advanced economy variables. **Overall, this survey concludes that while there are clearly limitations to the push-pull dichotomy, it still offers a very helpful analytical framework.**

Building on this framework, I conduct a qualitative meta-analysis for the evidence on the key cyclical drivers of the major components of capital flows. The results from over 40 empirical studies are summarized in Figure 1.1, which is a simplified version of Figure 1.8 on page 26. **Push factors are found to matter most for portfolio flows, somewhat less for banking flows, and least for FDI.** Specifically, there is evidence that increased global risk aversion has a strong adverse effect on portfolio and banking flows, but not on FDI. In addition, there is strong evidence that lower interest rates in mature economies push portfolio capital to emerging markets, especially into bond markets. There is also some evidence for such an effect for banking flows, while results for FDI flows are mixed. **Pull factors are found to matter for all three components, but most for banking flows.** Domestic output growth is the determinant that is most consistently found to show a strong and statistically robust relationship with the four types of capital flows. Greater country risk also appears to reduce all types of capital flows considered, although the evidence is not as robust and there are some exceptions for those country risk measures that imply increased financing needs, such as a widening current account deficit. Local asset returns seem to attract banking flows the most, followed by portfolio investment, while the evidence is mixed for FDI.

Figure 1.1: Drivers of EM Capital Flows by Major Component

Type	Driver	Portfolio Equity	Portfolio Debt	Banking Flows	FDI
Push	Global risk aversion	−	−	−	?
	Mature economy interest rates	−	−	–	?
	Mature economy output growth	+	+	?	?
Pull	Domestic output growth	+	+	+	+
	Asset return indicators	+	+	+	?
	Country risk indicators	–	–	−	–

+	Strong evidence for positive relationship
+	Some evidence for positive relationship
?	Mixed evidence, no clear relationship
–	Some evidence for negative relationship
−	Strong evidence for negative relationship

Notes: The matrix summarizes the available evidence on the role of push and pull factors for the major capital flows components. For example, the red cell in the top left corner of the matrix indicates that there is strong evidence that an increase in global risk aversion leads to a reduction in portfolio equity flows to emerging markets. This figure is a simplified version of Figure 1.8 on page 26.

Source: author's illustration.

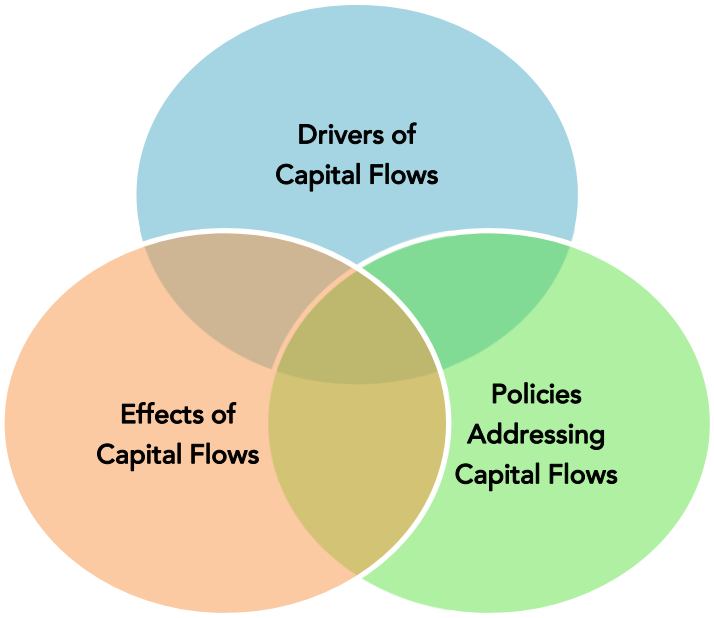
The rest of this chapter is structured as follows. Section 1.2 puts the scope of this survey into the broader context of the literature on EM capital flows. Section 1.3 discusses the theoretical rationale for the existence of international capital flows. Section 1.4 reviews the historical evolution of the literature on the drivers of EM capital flows. Section 1.5 provides a classification of the different concepts of capital flows that are commonly analyzed. Section 1.6 discusses the "push-pull" framework for capital flows drivers. Section 1.7 looks in detail at the drivers of the major components of capital flows. Section 1.8 reviews the main conclusions and provides guidance for future research.

1.2. Relationship between Surveyed Literature and other Literature Strands

The literature on international capital flows is voluminous, reflecting the central role of international capital flows in the global economy. **In order to situate the present survey in the broader context of the capital flows literature, it is useful to divide that literature into three broad categories (Figure 1.2): the causes, effects, and policy implications of capital flows.** The first area on the causes (or "drivers") of capital flows examines the various factors that affect the volume, composition, and dynamic behavior of capital flows to EM economies. This is the focus of the present survey. The

second area of research is primarily concerned with the economic impact of capital flows on recipient countries, including the potential benefits of capital flows (such as higher investment and growth) as well as the potential costs in terms of financial stability and risks associated with capital flows reversals (surveys on the costs and benefits of capital flows include Prasad et al. 2003 and Henry 2007). The third area considers a wide range of policy issues, including macroeconomic and macroprudential policy responses to capital inflow surges, policy prescriptions for capital account liberalization and for the use of capital controls, optimal reserve policies and the choice of exchange rate regimes (some surveys include Dooley 1995, BIS 2009, Ostry et al. 2010, and Alistair 2014).

Figure 1.2: Stylized Illustration of the Major Literature Strands on EM Capital Flows



Source: author's illustration.

To the extent possible, I will avoid discussions on the latter two areas of research and instead refer to existing surveys. The transition between the three areas is fluid, however, and some aspects pertaining to the capital flows behavior, consequences and policies have an important bearing on the drivers of capital flows. For example, some authors have examined how policy measures such as capital controls affect the subsequent volume and composition of capital inflows (e.g., Montiel and Reinhart 1999; Forbes et al. 2012). Conversely, the literature on the drivers of capital flows has important implications for the other two areas of research. For example, the appropriate policy response to a capital inflows surge may depend on whether flows are driven by external or domestic factors (Calvo et al. 1993). Similarly, the long-term economic impact of capital flows on the recipient economy is likely to differ depending on whether inflows are primarily cyclical or structural in nature (Prasad et al. 2003).

1.3. Theoretical Context

Before delving into the empirical determinants of EM capital inflows, it is helpful to review the theoretical rationale for the existence of international capital flows. For this purpose, it is necessary to distinguish between *net* capital flows and *gross* capital flows. Net capital flows are the mirror image of the current account balance (adjusted for changes in reserves, capital transfers, and errors and omissions), i.e. a current account deficit is typically reflected in positive net capital flows (International Monetary Fund 2010). By contrast, gross capital flows look at resident outward investment and foreign inward investment separately (i.e., they capture two-way capital flows that reflect the changes in assets and liabilities in the financial account). For the purpose of this survey, the dynamics of gross capital flows are most relevant. The main reason is that it is the two-way flows of international investment, lending, and financial intermediation that characterize a country's integration into global financial markets (Borio and Disyatat 2011).

The rationales for net and gross capital flows have in common that both types of flows enable welfare gains on the production side (i.e. a more productive allocation of capital) and on the consumption side (i.e. a superior consumption path for the providers and recipients capital). Figure 1.3 provides a stylized overview of those benefits.

Figure 1.3: Stylized Overview of the Theoretical Benefits of Net and Gross Capital Flows

	Production Benefits	Consumption Benefits
Net Flows	More efficient allocation of global capital (higher returns for given amount of risk)	Improved intertemporal consumption path (smoothing known/expected variations in income and returns)
Gross Flows	Riskier, but more productive allocation of global capital (higher return and more risk that is better diversified)	Reduced state-dependent variability of income (smoothing unknown/random variations in income and returns)

Source: author's illustration.

The theoretical benefits of net capital flows can be illustrated in the context of the intertemporal approach to the current account (Obstfeld and Rogoff 1995). In this approach, net capital flows are viewed as an exchange of assets in return for goods and services. Assets entitle their owner to future consumption, while goods and services are used for present consumption. Hence, in this framework, net capital flows are interpreted as intertemporal trade, i.e. present consumption is traded against future consumption. Net capital flows thus allow domestic consumption and saving to be separated from domestic investment. Countries with high returns on capital will receive net capital flows from abroad to finance investment until their rate of return equals the world rate of return. **Hence, on the production side, the rationale behind net capital flows is that resources can flow from countries with low returns on capital to countries with high returns on capital, resulting in a more efficient allocation of global capital.[2]**

On the consumption side, the rationale behind net capital flows is to enable countries to achieve an improved intertemporal consumption path by allowing them to smooth consumption in the face of known or expected variations in their national income. A classic example is the case of an oil-exporting country that uses present income from oil exports to accumulate external assets that will help finance future consumption when its natural resources are depleted (Sachs 1981).

By contrast, *gross* capital flows refer to trade in assets for other assets (referred to as "intratemporal trade" in the intertemporal approach to the current account). **By diversifying their portfolios countries are able to share risks internationally and trade across different states of nature, enabling the providers of capital to protect themselves against concentrated risks (Grubel 1968; Obstfeld 1994a). As a result, the residents of a country engaging in intertemporal trade achieve a smoother consumption path.** For example, when a country is hit by a natural disaster, household incomes and business profitability will decline. If the country's businesses are predominantly foreign-owned, some of the losses are borne by non-residents, reducing residents' exposure to this particular risk.[3] The consumption benefits of gross capital flows thus arise by diversifying across unknown or random

[2] Lucas (1990) discusses why, against the predictions of standard economic theory, net capital has tended to flow "uphill" from emerging to mature economies, a phenomenon dubbed the "Lucas paradox." However, Alfaro et al. (2011) show that sovereign-to-sovereign lending can explain upstream capital flows, and that net private capital flows are positively correlated with countries' productivity growth. Moreover, emerging markets have generally been net recipients of foreign capital in recent decades if international reserve accumulation is excluded (IIF 2015a).

[3] Theory predicts that a country-specific income shock should have only a limited impact on the country's consumption since household income risks are pooled across countries. Therefore, consumption should be more correlated across countries than output. However, Backus, Kehoe, and Kydland (1992) note that against the predictions of theory, consumption has historically been less correlated across countries than output, a phenomenon dubbed the "international consumption correlations puzzle" (Obstfeld and Rogoff 2000).

variations in incomes and returns, in contrast to the benefits of net flows that stem from known or expected variations in incomes or returns.[4]

In addition, gross capital flows also provide benefits on the production side. When the risks of a project are shared by a broad pool of investors worldwide, capital can be allocated to projects with higher risks and returns than if all the associated risk had to be borne by a narrower set of investors located within a particular country. This allows a riskier allocation of global capital that is more productive on average (Arrow 1971). The resulting welfare gains benefit both the providers of capital (via higher returns) and the recipients of capital (via faster economic growth). For example, Obstfeld (1994) shows in a theoretical model how international risk sharing can produce significant welfare gains through a world portfolio shift towards riskier assets. The production benefits of gross vs. net flows may be contrasted in that net flows enable a higher return for a given amount of risk, while gross capital flows help achieve a higher return while taking on more risk that is better diversified.

1.4. Historical Evolution of the Empirical Literature on the Drivers of EM Capital Flows

In order to provide a thorough review of the current state of the literature it is helpful to consider the economic developments from which this literature emerged and the key issues it aimed to address over time.[5] The early literature on the drivers of capital flows emerged in the context of the rebound in flows to Latin America in the early 1990s. The Latin American economies had suffered significant dislocations from the debt crises of the 1980s, in part due to a boom-bust cycle in foreign bank lending. In the late 1980s, many of these economies underwent major economic reforms, including inflation stabilization programs, privatization programs, and the liberalization of local equity markets (Calvo et al. 1992; Taylor and Sarno 1997). At the same time, the U.S. economy was in recession in 1990-91, which resulted in record-low interest rates in the U.S. and other mature economies. When capital inflows to Latin America rebounded in the early 1990s, the question was whether these flows reflected improved access to external financing as a reward for improved macroeconomic fundamentals, or if instead flows were driven by favorable external circumstances that were likely to reverse. This question was first raised in the seminal paper by Calvo, Leiderman and Reinhart (1993), who argued that the cyclical downturn in the U.S. had been a major driver behind rebound in capital inflows to Latin American countries. The authors used principal component analysis to assess the degree of co-movement between various U.S. variables (interest rates, equity and real estate returns)

[4] "Known" variations in incomes or returns include unexpected events once they have materialized, such as a country borrowing from abroad after experiencing a natural disaster.

[5] A more comprehensive survey of the early literature is provided by Lopez-Mejia (1999).

and a proxy of capital flows to Latin American economies (monthly data on reserve accumulation and real exchange rate appreciation). Their finding of significant co-movement between U.S. variables and their capital inflow proxy seemed to suggest that external factors were indeed playing a major role in driving capital flows.

Subsequent studies pointed out various limitations in the approach taken by Calvo et al. (1993) and addressed these shortcomings by introducing domestic control variables, extending the sample period, and using data on capital flows as the dependent variable (rather than a mere proxy). These subsequent studies generally found further support for the view that capital inflows were to a large extent driven by external factors (e.g., Fernandez-Arias 1996; Taylor and Sarno 1997).

This view was not unanimous, however. For example, Ghosh and Ostry (1993) found for a large group of EM economies that domestic economic fundamentals were the predominant driver of capital flows. Their findings were based on a theoretical model of intertemporal current account determination, whose predictions were largely consistent with observed capital flows. Other authors further attested to the importance of pull factors. For example, Chuhan et al. (1998) looked at the behavior of monthly gross capital inflows from the U.S. to a sample of 18 countries in Latin America and EM Asia. Using a panel approach with country fixed effects, they found that domestic factors are at least as important in driving capital flows as external factors, especially in Emerging Asia.

While it seemed plausible in the early 1990s that the cyclical downturn in the U.S. had contributed to the surge in EM capital flows, this notion became more difficult to uphold when capital flows continued during the subsequent acceleration in U.S. real GDP growth and rising policy interest rates. Capital inflows generally continued their upward trend in the mid-1990s, notwithstanding some major setbacks such as the 1994/1995 Mexico crisis. Other factors thus seemed to be at work that would support such a sustained increase in capital inflows. A World Bank (1997) study argued that structural changes were behind this trend. These included the rise of institutional investors in mature economies, the deregulation of financial markets in both emerging and mature economies, as well as the impact of new information and communication technology. Earlier studies on the topic had not considered the impact of these structural changes and arguably may have overemphasized the importance of cyclical factors. In addition, the World Bank study argued that behavioral factors such as learning on the part of international investors had resulted in greater country differentiation, increasing the relative importance of pull factors over time.

In the mid-2000s, the literature increasingly focused on the drivers of flows to individual emerging market regions as well as specific components of capital flows. For example, Baek (2006) used a

panel with country fixed effects for 9 emerging economies in two regions, finding that push factors tend to be more important for portfolio flows to Emerging Asia than to Latin America. De Vita and Kyaw (2008a) estimated a structural VAR model for 5 EM economies that suggested that EM productivity growth is more important for FDI flows than portfolio flows, while the domestic money supply is the dominant driver of portfolio inflows. FDI flows received particular attention in this period, reflecting the rapid growth of direct investment in emerging markets from an average of $40 billion per year in the early 1990s to an annual average of $300 billion in the mid-2000s (Institute of International Finance 2015a). For example, Albuquerque et al. (2005) investigated the connection between world market integration and FDI flows, finding that global factors had increased in importance, while local factors such as productivity growth, trade openness, and financial depth had become less important.

The global crisis of 2008/2009 sparked a major retrenchment of global capital flows, which soon became the subject of extensive academic inquiry. The crisis shifted the focus of the literature squarely on gross capital flows (i.e. the changes in external assets and liabilities, as distinct from net flows, which are captured by the financial account balance). Gross capital in- and outflows exhibited rapid growth in the period leading up to the crisis and saw sharp movements during the crisis itself. Early work on measuring the gross positions of international claims was done by Lane and Milesi-Ferretti (2001; 2007), documenting the remarkable rise in countries' gross external assets and liabilities. Obstfeld (2012) addresses the rise in flows during the years preceding the crisis, when gross capital flows far outpaced net flows, and concludes that gross external positions and their associated flows are the primary transmission channel of financial instability. Broner et al. (2013) find supporting empirical evidence by analyzing the cyclical behavior of gross capital flows to and from a sample of 103 low-, middle- and high-income countries. They find that gross capital flows have been much more volatile than net flows, especially during economic downturns. In addition, gross capital flows are found to be highly pro-cyclical, with both non-resident inflows and resident outflows of capital rising during economic expansions and declining during recessions.

In the post-crisis period, particular attention has also been devoted to the co-movement of (gross) capital flows across different components and regions. For example, a study by Milesi-Ferretti and Tille (2011) documents how the behavior of various capital flows components varied during the financial crisis, with banking flows contracting the most and FDI flows the least. Forbes and Warnock (2012) present a systematic framework for analyzing extreme episodes of capital flows, which are classified into four categories: surges (of non-resident inflows), stops (of non-resident inflows), flight (of resident outward investment), and retrenchment (of resident outward investment). In this framework, most of the extreme episodes countries experienced between 1980 and 2009 were

driven by external factors, notably global risk aversion. This result is confirmed by Ghosh et al. (2014a), who find that the single most important factor behind liability-driven surges is global risk aversion (as measured by the VIX).

During the last several years, significant attention has been devoted to the role of exceptionally loose monetary conditions in driving capital flows to emerging markets, with particular focus on the Federal Reserve's quantitative easing programs. Fratzscher et al. (2012) find a significant impact of central bank asset purchases on EM asset prices and portfolio flows using weekly data on flows to EM-dedicated funds from Emerging Portfolio Fund Research (EPFR) Global. By contrast, in a Federal Reserve discussion paper, Ahmed and Zlate (2013) find that unconventional U.S. monetary policy has left the volume of flows unaffected, but has shifted the composition of capital inflows towards portfolio investments. A more recent study by the World Bank (2014) concludes that the Fed's three quantitative easing programs have had a significant, but diminishing impact on the volume of EM capital flows over time. A limitation of this study, however, is that the impact of Fed asset purchases is not modeled explicitly and is instead estimated as a residual. Koepke (2014) takes a broader approach on the impact of U.S. monetary policy by focusing on shifts in market expectations for future Fed policy interest rates, which are found to be an important determinant of portfolio flows to EM economies, especially bond flows. This relationship is established for both EPFR fund flows data and BoP-consistent monthly portfolio flows data. Dahlhaus and Vasishtha (2014) build on this framework and confirm in a cross-country comparative analysis that Fed policy expectations have been an important determinant of equity and especially bond flows in recent years, particularly during the "Taper Tantrum" of 2013.

Overall, the academic focus has shifted substantially over time, reflecting changing economic circumstances, increasing data availability, and the growing role of emerging markets in the global economy. One recurring pattern is that the literature has tended to focus on cyclical push factors during and after U.S. recessions, while the other periods have seen greater focus on pull factors and secular forces shaping the evolution of capital flows. This may be in part because the relative importance of the drivers of capital flows themselves changes over time, for example due to changes in the magnitude of external and domestic shocks. In particular, Fratzscher (2012) finds that push factors were the dominant drivers of portfolio fund flows during the global financial crisis, while in the years after the financial crisis, portfolio flows responded more strongly to pull factors such as macroeconomic fundamentals, institutions and policies of recipient countries. In addition, Lo Duca (2012) specifically investigates the extent to which push and pull factors vary over time using a time varying coefficient model. He finds that pull factors are more important when risk aversion is

elevated, although extreme risk aversion generates panics where local developments play only a small role in shaping capital flows.

1.5. Classification of Capital Flows Analyzed in the Literature

A systematic review of the literature on the drivers of capital flows is complicated by two particular challenges. First, there are a number of different ways to measure international capital flows (and for each measure, there are often a range of datasets available). Second, there are a large number of potential explanatory variables for movements in capital flows, reflecting the central role of capital flows in the global financial system and the countless forces that may in principle affect international movements of capital. For any empirical analysis, this means that there are many choices for both the dependent and the independent variables, resulting in a very large number of possible combinations. In order to structure the discussion, it is thus helpful to introduce some classifications for both dependent and independent variables, which are discussed in this section and the next, respectively. Figure 1.4 provides an overview of relevant categories for analyzing capital flows.

Figure 1.4: Classification of Capital Flows

Basis for Distinction	Main Examples
Residency of investor	EM resident capital flows, non-resident capital flows, net capital flows
Component	FDI, portfolio equity, portfolio debt, bank lending
Type of investor	Retail and institutional investors
Data frequency	Annual, quarterly, monthly, weekly, daily
Official vs. private sector	Private investors vs. offical lending; private sector recipients vs. public sector borrowing
Currency	Local currency, foreign currency
Maturity	Short vs. long term (debt flows), indefinite (equity flows)
Geography	EM Asia, EM Europe, Latin America, Africa, Middle East, individual countries

Source: author's illustration.

It is noteworthy that for each of these measures of capital flows, there are a number of different ways to scale and adjust flows for the purpose of empirical analysis. The most appropriate form to use in an econometric analysis is likely to depend on the specific research objective. A helpful overview of capital flows specifications used in the empirical literature is provided by Ahmed et al. (2015, pp. 2-3), who list and discuss studies using as dependent variable "the dollar amount of flows, flows normalized by average past flows, log changes in portfolio positions, flows as a percent of lagged portfolio size, changes in the portfolio share, flows scaled by local market capitalization, and flows scaled by local GDP."

Residency of Investor

A key distinction is between gross and net capital flows. In balance of payments terminology, this distinction corresponds to changes in the liabilities of an emerging market country versus changes in its assets (International Monetary Fund 2010). Net capital flows are obtained by netting changes in liabilities against changes in assets.[6]

In the early literature, the distinction between gross and net capital flows was of little importance because up to the early 1990s, EM resident capital outflows were typically quite small (Figure 1.5). Therefore, net capital flows essentially reflected purchases and sales of EM assets by non-residents. Over time, however, EM resident outflows rose to sizeable amounts, meaning that the behavior of non-resident flows could no longer be approximated by net capital flows. To the extent that non-resident flows do not coincide with net capital flows, the literature on the drivers of capital flows (and this survey) generally focus on non-resident capital flows (although there are notable exceptions, such as Reinhart and Reinhart 2008; and Ghosh et al. 2014a).

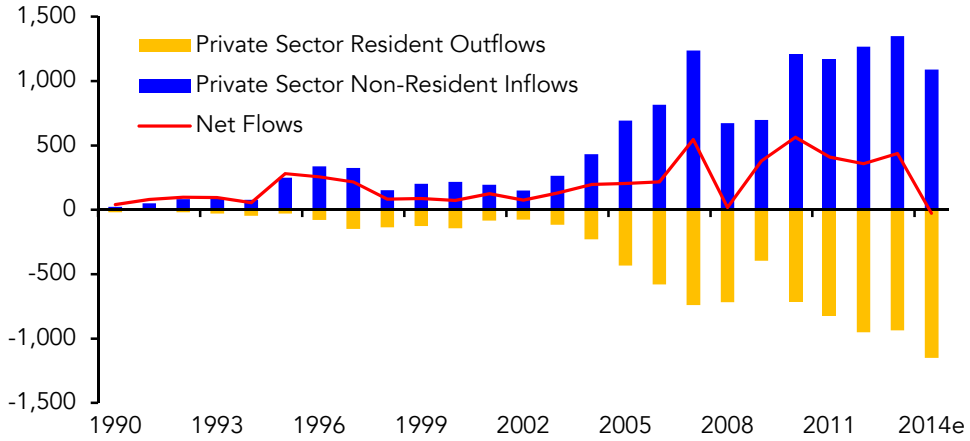
The main reason why the focus is on non-resident capital flows is that EM economies are typically most affected by the actions of foreign investors (Ostry et al. 2010; Broner et al. 2013). Non-resident flows are generally the more volatile component, especially during crisis periods, making them an important driver of exchange rates, domestic interest rates, and financial conditions more broadly. By contrast, EM resident capital outflows are more geographically concentrated in a limited number of countries that are large exporters of oil and other commodities. Meanwhile, net capital flows provide a narrower picture of external financing that is more closely linked to transactions in goods and services. In addition, net capital flows are jointly determined with the current account balance and the official settlements balance, each of which is subject to its own unique driving factors (see, for example, Debelle and Faruqee 1996; Chinn and Prasad 2003).

[6] If available, data on gross flows provide more information since actions by resident and non-resident investors can be analyzed separately (United Nations 2009). In principle, netting can be done in the same asset category (e.g., net FDI flows) or in groups of asset categories (i.e., overall net capital flows).

Figure 1.5

Emerging Market Capital Flows by Residency of Investors

$ billion



Source: IIF.

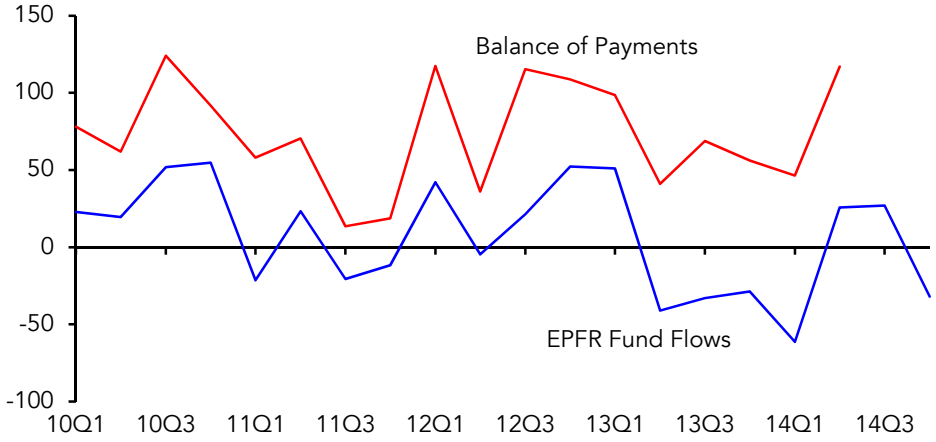
Most data sources on international capital flows clearly fit into one category within the residence-based framework, but there are exceptions. One example is BIS data on consolidated cross-border banking statistics, which include international banks' local claims, i.e. loans by their subsidiaries. Hence, the consolidated data are not consistent with balance of payments data, which only include transactions between residents and non-residents (see also Takats 2010 and BIS 2012; by contrast, BIS locational banking statistics are also compiled using a residence-based approach).

Another example is EPFR Global's data on flows in and out of funds that invest in emerging markets. While these flows are often used as a proxy for BoP portfolio flows (Miao and Pant 2012), the discrepancy between the two measures is quite large (Figure 1.6). Fund flows are also quite different conceptually as they measure net flows into an investment vehicle rather than transactions between the residents of different countries (for a more detailed discussion, see Koepke and Mohammed 2014a). While fund flows are certainly of significant scholarly interest on their own merits, there are justified questions about the degree to which empirical findings based on fund flows also apply to international capital flows.

Figure 1.6

Total Portfolio Flows to Emerging Economies

$ billion; BoP data based on IIF group of 30 emerging economies



Source: IIF, EPFR.

Capital Flows Components

Following the IMF's standard balance of payments presentation, capital flows can be broken down into four main components: foreign direct investment (FDI), portfolio equity investment, portfolio debt investment, and "other" investment, which includes bank lending (International Monetary Fund 2010). Capital flows differ greatly in scale and scope across these components, and so do their drivers. Because it so important to distinguish among the major components of capital flows, Section 1.7 of this survey is devoted to analyzing the drivers of each of the major components of capital flows.

FDI involves transactions where the investor owns a substantial portion of a firm's shares and typically exercises a degree of managerial control (International Monetary Fund 2010). In addition, FDI transactions often involve the ownership of physical plants and equipment. Therefore, direct investment flows are driven largely by long-term considerations about the real economy and less subject to short-term financial fluctuations (see, for example, Addison and Heshmati 2003; Biglaiser and DeRouen 2006). In most countries, FDI flows are the largest source of external financing, with total gross FDI inflows typically accounting for 40-60 percent of aggregate capital flows to emerging markets since the mid-1990s (Institute of International Finance 2015a). Blonigen (2005) provides a survey specifically on the determinants of FDI flows, covering flows to both emerging and mature economies.

By contrast, portfolio equity and debt flows involve transactions that can, in principle, be executed very quickly. Some investors may adjust the composition of their portfolios in response to economic

news and short-term fluctuations on financial markets. This is reflected in empirical evidence showing that a range of financial variables are important drivers of portfolio flows, including asset returns, exchange rate volatility, and external financial volatility indicators that indicate the degree of investor risk aversion (see, for example, Montiel and Reinhart 1999; Baek 2006; Broner et al. 2013).

Finally, banking flows are often analyzed as another separate category, reflecting the special status of the banking system as a financial intermediary (Buch 2002). There are various approaches to analyzing banking flows. Most studies that focus specifically on banking flows make use of BIS data on cross border bank claims, which include both bank lending as well as banks' holdings of debt and equity securities and other assets. Note that this concept differs from the standard balance of payments classification, where bank loans are included in the category "other investment," while all transactions in debt and equity securities (including those by banks) are included in the portfolio debt and equity investment categories, respectively (International Monetary Fund 2010).

Type of Investor

Institutional investors are likely to have different investment objectives from retail investors, and hence are likely to respond differently to changes in the economic and financial environment. For example, institutions like sovereign wealth funds, insurance companies and pension funds generally have long-term mandates that allow them to ride out short-run fluctuations on financial markets (BIS 2007). Hedge funds are an exception as they tend to place much greater emphasis on short term tactical asset allocation and adjust positions frequently (Tsatsaronis 2000). By contrast, mutual funds are predominantly owned by retail investors who may withdraw their capital during times of financial stress (IMF 2014). Mutual fund investments are an area of research where fund flows data can provide quite detailed insights into investor behavior. For example, Raddatz and Schmukler (2012) find evidence of a destabilizing effect of mutual funds by analyzing the interplay between actions of ultimate investors (i.e. the owners of fund shares) and fund managers. They conclude that mutual funds tend to exacerbate the pro-cyclicality of capital flows to emerging markets. Gelos (2011) provides a survey on the behavior of international mutual funds and the implications for capital flows.

Data Frequency

Capital flows data exist at frequencies ranging from daily to annual data and are published with various time lags. The lower the frequency, the more complete the dataset tends to be, but the more difficult it is to capture the impact of short term developments and rapid shifts in investor behavior. In recent years, the literature has increasingly focused on high-frequency data sources serving as proxies for EM capital flows, such as fund flows data (see, for example, Fratzscher et al. 2012; Lo Duca 2012; Feroli et al. 2014). A comparison of empirical results across different studies

suggests that the relative importance of capital flows drivers differs across data frequencies. For portfolio flows, the evidence suggests that external factors (especially risk aversion) are the dominant drivers of short run movements, while pull factors (especially macroeconomic conditions) seem to be less important at high frequencies and matter more for long-term trends. For example, Fratzscher (2012) and Koepke (2014) find only a limited role for domestic macroeconomic variables at the weekly and monthly frequencies, respectively, while Baek (2006) and De Vita and Kyaw (2008a) find strong evidence for the role of domestic output growth at the quarterly frequency. These results are consistent with Ananchotikul and Zhang (2014), who find based on weekly fund flows data that the contributions from external factors are much more volatile, while those of pull factors are small at high frequencies but more persistent. A promising avenue for future research would be to compare push and pull drivers systematically using a common methodological approach across different frequencies for the various capital flows components.

Official vs. Private Sector Flows

Another useful distinction is by the economic sector that provides the capital as well as the sector using the capital. While capital provided by the private sector can be expected to be driven by risk-return considerations, this may not be the case for official lending provided by international financial institutions like the World Bank and the International Monetary Fund or by bilateral official creditors (Gupta and Ratha 2000). Alfaro et al. (2011) address this question by separating flows from private sector sources and official flows such as official aid and reserve accumulation. The authors find evidence that private flows are indeed driven predominantly by economic factors such as productivity growth, consistent with theory, while official flows are not determined by these factors. Most of the literature (and this survey) focuses on the determinants of private sector sources of capital.

On the recipient side, creditworthiness and risk-return characteristics are likely to differ between securities issued by the public and the private sector, meaning that investors may take into account different factors when making investment decisions. In addition, equity flows are almost always directed to the private sector (except when the target company is partially state-owned), while bonds may be issued by either government entities or companies. The literature (and this survey) addresses capital flows to both public and private sector recipients, although most studies do not differentiate between the two.

Currency

Up to the early 2000s, emerging markets typically borrowed in "hard" currency, notably in U.S. dollars (Burger et al. 2012). Since then, there has been rapid growth in local currency bond markets,

against the "original sin" hypothesis, according to which emerging markets would not be able to borrow in their own currencies in large scale (e.g., Eichengreen and Hausmann 1999; 2005). Depending on the currency denomination of the securities issued, different factors are likely to matter for attracting foreign investors and lenders. For example, hard currency investors should be concerned about EM exchange depreciation primarily to the extent that the borrower's ability to service debt and repay principal is affected. By contrast, for local currency debt, exchange rate depreciation directly affects foreign investors' returns. Hence, the domestic inflation performance and central bank credibility should matter much more for local currency debt than foreign currency debt. Consistent with this, Burger and Warnock (2007) find that countries with a better inflation track record and creditor friendly policies have been able to issue more debt in local currency. In addition, Burger et al. (2012) find that flows into securities in local currency are particularly driven by investor-friendly institutions, regulations and policies (e.g., fewer capital controls), market liquidity, and creditor rights.

Maturity

For debt flows, the determinants are likely to vary depending on the maturity of credit, given the differences in risk-return characteristics and rollover risks. Notably, the price of a long-dated bond is more sensitive to changes in interest rates compared to a bond with a short remaining maturity. Consistent with this, there is evidence that flows into short-term bonds tend to be less sensitive to changes in mature economy interest rates compared to bonds with longer remaining maturities (Koepke 2014). On the other hand, short-term borrowing involves greater rollover risks for the issuer, which can lead to funding pressures during periods of emerging market stress. Indeed, Rodrik and Velasco (1999) find that greater short term borrowing increases the probability and severity of financial crises in emerging markets.

Regional and Country Differences

Studies frequently distinguish between various emerging market regions and contrast the behavior across these different groupings (e.g. Taylor and Sarno 1997; Baek 2006, and Förster et al. 2014). It is plausible that the determinants of capital flows differ systematically across countries, for example due to structural factors, such as whether a country is a major exporter of a particular commodity. In addition, empirical results may differ across studies because different country samples are used. In some cases, this may be due to different definitions of which countries are classified as emerging markets. EM country groupings differ between various international organizations like the International Monetary Fund, the World Bank, and private sector organizations such as Morgan Stanley Capital International (which provides benchmark equity indices like the MSCI Emerging Market index).

1.6. Classification and Discussion of Capital Flows Drivers

Push-Pull Framework

The distinction between push and pull factors for capital flows has been the dominant intellectual framework for classifying drivers since the focus of academic inquiry shifted to the role of external factors in the early 1990s. The appeal of this framework is that it is simple and intuitive, and yet is able to capture most of the key drivers of capital flows. From the perspective of an emerging market country, most of the relevant macroeconomic and financial developments affecting capital flows can be classified as being either domestic or external in nature. For example, domestic economic performance, asset return indicators, and country risk indicators stand out as important variables in emerging market economies that are found to have a significant bearing on capital flows. Similarly, mature economy interest rates and global risk aversion are unambiguously external in nature and have significant explanatory power for capital flows movements.

However, there are also several important caveats regarding the push-pull framework. Some factors do not seem to fit into either the external or the domestic category, such as the behavioral responses of international investors to local market developments. For example, contagion effects may arise through the interaction of country-specific developments (such as the deterioration in vulnerability indicators) and a flight-to-safety response by global investors (Calvo and Reinhart 1996). Such contagion effects are the subject of a separate, voluminous literature (for an overview, see Forbes and Rigobon 2001). Significant attention has also been devoted to contagion stemming from investment funds and their ultimate investors, which is surveyed in Gelos (2011). Other aspects of investor behavior are also closely linked to country-level developments, such as the degree to which investors shift their portfolios away from or towards assets whose prices have previously increased/declined ("rebalancing vs. return chasing," Bohn and Tesar 1996; Curcuru et al. 2011). Similarly, the effects of information asymmetries and transaction costs cannot be fully captured by the push-pull framework (Portes and Rey 2005).

In addition, there may be important interactions between external conditions and country fundamentals that are difficult to capture with the push-pull framework. For example, domestic asset return indicators are found to be an important determinant of portfolio and banking flows, but it is difficult to disentangle whether observed asset price movements are driven by domestic or external developments. Similarly, interactions between external and domestic variables also obscure the picture for real economy variables and country risk indicators. A classic example explored by Fernandez-Arias (1996) is the positive effect of low U.S. interest rates on the creditworthiness of EM borrowers, which in turn encourages foreign capital inflows. He finds that the improvement in the

creditworthiness of emerging markets in the early 1990s was primarily attributable to the decline in international interest rates and argues that the resulting increase in foreign inflows should not be interpreted as having been driven by domestic factors. Another example for such endogeneity issues is domestic real GDP growth, since capital flows are not only attracted by faster growth but also support such growth (for a recent discussion, see, for example, Kyaw and MacDonald 2009). These endogeneities make it notoriously difficult to establish true causal relationships for the drivers of capital flows.

Another argument raised against the push-pull framework is that for certain variables, both sets of factors may potentially be viewed as two sides of the same coin. If an increase in EM growth has the same impact on capital flows as a decline in mature economy growth of the same magnitude, then it is the growth *differential* that determines capital flows (Ahmed and Zlate 2013). However, a critical reading of the empirical literature does not support this view as there is substantial evidence that the EM and advanced economy effects on capital flows are quite different. While there is robust evidence that stronger EM real GDP growth tends to boost EM capital inflows, the impact of slower mature economy growth is much more ambiguous (see, for example, Gupta and Ratha 2000; Ferucci et al. 2004). Indeed, there is some evidence that slower mature economy growth tends to reduce certain types of capital flows (Jeanneau and Micu 2002; Baek 2006; De Vita and Kyaw 2008a).

Similarly, a decline in U.S. interest rates may in principle have the same impact on capital flows as an increase in EM interest rates, in which case capital flows can be thought of as being driven by interest rate differentials. Indeed, interest rate differentials are often seen as an important driver of portfolio flows in the context of the carry trade investment strategy (see, for example, Galati et al. 2007). However, analysis of aggregate capital flows movements finds little support for the role of interest rate differentials. While mature economy interest rates are found to be an important determinant of various types of EM capital inflows, the evidence is much more mixed for EM interest rates (e.g., Ahmed and Zlate 2013). A complication with estimates of how much local interest rates attract foreign capital flows is again endogeneity. Since greater foreign capital flows would tend to reduce local interest rates, estimations that do not address endogeneity would tend to obtain coefficients with a downward bias, i.e. the impact of domestic interest rates may be understated. Moreover, the literature on global interest rate transmission finds that EM interest rates themselves are to a significant degree driven by mature economy interest rates (Frankel et al. 2004; Edwards 2012). Hence, a large negative impulse from an increase in mature economy interest rates may lead to a sharp reduction in EM capital flows, but may only result in a small increase in the interest rate differential. Therefore, it would be seem more appropriate to explain such a reduction in flows with the large increase in mature economy rates rather than a modest rise in the interest rate differential.

Overall, the push-pull framework certainly has its limitations, but it continues to be a useful analytical perspective for structuring the discussion on the determinants of EM capital flows.

Cyclical vs. Structural Drivers of Capital Flows

One complementary dimension that may have received insufficient attention in the existing literature on country-specific and global factors is the distinction between cyclical and structural forces that shape the evolution of capital flows. Cyclical factors are more short-term in nature and often vary across different phases of the business cycle, such as real GDP growth and interest rates. By contrast, structural factors are more long-term in nature, and relate to the fundamental structure of an economy, its institutions, and its policy and regulatory frameworks. While structural factors typically shape longer-term trends in capital flows, abrupt changes in these factors may also have important short-term effects. A prime example would be an emerging market country that undertakes steps towards liberalizing its capital account to make it easier for foreigners to invest in its economy. The impact of capital account liberalization on foreign investment is among the topics that have received significant interest in the literature (e.g., Bartolini and Drazen 1997; Kim and Singal 2000; Bekaert et al. 2002). In addition, the longer-term effects of structural forces received particular attention in late 1990s and early 2000s literature, which saw some important contributions with respect to the rise of institutional investors and information and communication technology (including World Bank 1997; Lopez-Mejia 1999; Addison and Heshmati 2003). When it comes to explaining aggregate capital flows movements, however, there has been much more focus on the cyclical forces shaping capital flows to emerging markets. This is especially true for the most recent period since the global financial crisis of 2008/09, which shifted the focus squarely on the cyclical drivers of capital flows.

Arguably, the distinction between structural and cyclical factors is complementary to that between push and pull factors. Pull factors can be structural or cyclical in nature, as can be push factors. Figure 1.7 illustrates this complementarity and provides frequently cited examples of capital flows drivers. For example, the rise of institutional investors in mature economies is an important structural push driver, while the quality of institutions in emerging markets can be regarded as a structural pull driver.

Figure 1.7: Classification of the Main Drivers of Capital Flows

	Push	Pull
Cyclical	Global risk aversion	Domestic output growth
	Mature economy interest rates	Asset return indicators
	Mature economy output growth	Country risk indicators
Structural	Rise of institutional investors	Quality of institutions
	Portfolio diversification	Capital account openness
	Information & communication technology	Role of government in the economy

Source: author's illustration.

While structural drivers are clearly of great importance for a more complete understanding of international capital flows dynamics, the subsequent discussion will focus on cyclical push and pull drivers because they have received the most attention in the literature on the drivers of capital flows to emerging markets.

1.7. Drivers of Capital Flows by Major Component

Prior sections of this chapter have established the importance of differentiating between various types of capital flows and the continued analytical value of the push-pull framework. This section brings these two perspectives together by analyzing the available evidence on the main cyclical push and pull drivers for the major capital flows components. For this purpose, I consider the four main components of capital flows, namely portfolio equity and debt flows, banking flows, and foreign direct investment. In terms of drivers, the discussion addresses three push factors (global risk aversion, mature economy interest rates, and mature economy output growth) and three pull factors (domestic output growth, asset return indicators, and country risk indicators). Figure 1.8 provides a condensed summary of the results obtained by over 40 empirical studies. For the most part, the studies considered in this summary table focus specifically on individual components of emerging market capital flows. Some additional insights can be gained from studies that have a broader country focus and/or consider multiple components of capital flows at once (such as Milesi-Ferretti and Tille 2011, who do not differentiate between flows to emerging and mature economies). To the extent that inferences are possible from these studies, they are included in the table and the discussion below.

Figure 1.8: Overview of the Cyclical Drivers of Non-Resident Capital Flows by Major Component

Type	Driver	Portfolio Equity	Portfolio Debt	Banking Flows	FDI
Push	Global risk aversion	**Strong evidence for negative relationship** [negative: M&T 2011, F 2012, BDES 2013, R 2013, A&Z 2013, A&Z 2014, K 2014; negative/insignificant: B 2006]	**Strong evidence for negative relationship** [negative: M&T 2011, F 2012, BDES 2013, R 2013, A&Z 2013, A&Z 2014, K 2014; negative/insignificant: B 2006]	**Strong evidence for negative relationship** [negative: J&M 2002, FHST 2004, T 2010, M&T 2011, R 2013, B&S 2013a, B&S 2013b, H&M 2013]	**Mixed evidence, no clear relationship** [insignificant: ALS 2005; positive/negative: BDES 2013; negative: M&T 2011, positive: R 2013]
	Mature economy interest rates	**Strong evidence for negative relationship** [negative: F 1996, W 1997, M&R 1999, T&S 1997, CCM 1998, B 2006, FLS 2012, D&V 2014, FKSS 2014, K 2014; negative/insignificant: D&K 2008a; insignificant: HMV 2001; A&Z 2013]	**Strong evidence for negative relationship** [negative: F 1996, W 1997, T&S 1997, M&R 1999, B 2006, D&V 2014, FKSS 2014, K 2014; negative/insignificant: D&K 2008a; insignificant: HMV 2001, A&Z 2013; greater impact than for equity: T&S 1997, K 2014, D&V 2014; smaller impact than for equity: CCM 1998]	**Some evidence for negative relationship** [negative: B&S 2013a, GQS 2014; positive/negative: G 2002, CCR 2014; positive: J&M 2002]	**Mixed evidence, no clear relationship** [insignificant: W 1997, M&R 1999, HMV 2001, D&K 2008a; negative: ALS 2005; positive: G&R 2000]
	Mature economy output growth	**Some evidence for positive relationship** [positive/insignificant: B 2006, D&K 2008a, F&W 2012; insignificant: A&Z 2013]	**Some evidence for positive relationship** [positive/insignificant: B 2006, D&K 2008a, F&W 2012; insignificant: A&Z 2013]	**Mixed evidence, no clear relationship** [insignificant: FHST 2004; positive/negative: G 2002; positive: J&M 2002]	**Mixed evidence, no clear relationship** [insignificant: G&R 2000; positive/negative: D&K 2008a, ALS 2005]
Pull	Domestic output growth	**Some evidence for positive relationship** [positive: D&K 2008a; positive/insignificant: B 2006, D&K 2008b, A&Z 2013, K 2014; insignificant: F 2012]	**Some evidence for positive relationship** [positive: D&K 2008a; positive/insignificant: B 2006, D&K 2008b, A&Z 2013, F 2012; K 2014]	**Strong evidence for positive relationship** [positive: J&M 2002, FHST 2004, T 2010, H&M 2013, B&S 2013b]	**Strong evidence for positive relationship** [positive: GNP 1998, HMV 2001, A&H 2003, D&K 2008a, D&K 2008b; positive/insignificant: GR 2000]
	Asset return indicators	**Some evidence for positive relationship** [positive: FOS 2001, F 2012, L 2012, K 2014; positive/insignificant: CCM 1998, A&Z 2013]	**Some evidence for positive relationship** [positive: FOS 2001, F 2012, K 2014; positive/insignificant: CCM 1998]	**Strong evidence for positive relationship** [positive: FHST 2004, B&S 2013b, H&M 2013]	**Mixed evidence, no clear relationship** [insignificant: W 1997; negative: R&R 2003]
	Country risk indicators	**Some evidence for negative relationship** [negative: W 1997, K&W 2008, D&F 2012; negative/positive: H&K 2007]	**Some evidence for negative relationship** [negative: W 1997, K&W 2008, D&F 2012; negative/positive: H&K 2007]	**Strong evidence for negative relationship** [negative: W 1997, FHST 2004, H&K 2007, K&W 2008; negative/insignificant: J&M 2002; B&S 2013b]	**Some evidence for negative relationship** [negative: R&R 2003, B&D 2006; negative/insignificant: ALS 2005; negative/positive: K&W 2008; smaller impact than for other components: F&H 2001, D&F 2012]

Strong evidence for positive relationship
Some evidence for positive relationship
Mixed evidence, no clear relationship
Some evidence for negative relationship
Strong evidence for negative relationship

Source: author's illustration.

Notes on Figure 1.8:

- **The matrix summarizes the empirical evidence on the main drivers of EM capital flows for each of the major capital flows components. Findings are based on an in-depth review of over 40 studies.** For each cell, the relevant studies and their main results are reported in parentheses. For example, "positive/insignificant" indicates that each of the studies listed found some evidence for a statistically significant positive relationship as well as evidence for a statistically insignificant relationship. Due to space constraints, the studies are listed using abbreviated references. The series of letters indicate the initial of the last name for each author, followed by the publication year. For example, "T&S 1997" refers to the paper by Taylor and Sarno (1997). A full listing of references is provided below.
- **A color code is used to denote the direction of empirical relationships** (see legend below table). **"Positive relationship" means that an increase in the independent variable leads to an increase in the capital flows component in question.** The opposite holds for "negative relationship." The color code also indicates the strength of the empirical evidence for these relationships. "Strong evidence" indicates that the majority of studies find unambiguous evidence for a statistically significant relationship between the driver and the capital flows component in question (while there may be other studies that do not find a statistically robust relationship). "Some evidence" indicates that most studies agree on the direction of the relationship, but the results are sometimes statistically significant and sometimes not. "Mixed evidence" indicates that evidence regarding the direction of the relationship is ambiguous and/or most studies have not found a statistically significant relationship.
- **Inevitably, an attempt to summarize the vast body of empirical evidence in a single table requires simplification.** For example, no differentiation is made between contemporaneous and lagged relationships. In addition, the studies considered make use of widely different empirical approaches, including econometric models, datasets, and data frequencies, among others (see Section 1.5).

List of studies referenced in Figure 1.8, in chronological order of publication:

F 1996	Fernandez-Arias (1996)
T&S 1997	Taylor & Sarno (1997)
W 1997	World Bank (1997)
CCM 1998	Chuhan, Claessens & Mamingi (1998)
GNP 1998	Gastanaga, Nugent & Pashamova (1998)
M&R 1999	Montiel & Reinhard (1999)
D&R 2000	Gupta & Ratha (2000)
F&H 2001	Fernandez-Arias & Hausmann (2001)
FOS 2001	Froot, O'Connel & Seasholes (2001)
HMV 2001	Hernandez, Mellado & Valdes (2001)
G 2002	Goldberg (2002)
J&M 2002	Jeanneau & Micu (2002)
A&H 2003	Addison & Heshmati (2003)
R&R 2003	Reinhart & Rogoff (2003)
FHST 2004	Ferucci, Herzberg, Soussa & Taylor (2004)
ALS 2005	Albuquerque, Loayza & Serven (2005)
B 2006	Baek (2006)
B&D 2006	Biglaiser & DeRouen (2006)
H&K 2007	Hooper & Kim (2007)
D&K 2008a	De Vita & Kyaw (2008a)
D&K 2008b	De Vita & Kyaw (2008b)
K&W 2008	Kim & Wu (2008)
T 2010	Takats (2010)
M&T 2011	Milesi-Ferretti & Tille (2011)
D&F 2012	Daude & Fratzscher (2012)
F 2012	Fratzscher (2012)
FLS 2012	Fratzscher, Lo Duca & Straub (2012)
F&W 2012	Forbes & Warnock (2012)
L 2012	Lo Duca (2012)
A&Z 2013	Ahmed & Zlate (2013)
BDES 2013	Broner, Didier, Erce & Schmukler (2013)
B&S 2013a	Bruno & Shin (2013a)
B&S 2013b	Bruno & Shin (2013b)
H&M 2013	Herrmann & Mihaljek (2013)
R 2013	Rey (2013)
A&Z 2014	Ananchotikul & Zhang (2014)
CCR 2014	Cerutti, Claessens & Ratnovski 2014
GQS 2014	Ghosh, Qureshi & Sugawara (2014)
K 2014	Koepke (2014)
FKSS 2014	Feroli, Kashyap, Schoenholtz & Shin (2014)
D&V 2014	Dahlhaus & Vasishtha (2014)

Portfolio Equity and Debt Inflows

There is very robust evidence that both types of portfolio flows are strongly affected by global risk aversion, which has received particular attention since the global financial crisis of 2008/09. Empirical studies almost universally find a strong and statistically significant impact of increases in global risk aversion on portfolio flows to emerging markets (e.g., Milesi-Ferretti and Tille 2011; Broner et al. 2013; see Figure 1.8 and related notes for a full listing of references). The most common proxies for investor risk aversion used in the literature are U.S. implied equity volatility (as measured by the VIX index or the VXO) and the U.S. BBB-rated corporate bond spread over U.S. Treasury securities, which are both found to have a strong contemporaneous impact on portfolio flows. There does not seem to be conclusive evidence that one type of portfolio flow (debt or equity) is affected more than the other by changes in risk appetite.

Numerous studies published during the last 25 years have analyzed the relation of portfolio flows with world interest rates (often proxied by U.S. rates) and have overwhelmingly concluded that an increase in the external interest rate environment tends to exert a negative impact on portfolio flows and vice versa. Not all studies distinguish between equity and debt flows when analyzing portfolio flows movements, but to the extent that they do, most studies considered in this survey find that bond flows are more sensitive to mature economy interest rates than equity flows (including Taylor and Sarno 1997; Koepke 2014, and Dahlhaus and Vasishtha 2014; an exception is Chuhan et al. 1998).

Studies that do not find a significant relationship between global interest rates and EM portfolio flows include Hernandez et al. (2001) and Ahmed and Zlate (2013). Hernandez et al. (2001) attribute the result of no significant relationship to the use of low-frequency data (namely annual data for the real ex-post international interest rate, measured by U.S. dollar 3-month Libor minus U.S. CPI inflation and used in a various relatively short sample periods between 1987 and 1997). The results in Ahmed and Zlate (2013) are based on the U.S. policy interest rate in the pre-crisis period (2002Q1-2008Q2). Their results may be due to the limitations of using current policy rates as opposed to more forward-looking measures of interest rates that capture investor expectations about future interest rates, be it explicitly as in Koepke (2014) and Dahlhaus and Vasishtha (2014) or implicitly by using market-based measures of interest rates.

In terms of mature economy output growth, there is limited support for the notion that external growth encourages EM portfolio flows. For example, De Vita and Kyaw (2008a) find a statistically significant positive relationship in some specifications using a structural VAR model, but in alternative specifications the estimated coefficient on the mature economy growth variable turns negative (but insignificant). Baek (2006) finds a statistically significant positive relationship for portfolio flows to EM Asia, but not to Latin America (where the estimated coefficient is negative and insignificant). In addition, Ahmed and Zlate (2013) do not find a significant impact of mature economy growth on EM portfolio flows in a panel of 12 emerging market economies.[7] Some further insights are provided by Forbes and Warnock (2012), who find that stronger global growth is associated with an increased probability of a surge in foreign capital inflows to EMs and a reduced probability of a retrenchment episode. While their analysis is focused on total non-resident capital flows, portfolio flows and banking flows have generally been the most volatile components of capital flows and thus are likely to account for the majority of surge and retrenchment episodes (see also Bluedorn et al. 2013).

On the pull side, almost all studies find evidence that domestic economic performance is an important driver of portfolio flows, though in many studies, the evidence is not statistically robust (particularly for high-frequency data). Studies focusing specifically on the relationship between domestic growth and EM portfolio flows include Baek (2006), De Vita and Kyaw (2008a), and Ahmed and Zlate (2013), who all find supporting evidence for the role of domestic output growth. A caveat is provided by studies using high-frequency proxies for portfolio flows, notably fund flows data, which generally find that the importance of domestic output growth is smaller at the weekly and monthly data frequencies (e.g., Ananchotikul and Zhang 2014; Koepke 2014). This may be partly explained by the fact that comprehensive measures of output growth are typically only available on a quarterly basis (as for GDP growth), while higher-frequency data such as purchasing manager indices, economic surprise indices and growth forecasts may be less reliable and hence less important in informing investor decisions.

There is also some evidence that local asset returns serve as a pull factor for portfolio flows. The strongest evidence is available for local stock market returns, which a number of studies find to be associated with increased portfolio equity and bond inflows. Among the early literature, a notable study is Chuhan et al. (1998), which finds some evidence that portfolio flows are driven by local stock market returns. Another early study on the relation between flows and prices is Froot et al. (2001), which uses custodial data from State Street, one of the world's largest custodian banks, and finds

[7] Results reported in Section 1.7 for Ahmed and Zlate (2013) refer to the appendix of their study, where EM and mature economy variables are analyzed separately.

that flows are indeed influenced by past returns. Much of the supporting empirical evidence gathered in recent years is based on data on flows to EM-dedicated mutual funds and ETFs, including Fratzscher (2012) and Lo Duca (2012). The evidence is less conclusive for other asset return indicators, such as domestic policy interest rates (e.g., Ahmed and Zlate 2013). There is evidence, however, that return volatility dampens foreign portfolio inflows, especially real exchange rate volatility (e.g., World Bank 1997; Baek 2006).

There is some evidence that country vulnerability indicators impact portfolio flows, with greater country risk reducing inflows. For example, the World Bank (1997) finds that a higher external debt to GDP ratio tends to dampen flows. In addition, Kim and Wu (2008) find that lower sovereign credit ratings on foreign currency debt tend to reduce flows, particularly for long-term debt. An important caveat applies to vulnerability indicators that are closely tied to external financing needs, like the current account deficit or the government budget deficit. Here, studies generally find that the effect of reduced financing needs outweighs the opposing effect of improved creditworthiness, meaning that deficit reduction tends to reduce foreign portfolio inflows and vice versa (Hernandez et al. 2001; Baek 2006). This same result is also obtained for banking flows (Takats 2010; Herrmann and Mihaljek 2013) and FDI flows (Gupta and Ratha 2000).

Banking Flows

There is robust evidence that banking flows respond negatively to an increase in global risk aversion (and vice versa). This result is obtained by all seven studies included in this survey that look specifically at banking flows, spanning a variety of sample periods, country samples, and methodologies (see list of references below Figure 1.8).

By contrast, the evidence is much more mixed for the other cyclical push variables. Overall, the evidence seems to suggest that there is some negative impact of higher mature economy interest rates on banking flows, but this effect may at times be more than offset by the stronger economic and financial environment in which higher interest rates tend to prevail (and vice versa). Another reason why the evidence may be more mixed for banking flows than for portfolio flows is likely to be the lack of high-frequency data on cross-border banking flows. In terms of individual studies, Bruno and Shin (2013a) find the expected negative relationship for the 1995-2007 period, using BIS locational banking statistics (which are broadly consistent with capital flows as measured in the balance of payments; see Takats 2010 and BIS 2012). The authors focus on the role of the banking sector in transmitting U.S. monetary policy internationally. They argue that banks' financing costs are closely tied to central bank policy rates, and hence affect banks' willingness to lend internationally, including to local banks in emerging economies. This effect is amplified by a risk-taking channel, in

which measured risks decline during periods of low interest rates as borrowers' creditworthiness improves. In addition, Ghosh et al. (2014b) find a negative impact of U.S. real interest rates on cross-border banking flows to a sample of 76 countries, both emerging and mature (also based on BIS locational banking statistics).

However, an earlier BIS study by Jeanneau and Micu (2002) finds a positive relationship between higher global interest rates and banking flows to emerging markets. The authors focus on the 1985-2000 period and use semi-annual data from the BIS consolidated banking statistics database. Note that these data are not consistent with balance of payments data as they include international banks' local claims, i.e. loans by their subsidiaries (Takats 2010; BIS 2012). The explanation offered by the authors is that higher interest rates in mature economies reflect stronger economic conditions that result in improved confidence of international lenders, which may encourage cross-border bank lending. Another study by Goldberg (2002) uses micro-level U.S. banking data from banks' regulatory filings for the 1984-2000 period. She obtains mixed results on this relationship, with the sign of the coefficient depending on the model specification and with different results for U.S. lending to Latin America compared to EM Asia (for which there is more consistent evidence that higher interest rates lead to higher bank lending). Cerutti et al. (2014) provide mixed evidence for a sample of 77 countries (mature and emerging), finding that U.S. real interest rates are positively associated with cross-border bank flows, while the term premium shows the expected negative relationship.

Evidence for the role of mature economy output growth in driving banking flows is also mixed across various studies. Bruno and Shin (2013a) find a negative impact of external growth on banking inflows, while Jeanneau and Micu (2002) find a positive impact. Ferucci et al. (2004) find no statistically significant relationship, while Goldberg (2002) finds mixed evidence.

Regarding pull drivers, there is strong evidence for the roles of domestic output growth, domestic return indicators and country risk indicators in driving banking flows. Studies focusing on domestic output growth include Ferucci et al. (2004), Bruno and Shin (2013b) and Herrmann and Mihaljek (2013). These same studies also consider a variety of local asset returns and find evidence for a significant role of stock market returns, local currency appreciation, and especially banking sector equity performance in attracting foreign bank inflows. A caveat is that most of these studies are based on BIS data on cross-border bank claims, rather than data taken directly from the balance of payments (which are often not available for banking flows exclusively).

There is also robust evidence for the role of country risk indicators in driving banking flows. Jeanneau and Micu (2002) and Ferucci et al. (2004) find some evidence that a higher external debt ratio tends to reduce banking inflows. Hooper and Kim (2007) find that a higher institutional investor credit rating tends to boost banking flows. In addition, there is evidence that lower sovereign ratings by credit rating agencies tend to reduce banking inflows (Kim and Wu 2008). In a recent study, Bruno and Shin (2013b) look at the government debt to GDP ratio and find some evidence that greater indebtedness deters banking inflows, although this result is statistically insignificant in alternative specifications.

Looking beyond the selected variables considered in Figure 1.8, the literature on the drivers of banking flows identifies several other important determinants. For example, various studies emphasize the importance of the quality of institutions for banking flows, such as low corruption and a high-quality legal system (e.g., Papaioannou 2009) as well as a lower opacity index (Hooper and Kim 2007). "Gravity" effects are also found to be an important determinant of banking flows (i.e., geographic proximity tends to encourage inflows; see, for example, Buch 2005; Herrmann and Mihaljek 2013). In addition, bank health in lender countries is found to be an important push factor behind EM banking inflows (McGuire and Tarashev 2008; Herrmann and Mihaljek 2013).

Foreign Direct Investment

Out of the major capital flows components, FDI inflows to emerging markets are the least affected by global cyclical developments. Regarding the impact of changes in risk aversion, the empirical results are ambiguous and inconclusive: some studies find a positive relationship (e.g., Rey 2013, who looks at correlations between the VIX and FDI inflows to various EM regions), some studies find a negative relationship (e.g., Milesi-Ferretti and Tille 2011, who emphasize that the impact of risk shocks on FDI flows is smaller than for other components, looking at flows to both mature and emerging markets), and some studies find no relationship (e.g., Albuquerque et al. 2005).

There is more consensus in the literature about the impact of global interest rates on FDI flows, with the majority of empirical analyses finding no statistically significant relationship between the two. There are some exceptions, however. For example, Albuquerque et al. (2005) find that a measure of the average G3 interest rate negatively impacts FDI inflows to a country sample that includes emerging and mature economies. On the other hand, Gupta and Ratha (2000) find a strong positive relationship between FDI flows and international real interest rates.

When it comes to mature economy output growth, the literature again does not find a consistent relationship with FDI flows. Several studies obtain mixed results depending on the model

specification (e.g., De Vita and Kyaw 2008a), while others find no statistically significant relationship (Gupta and Ratha 2000). Albuquerque et al. (2005) find evidence for a negative impact of global growth on FDI flows to developing countries, but in an earlier version of their analysis (2002) provide a case study suggesting a positive relationship between global output growth and vertical FDI flows (i.e. production that is part of an integrated international supply chain and that satisfies demand outside the host country). Indeed, from a theoretical standpoint it seems plausible that the role of global growth differs for horizontal FDI (which replicates the same stage of production in various countries to satisfy demand in the local market) and vertical FDI. It seems plausible that vertical FDI would be more closely related to fluctuations in external demand, while the impetus for horizontal FDI is likely to depend to a greater extent on the performance of the host country's economy (Aizenmann and Marion 2004). Testing this hypothesis would seem to be a promising area for future research.

On the pull side, domestic output growth stands out as the most important driver of FDI inflows to emerging markets. Most studies find unambiguous results in support of such a relationship (e.g., Gastanaga et al. 1998; Hernandez et al. 2001; De Vita and Kyaw 2008a), with few exceptions (e.g., Gupta and Ratha 2000).

By contrast, most asset return indicators are unlikely to have a close relationship with FDI flows, given the longer-term nature of these investments. There are few empirical studies that focus specifically on the relation between asset returns and FDI, **but there is some evidence that return volatility deters FDI**, including World Bank (1997) and Reinhart and Rogoff (2003). Other studies that focus mainly on mature economy FDI inflows suggest that such inflows are encouraged by local exchange rate depreciation, including Froot and Stein (1991) and Klein and Rosengren (1994). In addition, Abbott et al. (2012) find that emerging markets with fixed exchange rates or intermediate regimes tend to attract more FDI inflows than countries with flexible exchange rates.

Country characteristics that make economies vulnerable to crises tend to deter foreign direct investment. While there is generally less evidence for a negative effect from external vulnerability indicators (such as foreign indebtedness), many studies find that domestic governance matters significantly. For example, a smaller size of government in the economy (measured as government consumption relative to GDP) tends to encourage FDI (Albuquerque et al. 2005), as do reduced expropriation risk and privatization efforts (Biglaiser and DeRouen 2006). **There is evidence, however, that country vulnerabilities affect FDI less than the other components of capital flows.** This caveat was first advanced by Fernandez-Arias and Hausmann (2001), who find that more vulnerable emerging markets generally receive less foreign capital, but FDI accounts for a greater share of

those inflows. In a more recent study, Daude and Fratzscher (2008) find that FDI flows are less sensitive to the quality of institutions than other types of capital flows, particularly portfolio equity and debt flows.

Besides the literature on the drivers of EM capital flows, there is a separate literature that addresses the unique determinants of FDI flows. A helpful overview of this literature is provided by Blonigen (2005), who considers FDI flows to all countries without differentiating between emerging and mature economies. Some of the unique factors include the tax regime (with lower taxes supporting greater inward FDI), trade protection (with some evidence that greater protection increases inward FDI to circumvent trade barriers), the strength of bilateral trade relations (since FDI can sometimes serve as a substitute for exports), exchange rate effects (with currency depreciation leading to increased inward FDI), and gravity effects. In addition, strong institutions, good governance and low corruption are also found to be important factors in attracting FDI flows (e.g., Gastanaga et al. 1998; Biglaiser and DeRouen 2006).

1.8. Conclusion

This survey has provided an overview of the empirical findings on the drivers of capital flows to emerging markets. The time-tested push-pull framework remains a very useful albeit imperfect way to structure the wealth of empirical evidence gathered in the literature. While most of the empirical work focuses on the cyclical drivers of capital flows, a more complete understanding can be achieved by considering secular forces such as the rise of institutional investors, trends in global portfolio diversification, and changes in the institutional framework in EM economies.

Within the push-pull framework, the literature has firmly established that both external and domestic factors matter for capital flows. A comprehensive review of the available evidence provides quite detailed guidance on the relative importance of these two sets of factors for different types of capital flows. Cyclical push factors like global risk aversion and mature economy interest rates are found to be most important for portfolio equity and debt flows. Evidence for banking flows suggests a significant role for both external factors (risk aversion and to a lesser extent foreign interest rates) and a range of country-specific factors (including domestic growth, country vulnerability indicators, and domestic asset returns, particularly in the banking sector). By contrast, evidence for the role of external factors is very mixed when it comes to foreign direct investment. Instead, FDI is found to be driven by country-specific factors like real GDP growth, as well as a number of factors that are specific to FDI flows.

In addition, there is robust evidence that the relative importance of push and pull factors varies over time, which is in part due to the fact that the relative magnitude of external and domestic shocks varies over time. Two contrasting periods are the mid-2000s global expansion, where push factors appear to have been relatively less important, versus the global financial crisis of 2008/09, which saw a sharp push shock for EM capital flows in the form of a surge in global risk aversion (Milesi-Ferretti and Tille 2011; Lo Duca 2012). **Overall, the answer to the popular question of whether push or pull factors are more important in driving capital flows thus depends not only on the types of capital flows considered, but also on the time period, among other factors.** A further caveat is that push and pull factors are interrelated. This complication receives substantial attention in the literature, beginning with the seminal work of Fernandez-Arias (1996), who analyzed the boost to EM borrowers' creditworthiness provided by a decline in U.S. interest rates. This theme is also picked up in the more recent literature, such as the study by Bruno and Shin (2013a) on the risk-taking channel of monetary policy.

These findings have important policy implications. **Policy challenges typically arise when a country experiences either large inflows or abrupt outflows of foreign capital.** The appropriate policy response to surges and reversals of capital flows depends on the extent to which these are driven by domestic versus external factors (Calvo et al. 1993). For example, if unduly large inflows are attracted predominantly by a strong domestic economy, a combination of fiscal tightening and exchange rate appreciation may be warranted. If, on the other hand, flows are primarily driven by a temporary decline in foreign interest rates, this may warrant additional reserve accumulation as a buffer for when favorable external conditions reverse (Ostry et al. 2010). This survey has shown that the drivers of capital flows depend crucially on the specific flows considered, particularly in terms of instruments, investor types, recipient sector, currency denomination, and other factors. Therefore, **policymakers need to take into account the composition of observed capital flows in order to assess how vulnerable a country's sources of external financing are to a deterioration in factors that are beyond its control.** For example, the central bank of a country that has previously received large inflows in the form of portfolio debt should be more concerned about an abrupt increase in foreign interest rates than if the inflows had been in the form of FDI or even bank lending.

Several promising avenues for further research emerge from this survey. The first is a more systematic effort to disentangle cyclical and structural factors driving capital flows to emerging markets. This would be particularly valuable given that a number of structural changes in the international financial system are likely to play an important role in driving capital flows going forward. Examples include the increasing role of emerging markets as source countries for capital

inflows to other EM economies ("south-south flows"), as well as the growing popularity of passive investment vehicles like exchange-traded funds (ETFs), with global assets held by ETFs growing from around $97 billion in 2000 to about $2.7 trillion in 2014 (McKinsey 2011; State Street Global Advisors 2015). A better understanding of the interplay of these forces with cyclical effects would enable a more holistic understanding of the drivers of capital flows.

Other promising areas of research include those potential driving forces whose role has not been ascertained conclusively by the extant empirical literature, such as the impact of various external factors for FDI flows. One specific example would be the relationship between mature economy growth and FDI inflows to emerging markets, where the theoretical case for external growth boosting vertical FDI seems compelling, but empirical evidence is scarce. **Recent improvements in data availability may facilitate such research.** For example, since 2009 the IMF has provided bilateral data on the total stock of direct investment from one country to another (Mink et al. 2012) as part of its annual coordinated direct investment surveys (CDIS). Such data may allow more nuanced insights about the role of output growth in source countries in determining FDI inflows to emerging markets. Similar advances may be possible for portfolio flows, where recent efforts have focused on developing high-frequency measures of portfolio flows that track balance of payments data. Examples include the databases on monthly and daily portfolio flows data compiled by the Institute of International Finance, which are broadly consistent with BoP principles (Koepke and Mohammed 2014b). Such high-frequency data may be particularly useful for assessing the role of volatile asset returns and would also make it possible to conduct event studies related to the announcement of unconventional monetary policy measures (which thus far have generally relied on proxies for capital flows, such as fund flows data).

A final area of research would be a more systematic assessment of how drivers differ between flows to emerging and mature economies, and the extent to which emerging markets are treated as a homogenous group. Emerging markets are generally perceived to be a riskier asset class, which is reflected in the volatility of capital flows (Bluedorn et al. 2013). Nonetheless, emerging economies are quite heterogeneous in their economic structures and level of development. A deeper understanding of how such fundamental country characteristics affect the importance of various capital flows drivers would be valuable.

Chapter 2

Fed Policy Expectations and Portfolio Flows to Emerging Markets[8]

2.1. Introduction

Will capital flows to emerging markets wane as the Fed tightens monetary policy further in the coming years? The existing empirical literature seems to suggest that flows should indeed weaken as the Fed continues to raise policy interest rates. Many studies have found that U.S. interest rates are a key driver of capital flows to EMs (e.g., Fernandez-Arias 1996; Taylor and Sarno 1997; Baek 2006; De Vita and Kyaw 2008; Bluedorn et al. 2013). The common interpretation of the existing empirical findings is that low U.S. interest rates tend to "push" capital to EMs, while higher interest rates reduce those flows. An early example of this reasoning is the seminal study by Fernandez-Arias (1996, p. 414), which concludes that "[c]apital inflows in the typical country are largely dependent on favorable international interest rates and, ceteris paribus, would not be sustained if they return to higher levels." The analysis presented in this chapter offers a more nuanced assessment. This study argues that the literature has neglected the role of market expectations when examining how U.S. interest rates affect capital flows to EMs. If market pricing already reflects expectations that Fed tightening lies ahead, an adverse impact on capital flows should materialize primarily, if not exclusively, if rates rise faster than expected. In recent years, futures markets have consistently anticipated sustained increases in both the short-term policy interest rate and long-term market interest rates for the years ahead. If rates were to increase less rapidly than priced in by markets, this could instead boost EM portfolio flows.

The main contribution of this chapter is to bring the expectations perspective to the EM capital flows literature. The role of monetary policy expectations and surprises has received significant attention in the literature on monetary transmission to the domestic economy in recent years. In this literature, a growing consensus has emerged that the primary source of monetary policy shocks "is not what the Fed just did, but is instead new information about the Fed's future intentions" (Hamilton 2008, p. 1171). These findings have received little attention in the literature on the determinants of capital flows, however, and this study is among the first to link changes in monetary policy expectations to capital flows movements.[9] The results are particularly important given the prospect of sustained

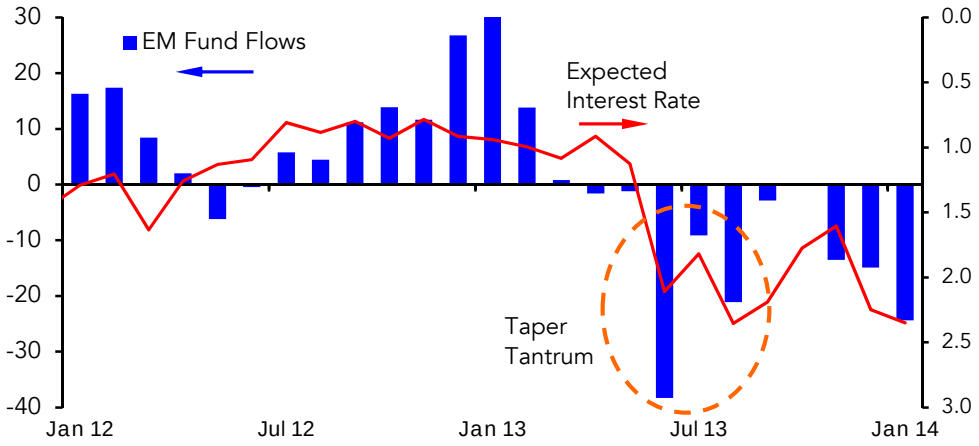
[8] This chapter was published as Koepke (2014).
[9] To my knowledge, this link was first established in two earlier versions of the present study, published in IIF (2013) and Koepke (2013). Both of these earlier versions were released just after the 2013 "taper tantrum" of the summer of 2013 and

increases in U.S. policy interest rates in coming years. In addition, the findings help explain the market turmoil during the 2013 "taper tantrum", when comments by the Fed's leadership about an imminent reduction in the pace of asset purchases fueled concerns that interest rates may be raised faster than expected, triggering a sell-off of EM assets and a reversal of emerging market capital flows. The empirical results of this study suggest that the sharp retrenchment of EM portfolio flows observed during this episode was driven by an abrupt upward adjustment in the expected policy rate path (Figure 2.1).

Figure 2.1

EM Fund Flows and Market-Implied U.S. Short Term Interest Rate

fund flows in $ billion *3-year ahead market-implied interest rate in percent, based on eurodollar futures contracts*



Source: EPFR, Bloomberg, author's illustration.

The second contribution of this chapter is to help bridge the gap between high-frequency data on fund flows and international portfolio flows as measured in the balance of payments (BoP). Fund flows data such as those provided by EPFR Global have become increasingly popular in the academic literature in recent years (e.g., Fratzscher 2012; Lo Duca 2012; Ananchotikul and Zhang 2014). While fund flows provide a timely perspective on investment decisions vis-à-vis emerging markets, they are conceptually different from international portfolio flows in a number of ways and are subject to various sampling issues (see Section 2.4). It is thus no surprise that portfolio flows as measured by the two data sources differ significantly in their magnitude and dynamic behavior. Arguably, empirical studies have not been emphatic enough in pointing out the differences between fund flows and international portfolio flows as defined in the BoP (Koepke 2015a). To my knowledge, this study is the first to provide estimation results on the determinants of portfolio flows using both EPFR fund flows data and BoP-consistent portfolio flows data. For the latter, I use a novel data set on

discuss that episode in greater detail. Other studies have since built on the expectations approach used in this study, including Dahlhaus and Vasishtha (2014).

monthly portfolio flows that is compiled based on national sources of 14 EM countries and is regularly updated by the Institute of International Finance (IIF).[10] The core findings of this study are shown to hold for both data sources, despite their many differences.

In terms of the estimation results, two main findings stand out: First, changes in U.S. monetary policy expectations have a statistically significant and economically important impact on both EM fund flows and BoP-consistent portfolio flows. A one percentage point shift in market expectations for the federal funds rate three years forward is estimated to reduce portfolio flows by about $15.3 billion contemporaneously. For fund flows, the estimated impact is smaller in the short term (-$11.7 billion), but larger in the long term (-$26.7 billion), reflecting persistence in fund flows.

Second, shifts in expectations towards tighter monetary policy have tended to exert a greater impact on EM portfolio inflows than shifts towards easier monetary policy. For example, for bond fund flows and portfolio debt flows the estimated coefficients for shifts towards tighter policy are typically about 5 times as high as the coefficient for shifts towards easier policy. A disaggregation of the fund flows dataset by investor type suggests that the asymmetric response to upward shifts in Fed policy rate expectations is driven primarily by retail investors (as opposed to institutional investors).

The model setup also makes it possible to test a number of additional hypotheses. For example, it enables an assessment of how the Fed's large-scale asset purchases have impacted flows to emerging markets. There is some evidence that changes in the pace of asset purchases have had an impact on EM fund flows above and beyond what is captured by the market expectations channel. The long-term impact of a one-time $10 billion reduction in the pace of Fed asset purchases (as observed during the period of Fed "tapering" from January to October 2014) is estimated to be a decline in EM fund flows by a total of about $2 billion.

In addition, I find tentative evidence for a market expectations channel relating to country-level developments. An economic surprise index that captures the strength of the economic data flow in emerging economies relative to market expectations is a statistically significant explanatory variable for portfolio equity flows.

Another finding relates to the role of policy interest rate differentials between emerging and advanced economies, which are often seen as an important driver of portfolio flows in the context of the carry trade (see, for example, Galati et al. 2007). This variable is tested as a potential explanatory variable in a variety of model specifications, which do not yield statistically robust evidence that policy interest rate differentials were a driver of portfolio flows in the period studied.

[10] The dataset is posted on the following website: https://www.iif.com/publications/portfolio-flows-tracker.

The remainder of this chapter is organized as follows: Section 2.2 reviews the related literature. Section 2.3 provides the conceptual framework for the role of monetary policy in driving portfolio flows to EM economies. Section 2.4 describes the data used in the empirical part and presents the empirical methodology. Section 2.5 summarizes the estimation results and Section 2.6 discusses a range of robustness checks. Section 2.7 concludes the chapter.

2.2. Related Literature

The voluminous literature on the drivers of capital flows to emerging markets has firmly established the importance of both country-specific "pull" factors and global "push" factors. Pull factors primarily relate to economic growth, country risk factors and return prospects in emerging market countries. By contrast, push factors affect the supply of foreign capital and relate to global financial conditions, most notably the global interest rate environment and investor risk appetite.

The focus of this study is primarily on the role of U.S. interest rates, a push factor. The important role of U.S. interest rates and other external factors was first identified in the seminal paper by Calvo, Leiderman and Reinhart (1993), who find that record-low U.S. interest rates after the 1990/1991 recession had contributed to the rebound in capital flows to Latin American economies. Most subsequent studies find further support for the role of U.S. interest rates, including Fernandez-Arias (1996), Taylor and Sarno (1997), World Bank (1997), Montiel and Reinhart (1999), Baek (2006), De Vita and Kyaw (2008), and Bluedorn et al. (2013).

The present study differs from previous work in that it uses changes in expected Fed policy interest rates as the explanatory variable (derived mainly from federal funds futures contracts), while previous work has predominantly relied on some form of market-based yield on U.S. Treasury securities to proxy U.S. or global interest rates. Frequently used maturities in the literature include the 3- and 12-month T-bill rates and the 10-year Treasury yield (e.g., Fernandez-Arias 1996; Montiel and Reinhart 1999; De Vita and Kyaw 2008). A limited number of studies use U.S. short-term policy interest rates, i.e. the federal funds target or effective rates (e.g., Ahmed and Zlate 2013; Bruno and Shin 2015). In a recent working paper, Dahlhaus and Vasishtha (2014) take an approach that is more similar in spirit to the present study (building on an earlier version of this chapter). The authors find support for the notion that monetary policy surprises drive EM portfolio flows, using a monetary policy shock as explanatory variable that is estimated based on both market interest rates and federal funds futures contracts.

While most of the empirical literature analyzes U.S. or global interest rates as self-standing drivers of capital flows, some have looked at the interest rate differentials between emerging and advanced economies. For example, Ahmed and Zlate (2013) find that a wider policy interest rate differential in favor of emerging markets tends to boost capital flows (including portfolio flows), and that this effect has increased after the global financial crisis. However, their robustness checks also indicate different effects of emerging and mature economy interest rates on capital flows in terms of magnitude and statistical significance. Herrmann and Mihaljek (2013) investigate whether interest rate differentials affect banking flows to emerging markets and find supporting evidence for some emerging market regions (Asia and Latin America), but not others (central and eastern Europe). A recent study by the World Bank (2014) does not find statistically robust evidence in support of interest rate differentials.

The present study also builds on the literature about the relationship between Fed policy actions and U.S. market interest rates, particularly the work in the vein of the seminal paper by Cook and Hahn (1989). In an event study approach, the authors estimate the impact of changes in the federal funds target rate on bond yields during the 1970s, and find a significant and positive effect across maturities, suggesting a tight causal link between Fed policy actions and market interest rates. Subsequent studies found a smaller impact for later sample periods, however (e.g., Roley and Sellon 1995). Kuttner (2001) provides an explanation for the diminishing impact of changes in the federal funds target rate on bond yields, arguing that market participants had become better at predicting imminent policy rate changes, mainly because Fed policy had become more transparent over time. His analysis distinguishes between anticipated and unanticipated changes in the federal funds rate, which shows that it is the unanticipated component of Fed actions that affects market interest rates, while anticipated changes have virtually no effect on market interest rates.

Hamilton (2008), develops this point further by emphasizing that monetary policy shocks are primarily about news regarding what the Fed is going to do in the future rather than its most recent actions. In other words, the impact of monetary policy on the economy is thought to arise from changes in the entire path of future short-term interest rates anticipated by markets. Gürkaynak (2005) provides a useful framework for analyzing these changes by decomposing shifts in the fed funds futures path into timing, level, and slope components. His analysis shows that asset prices are most affected by shifts in the futures curve that extend beyond the near term (i.e. a level shift in the futures path or a change in its slope, rather than a mere change in the timing of a near-term change in the federal funds target rate). The present study takes due account of these findings by making use of futures-implied interest rates for several years ahead, which are more likely to affect capital flows movements than futures-implied interest rates for just a few months ahead.

2.3. Conceptual Framework for the Role of Monetary Policy Expectations

The focus of this chapter is to explore the link between U.S. monetary policy and EM capital flows. In order to frame the monetary policy expectations approach taken in this study in the context of the existing literature, it is helpful to review the theoretical link between monetary policy expectations and market interest rate variables used in much of the literature. According to the expectation theory of the term structure of interest rates, the forces affecting Treasury yields can be broken down into two components, namely the expected path of future short-term interest rates and the term premium (Kim and Wright 2005). The first component reflects market expectations of how the Fed will set the policy interest rate over time. If market participants come to expect tighter U.S. monetary policy in the future, yields on Treasury securities with sufficiently long remaining maturities will rise (other things equal). The term premium captures the additional yield required by investors to hold a bond with a longer maturity rather than holding a series of short-term bonds. Changes in the term premium reflect shifts in the demand and supply of Treasury securities, which may occur for many reasons.

Accordingly, a change in market expectations for Fed policy will generally have an immediate impact on Treasury yields, reflecting a revised path of expected future short-term interest rates.[11] At the same time, Treasury yields can fluctuate due to a host of factors unrelated to changes in the expected path of future short-term interest rates, captured by the term premium. Therefore, using federal funds futures contracts as an explanatory variable for capital flows movements can be considered a more targeted approach towards capturing the impact of U.S. monetary policy than using market interest rates. Such a targeted approach can help reduce the noise introduced by confounding factors, such as omitted variables that affect both the term premium and portfolio flows. For example, one such factor is the degree of risk appetite among investors, particularly during periods of intense market stress. When risk aversion jumps market participants tend to reduce their emerging market exposures and seek refuge in "safe" Treasury securities (Bertaut and DeMarco 2009, Milesi-Ferretti and Tille 2011). This "flight-to-safety" effect thus tends to reduce Treasury yields during periods when investors withdraw portfolio capital from emerging markets, which by itself would introduce a positive association between the level of U.S. market interest rates and portfolio flows to emerging markets.

[11] Note that U.S. monetary policy affects a host of other financial variables besides Treasury yields, such as yields on corporate bonds and mortgage backed securities, as well as stock prices and exchange rates (Bofinger 2001).

While most empirical studies have made use of market interest rates as explanatory variables for portfolio flows, some studies have instead used U.S. monetary policy variables, such as the federal funds target rate or effective rate (e.g., Ahmed and Zlate 2013; Bruno and Shin 2015). These short-term interest rates do not pick up changes in the expected path of future interest rates, however, making them a rather narrow measure of the external interest rate conditions facing emerging markets. This is especially true given ample evidence that monetary policy works via the expectations channel, as emphasized in the recent literature (e.g., Kuttner 2001; Hamilton 2008). Market participants act in anticipation of changes in monetary policy settings, meaning that financial asset prices will quickly incorporate new information about the future course of monetary policy (see, for example, Bernanke and Kuttner 2005 for estimates of the impact of monetary policy shocks on stock markets). Given the immediate adjustment of asset prices to a shift in market expectations of monetary policy, it is plausible that such shifts also trigger reallocations of investor portfolios, even in the absence of a change in the policy interest rate settings. A second reason not to use short-term (policy) interest rates as explanatory variable is that U.S. policy interest rates are often stable for extended periods, making it difficult to use them in econometric models. This caveat is particularly relevant for the period following the global financial crisis, when the federal funds target rate remained unchanged at 0-0.25 percent for seven years.

The fact that the literature has generally relied on changes in market interest rates (which capture both anticipated and unanticipated movements in interest rates) rather than changes in policy interest rates (which most of the time are largely anticipated, Kuttner 2001) may be an indication that it is indeed the unanticipated element of interest rate movements that matters most for international capital flows.

In this context, it is noteworthy that the relative magnitude of expected vs. unexpected changes in interest rates varies for different time horizons and thus data frequencies. Anticipated interest rate increases are quite small at short time horizons (for example, in recent years, futures markets have typically priced in increases in 10-year Treasury yields in the range of two to four basis points per month), while short-term fluctuations in market interest rates can be sizeable. Over longer time horizons, anticipated interest rate changes are typically much larger since the anticipated monthly interest rate changes essentially accumulate (i.e. expected monthly changes typically all have the same sign), while a large portion of the unanticipated monthly fluctuations in interest rates cancel out. The literature has typically found that changes in market interest rates are an important driver of EM capital flows at high data frequencies (e.g., Taylor and Sarno 1997; Baek 2006; Fratzscher et al. 2012), consistent with the idea that it is the unanticipated component of interest rate changes that matters for capital flows. By contrast, at low data frequencies, the literature has not found conclusive

evidence that changes in market interest rates impact EM capital flows (e.g., Hernandez et al. 2001, which is based on annual data), consistent with the idea that the anticipated component of interest rate changes does not have a statistically significant impact on EM capital flows.

The approach pursued in this study is to take account of the forward-looking nature of interest rate markets and monetary policy by focusing on the unanticipated component of changes in interest rates. Estimations are based on monthly data, and thus the focus is on the impact of short-term fluctuations in expected interest rates. Specifically, I make use of federal fund futures contracts to measure the extent to which future changes in policy interest rates are priced in by financial markets. Changes in the future interest rates implied by federal funds futures contracts indicate a revised path for monetary policy, capturing the unanticipated component of changes in interest rates. The main hypothesis is that these changes in Fed policy rate expectations drive international portfolio flows movements, with shifts towards easier anticipated future monetary policy resulting in a boost to portfolio flows to emerging markets, and vice versa.

2.4. Data and Empirical Strategy

I use two alternative datasets on portfolio flows to emerging markets. The first is data from Emerging Portfolio Fund Research Global (EPFR) on equity and bond flows into EM-dedicated funds, i.e. investment funds that are (almost) fully invested in emerging market assets. These data are commonly used as a high-frequency proxy for non-resident (or "gross") portfolio flows to emerging markets (see Miao and Pant 2012). Equity fund flows are available from February 1996 onwards and bond flows are available starting in November 2003. The data are based on a large sample of mutual funds and exchange-traded funds (ETFs) whose fund managers/administrators report to EPFR. As of 2014, the EM equity flows data were based on funds with a total of over $1 trillion of assets under management, while the corresponding bond funds had in excess of $300 billion under management. In addition to the aggregated movements in and out of funds, EPFR makes available disaggregated data on the basis of investor type (institutional vs. retail), domicile (by country), and currency, among others. EPFR fund flows data have enjoyed growing popularity in the academic literature in recent years (e.g., Fratzscher 2012, Lo Duca 2012, Ananchotikul and Zhang 2014). In addition, EPFR data are widely relied on by central banks and the financial industry as a timely high-frequency indicator of portfolio flows movements.

Despite their growing popularity, there are a number of caveats regarding the use of fund flows data (see Brandt et al. 2015). Conceptually, the transactions captured by fund flows are not necessarily

capital flows as defined in the BoP, which would require that the transaction be between a resident of an EM country and a non-resident. This may not be the case for fund flows because investment funds and the counterparties to their transactions may be residents of any country in the world. In addition, funds maintain cash buffers, meaning that an inflow to a fund does not necessarily prompt the fund to purchase a security. Moreover, EPFR fund flows data do not treat dividend distributions in the same way as under standard BoP practices (International Monetary Fund 2010; Emerging Portfolio Fund Research Global 2015). Dividend payments are recorded as an outflow in the fund flows data, but not in BoP data (where they are recorded in the current account). Conversely, dividends that are reinvested to purchase additional securities do not affect fund flows estimates, but they are recorded as a portfolio inflow in the BoP accounting framework. This difference is likely to account for some of the downward bias in fund flows relative to BoP portfolio flows (see below). Finally, fund flows are sample-based, and while the sample of reporting funds is quite sizeable, certain institutional investors are underrepresented (such as hedge funds and pension funds; Brandt et al. 2015).

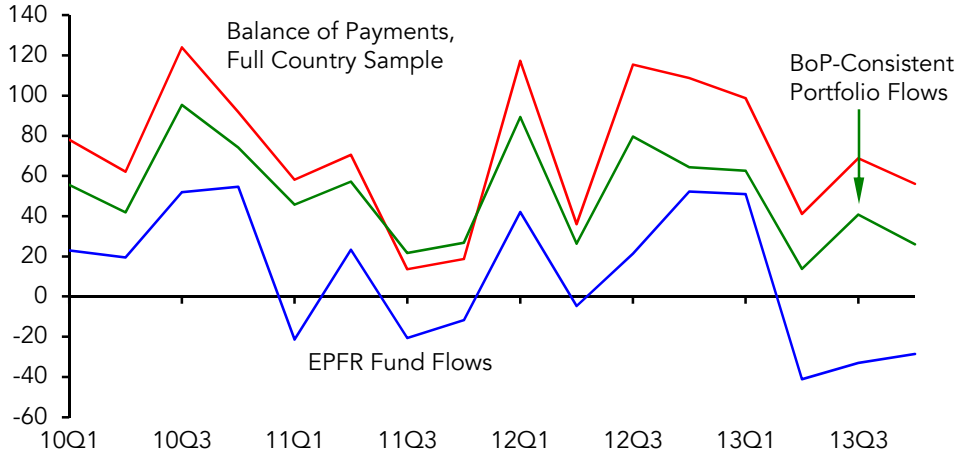
The second data source for portfolio flows is high-frequency data published by national sources in 14 EM countries and compiled by the Institute of International Finance (IIF).[12] According to IIF estimates, these data cover about 70% of total non-resident portfolio flows to emerging markets for both equity and bond flows (Koepke and Mohammed 2014b). The data are published by national central banks and stock exchanges, and are released at least at the monthly frequency (some national sources publish weekly or even daily data). These data typically feed into the calculation of countries' quarterly balance of payments data, and in some cases are identical to the lower-frequency BoP data. An additional benefit is that the data have a much shorter publication lag than quarterly balance of payments data, which are often released several months after the end of a quarter. As Figure 2.2 shows, the monthly dataset tracks total quarterly portfolio flows as measured by the IIF quite closely – much more so than EPFR fund flows data. For example, total portfolio inflows (debt and equity) in the years 2010-2013 averaged $290 billion per year for BoP data, which compares to $205 billion per year for monthly BoP-consistent portfolio flows data, but only $45 billion for EPFR's fund flows data. As such, the estimations based on portfolio flows data provide an important complement to the findings based on fund flows data, which in turn have the advantage that they can be disaggregated by investor type and maturity, among others. Additional charts of all the main regression variables are provided in Appendix 1 at the end of this chapter.

[12] The countries are Bulgaria, Brazil, Czech Republic, Chile, Hungary, India, Indonesia, Korea, Mexico, Poland, South Africa, Thailand, Turkey, and Ukraine.

Figure 2.2

Portfolio Equity and Debt Flows to Emerging Economies

$ billion; non-resident flows; BoP data based on IIF group of 30 emerging economies



Source: IIF, EPFR, author's illustration.

Expectations for U.S. policy interest rates are calculated primarily using federal funds futures contracts. These contracts can be thought of as the market expectation for the federal funds effective rate at the date specified in the contract. According to Krueger and Kuttner (1996), federal funds futures rates provide efficient forecasts of changes in the federal funds rate. An alternative measure of monetary policy expectations are eurodollar futures, which are a more liquid and are available further into the future (Rigobon and Sack 2002). Gürkaynak, Sack and Swanson (2007) find that both instruments are good predictors of changes in the federal funds target rate, with fed funds futures being the single best predictor at short time horizons. In terms of the variable specification, I use the 1-month change in the expected federal funds rate 34 months later, which is the most distant data point that is available. Using expectations for policy settings relatively far into the future is the most promising strategy because markets in certain periods did not expect any changes in the federal funds rate over the subsequent 1-2 years. This approach is also consistent with prior research on the impact of changes in federal fund futures prices on asset prices (Gürkaynak 2005). To provide an example for the calculation of the variable used in the regression model, the observation for December 2013 is based on the futures contract for October 2016, and is calculated as the average fed funds rate expected for that month during December 2013 less the average expected during November 2013. Data availability on Bloomberg for federal funds futures contracts begins in February 2011. For the period prior to February 2011, I use data on expected future interest rates from eurodollar futures contracts, which have a near-perfect correlation of 0.98 with federal funds futures contracts. The two variables are often used interchangeably in the literature (e.g., Femia et al.

2013).[13] Robustness checks indicate that the estimation results are substantively the same when using either eurodollar futures or federal funds futures for the period when both series are available (see Section 2.6).

Control variables for country-specific and global developments are used consistent with the literature. On the push side, the preferred proxy for global risk aversion is the BBB-rated U.S. corporate bond spread over Treasuries, calculated by Bank of America Merrill Lynch ("U.S. Corporate BBB Option-Adjusted Spread") and obtained via Bloomberg. As an alternative risk variable, I use the VIX index, a measure of expected volatility in the S&P 500 over the next 30 days, which is derived from options contracts. In terms of pull variables, I use an aggregate emerging market stock market index (the Morgan Stanley Capital International [MSCI] EM index) as a return indicator that is also able to capture cyclical conditions in EM countries to some degree. As an alternative, I use the Citigroup Economic Surprise Index for emerging markets, which is a quantitative measure of the surprise element contained in economic data releases. When newly released economic data exceed the median forecast in the Bloomberg consensus survey, the economic surprise index increases and vice versa. A further pull variable is the EMBIG spread, which is the yield difference (in basis points) of the J.P. Morgan Emerging Markets Bond Index Global over U.S. Treasury securities.

In alternative specifications of the model I make use of several additional variables, such as total assets on the Federal Reserve's balance sheet in $ billion. Another variable of note is the policy interest rate differential between emerging and advanced economies, which is calculated as the GDP-weighted average of policy interest rates in 16 emerging economies that make these data available from the year 2000 onward, less the U.S. Federal Reserve's federal funds target rate.[14] Data were obtained via Bloomberg and Datastream.

[13] One limitation of eurodollar contracts is that expiration dates are only available for 4 out of 12 calendar months in the year (March, June, September, and December). In order to make the data comparable to the federal funds futures time series (which refers to 34 months into the future), I interpolate between the two relevant eurodollar contracts when necessary (i.e. in the months when expiration dates are 32 and 35 months ahead and in the months when expiration dates are 33 and 36 months ahead).

[14] These countries are Brazil, Chile, China, Colombia, Czech Republic, Hong Kong, Hungary, India, Indonesia, Israel, Korea, Malaysia, the Philippines, Poland, Thailand, and Turkey.

Econometric Model

I estimate variants of the following general model:

$$Flows_t = \alpha_0 + \alpha_1 \cdot Flows_{t-1} + \beta \cdot MonPol_t + \sum_{i=1}^{n} \gamma_i \cdot Pull_{it} + \sum_{i=1}^{n} \delta_i \cdot Push_{it} + \varepsilon_t \quad (2.1)$$

$Flows_t$ are net flows to EM-dedicated funds in month t in $ billion, or alternatively net non-resident purchases of bonds and stocks from BoP-consistent portfolio flows data. $Flows_{t-1}$ is the lagged dependent variable, which is included in the fund flows regressions to take account of autocorrelation. $MonPol_t$ is the change in federal funds futures contracts three years into the future in percentage points. "*Pull*" refers to emerging market explanatory variables, while "*Push*" captures external variables. The main variables of interest are as follows:

$$Pull_{it} = [EM\_Stocks_t\ ;\ EMBIG_t\ ;\ EM\_Surprise_t] \quad (2.2)$$

EM_Stocks_t is an emerging market stock market index (the MSCI EM), $EMBIG_t$ is the EM bond yield spread over U.S. Treasuries, and $EM\_Surprise_t$ is Citigroup's Economic Surprise Index.

$$Push_{it} = [Risk_t, QE_t] \quad (2.3)$$

The variable $Risk_t$ captures investor risk aversion, measured either as the BBB-rated U.S. corporate bond spread over Treasuries or as the VIX U.S. equity volatility index. The variable QE_t is included in some specifications to analyze the impact of Fed asset purchases on portfolio flows.

The model is estimated via OLS. Functional forms for all variables are based on augmented Dickey-Fuller tests. The specific functional forms for control variables are reported in the results section.

An important variant of the baseline model is a specification that tests whether the impact of shifts in monetary policy expectations is symmetric. For this purpose, I augment the baseline model by including dummy variables that capture whether policy rate expectations have shifted up or down in a given month:

$$D_1 = \begin{cases} 1 & when\ MonPol_t > 0 \\ 0 & when\ MonPol_t < 0 \end{cases} \quad (2.4)$$

$$D_2 = \begin{cases} 1 & when\ MonPol_t < 0 \\ 0 & when\ MonPol_t > 0 \end{cases} \quad (2.5)$$

That is, the dummy variable D1 is equal to 1 for months where policy rate expectations move up, while the dummy variable D2 is equal to 1 for months where policy rate expectations move down.

The augmented model then includes separate coefficient estimates for upward and downward shifts in policy interest rate expectations:

$$Flows_t = \alpha_0 + \alpha_1 \cdot Flows_{t-1} + \boldsymbol{\beta_1} \cdot \boldsymbol{D_1} \cdot \boldsymbol{MonPol_t} + \boldsymbol{\beta_2} \cdot \boldsymbol{D_2} \cdot \boldsymbol{MonPol_t} + \sum_{i=1}^{n} \gamma_i \cdot Pull\ Factors_{it} + \sum_{i=1}^{n} \delta_i \cdot Push\ Factors_{it} + \varepsilon_t \quad (2.6)$$

Moreover, the BoP-consistent portfolio flows dataset is aggregated from country-level data that make it possible to estimate a pooled regression across individual countries. The pooled model has the advantage that country fixed effects can be included to control for country-specific factors that may affect flows to individual countries (Greene 2008a). In addition, the pooled estimations include a substantially greater number of observations than the estimations with aggregate flows as the dependent variable. In order to make the country-level portfolio flows data comparable across countries they are scaled by each country's nominal GDP (in U.S. dollar terms). One implication of this scaling is that the estimated coefficients are not directly comparable to those obtained in regressions with aggregate flows as the dependent variable.

The specification of the pooled model is as follows:

$$Flows_{jt} = \alpha_0 + \beta \cdot MonPol_t + \sum_{j=1}^{m} \cdot \sum_{i=1}^{n} \gamma_{ij} \cdot Pull_{ijt} + \sum_{i=1}^{n} \delta_i \cdot Push_{it} + a_j + \varepsilon_t \quad (2.7)$$

The model specification is unchanged from equation (2.1), except for the addition of the country-subindex *j* and the term a_j capturing the country fixed effects. The lagged dependent variable is not included since BoP-consistent portfolio flows do not exhibit significant serial correlation.

The pooled model is also estimated with the augmented specification, testing for the presence of asymmetric effects depending on the direction of shifts in Fed policy expectations. The precise specification is as follows:

$$Flows_{jt} = \alpha_0 + \beta_1 \cdot D_1 \cdot MonPol_t + \beta_2 \cdot D_2 \cdot MonPol_t + \sum_{j=1}^{m} \cdot \sum_{i=1}^{n} \gamma_{ij} \cdot Pull_{ijt} + \sum_{i=1}^{n} \delta_i \cdot Push_{it} + a_j + \varepsilon_t \quad (2.8)$$

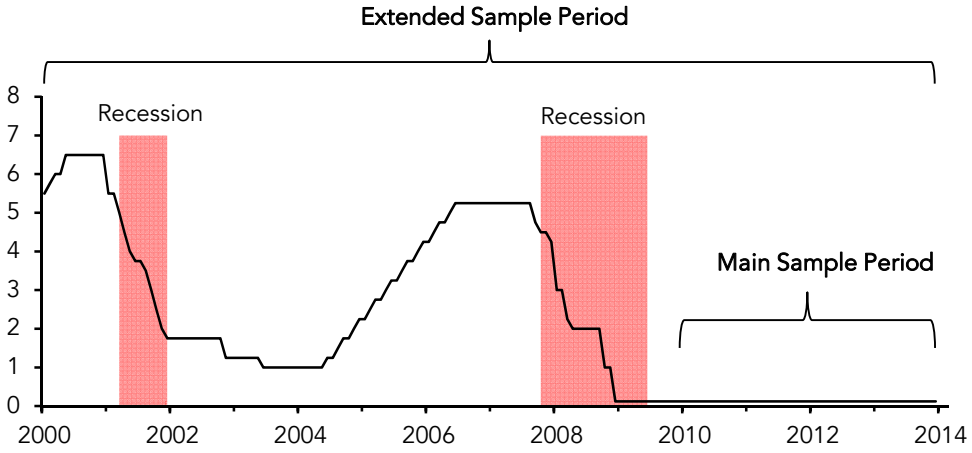
Sample Periods

The main results are presented for two different sample periods. The main sample period ranges from January 2010 to December 2013 and captures the period where data quality for fund flows and portfolio flows is best. Prior to 2010, both capital flows datasets are somewhat more limited. For the portfolio flows dataset, the number of reporting countries gradually declines before 2010, while for the fund flows dataset, the number of reporting funds and the amount of assets under management is progressively smaller. Another reason why it seems appropriate to begin the sample period in early 2010 is that it excludes the severe 2007-2009 U.S. recession and global financial crisis, where

capital flows are likely to have been subject to different driving forces (Milesi-Ferretti and Tille 2011). Moreover, the 2010-2013 period captures a time where the federal funds target rate was stuck at the zero lower bound, marking a period where the forward-looking aspect of Fed policy was particularly relevant (Figure 2.3). In a second set of regressions, the sample period is extended back to the year 2000, which allows for a larger number of observations. One qualification is that EPFR bond flows data only begin in November 2003, resulting in a somewhat shorter sample period for bond fund flows regressions.

Figure 2.3

Sample Periods and Federal Funds Target Rate
percent per annum, recession periods as per NBER's Business Cycle Dating Committee



Source: Datastream, NBER, author's illustration.

2.5. Estimation Results

2.5.1. Baseline Model: Estimation Results for the Post-Crisis Period (2010-2013)

The baseline regression results are reported in Table 2.1, which shows estimations using either fund flows or international portfolio flows as the dependent variable. Overall, the models typically explain around 45% to 65% of the observed variation in monthly flows. The main variable of interest is the monetary policy expectations variable, which has the expected negative sign and is highly statistically significant for total flows, using either of the two flows datasets. An increase in the expected policy interest rate three years ahead by one percentage point leads to a reduction in EM flows of about $11.7 billion for EPFR fund flows and about $15.3 billion for portfolio flows. The monetary policy coefficients in the regression with bond flows as the dependent variable are also highly statistically significant, while this is not the case in regressions with equity flows (in either dataset), although the coefficient does have the expected negative sign. Note, however that

the monetary policy variable is significant in various alternative specifications of the equity flows regression, reported below. A potential reason why bond flows may react more strongly to interest rate surprises than equity flows is that bond prices are more closely linked to interest rates than stock prices, at least for bonds with sufficiently long remaining maturities. Consistent with this, several other studies have found a larger impact of U.S. interest rates on bond flows compared to equity flows, such as Taylor and Sarno (1997) and Dahlhaus and Vasishtha (2014).

Table 2.4 in the appendix to this chapter provides estimation results for the pooled model that uses individual country-level portfolio flows for 11 emerging markets as the dependent variable. The results are fully consistent with the portfolio flows regressions reported in Table 2.1. The statistical significance of the Fed variable is generally higher in the pooled model, adding to the evidence regarding the role of shifts in monetary policy expectations for EM portfolio flows.

Table 2.1: Baseline Estimation Results for EPFR Fund Flows and BoP-Consistent Portfolio Flows

	EPFR Fund Flows			BoP-Consistent Portfolio Flows		
	Total	Debt	Equity	Total	Debt	Equity
Constant	0.016	-0.101	-0.008	14.716 ***	10.854 ***	3.862 ***
	(1.386)	(0.547)	(1.013)	(1.284)	(0.927)	(0.948)
$Flows_{t-1}$	0.563 ***	0.662 ***	0.496 ***			
	(0.100)	(0.097)	(0.108)			
Monetary Policy Expectations	-11.668 **	-6.357 ***	-5.238	-15.254 ***	-10.70 ***	-4.553
	(5.016)	(1.886)	(3.748)	(4.542)	(3.280)	(3.353)
BBB Spread	-13.845	-9.758 ***	-5.396	-38.608 ***	-22.97 ***	-15.634 **
	(9.277)	(3.331)	(7.132)	(8.291)	(5.987)	(6.121)
MSCI EM	1.160 ***	0.283 ***	0.880 ***	1.299 ***	0.52 ***	0.782 ***
	(0.250)	(0.095)	(0.186)	(0.230)	(0.166)	(0.170)
Adjusted R^2	0.59	0.61	0.54	0.63	0.44	0.45
Standard Error of Regression	8.80	3.30	6.58	8.21	5.93	6.06
Number of Observations	48	48	48	48	48	48
Durbin-Watson Statistic				1.71	1.54	1.86
Durbin h Statistic	-1.48	-1.04	-1.06			

Notes: Asterisks denote significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. Standard errors are reported in parentheses. Models were estimated using monthly data for January 2010 to December 2013. Functional forms are based on standard stationarity tests for all variables (Augmented Dickey-Fuller tests). For fund flows, the dependent variable is net flows to EM-dedicated funds as reported by EPFR Global, while for portfolio flows it is net non-resident purchases of EM securities. $Flows_{t-1}$ is the lagged dependent variable. Monetary Policy Expectations refers to the change in the federal funds futures contract three years into the future. BBB Spread is the change in the yield difference on U.S. BBB-rated corporate bonds relative to U.S. Treasuries. MSCI EM is the percent change in the Morgan Stanley Capital International EM stock market index from the prior month. For further details, see the data descriptions in Section 2.4.

In terms of the other explanatory variables, an increase in global risk aversion is associated with a reduction in both fund flows and portfolio flows, as expected. The variable is highly statistically significant and economically important in all specifications except one (for equity fund flows). An increase in the BBB spread by one percentage point is associated with a reduction in total fund flows of $13.8 billion and a reduction in total portfolio flows of $38.6 billion. In addition, there is a strong relationship between the local stock market index and investment flows, which has the expected positive sign. A one percent increase in EM stock prices is associated with additional fund flows of about $1.2 billion and increased portfolio flows of $1.3 billion.

Results for several alternative specifications of the baseline regressions are reported in Table 2.2 for bond flows and Table 2.3 for equity flows. Fund flows consistently exhibit strong positive first-order autocorrelation, indicating momentum in investor behavior. One explanation for this may be return-chasing on the part of fund investors (Bohn and Tesar 1996). Positive autocorrelation implies that an initial shock in one of the drivers will impact portfolio flows not just in the same month, but also in the following months (with a diminishing impact over time for an autocorrelation coefficient between 0 and 1). Therefore, the coefficient estimates on the various push and pull drivers indicate the short run (contemporaneous) impact, while the long run impact is a multiple of the short run impact whose size depends on the autocorrelation coefficient (Greene 2008a).[15]

For bond fund flows (Table 2.2, Panel A), the model typically explains around 60-65% of the observed variation in flows. Market expectations for Fed policy rates are a highly statistically significant and economically important explanatory variable. In all specifications shown in Table 2a the significance level is below 1%. A one percentage point upward shift in market expectations for the federal funds rate three years out is estimated to be associated with net portfolio debt outflows of about $6-7 billion contemporaneously. The total (long term) impact is estimated to range between $15 and $18 billion across the various model specifications. To put these estimates into context, total annual inflows to bond funds as reported by EPFR averaged $26 billion from 2010-2013. Table 2.2, Panel B shows that the estimated impact on portfolio debt flows ranges from $10 to $15 billion, with the coefficient being significant across model specifications.

In terms of the other explanatory variables, the impact of global risk aversion is estimated using either the BBB spread or the VIX. While the model fit tends to be slightly better when using the BBB spread, both proxies for global risk aversion yield quite similar results, with an increase in stock market volatility being associated with a lower volume of flows into EM-dedicated funds.

[15] For an autocorrelation coefficient between 0 and 1, the multiplier can be calculated as $\frac{1}{(1-\alpha_1)}$, i.e. the long term impact is $LT\_Impact = \frac{ST\_Impact}{(1-\alpha_1)}$. For example, for the correlation coefficient of 0.563 reported in the first regression of Table 2.1, the multiplier is 2.29.

Table 2.2: Estimation Results for Bond Flows, Baseline Model (2010-2013)

Panel A: Estimation Results for Bond Fund Flows

	(1)	(2)	(3)	(4)
Constant	-0.101	-0.032	0.069	0.117
	(0.547)	(0.544)	(0.595)	(0.594)
$Flows_{t-1}$	0.662 ***	0.661 ***	0.594 ***	0.685 ***
	(0.097)	(0.097)	(0.104)	(0.106)
Monetary Policy Expectations	-6.357 ***	-6.528 ***	-5.480 ***	-4.833 **
	(1.886)	(1.888)	(2.190)	(2.020)
BBB Spread	-9.758 ***	-9.559 ***	-12.958 ***	
	(3.331)	(3.350)	(3.462)	
MSCI EM	0.283 ***			0.459 ***
	(0.095)			(0.130)
EMBIG Spread		-0.056 ***		
		(0.019)		
EM Economic Surprise Index			0.017	
			(0.023)	
VIX				0.128
				(0.163)
Adjusted R^2	0.61	0.61	0.53	0.54
Number of Observations	48	48	48	48

Panel B: Estimation Results for Portfolio Debt Flows

	(1)	(2)	(3)	(4)
Constant	14.716 ***	11.024 ***	10.921 ***	11.651 ***
	(1.284)	(0.943)	(1.024)	(1.027)
Monetary Policy Expectations	-15.254 ***	-10.344 ***	-9.914 **	-6.477 *
	(4.542)	(3.326)	(3.794)	(3.627)
BBB Spread	-38.608 ***	-22.953 ***	-29.922 ***	
	(8.291)	(6.158)	(6.353)	
MSCI EM	1.299 ***			1.007 ***
	(0.230)			(0.242)
EMBIG Spread		-0.094 ***		
		(0.033)		
EM Economic Surprise Index			-0.006	
			(0.041)	
VIX				0.467
				(0.302)
Adjusted R^2	0.63	0.42	0.32	0.29
Number of Observations	48	48	48	48

For explanations, see notes under Table 2.1.

Regarding EM pull variables, there is a strong relationship between the local stock market index and bond flows, which has the expected positive sign. As an alternative, the EMBIG spread is used as a control variable, which is also highly significant and has the expected negative sign.

Both the MSCI stock index and the EMBIG spread are likely to incorporate new information about changing local economic and financial conditions quickly and effectively. However, both variables are likely to be influenced by global financial developments, such as fluctuations in world equity and bond markets. Therefore, in a further variation of the core model, I use a control variable that should not be influenced by global financial conditions – an EM economic surprise index. Positive economic data surprises in emerging markets are associated with increased bond inflows. While the variable carries the expected sign, it is not statistically significant at the 10% level for bond flows (although it is significant for equity flows, see below). In all these specifications, the choice of the "pull" control variable has only a small impact on the estimated coefficient for monetary policy expectations.[16]

Turning to equity flows, the estimated coefficients generally show the same sign as for bond flows, but the overall fit of the model is less good (Table 2.3). This may be partly explained by the fact that equity flows exhibit somewhat lower positive autocorrelation than bond flows. The estimated coefficient on market expectations for U.S. monetary policy is somewhat lower than for bond flows and is not statistically significant at the 10 percent level. Interestingly, the emerging market economic surprise index is a significant determinant of portfolio equity flows, with positive data surprises resulting in greater inflows to emerging economies. This is a noteworthy finding since in the literature there are no firmly established macro pull drivers at the monthly frequency, given that GDP estimates and many other important macro indicators are typically published at the quarterly frequency (see also Koepke 2015a).

[16] I tested several additional proxies for macroeconomic conditions in emerging markets, such as the consensus forecast for real GDP growth and purchasing manager indices (PMIs). While there was no statistically robust evidence that these variables are drivers of portfolio flows over the sample period, the estimation results for the monetary policy expectations variable are substantively the same when using these control variables.

Table 2.3: Estimation Results for Equity Flows, Baseline Model (2010-2013)

Panel A: Estimation Results for Equity Fund Flows

	(1)	(2)	(3)	(4)
Constant	-0.008	0.213	0.306	0.140
	(1.013)	(1.212)	(1.151)	(0.994)
$Flows_{t-1}$	0.496 ***	0.387 ***	0.386 ***	0.531 ***
	(0.108)	(0.129)	(0.128)	(0.098)
Monetary Policy Expectations	-5.238	-1.307		-3.789
	(3.748)	(4.771)		(3.642)
BBB Spread	-5.396	-16.437 **	-15.753 **	
	(7.132)	(7.966)	(7.484)	
MSCI EM	0.880 ***			1.167 ***
	(0.186)			(0.235)
EM Economic Surprise Index		0.081	0.086 *	
		(0.050)	(0.047)	
VIX				0.413
				(0.292)
Adjusted R^2	0.54	0.34	0.35	0.55
Number of Observations	48	48	48	48

Panel B: Estimation Results for Portfolio Equity Flows

	(1)	(2)	(3)	(4)
Constant	3.862 ***	4.002 ***	4.105 ***	4.514 ***
	(0.948)	(1.122)	(1.036)	(1.190)
Monetary Policy Expectations	-4.553	-1.059		1.458
	(3.353)	(4.156)		(4.378)
BBB Spread	-15.634 **	-23.143 ***	-22.503 ***	
	(6.121)	(6.959)	(6.421)	
MSCI EM	0.782 ***			
	(0.170)			
EM Economic Surprise Index		0.071	0.075 *	0.092 *
		(0.044)	(0.042)	(0.047)
VIX				-0.477 *
				(0.255)
Adjusted R^2	0.45	0.23	0.25	0.11
Number of Observations	48	48	48	48

For explanations, see notes under Table 2.1.

2.5.2. Asymmetric Model: Estimation Results for the Post-Crisis Period (2010-2013)

In order to test whether the impact of shifts in monetary policy expectations is symmetric, the baseline model is augmented with a dummy variable D1 that is equal to 1 for months where policy rate expectations shifted up and a second dummy variable D2 that is equal to 1 for months where policy rate expectations shifted down. The results for bond and equity flows in the 2010-2013 period are reported in Table 2.5 in the appendix.

The estimation results suggest that the adverse effect on EM portfolio inflows resulting from a shift in policy rate expectations towards tighter monetary policy is much greater than the boost from a shift towards easier policy. For both bond fund flows and portfolio debt flows the estimated coefficient for shifts towards tighter policy is 5-10 times as high as the coefficient for shifts towards easier policy and the coefficients on downward shifts in Fed policy expectations are not statistically significant. For equity flows, the estimated coefficient on shifts towards tighter Fed policy is also greater than for shifts towards easier Fed policy for both fund flows and portfolio flows, but the coefficients are statistically significant only in some specifications.

The asymmetric effect is also corroborated by the estimations based on the pooled model of portfolio flows to individual EM countries (reported in Table 2.5, Panel E in the appendix). In the pooled model, the estimated effect of shifts in expectations towards tighter monetary policy is typically 2-3 times as high as for shifts towards easier monetary policy. The lower multiplier obtained in the pooled model may suggest that the asymmetric effect is driven particularly by large EMs, which are likely to dominate flows dynamics in dollar terms, but which receive the same weight as small economies in the pooled model (since country flows are scaled by nominal GDP).

A possible explanation for the asymmetric effect relates to the fact that Fed easing by design tends to encourage risk-taking by investors (Bruno and Shin 2015). When investors are pushed into risky assets, as opposed to being attracted by the intrinsic qualities of these assets, they may be less committed to those positions and thus more likely to unwind them when the tide turns. In addition, loss aversion on the part of investors may also help explain the asymmetric response to "good news" versus "bad news" from the Fed.

Another possibility is that it may take longer for investors to increase their EM allocations than to unwind them, for example because entering a market requires making a decision about the specific asset allocation across countries and instruments. This would mean that the total effect of shifts in expectations towards easier policy may be not quite as different in magnitude compared to shifts towards tighter policy, but the adjustment may take place over a longer period.

2.5.3. Estimation Results for the Extended Sample Period (2000–2013)

The regression results for the extended sample period are reported in Table 2.6 in the appendix to this chapter. As a caveat, it is worth repeating that data for measures of portfolio flows are more limited for the 2000 to 2009 period. In terms of the baseline regressions, all coefficients that were statistically significant in the post-crisis period have the same sign in the extended sample period, but the estimated coefficients are lower and sometimes also have a lower level of statistical significance. Nonetheless, the evidence for the role of shifts in monetary policy expectations remains robust.

One reason for the lower coefficient estimates is that actual and especially measured flows were significantly smaller in the mid-2000s than post-crisis. For fund flows data, measured inflows have increased since the mid-2000s in part because the sample of mutual funds reporting to EPFR expanded over time. Moreover, there are reasons to believe that the importance of Fed signaling regarding its monetary policy intentions has increased over time. It seems plausible that such signaling was not as important during the Fed's mid-2000s policy tightening cycle, which occurred in a very steady and predictable fashion, reducing the scope for gyrations in expected future policy rates. Specifically, the federal funds rate was raised by 25 basis points at each of the 17 policy meetings from June 2004 to June 2006. More recently, the Fed leadership has distanced itself from this approach to policymaking, indicating that prospective rate hikes are unlikely to occur in the same steady and predictable fashion, and instead will be data-dependent (see, for example, Federal Reserve Board 2014).

Both the BBB spread and the stock market index were statistically significant and economically important drivers of bond flows in the pre-crisis period. Again, the coefficient estimates are smaller than in the post-crisis period, likely reflecting the growing volume of actual and measured capital flows over that period. For equity flows, the estimated coefficient for the risk variable is statistically different from zero only when using the economic surprise index as a control variable.

The asymmetric model for the impact of shifts in policy expectations also yields similar results for the extended sample period. For bond flows, there is again strong evidence of a disproportionate adverse impact of upward shifts in policy rate expectations. For equity flows, this disproportionate impact is only evident in the portfolio flows regressions, but not in the fund flows data.

2.5.4. Impact of Fed Asset Purchases

The impact of the Fed's large-scale asset purchase programs on EM flows has received significant attention in recent years. It is plausible that asset purchases impact portfolio flows above and beyond the effect captured by the Fed policy expectations channel. In order to test this hypothesis, I include as an additional regressor the total assets on the Federal Reserve's balance sheet. Based on stationarity tests, the variable is specified as the second difference of the level of assets held by the Fed, i.e. the change in the pace of asset purchases.

The results are reported in Table 2.7 of the annex. There is evidence that asset purchases do have an impact on EM fund flows above and beyond the expectations channel, but this result does not hold when using BoP-consistent portfolio flows as the dependent variable. For fund flows, the estimated coefficient is consistently positive and statistically significant at the 10% level. The estimation results can usefully be applied to the Federal Reserve's reduction in the pace of asset purchases during the course of 2014. The coefficient estimates suggest that the short-term impact of a $10 billion reduction in the monthly pace of asset purchases is associated with a reduction in EM fund flows of $0.7 billion. Given the positive autocorrelation of fund flows, the long-term impact of such a reduction is estimated at about $2 billion.

2.5.5. Policy Interest Rate Differentials

I also test the policy interest rate differential between emerging and advanced economies as a potential driver of portfolio flows. This variable is of particular interest in the context of the "carry trade" investment strategy, where an investor borrows money in a low-yielding currency in order to invest it in a high-yielding currency (Galati et al. 2007). This strategy is profitable so long as exchange rates movements do not offset these gains (as would be predicted by the theory of uncovered interest parity; Fama 1984).

The regression results for the models that include the policy interest rate differential are reported in Table 2.8 of the appendix. There is no statistically robust evidence in support of the hypothesis that policy interest rate differentials have been a driver of aggregate emerging market portfolio equity or debt flows in the post-crisis period. For BoP-consistent portfolio flows, the estimated coefficient on the proxy for the interest rate differential does have the expected positive sign, but for fund flows the sign is often negative.

A few words of caution are in order against drawing premature conclusions from the lack of support for the carry trade effects. Strategies like the carry trade are arguably more likely to be pursued by a subgroup of institutional investors, such as hedge funds, which are typically very secretive about their investments and thus are unlikely to be included in EPFR's sample of reporting funds (Galati and Melvin, 2004). This may help explain why the estimated coefficient sometimes does not have the expected sign when using fund flows data as the dependent variable. Another limitation is that the empirical model is best-suited for capturing the contemporaneous effect of a change in the policy interest rate differential, while in reality this effect may be playing out over a longer time period. In an attempt to capture such a dynamic effect, I tested whether lagging the policy interest rate differential by one period would yield a different result, which was not the case.

2.5.6. Institutional Investors vs. Retail Investors

The fund flows dataset from EPFR also includes a breakdown of flows by investor type, which allows a distinction between actions by institutional investors and retail investors. The classification is primarily based on the share classes made available to investors by mutual funds and exchange-traded funds. In contrast to the retail share class, the institutional share class generally has a high minimum investment requirement, implying that typically (though not always) the investor is a firm rather than an individual.

Table 2.9 in the appendix shows the estimation results by investor type for the 2010-2013 sample period. Overall, both investor types appear to respond to EM local conditions and external developments in broadly similar ways. In the baseline model for equity flows, changes in monetary policy expectations seem to have a greater effect on institutional investors, while the variable is not statistically significant for retail investors. This does not apply to debt flows, however, where there is robust statistical evidence that both investor types respond to changes in monetary policy expectations.

The asymmetric model suggests that the tendency of market participants to respond disproportionately to a shift in expectations towards tighter monetary policy is primarily driven by retail investors. Both equity and debt flows from retail investors seem to respond much more strongly to an anticipation of tighter Fed policy than to shifts in the opposite direction. While the evidence is not statistically robust for equity flows from institutional investors, the estimated coefficients for upward shifts in expectations for the federal funds rate are modestly greater than the coefficient on downward shifts. For debt flows, the estimated coefficients on the monetary policy

expectations variable are statistically significant, and there is tentative evidence of a disproportionately strong response of institutional investors to "bad news" from the Fed, though the two coefficients are relatively close to each other.

2.5.7. Maturity of Bonds

It seems compelling to think that the degree to which interest rate expectations affect bond flows depends on the maturity of bonds. Arguably, changes in expectations for future monetary policy should have a stronger impact on flows into bonds with long remaining maturities, while short-dated bonds may not be much affected by expected changes in policy interest rates.

EPFR provides limited data on the bond flows by maturity, which are broken down into three classes of remaining maturities: short term, intermediate term and long term. For the bulk of EM bond flows, however, maturities are not reported by the participating funds. In practice, only the sample for *short term* maturities seems sufficiently large (in terms of assets under management) to be suited for empirical analysis. Regressions with short-term bond flows as the dependent variable are reported in Table 2.10 of the appendix. The results are consistent with the hypothesis that short-dated bonds are less impacted by changes in monetary policy expectations. Indeed, in most specifications, the coefficient on the monetary policy expectations variable is not statistically significantly different from zero.

2.6. Robustness Checks

A broad range of robustness checks were conducted to ensure the validity of all core findings. It is worth noting that the baseline and the augmented models typically explain around 40-60% of the variation in portfolio fund flows over time, leaving a substantial portion to be explained by other factors. I tested a number of additional country-specific macro variables to control for local conditions in emerging markets, such as manufacturing purchasing manager indices (PMIs) and changes in the consensus forecast for real GDP growth in emerging markets. The core estimation results are substantively the same when using either of these alternative control variables. In terms of the variables themselves, however, there is no robust evidence that PMIs or changes in growth expectations are in fact driving portfolio flows at the monthly frequency.

I also tested three alternative "push" variables in lieu of the monetary policy expectations variable that are more closely aligned with the traditional variables used in the literature. These variables are (1) changes in the slope of the U.S. yield curve as measured by the difference between the yield on 10-year bonds and 2-year bonds, (2) changes in the term premium of 10-year U.S. Treasury bonds, as calculated by Kim and Wright (2005), and (3) changes in 3-year Treasury yields (i.e. using the same time horizon as for federal funds futures contracts). Each of these three variables was highly statistically significant for bond flows, but for equity flows only the coefficient on 3-year Treasury yields was statistically significant. For both types of flows, the asymmetric model does not indicate that *increases* in 3-year Treasury yields, the term premium or the slope of the yield curve have a disproportionately strong impact on EM flows (compared to *declines* in the term premium or the slope of the yield curve, respectively). This may suggest that federal funds futures contracts are a "purer" measure of the push effect that investors respond to (in the sense discussed in Section 2.3).

Conceptually, it is possible that the impact of shifts in monetary policy expectations depends on the trigger of those shifts, which could either be a perceived change in the economic outlook or a perceived change in the Fed's reaction function. To test this hypothesis, I included a U.S. economic surprise index as an additional control variable in order to take account of the "strength" of the U.S. economic data flow. However, the results were unaffected and the estimated coefficient for this control variable was not statistically significantly different from zero.

Additional robustness checks included variations in the sample period, which did not substantively affect the estimation results. For the post-crisis sample period, I also tested eurodollar futures as an alternative proxy for changes in monetary policy expectations. These contracts have a near-perfect correlation with federal funds futures contracts and the two variables are often used interchangeably in the literature. The results were not affected by the choice of variable. Furthermore, I also varied the calculation of the monetary policy expectations variable by using the end-of-month value rather than the monthly average. The results are essentially identical in these two specifications.

2.7. Conclusion

The findings presented in this chapter provide robust evidence that changes in market expectations for U.S. monetary policy are an important determinant of portfolio flows to emerging markets, especially for bond flows. There is also significant empirical support for the existence of an asymmetric impact, where shifts in expectations towards tighter monetary policy have a substantially

stronger adverse impact on portfolio bond flows (and to a lesser extent equity flows) than the boost that comes from shifts towards easier policy. These results hold for two alternative high frequency measures of investment flows, namely EPFR fund flows data, which have enjoyed growing popularity in the academic and policy literature in recent years, and a novel dataset on monthly BoP-consistent portfolio flows data compiled by the Institute of International Finance.

The findings of this study suggest that a more nuanced reading of the empirical literature is needed. In the existing literature, the prospect of Fed tightening is typically portrayed as an unambiguous adverse factor for capital flows to emerging markets. By contrast, the "surprise view" advanced in this study suggests that Fed interest rate hikes per se may not have any effect on EM capital flows at all. Instead, the empirical results suggest that the impact on capital flows stems from shifts of market expectations for future Fed policy interest rates.

To be sure, more research is needed to ascertain the relative importance of expected versus unexpected interest rate increases on capital flows. While this study has provided robust evidence that the unanticipated portion of interest rate movements affects EM portfolio flows, it has not directly tested whether anticipated interest rate changes have any such impact. This would be a useful avenue for future research. An empirical assessment may need to be based on lower-frequency data than was used in the present study, such as annual data. This is because anticipated interest rate changes are greater at longer-term horizons and thus typically account for a larger portion of observed interest rate changes at lower data frequencies (see Section 2.3). Prior work based on low-frequency data provides some support for the notion that anticipated interest rate increases do not have a statistically significant impact on EM portfolio flows (e.g., Hernandez et al. 2001). Since prior work did not distinguish between anticipated and unanticipated interest rate increases, this support is tentative and more targeted analysis is needed.

The findings in this study also highlight the potential usefulness of federal funds futures contracts as planning tool for policy analysis and risk management. Federal funds futures data can be used to construct risk scenarios about the future course of Fed policy in order to quantify how a potential shift in the expected rate path is likely to impact portfolio flows. For example, in IIF (2014), I model a risk scenario in which Fed interest rate hikes are implemented at the same pace as during the 2004-2006 tightening cycle, rather than at the much slower pace that futures markets have priced in during the last several years. Such a scenario would result in a substantial upward shift in the path of expected future policy rates, which would likely trigger a sharp reduction in non-resident portfolio flows to emerging markets that could take a significant toll on asset prices and economic activity.

A reinterpretation of the empirical literature in line with the "surprise view" has a number of policy implications. On the one hand, this new perspective provides reassurance at the current juncture, where the Fed seems to be set to continue on a sustained, albeit gradual, interest rate hiking cycle. Against the conventional wisdom, policy risks are not one-sided. While capital flows could reverse if Fed policy normalization takes place faster than markets anticipate, it is equally possibly that capital flows will be boosted by a slower-than-expected tightening cycle. In either case, emerging market policymakers may need to lean against the wind and stabilize their economies in the face of external spillovers.

On the other hand, the finding that shifts in Fed policy expectations have an asymmetric impact depending on the direction of the shift suggests that caution is warranted on the part of EM policymakers. Disproportionate spillovers from an upward shift in Fed policy expectations add to the risks of a sudden stop in emerging markets. This risk serves to highlight the importance of maintaining sufficient policy space and encouraging prudent risk management practices in the private sector to buffer the impact of external pressures. For example, EM central banks should maintain sufficient foreign exchange reserves to counteract excessive exchange rate volatility if needed, governments should use prudent fiscal policy and avoid excessive dependence on external financing, and businesses should reduce currency mismatches between liabilities and assets to shield themselves from swings in exchange rates.

The role of market expectations also has important implications for monetary policymaking by the Fed. The findings of this study highlight the importance of effective Fed communication and appropriate anchoring of market expectations. This is particularly noteworthy in the context of the ongoing policy debate about the merits and risks of central bank forward guidance (see, for example, Woodford 2012). In recent years, the Fed has attempted to provide a stronger anchor for market expectations via its forward guidance, by describing in both quantitative and qualitative terms how monetary policy is expected to evolve under future economic conditions.

Thus far, however, the Fed's efforts appear to have had only limited success in stabilizing market expectations of future monetary policy, judging by the observed gyrations in federal funds futures contracts (see Figure 2.4 in the appendix) and judging by comments made by participants of the Federal Open Market Committee, which suggest that market expectations have at times moved in the opposite direction of the Fed's own assessment.[17] During the 2013 "taper tantrum" a rapid

[17] For example, the policy meeting minutes of the FOMC's April/May 2013 meeting state: "A few members expressed concerns that investor expectations of the cumulative size of the asset purchase program appeared to have increased somewhat since it was launched last September despite a notable decline in the unemployment rate and other improvements in the labor market since then" (Federal Reserve 2013a, p. 8). On other occasions, market participants appear to have misread

upward shift in market expectations for the future course of the federal funds rate took a significant toll on emerging markets as portfolio flows reversed – a toll that could be avoided in the future if the Fed manages to anchor expectations more effectively.

the Fed's policy intentions until they were confronted with Fed policy actions, such as the September 2013 decision to delay the widely expected tapering of asset purchases, which resulted in a sharp decline in the expected path of short-term interest rates that, according to the FOMC minutes, "brought the path more closely into alignment with the Committee's forward guidance" (Federal Reserve 2013b, p. 7).

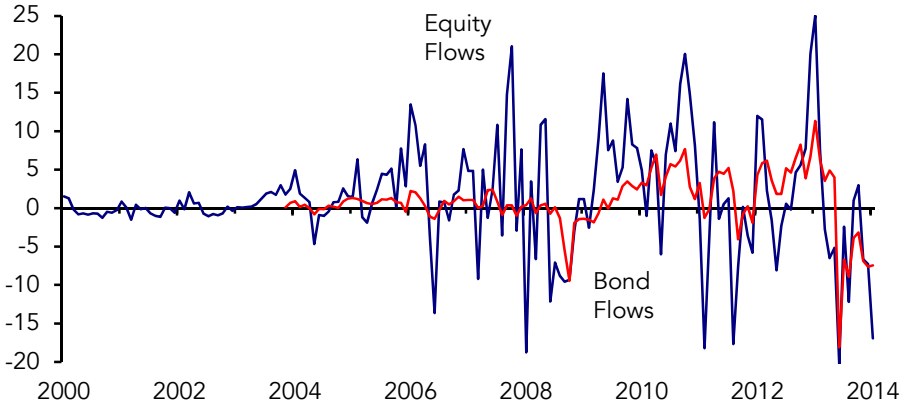
2.8. Appendix to Chapter 2

2.8.1. Charts of the Main Regression Variables

The charts below illustrate the main regression variables used in the estimations in Chapter 2. For variable descriptions, see Section 2.4, "Data and Empirical Strategy."

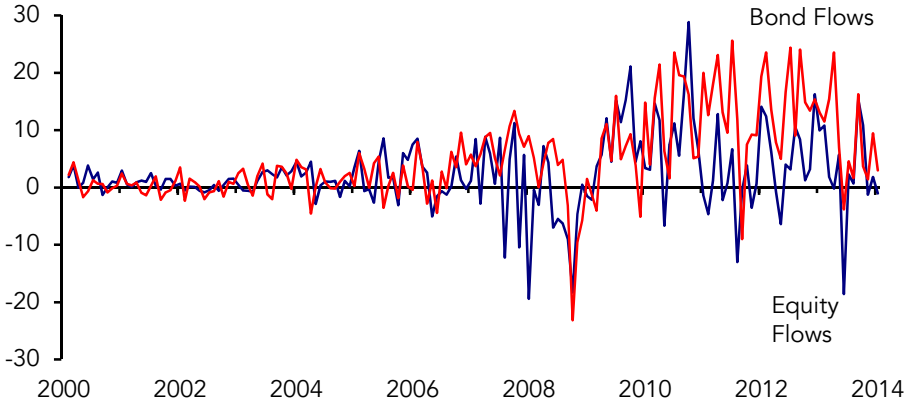
Figure 2.4: Charts of the Main Regression Variables

Chart 1
Flows to Emerging Market Dedicated Funds
$ billion, monthly data



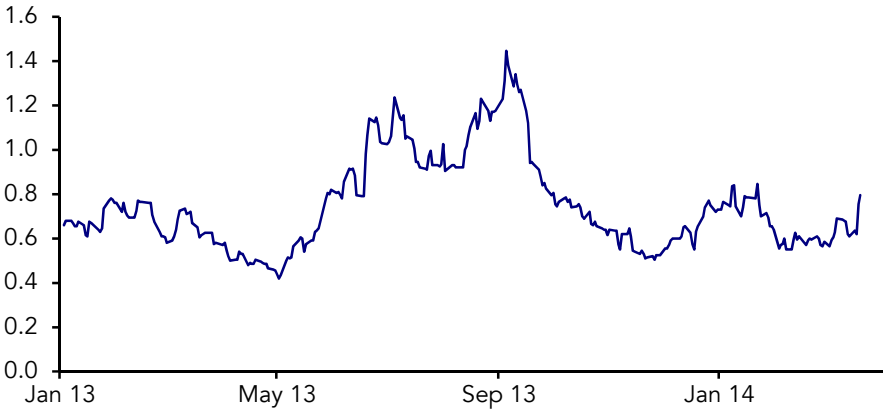
Source: EPFR.

Chart 2
Non-Resident Portfolio Flows to Emerging Markets
$ billion, monthly data



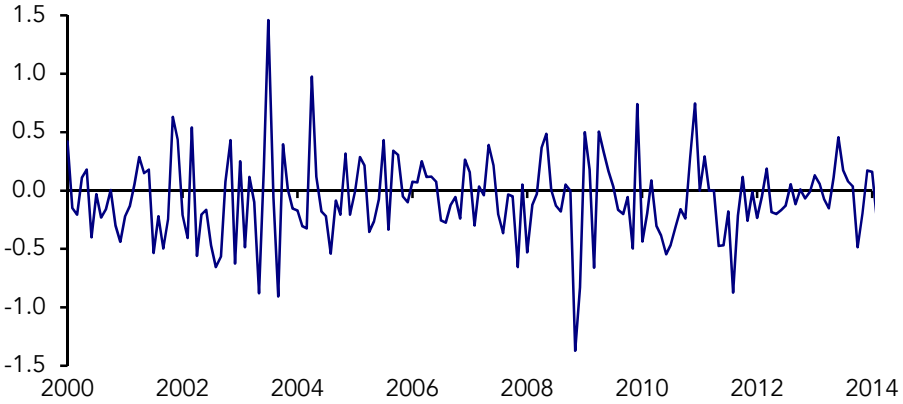
Source: IIF.

Chart 3
Market Expectations for the Federal Funds Rate in December 2015
percent per annum, based on fed funds futures contracts



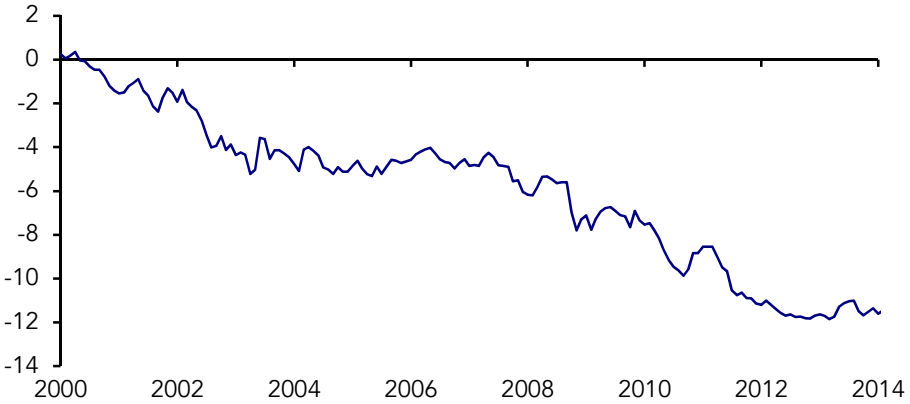
Source: Bloomberg

Chart 4
Monthly Change in Market Expectations for the Fed Funds Rate 3 Years Ahead
percentage points, data prior to February 2011 are based on Eurodollar contracts



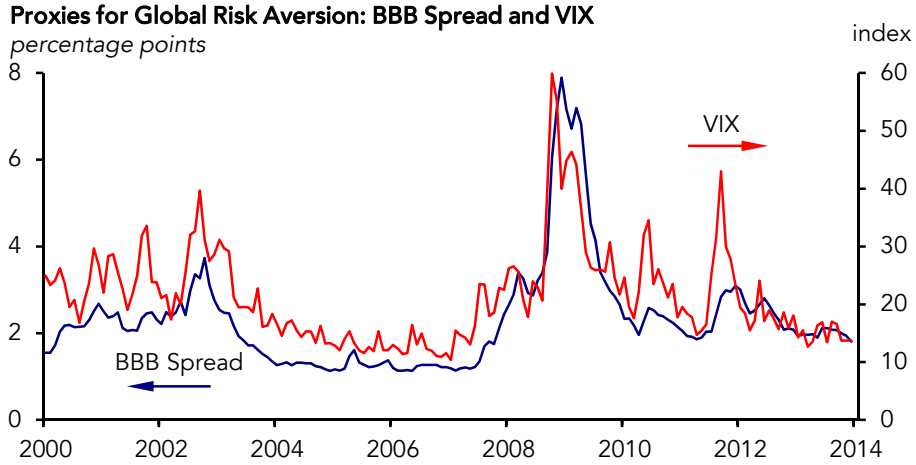
Source: Bloomberg.

Chart 5
Cumulative Change in Market Expectations for the Fed Funds Rate 3 Years Ahead
percentage points, data prior to February 2011 are based on Eurodollar contracts



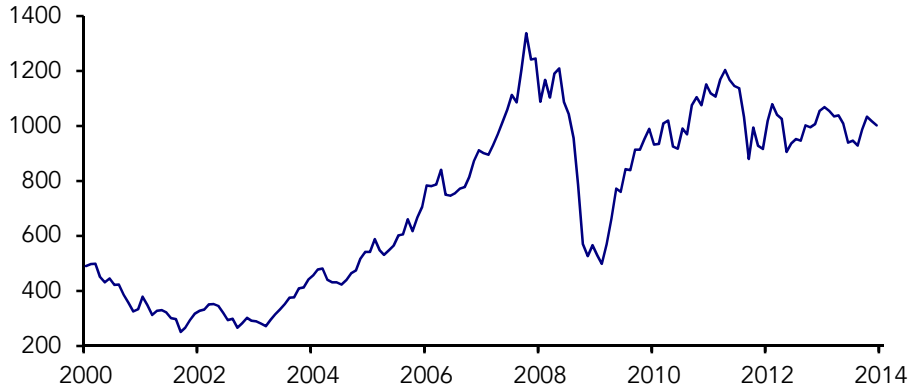
Source: Bloomberg.

Chart 6
Proxies for Global Risk Aversion: BBB Spread and VIX
percentage points



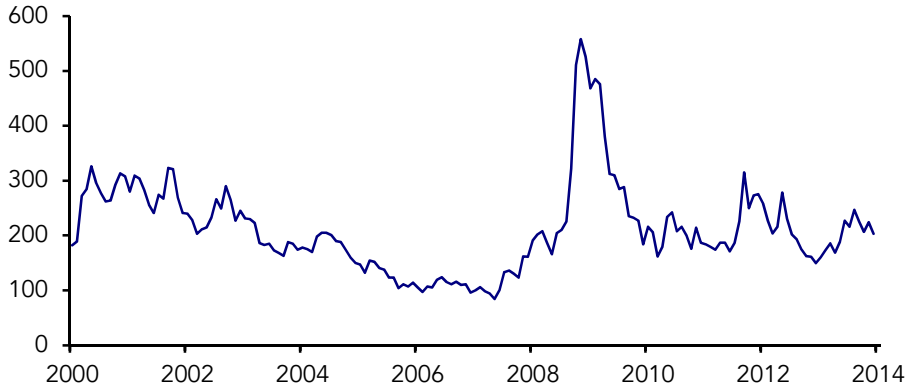
Source: Bloomberg.

Chart 7
MSCI EM Stock Market Index
index



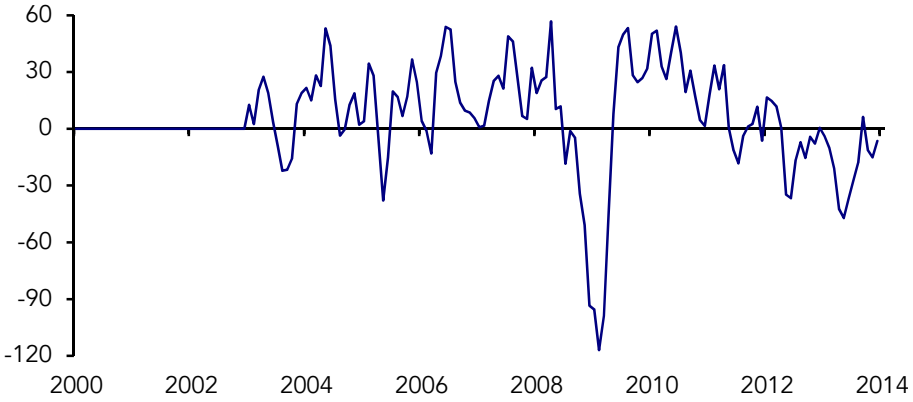
Source: Bloomberg.

Chart 8
EMBIG Spread
basis points



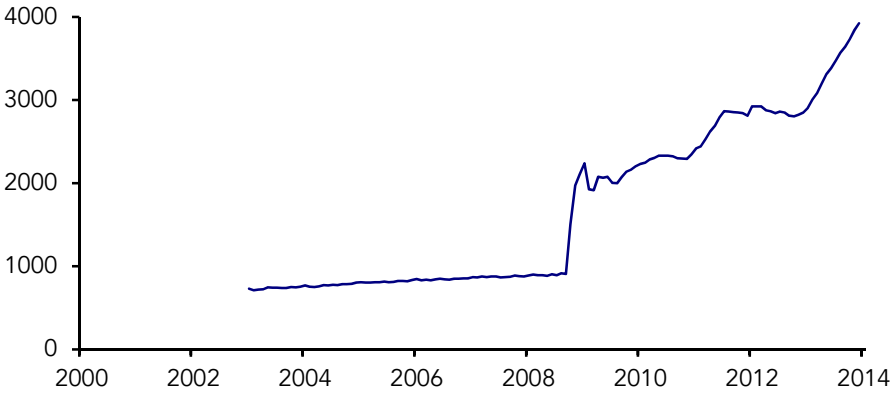
Source: Bloomberg.

Chart 9
Emerging Market Economic Surprise Index
index, 0 = breakeven



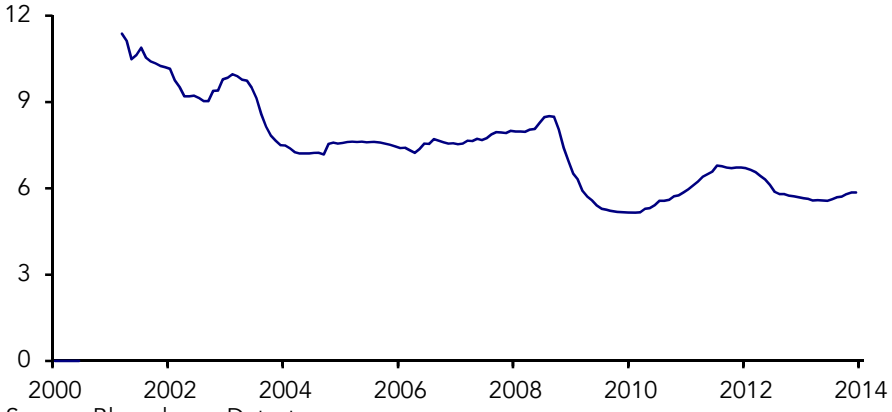
Source: Bloomberg.

Chart 10
Federal Reserve: Total Assets
$ billion



Source: Datastream.

Chart 11
Policy Interest Rate Differential between Emerging and Mature Economies
percentage points



Source: Bloomberg, Datastream.

2.8.2. Additional Estimation Results

Notes: Asterisks denote significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. Standard errors are reported in parentheses. Functional forms are based on standard stationarity tests for all variables (Augmented Dickey-Fuller tests). The dependent variable is either (1) net flows to EM-dedicated funds as reported by EPFR or (2) BoP-consistent portfolio flows. In the pooled regressions, portfolio flows are scaled by each country's nominal GDP. $Flows_{t-1}$ is the lagged dependent variable. *Monetary Policy Expectations* refers to the change in the federal funds futures contract three years into the future. *BBB Spread* is the change in the yield difference on U.S. BBB-rated corporate bonds relative to U.S. Treasuries. *MSCI EM* is the percent change in the MSCI EM stock market index from the prior month. For further details, see Section 2.4.

Table 2.4: Pooled Model – Baseline Estimation Results for BoP-Consistent Portfolio Flows

Specification includes country fixed effects	Total Flows	Debt Flows	Equity Flows
Constant	0.158 ***	0.119 ***	0.039 ***
	(0.013)	(0.012)	(0.006)
Monetary Policy Expectations	-0.214 ***	-0.192 ***	-0.022
	(0.048)	(0.044)	(0.021)
BBB Spread	-0.448 ***	-0.342 ***	-0.105 **
	(0.085)	(0.078)	(0.037)
MSCI EM	0.010 ***	0.005 **	0.005 ***
	(0.002)	(0.002)	(0.001)
Adjusted R^2	0.19	0.14	0.16
Standard Error of Regression	0.28	0.26	0.12
Number of Observations	528	528	528

Table 2.5: Estimation Results for the Asymmetric Model

Panel A: Estimation Results for Bond Fund Flows - Asymmetric Model (2010-2013)				
	(1)	(2)	(3)	(4)
Constant	0.272	1.304	0.956	1.286
	(0.712)	(0.777)	(0.713)	(0.752)
$Flows_{t-1}$	0.667 ***	0.599 ***	0.665 ***	0.690 ***
	(0.094)	(0.099)	(0.094)	(0.101)
Tighter Monetary Policy Expectations	-12.893 ***	-12.982 ***	-12.790 ***	-12.882 ***
	(3.550)	(3.844)	(3.562)	(3.919)
Easier Monetary Policy Expectations	-1.819	0.265	-2.154	0.221
	(2.789)	(3.235)	(2.809)	(2.880)
BBB Spread	-8.515 **	-10.935 ***	-8.449 **	
	(3.252)	(3.411)	(3.278)	
MSCI EM	0.272 ***			0.396 ***
	(0.091)			(0.127)
EM Economic Surprise Index		0.027		
		(0.022)		
EMBIG Spread			-0.053 ***	
			(0.018)	
VIX				0.064
				(0.157)
Adjusted R^2	0.64	0.58	0.64	0.58
Number of Observations	48	48	48	48

Panel B: Estimation Results for Portfolio Bond Flows - Asymmetric Model (2010-2013)

	(1)	(2)	(3)	(4)
Constant	12.547 ***	12.891 ***	12.848 ***	13.801 ***
	(1.360)	(1.506)	(1.372)	(1.445)
Tighter Monetary Policy Expectations	-20.387 ***	-20.910 ***	-20.843 ***	-20.044 **
	(1.360)	(7.295)	(6.701)	(7.496)
Easier Monetary Policy Expectations	-4.071	-1.932	-3.207	1.770
	(5.104)	(5.877)	(5.139)	(5.338)
BBB Spread	-20.715 ***	-26.542 ***	-20.363 ***	
	(6.021)	(6.502)	(6.181)	
MSCI EM	0.495 ***			0.897
	(0.163)			(0.240) ***
EM Economic Surprise Index		0.005		
		(0.040)		
EMBIG Spread			-0.091 ***	
			(0.032)	
VIX				0.377
				(0.295)
Adjusted R^2	0.46	0.35	0.45	0.34
Number of Observations	48	48	48	48

Panel C: Estimation Results for Equity Fund Flows - Asymmetric Model (2010-2013)

	(1)	(2)	(3)
Constant	1.560	2.295	1.558
	(1.397)	(1.678)	(1.341)
$Flows_{t-1}$	0.535 ***	0.432 ***	0.55 ***
	(0.109)	(0.129)	(0.098)
Tighter Monetary Policy Expectations	-15.390 **	-14.264	-13.758 *
	(7.341)	(8.742)	(7.383)
Easier Monetary Policy Expectations	1.882	8.571	2.409
	(5.779)	(7.315)	(5.382)
BBB Spread	-2.519	-12.068	
	(7.234)	(8.171)	
MSCI EM	0.872 ***		1.090 ***
	(0.183)		(0.237)
EM Economic Surprise Index		0.096 *	
		(0.050)	
VIX			0.34
			(0.292)
Adjusted R^2	0.55	0.37	0.57
Number of Observations	48	48	48

Panel D: Estimation Results for Portfolio Equity Flows - Asymmetric Model (2010-2013)

	(1)	(2)	(3)
Constant	5.164 ***	6.058 ***	5.960 ***
	(1.410)	(1.656)	(1.392)
Tighter Monetary Policy Expectations	-12.002 *	-12.527	-10.853
	(1.410)	(8.018)	(7.222)
Easier Monetary Policy Expectations	0.546	7.265	4.478
	(5.292)	(6.460)	(5.144)
BBB Spread	-13.897 **	-19.618 ***	
	(6.243)	(7.146)	
MSCI EM	0.764 ***		1.130
	(0.169)		(0.231)
EM Economic Surprise Index		0.082 *	
		(0.044)	
EMBIG Spread			
VIX			0.421 ***
			(0.284)
Adjusted R^2	0.46	0.26	0.43
Number of Observations	48	48	48

Panel E: Pooled Model - Estimation Results for BoP-Consistent Portfolio Flows

Estimation includes country fixed effects

	Total Flows	Debt Flows	Equity Flows
Constant	0.180 ***	0.133 ***	0.048 ***
	(0.018)	(0.017)	(0.008)
Tighter Monetary Policy Expectations	-0.352 ***	-0.275 ***	-0.077 *
	(0.095)	(0.087)	(0.041)
Easier Monetary Policy Expectations	-0.118	-0.135 **	0.017
	(0.074)	(0.068)	(0.032)
BBB Spread	-0.422 ***	-0.327 ***	-0.095 **
	(0.086)	(0.079)	(0.037)
MSCI EM	0.010 ***	0.005 **	0.005 ***
	(0.002)	(0.002)	(0.001)
Adjusted R^2	0.20	0.14	0.17
Standard Error of Regression	0.28	0.26	0.12
Number of Observations	528	528	528

Table 2.6: Estimation Results for the Extended Sample Period (2000-2013)

Panel A: Estimation Results for EPFR Fund Flows and BoP-Consistent Portfolio Flows (2000-2013)

	EPFR Fund Flows			BoP-Consistent Portfolio Flows		
	Total	Debt	Equity	Total	Debt	Equity
Constant	0.639	0.071	0.537	6.807 ***	4.697 **	1.129 **
	(0.733)	(0.248)	(0.434)	(0.771)	(0.540)	(0.466)
$Flows_{t-1}$	0.477 ***	0.647 ***	0.378 ***			
	(0.069)	(0.066)	(0.063)			
Monetary Policy Expectations	-0.956	-2.306 ***	-0.041	-3.926 *	-3.25 **	-0.149
	(2.290)	(0.777)	(1.236)	(2.254)	(1.579)	(1.362)
BBB Spread	-0.552	-1.778 **	-0.607	-14.242 ***	-8.47 ***	-3.762 **
	(2.556)	(0.832)	(1.594)	(2.745)	(1.923)	(1.659)
MSCI EM	0.835 ***	0.136 ***	0.525 ***	0.608 ***	0.18 **	0.490 ***
	(0.111)	(0.038)	(0.067)	(0.121)	(0.085)	(0.073)
Adjusted R^2	0.51	0.53	0.42	0.33	0.16	0.30
Standard Error of Regression	7.46	2.53	5.33	9.72	6.81	5.87
Number of Observations	121	121	168	168	168	168
Durbin-Watson Statistic				0.88	0.75	1.22
Durbin h Statistic	-1.23	-0.97	-1.46			

Panel B: Asymmetric Model, Estimation Results for Fund Flows and Portfolio Flows (2000-2013)

	EPFR Fund Flows			BoP-Consistent Portfolio Flows		
	Total	Debt	Equity	Total	Debt	Equity
Constant	1.614	0.308	1.201 *	9.972 ***	6.903 *	3.069 ***
	(1.008)	(0.353)	(0.611)	(1.061)	(0.744)	(0.585)
$Flows_{t-1}$	0.482 ***	0.641 ***	0.384 ***			
	(0.069)	(0.066)	(0.063)			
Tighter Monetary Policy Expectations	-5.907	-3.452 **	-2.905	-17.377 ***	-12.623 ***	-4.754 **
	(4.208)	(1.200)	(2.234)	(3.898)	(2.428)	(2.150)
Easier Monetary Policy Expectations	2.804	-1.444	2.354	7.306 **	4.58 *	2.730
	(3.523)	(1.200)	(1.986)	(3.464)	(2.428)	(1.910)
BBB Spread	-0.227	-1.740 **	-0.394	-13.502 ***	-7.96 ***	-5.544 ***
	(2.556)	(0.834)	(1.594)	(2.625)	(1.840)	(1.448)
MSCI EM	0.838 ***	0.136 ***	0.532 ***	0.637 ***	0.20 **	0.439 ***
	(0.111)	(0.038)	(0.067)	(0.116)	(0.081)	(0.064)
Adjusted R^2	0.52	0.53	0.43	0.39	0.24	0.37
Standard Error of Regression	7.43	2.53	5.30	9.27	6.50	5.11
Number of Observations	121	121	168	168	168	168
Durbin-Watson Statistic				0.99	0.91	1.51
Durbin h Statistic	-1.38	-0.98	-1.44			

Table 2.7: Estimation Results for Federal Reserve Assets as Explanatory Variable

	EPFR Fund Flows			BoP-Consistent Portfolio Flows		
	Total	Debt	Equity	Total	Debt	Equity
Constant	-0.161	-0.171	-0.112	15.093 ***	11.203 ***	3.890 ***
	(1.326)	(0.532)	(0.978)	(1.276)	(0.934)	(0.924)
$Flows_{t-1}$	0.576 ***	0.675 ***	0.506 ***			
	(0.095)	(0.095)	(0.104)			
Monetary Policy Expectations	-12.794 **	-6.710 ***	-6.017	-15.221 ***	-9.71 ***	-5.508
	(4.813)	(1.840)	(3.635)	(4.791)	(3.506)	(3.469)
BBB Spread	-14.252	-9.960 ***	-5.677	-37.543 ***	-21.79 ***	-15.756 **
	(8.857)	(3.233)	(6.880)	(8.399)	(6.146)	(6.081)
MSCI EM	1.036 ***	0.244 **	0.795 ***	1.272 ***	0.52 ***	0.752 ***
	(0.245)	(0.094)	(0.184)	(0.241)	(0.176)	(0.174)
Fed Assets	**0.074 ** **	**0.024 * **	**0.050 ** **	**0.007**	**-0.009**	**0.016**
	(0.032)	**(0.012)**	**(0.024)**	**(0.032)**	**(0.024)**	**(0.023)**
Adjusted R^2	0.67	0.67	0.62	0.65	0.45	0.50
Standard Error of Regression	0.63	0.63	0.57	0.62	0.40	0.45
Number of Observations	48	48	48	48	48	48

Notes: This table shows regression results augmented by the total assets held by the Federal Reserve as an additional explanatory variable. Based on standard stationarity tests, the variable is specified as the second difference, i.e. the change in the pace of asset accumulation. The variable is expressed in $ billion and the data were obtained via Datastream.

Table 2.8: Estimation Results with Policy Interest Rate Differential as Explanatory Variable

	EPFR Fund Flows			BoP-Consistent Portfolio Flows		
	Total	Debt	Equity	Total	Debt	Equity
Constant	0.039	-0.086	-0.012	14.930 ***	-7.986	3.785 ***
	(1.421)	(0.564)	(1.037)	(1.281)	(12.739)	(0.931)
$Flows_{t-1}$	0.563 ***	0.660 ***	0.496 ***			
	(0.101)	(0.099)	(0.109)			
Monetary Policy Expectations	-11.656 **	-6.354 ***	-5.240	-15.208 ***	-10.04 ***	-5.333
	(5.076)	(1.909)	(3.794)	(4.728)	(3.405)	(3.437)
BBB Spread	-13.814	-9.747 ***	-5.405	-37.749 ***	-24.29 ***	-15.803 **
	(9.390)	(3.370)	(7.226)	(8.332)	(6.203)	(6.057)
MSCI EM	1.163 ***	0.284 ***	0.880 ***	1.257 ***	0.50 ***	0.759 ***
	(0.256)	(0.096)	(0.190)	(0.235)	(0.167)	(0.171)
Interest Rate Differential	**-1495**	**-733**	**249**	**11745**	**3316**	**8927**
	(14594)	**(5525)**	**(10927)**	**(13616)**	**(2198)**	**(9899)**
Adjusted R^2	0.63	0.64	0.58	0.66	0.48	0.50
Standard Error of Regression	0.58	0.60	0.53	0.62	0.43	0.46
Number of Observations	48	48	48	48	48	48

Notes: This table shows regression results augmented by the policy interest rate differential between emerging and advanced economies as an additional explanatory variable. The policy interest rate differential is calculated as a GDP-weighted average of individual EM policy rates, less the federal funds target rate (see Section 2.4). It is expressed in percentage points. The estimated coefficient on this variable is not statistically significantly different from zero in any of the above specifications, suggesting that this variable was not among the key drivers of portfolio flows during the sample period.

Table 2.9: Estimation Results for Fund Flows by Institutional vs. Retail Investors

Panel A: Estimation Results for Institutional vs. Retail Investors (Baseline Model, 2010-2013)

	Debt		Equity	
	Institutional	Retail	Institutional	Retail
Constant	0.433	-0.328	1.039	-1.061 **
	(0.341)	(0.269)	(0.722)	(0.483)
$Flows_{t-1}$	0.523 ***	0.721 ***	0.498 ***	0.454 ***
	(0.119)	(0.087)	(0.107)	(0.118)
Monetary Policy Expectations	-2.964 ***	-3.426 ***	-4.230 *	-1.023
	(1.022)	(0.999)	(2.439)	(1.696)
BBB Spread	-4.703 **	-5.089 ***	-2.256	-3.474
	(1.807)	(1.761)	(4.564)	(3.222)
MSCI EM	0.138 **	0.129 **	0.596 ***	0.273 ***
	(0.053)	(0.049)	(0.121)	(0.084)
Adjusted R^2	0.43	0.68	0.53	0.42
Number of Observations	48	48	48	48

Notes: This table shows regression results for the core baseline models, using EPFR fund flows by type of ultimate investor. Specifically, total EPFR fund flows are broken into two components, institutional investors and retail investors.

Panel B: Estimation Results for Institutional vs. Retail Investors (Asymm. Model, 2010-2013)

	Debt		Equity	
	Institutional	Retail	Institutional	Retail
Constant	0.962 **	0.195	2.068 **	-0.544
	(0.426)	(0.365)	(0.932)	(0.727)
$Flows_{t-1}$	0.518 ***	0.730 ***	0.521 ***	0.494 ***
	(0.116)	(0.084)	(0.105)	(0.126)
Tighter Monetary Policy Expectations	-6.248 ***	-6.737 ***	-11.111 **	-3.885
	(1.946)	(1.884)	(4.713)	(3.457)
Easier Monetary Policy Expectations	-0.694	0.560	-1.114	1.011
	(1.523)	(3.702)	(1.485)	(2.731)
BBB Spread	-4.095 **	-4.446 **	-0.631	-2.521
	(1.777)	(1.728)	(4.570)	(3.377)
MSCI EM	0.132 **	0.124 **	0.587 ***	0.272 ***
	(0.051)	(0.048)	(0.118)	(0.084)
Adjusted R^2	0.47	0.70	0.55	0.42
Number of Observations	48	48	48	48

Notes: This table shows regression results for the core baseline models, using EPFR fund flows by type of ultimate investor. Specifically, total EPFR fund flows are broken into two components, institutional investors and retail investors.

Table 2.10: Estimation Results for Bond Flows with Short Maturities of 1-4 Years

	Baseline		Asymmetric	
Constant	60.209	57.698	91.167	87.591
	(74.706)	(74.939)	(105.015)	(105.196)
$Flows_{t-1}$	0.429 ***	0.437 ***	0.426 ***	0.435 ***
	(0.141)	(0.141)	(0.143)	(0.142)
Monetary Policy Expectations	-52.177	-56.251		
	(265.680)	(267.395)		
Tighter Monetary Policy Expectations			-244.709	-242.654
			(527.683)	(529.646)
Easier Monetary Policy Expectations			80.819	73.398
			(412.904)	(416.350)
BBB Spread	-701.234	-648.895	-664.377	0.817
	(470.113)	(476.898)	(482.569)	(2.619)
MSCI EM	-8.069		-8.422	
	(13.113)		(13.266)	
EMBIG Spread		0.723		0.817
		(2.584)		(2.619)
Adjusted R^2	0.13	0.12	0.11	0.10
Number of Observations	48	48	48	48

Notes: This table shows regression results for bond flows related to purchases and sales of bonds with short maturities of up to 4 years. Bond flows data by maturities were kindly provided by EPFR and are based on reported transactions from funds that only invest in a particular range of maturities (short term, intermediate term, and long term). In practice, the assets under management (AUM) for the intermediate and long-term range appear to be too small (<$1 billion) to draw any reliable inferences, while for short-dated bonds, AUM of $6 to $32 billion in 2010-2013 may be sufficiently large to draw such inferences.

Chapter 3

Determinants of Emerging Market Crises: the Role of U.S. Monetary Policy[18]

3.1. Introduction

For much of the past 15 years, emerging markets were the engine of the global economy, witnessing years of rapid economic growth and demonstrating remarkable resilience during the global financial crisis. In recent years, however, EMs have faced growing pressures. The Institute of International Finance estimates that EMs experienced net capital outflows of an unprecedented $763 billion in 2015, amid sharp currency depreciations and increases in risk spreads (IIF 2016). The currencies of Russia, Colombia, and Brazil depreciated so sharply in 2015 as to reach crisis proportions, based on standard definitions.[19] The recent turbulence has led some commentators to ask whether it is "time to declare an emerging market crisis" (Financial Times 2015).

In the existing literature, emerging market crises are seen primarily as the result of EM-specific vulnerabilities (e.g., Kamin et al. 2001; Bussière and Fratzscher 2006; Gourinchas and Obstfeld 2012). These and other studies typically see the root cause of emerging markets' susceptibility to crises in weak institutions that make countries vulnerable to economic and financial instability. By contrast, the present study finds that U.S. monetary policy is often just as important as domestic factors in explaining the incidence of EM crises, if not more important. The results presented in this chapter suggest that the existing literature neglects the importance of Fed monetary policy in driving crises. The findings are particularly relevant in today's environment where the Fed is expected to tighten U.S. monetary policy for the next several years (Federal Reserve 2016).

It is compelling to view the cause of a crisis as the confluence of some underlying vulnerability with a specific trigger (Chamon et al. 2012). When this framework is used in the literature, U.S. monetary policy is seen as one of the potential crisis triggers. By contrast, the findings of this study suggest that U.S. monetary policy settings can also compound the underlying vulnerabilities that make emerging markets susceptible to crises in the first place (even if the ultimate crisis trigger is a different factor). For example, emerging markets are found to be more vulnerable to crises during

[18] This chapter was published as Koepke (2016).

[19] The most commonly used definition in the literature is based on Frankel and Rose (1996), who define a currency crisis as a depreciation in the nominal exchange rate vis-à-vis the U.S. dollar of at least 25% year-on-year. See further details in Section 3.1.

Fed policy tightening cycles and in periods when the stance of U.S. monetary policy is already restrictive.

Moreover, this study quantifies the role of U.S. monetary policy as a crisis trigger in EMs, focusing on the role of shifts in market expectations for future Fed tightening. The empirical evidence suggests that the triggering mechanism is most powerful when the Fed is in the early stage of a policy tightening cycle and market participants are surprised by signals that there will be more/faster interest rate hikes than previously expected (i.e., when the Fed is perceived to be "behind the curve" in tightening policy).

The contribution of the present study is to highlight the important role of Fed policy by providing evidence on the specific aspects of U.S. monetary policy that affect the likelihood of emerging market crises. In particular, the study analyzes three main factors, namely the *stance*, *direction*, and *surprise element* of U.S. monetary policy:

- The "stance" of U.S. monetary policy can be characterized as contractionary [expansionary] when the real short term interest rate is above [below] its natural level (Laubach and Williams 2003). This natural (or "neutral") interest rate is the real short-term interest rate that leads actual output to converge to potential output (Bofinger 2001). The empirical results of this study show that the incidence of EM crises increases the more restrictive the stance of U.S. monetary policy is (as measured by the deviation of the real short term interest rate from its natural rate).
- The "direction" of U.S. monetary policy is captured by a binary variable that indicates whether the Fed is in a policy tightening cycle or not. There is evidence that the incidence of crises increases during Fed policy tightening cycles, especially during the first year of Fed tightening.
- The "surprise element" of U.S. monetary policy is captured by futures contracts that reflect market participants' expectations of future Fed policy rates. A shift in expected policy rates indicates that market participants were surprised by new information that led them to change their view of the likely policy rate path (Kuttner 2001). The findings of this study show that, conditional on the Fed being on a policy tightening cycle, upward shifts in expected policy rates can substantially raise the probability of crises in emerging markets.

To my knowledge, this is the first study in the literature on crisis determinants that examines the role of any of these three aspects of Fed policy.[20] The only exception relates to the "direction" aspect of Fed policy, which is also analyzed in a recent study by Escolano et al. (2014), although their analysis is limited to sovereign default episodes, among other differences.

[20] I presented preliminary findings for this study in Koepke (2015b) and Institute of International Finance (2014b) and (2015b).

The empirical strategy used in this chapter is to estimate two complementary econometric models. The first model examines the aggregate incidence of crises in emerging markets and uses the total number of such crises as the dependent variable. In particular, I estimate a negative binomial count model to analyze the determinants of crises in a group of 27 emerging economies. Focusing on the aggregate incidence of crises is a natural way to begin an analysis of the external factors behind emerging market crises, since external factors by definition are common across all countries and thus can be expected to exhibit a close relationship with the total number of crises.

The second model is a panel logit model that estimates crisis probabilities at the country level. The main advantage of this model is that it is able to control for domestic developments affecting the likelihood of a crisis. In particular, I control for domestic crisis determinants including real exchange rate appreciation, credit growth, external debt, the current account, official reserves, interest rates, and output growth.

The estimation results from both models provide strong evidence for a significant role of U.S. monetary policy in determining emerging market crises. The main results are summarized in Figure 3.1. Estimation results are obtained both for the aggregate incidence of crises and for each type of crisis. Each of the three aspects of U.S. monetary policy (the stance, direction, and surprise element of monetary policy) seem to have played an important role in bringing about emerging market crises over the past several decades. The empirical evidence is particularly robust for currency and banking crises, but there is also considerable support for this relationship in the context of sovereign default episodes. Estimation results obtained from the panel model generally provide more robust evidence for the Fed policy variables, which may be due to the fact that these estimates are based on country-level data that allow for a much larger number of observations.

Figure 3.1: Summary of Estimation Results for the Role of Fed Policy in Determining EM Crises

Results based on count model and panel logit model

Measure of EM Crises	All Crises		Currency Crises		Sovereign Default		Banking Crises	
Model	**Count**	**Panel**	**Count**	**Panel**	**Count**	**Panel**	**Count**	**Panel**
Stance of U.S. Monetary Policy								
Direction of U.S. Monetary Policy								
Surprises of U.S. Monetary Policy								

Consistent statistically robust evidence
Some statistically robust evidence
No statistically robust evidence

Source: author's illustration.

These findings have a number of policy implications for EM policymakers and the Fed. In emerging markets, the results of this study highlight the need for policymakers to monitor changing conditions in the external environment and to stand ready to respond to spillovers from abroad. For the Fed, the empirical evidence underscores the risks associated with being "behind the curve" in tightening monetary policy. The findings also highlight the importance of effective Fed communication regarding its policy intentions, particularly in the early stages of a tightening cycle.

The remainder of this chapter is structured as follows. Section 3.2 provides an overview of the related literature. Section 3.3 explains the different types of EM crises, discusses a number of stylized facts about the incidence of EM crises, and explains the Fed policy variables. Section 3.4 presents the empirical analysis of the aggregate incidence of crises in the context of the count model. Section 3.5 analyzes crisis probabilities using country-level data in the panel logit model. Section 3.6 concludes the chapter and discusses implications for policymaking and potential avenues for future research.

3.2. Related Literature

There is no commonly accepted, unified theory of what causes crises in emerging markets. Theoretical models of the causes of crises have evolved over time and are broadly classified into first, second, and third generation models. While first generation models focused on currency crises, the principles underlying second and third generation models are applicable to all three types of crises studied in this chapter, including banking crises and sovereign default episodes (Krugman 2001).

First generation models focus on inconsistent government policies that attempt to combine a currency peg with monetary financing of a budget deficit, leading the central bank to draw down reserves in an attempt to defend the peg and ultimately forcing it to devalue (e.g., Krugman 1979; Flood and Garber 1984). In first-generation models, crises are seen as inevitable due to fundamentally unsustainable policy choices, in contrast to second generation models, which emphasize the presence of multiple equilibria. Second generation models highlight the role of self-fulfilling speculative attacks on currency pegs, giving rise to currency crises that occur precisely because agents believe there will be a currency crisis (e.g., Obstfeld 1994b and 1996). Third generation models focus particularly on balance sheet vulnerabilities, for example in the context of currency mismatches and/or an excessive build-up of external debt (e.g., Krugman 1999; Corsetti et

al. 1998). Moreover, recent models have focused on institutional imbalances, information asymmetries, and contagion effects (e.g., Kaminsky and Reinhart 2003; Yuan 2005; Vaugirard 2007).

While there is no all-encompassing theory for the causes of crises, theoretical work suggests a number of characteristics that may make EMs vulnerable to crises. Gourinchas and Obstfeld (2012) group these weaknesses into six broad areas: (1) political and economic instability, (2) undeveloped and unstable financial markets, (3) dollarization and currency mismatches, (4) fear of floating, (5) debt intolerance and vulnerability to sudden stops, and (6) overregulation of nonfinancial markets.

Consistent with the notion that these characteristics make EMs vulnerable to crises, the empirical literature on crisis prediction has identified a number of domestic variables that can help anticipate crisis episodes. Among the most frequently cited precursors of crises are real exchange rate appreciation and domestic credit growth (e.g., Frankel and Rose 1996; Sachs et al. 1996; Bussière and Fratzscher 2006; Chamon et al. 2012; and Ghosh et al. 2015). Additional harbingers of crises include large current account deficits, slow real GDP growth, and high external indebtedness (e.g., Berg et al. 1999; Manasse et al. 2003; Bussière and Fratzscher 2006). Declining official reserves are a robust predictor of currency crises (Frankel and Rose 1996; Gourinchas and Obstfeld 2012), while short term debt and the fiscal balance matter particularly for the incidence of sovereign default (Manasse et al. 2003; Bussière and Fratzscher 2006). High domestic interest rates are found to increase the likelihood of banking crises (Kaminsky and Reinhart 1996; Demirgüç-Kunt and Detragiache 1997).

While the focus in the literature is generally on the domestic determinants of crises, a number of studies have pointed to the role of U.S. monetary policy. For example, Eichengreen and Rose (1998) find that elevated interest rates in advanced economies increase the probability of banking crises in emerging markets. Kamin et al. (2001) find that external factors (including U.S. interest rates, terms of trade, and advanced economy GDP growth) matter less than domestic factors, but also contribute to the likelihood of EM crises. The authors argue that external factors often appear to have been sufficient to push countries "over the edge" into a crisis. This argument ties in with the view advanced in the more recent literature that a crisis typically requires some underlying vulnerability and a specific trigger (e.g., Chamon et al. 2012). In this framework, the underlying vulnerability is seen as pertaining to domestic issues such as balance sheet mismatches, while the specific trigger can be either external or domestic in nature.

Most of these studies consider a simple measure of U.S. short term interest rates such as the 3-month T-bill rate and find that higher rates are associated with an increased incidence of crisis

episodes (including banking, currency, and default crises). The main channels through which higher rates are thought to affect emerging markets include higher borrowing costs, reduced capital flows, heightened investor risk aversion, and lower commodity prices (e.g., Frankel and Roubini 2001).

The present study contributes to the literature in that it highlights the role of external factors in triggering EM crises and addresses the specific aspects of Fed policy that matter for the incidence of emerging market crises. The paper closest to the present study is Escolano et al. (2014), which focuses on the link between Fed tightening and sovereign default episodes. The authors find that the beginning of a Fed hiking cycle tends to increase the incidence of sovereign default. Unlike Escolano et al. (2014), the present study (1) considers banking and currency crises in addition to sovereign default episodes, (2) takes into account the stance of U.S. monetary policy, (3) examines the role of shifts in market expectations for future Fed policy, (4) applies a more holistic definition of Fed tightening cycles, and (5) uses a range of domestic control variables, building on the broader literature on EM crisis determinants.

3.3. Data on Emerging Market Crises and Fed Policy Variables

3.3.1. Definitions and Dating of Crisis Episodes

There is a large empirical literature geared towards defining and dating various types of emerging markets crises. This study builds on the work by Gourinchas and Obstfeld (2012), which integrates the work of numerous prior studies to construct a single, comprehensive database for the three types of crises. The dating of crises for the period from 1973 to 2010 is directly taken from Gourinchas and Obstfeld (2012), while data for subsequent years are based on Institute of International Finance (2014b). The three types of crises are defined as follows:

(1) The definition of currency crises is based on Frankel and Rose (1996). Their main criterion is a depreciation in the nominal exchange rate vis-à-vis the U.S. dollar of at least 25% year-on-year. The authors require as a second criterion that the depreciation also be 10 percentage points greater than in the prior year. This second criterion addresses the issue that some countries have had persistently high inflation rates and thus high expected (and actual) rates of depreciation. In addition, the authors exclude crises observations that occur within the three years following a currency crisis so as to avoid double-counting.

(2) The definition for systemic banking crises comes from Laeven and Valencia (2010). Their definition requires that two conditions be met, namely "significant signs of financial distress

in the banking system" and "significant banking policy intervention measures in response to significant losses in the banking system" (Laeven and Valencia 2010, p. 6). The authors apply various quantitative subcriteria to decide whether policy interventions are "significant."[21]

(3) The dating of default crises relies on a number of prior studies, including Reinhart and Rogoff (2009), Cantor and Packer (1995), Chambers (2011), Moody's (2009), and Sturzenegger and Zettelmeyer (2007). The definitions of sovereign default applied by the various studies generally involve (1) a payment of interest and/or principal that is not made on time and in full or (2) a distressed exchange.

3.3.2. Stylized Facts about EM Crises

Applying the above definitions to the country sample of 27 EM economies yields a total of 154 crisis episodes for the period from 1973 to 2014. Currency crises are the most frequent type of episode (44%), followed by sovereign defaults (31%). Summary statistics are provided in Table 3.1.

Table 3.1: Summary Statistics – Number of EM Crisis Episodes (Annual Data, 1973-2014)

Summary statistics are based on the incidence of crises in all 27 EMs included in the sample.
For example, "mean" refers to the average number of crises per year in all EMs.

	Sum	Mean	Median	Minimum	Maximum	St. Dev.	Skewness	Kurtosis
Currency Crises	67	1.6	1	0	7	1.6	1.1	4.2
Sovereign Defaults	47	1.1	1	0	6	1.3	1.6	5.8
Banking Crises	40	1.0	0	0	5	1.4	1.5	4.6
Total No. of Crises	154	3.7	3	0	13	3.5	1.2	3.8

Source: author's calculations.

A number of interesting stylized facts can be illustrated with the crisis dataset. First, crisis episodes have come in waves over the past several decades (Figure 3.2 A; Kaminsky and Reinhart 1999). For example, there were about a dozen crisis episodes per year in 1982-83 (during the Latin American debt crisis) and 1997-98 (during the Asian crisis), while the average number for the full sample period is only 3.7 crisis episodes per year. A number of factors may contribute to this clustering pattern, including contagion effects across countries and spillover effects across different sectors within a country, notably from the banking sector to the external sector (Kaminsky and Reinhart 1999; Glick and Hutchinson 2000). Moreover, the clustering pattern may point to the role of common external factors that affect all EM countries simultaneously (Calvo 2005).

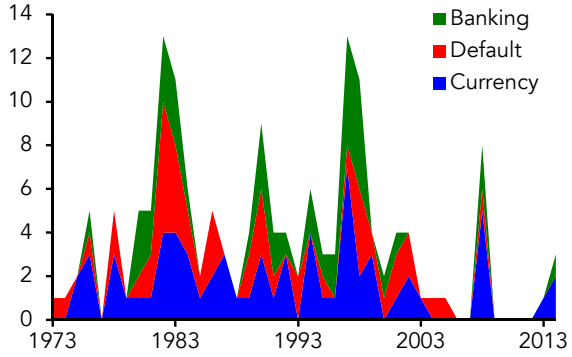
[21] Specifically, the authors require that three out of the following six criteria are met: (1) liquidity support of at least 5 percent of deposits and liabilities to non-residents; (2) bank restructuring costs of at least 3 percent of GDP; (3) significant bank nationalizations; (4) significant guarantees put in place; (5) asset purchases of at least 5 percent of GDP; and (6) deposit freezes and bank holidays.

Second, the incidence of crises has greatly diminished over the past 15 years (Gourinchas and Obstfeld 2012). For example, in the 1980s and 1990s there were a total of 55 and 59 crises, respectively, while in the 10 years ending 2014 (which include crisis episodes during the global financial crisis) there were a total of only 13 crises. The declining trend is most apparent when smoothing the crisis time series with a moving average, as shown in Figure 3.2 B.

Third, in terms of the country distribution, it is noteworthy that some emerging market countries have experienced very few crises (such as Hungary, Malaysia and India), while others have suffered a considerable number of crisis episodes during the past 40 years, particularly in Latin America. Figure 3.2 C lists all countries considered in this study and shows the total number of crises during the sample period.

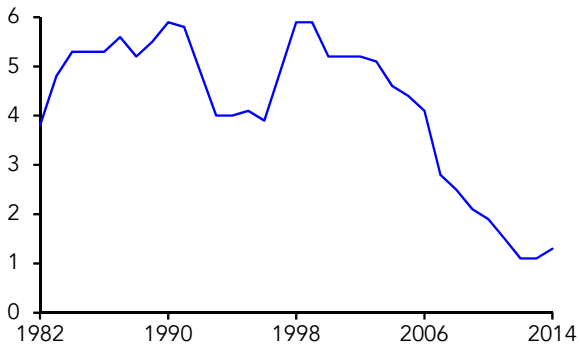
Figure 3.2: Number of EM Crises per Year

Figure 3.2 A: Number of EM Crises per Year by Type
number



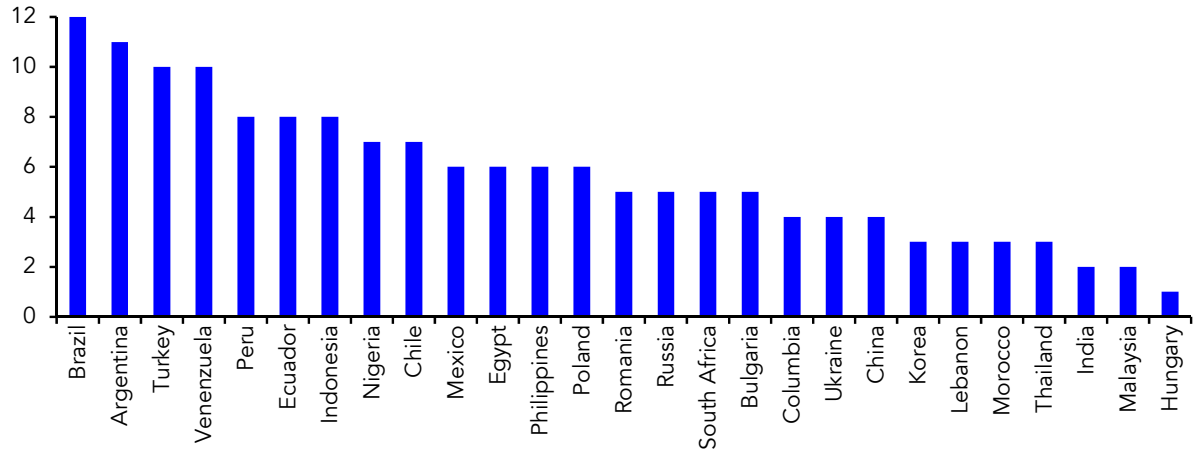
Source: author's calculations based on Gourinchas and Obstfeld (2012), Laeven and Valencia (2012) and IIF (2014b).

Figure 3.2 B: Total Number of EM Crises per Year
10-year moving average



Source: author's calculations based on Gourinchas and Obstfeld (2012), Laeven and Valencia (2012) and IIF (2014b).

Figure 3.2 C: Number of Emerging Market Crises by Country, 1973-2014
total of currency crises, sovereign defaults, and banking crises



Source: author's calculations based on Gourinchas and Obstfeld (2012), Laeven and Valencia (2012), and IIF (2014b).

3.3.3. Motivation and Definitions of Fed Policy Variables

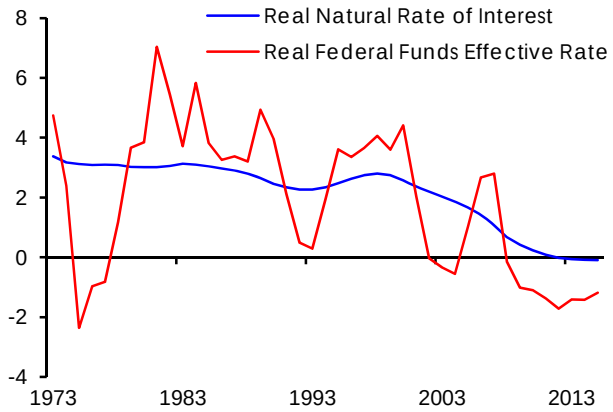
I consider three main variables to capture the impact of U.S. monetary policy on emerging markets. The first relates to the overall stance of U.S. monetary policy, calculated as the deviation of the real federal funds effective rate (FFR) from its natural rate. The natural rate of interest is the policy interest rate that is consistent with GDP at potential and stable inflation. The estimates of the natural rate of interest used in this study are based on Laubach and Williams (2003).

From a theoretical standpoint, it is compelling to make use of the "stance of monetary policy" concept (i.e. the deviation of the real policy rate from its natural rate) when studying the role of Fed policy over a period spanning several decades. U.S. policy interest rates have been on a structural downward trend over the past three decades, which means that it would be problematic to use the level of the federal funds rate in regression analysis. By utilizing the deviation of the real policy rate from its natural rate it is possible to test whether there is a level effect on the incidence of EM crisis. There are good reasons to believe that a restrictive stance of U.S. monetary policy would raise the incidence of crises in emerging markets. For example, a cyclical increase in U.S. short-term interest rates is likely to affect emerging markets through a combination of increased borrowing costs (Frankel et al. 2004) and reduced capital flows (Calvo et al. 1993). It is worth noting that the stance of U.S. monetary policy typically changes only gradually over time, which means that it is more compelling to think of this variable in terms of affecting a country's crisis vulnerability over a period of time rather than being a trigger at a particular point in time.

The data for the estimates of the U.S. natural rate of interest based on Laubach and Williams (2003) were obtained from the Federal Reserve Bank of San Francisco. Figure 3.3 illustrates the estimated real natural rates of interest and the real federal funds effective rate (deflated by the core measure of the personal consumption expenditure deflator, the Fed's preferred measure of inflation). In the regression analysis, I make use of the deviation of the real effective rate from its natural rate, lagged by one year to reflect the chain of causality and the transmission lag to EM crisis episodes.

Figure 3.3: Natural Rate of Interest and Federal Funds Effective Rate

real interest rates in percent per annum



Source: Laubach and Williams (2003), Federal Reserve Bank of San Francisco, Haver Analytics, author's calculations.

The second U.S monetary policy variable considered in this study relates to Fed policy tightening cycles. It seems plausible that the incidence of crises is higher during periods of Fed tightening than in periods when Fed policy is on hold or easing. Beyond the above-mentioned impact of higher U.S. rates on EM borrowing conditions and availability of external financing, Fed tightening also affects emerging markets through a risk-taking channel (Bruno and Shin 2015). In essence, a tightening of monetary conditions tends to reduce risk-taking by the banking sector (and the financial sector more broadly), and thus weighs on financial and economic conditions in emerging markets. This initial impetus may be reinforced by a depreciation of EM currencies and slumping asset prices, adding to financial market volatility and investor risk aversion.

Hence, emerging markets' crisis vulnerability is likely to increase during a Fed tightening cycle. In addition, the onset of a Fed tightening cycle could plausibly serve as a trigger of a crisis, particularly in conjunction with a surprise upward shift in monetary policy expectations (see below).

In the literature, there is no commonly accepted definition of a monetary tightening cycle. The identification of the end of tightening cycles proposed by Adrian and Estrella (2008) is used by a number of studies (including Escolano et al. (2014), which is similar in scope to the present study). However, this definition has a number of theoretical and practical shortcomings. For example, the criteria set forth by Adrian and Estrella (2008) do not yield an end date for the most recent tightening cycle from 2004 to 2006.[22]

[22] Adrian and Estrella (2008, p. 260) define the end of a Fed tightening period as the month when at least one of the following two criteria is met: "(1) the federal funds [effective] rate is higher than at any time from 12 months before to 9 months after and is at least 50 basis points higher than at the beginning of this period, or (2) the federal funds rate is higher than at any

For the purpose of the present study, I therefore propose a new definition that is based on a single, simple criterion: *A tightening cycle encompasses all consecutive years in which the average annual federal funds effective rate increases by at least 10 basis points.*[23] A definition based on annual data for the federal funds rate is appropriate for the present study given that the crisis dataset is at the annual frequency. The threshold of 10 basis points is high enough to eliminate years when there was a modest increase in the federal funds effective rate but no increase in the target rate. For example, the average federal funds effective rate rose from 0.10% in 2011 to 0.14% in 2012, even though the federal funds target range remained at 0 to 0.25% during this period. At the same time, the threshold is low enough to pick up years when policy tightening began around mid-year or later. For example, the 2004 policy tightening cycle began with a first rate hike in June 2004, resulting in an increase in the annual average federal funds effective rate of 22 basis points relative to 2003 (and thus exceeding the threshold of 10 basis points). It is worth noting that there are no "close calls" in the historical data on the federal funds effective rate where a different threshold of, say, 5 or 15 basis points would have resulted in a different dating of Fed tightening cycles.

This simple definition yields 8 tightening cycles with a total of 17 years of Fed tightening during the period from 1973 to 2014, as illustrated in Figure 3.4.

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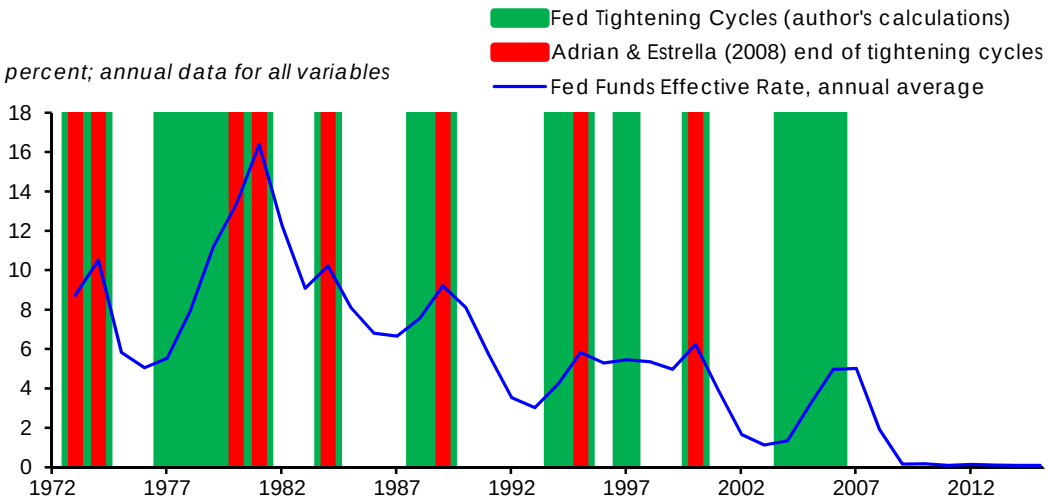
time from 6 months before to 6 months after and is 150 basis points higher than the average at these endpoints." The criteria seem to work well for the period from 1955 to 2000 that is studied by the authors, yielding end dates for 13 Fed policy tightening cycles. However, from a theoretical standpoint, there are several issues with this definition. The first issue is that criterion 1 requires a local peak in the federal funds effective rate ("higher than at any time from 12 months before to 9 months after"). If the effective rate were to be stable in the period following the last hike of a tightening cycle, there would be no end to this cycle based on this criterion. If anything, the requirement should be for the effective rate to be "higher than at any time in the 12 months before and higher or equal than at any time in the 9 months after month that marks the end of the cycle." Note, however, that the federal funds effective rate fluctuates with market conditions, which means that even this definition would be problematic. If the rate were to move slightly higher in the period following the last hike of a tightening cycle, the end of that cycle could be dated many months after the last rate hike or there could be no end to that cycle (namely if the peak occurred more than 12 months after the last rate hike). Incidentally, this problem arises in the data for the mid-2000s tightening cycle, when the target rate was last hiked in June 2006, to 5.25%. The effective rate reached 5.24% in July 2006, but climbed to 5.26% in both February and March 2007. Strictly speaking, there would be no end to this tightening cycle according to Adrian and Estrella's (2008) definition as neither of their two criteria is met.

[23] One issue that arises in the recent period after the global financial crisis is that this definition of Fed tightening cycles does not capture the effect of unconventional monetary policy at a time when the effective lower bound for the federal funds rate is reached. This issue can be overcome by using estimates of a "shadow" federal funds rate, which is essentially an estimate of a virtual policy rate that captures the effect of unconventional monetary policy measures. Applying the above definition to the shadow federal funds rate estimated by Wu and Xia (2016) indicates that a policy tightening cycle began in 2015 (rather than 2016, as annual data for the federal funds effective rate would suggest). The estimation results are unaffected by this issue since the sample period ends in 2014.

Figure 3.4: Federal Funds Effective Rate and Identified Policy Tightening Cycles



Source: Federal Reserve, Adrian & Estrella (2008) and author's calculations.

The third U.S. monetary policy variable captures market expectations for Fed policy interest rates. The rationale behind looking at interest rate expectations is that asset prices fundamentally depend on the outlook for *future* interest rates rather than on today's interest rates. There is a growing consensus in the literature on domestic monetary transmission regarding the importance of monetary policy expectations. For example, Hamilton (2008, p. 1171), emphasizes that what matters "for market participants is not what the Fed just did, but is instead new information about the Fed's future intentions." To my knowledge, the present study is the first to apply the monetary policy expectations framework to the literature on the determinants of emerging market crises.

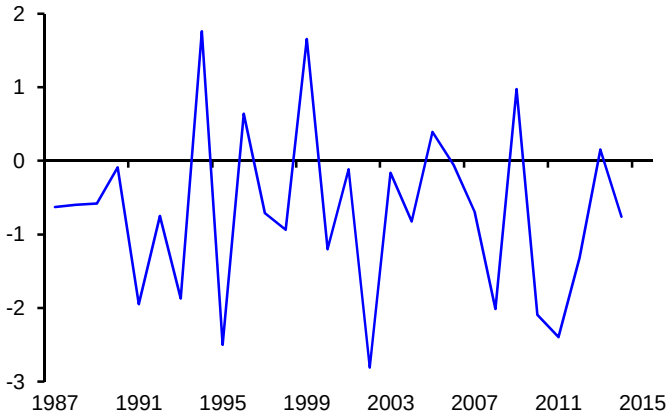
In the context of the crisis literature, the surprise element of monetary policy stands out as the prime candidate for being a crisis trigger (particularly in conjunction with the onset of a tightening cycle). Indeed, changes in monetary policy expectations can rapidly affect pricing in other asset markets, including emerging markets, as observed during the 2013 "taper tantrum" (Koepke 2015b).

The monetary policy expectations variable is calculated based on eurodollar futures contracts, which measure market-implied interest rates on future 3-month dollar deposits. Eurodollar futures are nearly perfectly correlated with federal funds futures contracts, but have the advantage that there is a longer period of historical data available. Moreover, the eurodollar futures market is more liquid and contracts are available further into the future than for federal funds futures contracts (Rigobon and Sack 2004; Labuszewski 2013). Both types of futures contracts have been used in the literature, and Gürkaynak et al. (2007) find that both instruments are good predictors of changes in the federal funds target rate.

In the empirical analysis, the interest rate expectations variable is calculated as the change in the expected interest rate three years ahead (based on annual averages of the corresponding futures contract values, Figure 3.5). The three-year time horizon is chosen consistent with the work of Gürkaynak (2005), who finds that asset prices are most affected by shifts in the futures curve that extend beyond the near term (i.e. a level shift in the futures path or a change in its slope, rather than a mere change in the timing of a near-term change in the federal funds target rate). The eurodollar futures data used in this study is only available from 1986 onwards, while the other two Fed policy variables are available for the entire sample period.

Figure 3.5: Change in Eurodollar Futures Implied Interest Rates

percentage points, annual data based on Eurodollar futures contracts 3 years ahead



Source: CME Group, author's calculations.

One issue that particularly affects analysis of the direction and the surprise element of U.S. monetary policy is reverse causality. While U.S. monetary policy is inherently geared towards domestic economic objectives, namely to generate full employment in a context of price stability, in pursuing these objectives the Fed also needs to take into account international developments. If a tightening of U.S. monetary policy contributes to a crisis in emerging markets the Fed may be compelled to slow down the pace of tightening on the grounds that the slump in foreign demand could weigh on the domestic economy. For example, during the Asian crisis, the Fed was concerned about the effects of turmoil in Southeast Asia on the U.S. economy and stopped tightening monetary policy.[24]

[24] For example, the December 1997 FOMC minutes note: "A majority of the members indicated a preference for a shift to a symmetrical directive even though many continued to anticipate that the next policy move was likely to be in a tightening direction. They noted that while the probability of any policy change in the near term was very low, uncertainties in the outlook had increased, and they could not rule out the possibility that the next change might be in the direction of some easing if, contrary to current expectations, the turmoil in Asia were to intensify to the extent that it seemed likely to exert very substantial effects on the U.S. economy." (Federal Reserve 1997).

These types of "spillbacks" may result in a downward bias of the estimated impact of Fed policy tightening on the incidence of crises. This downward bias may be mitigated to a certain degree by the use of a dummy variable for periods of Fed tightening rather than a quantitative indicator like the change in the federal funds effective rate. Nonetheless, the issue of reverse causality means that estimates of the Fed's impact on the incidence of crises are likely to be conservative and the actual impact (and statistical significance levels) may be greater than estimated.

3.4. Estimation of the Aggregate Incidence of Crisis: a Count Model

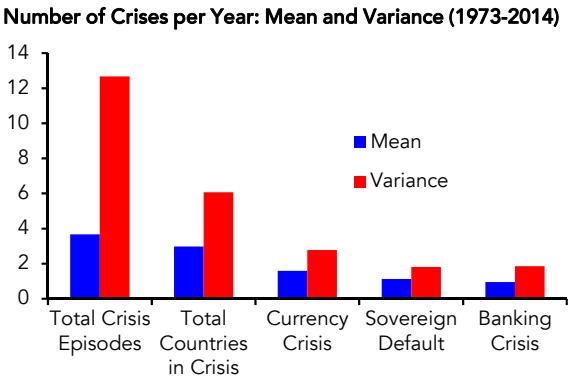
3.4.1. Model Setup

This study aims to explain the incidence of EM crises, measured as the number of EM crisis episodes per year. This variable is restricted to positive integers (i.e. there are no "half" crises etc.), a characteristic that is exploited by the use of a count model, which is specifically geared towards such data. Estimating the count model requires making an assumption about the probability distribution of the dependent variable. Frequently used distributions in the literature include the Poisson distribution and the negative binomial distribution (Greene 2008b). For example, Escolano et al. (2014) use the Poisson distribution in a count model geared towards explaining the incidence of sovereign debt crises.

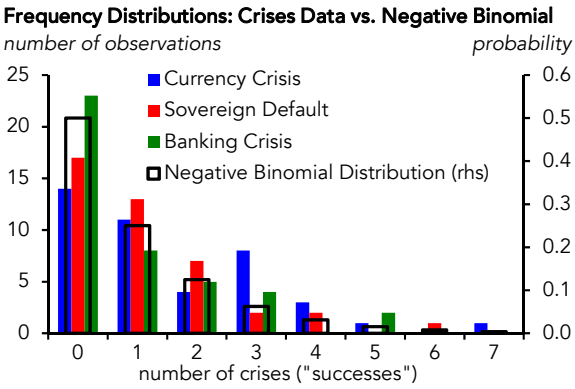
Based on statistical and graphical examination of the crisis data, the negative binomial distribution seems most appropriate. From a statistical perspective, the Poisson distribution is more restrictive in that it requires the mean of the variable to be equal to its variance. The crisis variables do not meet this requirement as the variance is typically almost twice the mean for the three types of crises (Figure 3.6, first panel). This property favors the use of the negative binomial distribution. In addition, the observed frequency distribution of the crisis variable matches the density function of the negative binomial distribution quite well, as shown in Figure 3.6, second panel.[25]

[25] The parameters used for the binomial distribution shown in the chart are as follows: probability of success = 0.5, number of failures = 1.

Figure 3.6: Frequency Distribution of Crisis Dataset



Source: author's calculations.



Source: author's calculations.

Econometric Model

I use a standard negative binomial regression model (e.g., Greene 2008b):

$$Prob(Y = y_t|X_t) = \frac{\Gamma(\theta+y_t)}{\Gamma(y_t+1)\Gamma(\theta)} p_t^{y_t}(1-p_t)^{\theta} \quad (3.1)$$

Where y is the number of "successes" (in the language of probability theory; here it is the number of crises), θ is the number of "failures" (here: 1), p is the probability of success, and Γ is the Gamma distribution. The regressors enter the equation via the probability p:

$$p_t = \lambda_t/(\theta + \lambda_t) \quad (3.2)$$

$$\lambda_t = e^{X'\beta} \quad (3.3)$$

Where λ is the expected number of crises per year, while X′ are the regressors and β captures the estimated coefficients. I estimate variants of this general model using a number of explanatory variables. The main regressors of interest are:

$$X_t = [FedGap_{t-1} + D_t + Fed\_Expect_t + D_t \cdot Fed\_Expect_t] \quad (3.4)$$

where $FedGap_{t-1}$ captures the stance of U.S. monetary policy in the preceding year, defined as the deviation of the real federal funds rate from its natural rate, based on Laubach and Williams (2003). D_t is a dummy variable that is equal to one for years of Fed tightening and zero otherwise, indicating the direction of Fed policy. Fed_Expect_t captures shifts in market expectations of future policy interest rates, measured as the change in the eurodollar futures rate three years ahead. The last term is an interaction term between the prior two variables, measuring the impact of shifts in market expectations for Fed policy during Fed tightening cycles. This interaction term captures the "surprise

element of monetary policy" and helps answer the question: "Conditional on the Fed tightening policy, how does a shift in market expectations for future policy rates affect the incidence of EM crises?".

Accordingly, the expected number of crises per year, λ, equals:

$$\lambda(X_t) = e^{(\beta_1 \cdot FedGap_{t-1} + \beta_2 \cdot D_t + \beta_3 \cdot Fed\_Expect_t + \beta_4 \cdot D_t \cdot Fed\_Expect_t + \sum_{i=5}^{n} \beta_i \cdot Control_i)} \quad (3.5)$$

The regression coefficients from the negative binomial regression need to be interpreted with caution, taking due account of the exponential function. For a one unit change in a regressor, the log of the expected count of the crisis variable changes by the respective regression coefficient, holding constant the other regressors.

3.4.2. Estimation Results from the Count Model

The baseline regression results are reported in Table 3.2 and focus on the total number of EM countries in crisis as the dependent variable (i.e., a country with two or three types of crisis episodes in the same year is counted as one country in crisis). There is robust evidence that the stance of U.S. monetary policy (measured as the deviation of the real federal funds effective rate from its natural rate) is an important driver of EM crises. This suggests that the incidence of crises increases substantially for years when U.S. monetary policy was restrictive in the preceding year (and declines when the stance of policy was expansionary). The coefficient is significant at the 1% level in most specifications, and the coefficient estimate for this variable increases when additional control variables are included.

There is also evidence that the number of crises is higher during years of Fed tightening. The estimated coefficient is consistently positive, highly statistically significant in most specifications, and economically meaningful.

Table 3.2: Baseline Estimation Results for the Count Model

	(1)	(2)	(3)	(4)
Constant	0.784 ***	0.115	-0.334	-0.104
	(0.233)	(0.306)	(0.451)	(0.369)
Number of EM countries in crisis in prior year	0.072	0.139 **	0.137 **	0.188 ***
(lagged dependent variable)	(0.047)	(0.062)	(0.054)	(0.069)
Stance of U.S. monetary policy in prior year	**0.178 ***	**0.432 ***	**0.378 ***	**0.470 ***
(real fed funds rate minus natural rate)	(0.099)	(0.101)	(0.094)	(0.097)
Direction of U.S. monetary policy	**0.126**	**0.866 **	**0.915 **	**1.242 ***
(dummy for Fed tightening cycle)	(0.243)	(0.358)	(0.360)	(0.361)
Surprise element of U.S. monetary policy		**0.706 ***	**0.691 ***	**0.527 **
(interaction of tightening dummy and Eurodollar futures)		(0.257)	(0.259)	(0.207)
Upward shift in U.S. interest rate expectations		-0.246 **	-0.209 ***	-0.164
(Eurodollar futures)		(0.099)	(0.081)	(0.114)
Change in global risk aversion			0.021	
(VXO index)			(0.015)	
Change in EM current account balance in prior year				-0.664 **
				(0.275)
Adjusted R^2	0.31	0.35	0.41	0.51
Number of Observations	41	28	28	28
Standard Error of Regression	2.04	1.78	1.70	1.56

Notes: Standard errors are shown below the estimated coefficients and asterisks indicate significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. All regressions results are based on Huber/White-robust standard errors to correct for heteroscedasticity in the residuals. The dependent variable is the total number of EM countries in crisis. "Stance of U.S. monetary policy" is the deviation of the real federal funds effective rate from its natural rate, based on Laubach and Williams (2003) and obtained from the San Francisco Fed (see Section 3.3). "Direction of U.S. monetary policy" is a dummy variable that is equal to one for years of Fed tightening. The variable "Surprise element of U.S. monetary policy" captures shifts in market expectations of future Fed policy rates during Fed tightening cycles, based on the interaction between the dummy for Fed tightening cycles and the variable capturing shifts in market expectations for future interest rates. "Upward shift in U.S. interest rate expectations" refers to the shifts in market expectations for future interest rates by themselves (i.e. without an interaction term). "Change in global risk aversion" refers to the first difference of the VXO equity volatility index. The variable "change in the current account balance in prior year" refers to the change in the aggregate EM current account balance as a share of EM GDP.

In addition, there is evidence that Fed tightening makes EMs particularly susceptible to crises if it occurs in a context of rising market expectations of future U.S. interest rates. This result is obtained by interacting the dummy for years of Fed tightening with the variable capturing shifts in market expectations of future interest rates. This interaction can be thought of as capturing faster-than-expected Fed tightening. The intuition is that markets will typically price in additional rate hikes when the Fed is on a policy tightening cycle. So if market expectations for future policy rates shift up when the Fed is already tightening policy, this typically means that Fed tightening is now likely to take place faster than previously expected. It is compelling that faster than expected Fed tightening should have a particularly strong impact on market interest rates and asset prices, since there will be increases in both short-term bond yields (due to rising policy interest rates) and longer-term bond

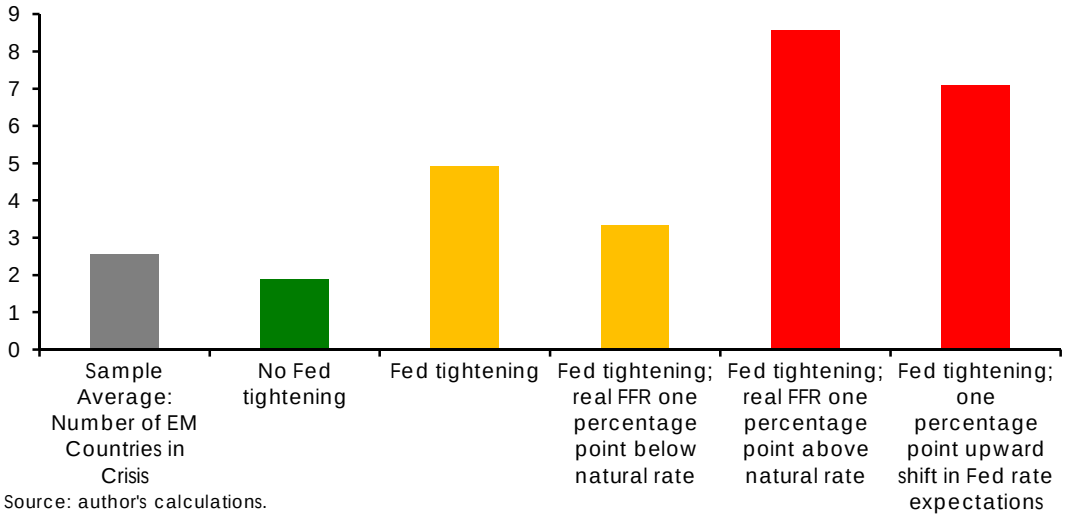
yields (due to an upward shift in the expected path of short-term interest rates).

The regression results also suggest that it is important to distinguish between shifts in market expectations during periods of Fed tightening versus periods when there is no Fed tightening. Indeed, the sign of the estimated coefficient on shifts in policy rate expectations is negative during periods when the Fed is tightening, at least when the interaction term between Fed tightening cycles and shifts in market expectations is included.[26] A possible explanation is that an upward shift in policy rate expectations during a Fed easing period may convey an improved U.S. economic outlook and reduced investor concerns about recession risks and financial stability.

Figure 3.7 illustrates the economic magnitude of the estimation results, using regression 4 from Table 3.2. As a benchmark, the average number of EMs in crisis over the sample period (1987 to 2014) is 2.6. In years when the Fed is not tightening policy, the expected number of EM countries in crisis is 1.9, while in a year of Fed tightening, the expected value rises to 4.9.

Figure 3.7: Count Model Prediction for the Number of EM Countries in Crisis

total number of EM countries in crisis per year, regressors at sample average (1987 to 2014) unless indicated otherwise



Source: author's calculations.

The estimation results suggest that for a real federal funds rate that is one percentage point below its natural rate during a year of Fed tightening, the expected crisis count comes down to 3.3.[27] By contrast, in a year when the real FFR is one percentage point above its natural rate and the Fed still raises rates, the expected crisis count is as high as 8.6. Moreover, if Fed tightening occurs against

[26] If the interaction term is not included, the estimated coefficient is close to zero and not statistically significant. This result is not reported in the regression tables due to space constraints.

[27] At the onset of a tightening cycle, the real federal funds rate is typically below its natural level. On average, in the year before Fed tightening began the real federal funds rate has been 0.5 percentage points below its natural rate during the sample period, per the estimates based on Laubach and Williams (2003). Moreover, their estimates suggest that in 2015, the real federal funds rate stood about 1 percentage point below its natural rate.

the backdrop of an upward shift in expected policy rates by one percentage point 3 years ahead (and the real FFR is at its sample average), the expected crisis count is estimated at 7.1.[28]

Thus far, the discussion has focused on explaining the number of emerging market economies in crisis, regardless of the types of crisis episodes that countries are experiencing. Further insights can be gained by looking at the incidence of each of the three types of crisis, as well as the total number of crisis episodes (which is different from the number of countries in crisis if there is more than one crisis episode in the same country and year). The estimation results are reported in Tables 3.5 to 3.8 in the appendix and are summarized in Figure 3.8.

Figure 3.8: Summary of Count Model Estimation Results

Determinant	Total # of Crisis Countries	Total # of Crisis Episodes	Currency Crises	Sovereign Default	Banking Crises
Stance of U.S. Monetary Policy					
Direction of U.S. Monetary Policy					
Surprises of U.S. Monetary Policy					

Consistent statistically robust evidence
Some statistically robust evidence
No statistically robust evidence

Source: author's illustration.

Estimations with the total number of EM crises as the dependent variable yield very similar results to the baseline regressions discussed above. Coefficient estimates are generally somewhat higher than in the baseline, reflecting the fact that the total number of crises exceeds the total number of countries in crisis (i.e. when counting multiple simultaneous types of crises in one country separately). There is strong support for all the main variables of interest, particularly the deviation of the real FFR from its natural rate and the Fed tightening dummy variable. The statistical significance of the "faster than expected tightening" variable is modestly lower than in the baseline regressions, but still passes the 10% significance threshold in all baseline specifications.

Looking at the determinants of individual types of crises, the stance of U.S. monetary policy is an important and statistically highly significant determinant for all crisis types. The estimated coefficient is highest for banking crises, but the coefficient estimates are not much different for currency crises and sovereign defaults.

[28] It is worth noting these last two scenarios are not particularly common, but are referenced here for illustrative purposes. The last time the Fed was in tightening cycle when the real federal funds rate was at least a percentage point above its natural rate was in 1974. The last time the expected short-term interest rate shifted up by at least a percentage point during a tightening cycle was in 1994.

In terms of the other variables of interest, the results highlighted in the baseline estimations are confirmed for banking crises, which are found to be significantly affected by the stance of U.S. monetary policy and the process of Fed tightening, while evidence for shifts in the expected path of Fed policy rates is somewhat less robust. For currency crises and sovereign defaults, the estimated coefficients generally have the same sign as in the baseline regressions in Table 3.2, but the statistical significance is diminished when looking at either of the two types of crises separately.

3.4.3. Robustness Checks and Additional Estimations

A number of robustness checks were conducted to ensure the validity of all main findings. One set of robustness checks relates to the dummy variable for Fed tightening cycles. In an alternative definition, I set the dummy to one only for the first year of each Fed tightening cycle. The estimation results are very similar overall. On average, the coefficient estimate for the first year of Fed tightening is somewhat higher than for all years of Fed tightening, suggesting that the beginning of U.S. monetary tightening has a disproportionate impact on the incidence of crises in EMs. The results are reported in Table 3.9 of the appendix.

Another robustness check was to estimate the count model assuming the Poisson distribution rather than the negative binomial distribution for the crisis variable. The results from this estimation are very similar to the baseline, but are slightly more statistically robust (reported in Table 3.10 of the appendix).

For the variable capturing the stance of U.S. monetary policy, I also tested a measure based on a simple and intuitive estimate of the natural rate of interest, rather than using than the more sophisticated Laubach-Williams based estimates. In that simple measure, the natural rate is estimated with an HP-filter that is applied to the federal funds effective rate. The results are substantively the same, with the estimated coefficients for the federal funds rate gap being significant at the 5% level, although the statistical significance is somewhat lower than when the more sophisticated estimate of the natural rate is used.

I also tested a number of additional control variables, particularly alternative variables that would control for EM economic conditions, such as EM real GDP growth in the preceding year, the ratio of official reserves to imports, and the change in the ratio of external debt to exports. Including these various EM domestic variables did not substantively change the estimation results (nor did they turn out to be statistically significant and hence were not included in the baseline specification). In addition, I tested if the prevalence of fixed exchange rate regimes in the prior year would help

explain the incidence of crises, using the de facto classification from Ghosh et al. (2015). The estimated coefficient on this variable also turned out insignificant.

A limitation of the count model is that it can only control for aggregate EM developments and is unable to control for country-specific developments. The panel model set out in the next section addresses this limitation, providing further insights on the role of country-level factors that may mitigate or exacerbate the incidence of EM crises.

3.5. Estimation of Country-Specific Crisis Probabilities: a Panel Logit Model

3.5.1. Model Setup

I estimate a panel logit model with country fixed effects, using a cross-section of 27 emerging market countries. The approach taken is similar to Bussière and Fratzscher (2006) and Gourinchas and Obstfeld (2012). The dependent variable is a binary variable that takes the value of 1 if a particular country had a crisis in a given year and 0 otherwise. A binary dependent variable favors the use of a discrete choice model in which the probability of a crisis occurring in a particular country during a particular year is estimated. The discrete dependent variable is:

$$Y = \begin{cases} 1 & with\ probability\ Prob\ (Y = 1) = P \\ 0 & with\ probability\ Prob(Y{=}0){=}1{-}P \end{cases} \quad (3.6)$$

The logit model estimated here takes the following form:

$$\mathrm{Prob}\left(\mathrm{y_{jt}} = 1 \middle| X\right) = \frac{\mathrm{e}^{\mathrm{X'\gamma_{jt}}}}{1+\mathrm{e}^{\mathrm{X'\gamma_{jt}}}} \quad (3.7)$$

where the dependent variable is the probability of a crisis of the type *j* occurring in year *t*, given the independent variables X. In the baseline specification, the dependent variable is defined as the number of countries in crisis, as in the count model baseline specification (i.e. the discrete variable is equal to one for a particular country and year if there is at least one crisis episode in that particular country and year). Indeed, one shortcoming of the discrete choice panel model relative to the count model is that it is not possible to differentiate between a country that experiences one crisis episode in a given year and a country that experiences two or three crisis episodes in the same year (although each type of crisis can still be analyzed separately).

The independent variables include the Fed policy variables from the count model, a number of domestic control variables, and country fixed effects as an additional control variable:

$$X_t = [FedGap_{t-1} + D_t + Fed\_Expect_t + D_t \cdot Fed\_Expect_t + \textstyle\sum_{i=1}^{n} Control_i)] \quad (3.8)$$

In the logit model, the crisis probability is a non-linear function of the regressors. An important implication of this non-linearity is that the marginal effect of a change in a regressor depends on the states of that regressor and all other regressors. When interpreting the regression coefficients, the marginal effect is evaluated under the assumption that all other independent variables are at their sample averages.

The domestic control variables used in the panel analysis are listed in Table 3.3. Functional forms were chosen based on panel stationarity tests (Levin, Lin and Chu; Breitung; Im, Pesaran and Shin, and Fisher chi square tests). All variables were determined to be stationary with the exception of the real effective exchange rate, the ratio of domestic credit to GDP, and real GDP. Functional forms for these variables are based on the first difference or the percent change (i.e. the *growth* in real GDP etc.). In the regression, lagged values are used for all domestic control variables, reflecting the chain of causality from, e.g., a deterioration in domestic economic conditions in the prior year to an increase in the probability of crisis in the current year.

Table 3.3: Overview of Domestic Control Variables

Variable	Unit	Data Source
Real Effective Exchange Rate	percent change, y/y	National Sources, Institute of International Finance
Domestic Credit Growth	change in percent of GDP, y/y	Bank for International Settlements
External Debt	ratio to annual exports	National Sources, Institute of International Finance
Current Account Balance	percent of GDP	National Sources, Institute of International Finance
Official Reserves	ratio to imports	National Sources, Institute of International Finance
Real Deposit Rate	percent per annum	National Sources, Institute of International Finance
Real GDP Growth	percent change, y/y	National Sources, Institute of International Finance

3.5.2. Estimation Results from the Panel Logit Model

Table 3.4 presents the baseline regression results for the panel logit model. The first specification includes all external variables from the baseline count model specification as independent variables (but no domestic control variables). The results are consistent with those from the count model, indicating a statistically significant impact on the incidence of EM crises of all three U.S. monetary policy variables (that is, more crises when (1) Fed policy is restrictive, (2) Fed policy is tightened, and (3) there is an upward shift in interest rate expectations during Fed tightening periods).

The second specification includes the main domestic determinants of EM crises established in the empirical literature and discussed in Section 3.2 (but no external explanatory variables). All regressors have the expected sign, though only three of them are statistically significant, namely domestic credit growth, external debt, and the domestic deposit rate.

Table 3.4: Baseline Estimation Results for the Panel Logit Model, 1987-2014

	(1)	(2)	(3)	(4)
Constant	-1.562 ***	-3.492 **	-4.540 ***	-4.196 **
	(0.531)	(1.446)	(1.289)	(1.693)
Stance of U.S. monetary policy in prior year	**0.484 *****		**0.694 *****	**0.672 *****
(real fed funds rate minus natural rate)	(0.109)		(0.190)	(0.210)
Direction of U.S. monetary policy	**0.672 ***		**1.923 *****	**1.907 *****
(dummy for Fed tightening cycle)	(0.350)		(0.678)	(0.664)
Surprise element of U.S. monetary policy	**0.587 ***		**1.384 ** **	**1.342 ** **
(interaction of Dummy and Eurodollar futures)	(0.348)		(0.553)	(0.550)
Upward shift in U.S. interest rate expectations	-0.177		-0.639 **	-0.638 **
(Eurodollar futures)	(0.140)		(0.296)	(0.303)
Country fixed effects	-1.052 **	0.055	-0.160	-0.174
	(0.520)	(0.872)	(0.852)	(0.966)
Real effective exchange rate appreciation in prior year		0.029		0.020
		(0.018)		(0.023)
Domestic credit growth in prior year		0.074 *	0.065 **	0.064
		(0.041)	(0.033)	(0.050)
External debt in prior year		0.006 **	0.005 **	0.005 *
		(0.002)	(0.002)	(0.003)
Current account balance in prior year		-0.008		-0.019
		(0.052)		(0.058)
Reserves in prior year		-0.091		-0.037
		(0.107)		(0.103)
Domestic deposit rate in prior year		0.072 **	0.071 **	0.075 **
		(0.028)	(0.031)	(0.031)
Real GDP growth in prior year		0.016		-0.029
		(0.056)		(0.054)
McFadden R^2	0.06	0.13	0.20	0.21
Number of Observations	756	357	357	357
Standard Error of Regression	0.29	0.27	0.26	0.26

Notes: Standard errors are shown below the estimated coefficients and asterisks indicate significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. All regressions results are based on Huber/White-robust standard errors to correct for heteroscedasticity in the residuals. The dependent variable is the total number of EM countries in crisis. "Stance of U.S. monetary policy" is the deviation of the real federal funds effective rate from its natural rate, based on Laubach and Williams (2003) and obtained from the San Francisco Fed (see Section 3.3). "Direction of U.S. monetary policy" is a dummy variable that is equal to one for years of Fed tightening. The variable "Surprise element of U.S. monetary policy" captures shifts in market expectations of future Fed policy rates during Fed tightening cycles, based on the interaction between the dummy for Fed tightening cycles and the variable capturing shifts in market expectations for future interest rates. "Upward shift in U.S. interest rate expectations" refers to the shifts in market expectations for future interest rates by themselves (i.e. without an interaction term).

Specifications (3) and (4) include the domestic determinants from regression (2) as control variables. In particular, specification (3) includes the statistically significant variables only, while specification (4) includes all domestic variables considered in specification (2). The estimation results for the external

variables are essentially the same in these two specifications, and they point once again to a statistically significant and economically meaningful impact of the three U.S. monetary policy variables.

It is worth noting that the estimated magnitude of all three Fed policy variables increases when including the domestic control variables (and the statistical significance generally increases, too). The estimated impact of Fed tightening and the impact of shifts in policy interest rate expectations rises by a multiple of two to three when controlling for domestic developments.

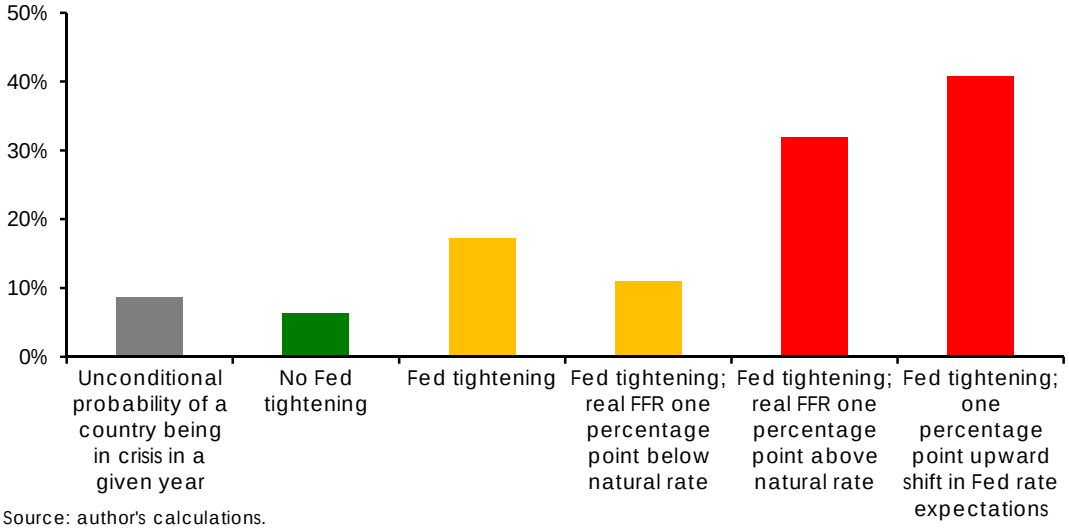
The magnitude of the estimated effects of U.S. monetary policy variables can be illustrated by evaluating the marginal impact on the probability of a crisis in a given country, assuming that all independent variables are at their sample means. Figure 3.9 illustrates the estimated effects for the same scenarios as discussed in the count model section, using regression (4) from the Table 3.4 (which includes all domestic control variables).

As a benchmark, the unconditional probability of an EM country being in a crisis in any given year over the sample period (1987 to 2014) is 8.7 percent. The estimation results suggest that in years when the Fed is not tightening policy, the predicted probability is 6.4 percent, while in a year of Fed tightening, the predicted probability jumps to 17.3 percent.

In addition, the estimation results suggest that the incidence of crises also depends on the prevailing stance of U.S. monetary policy. For example, the predicted crisis probability is reduced to 10.9% in a year when the Fed is tightening policy if the real federal funds rate was one percentage point below its natural rate in the prior year. By contrast, if the real FFR was a percentage point above its natural rate in the prior year and the Fed tightens policy, the predicted crisis probability is 32%. Moreover, if Fed tightening occurs against the backdrop of an upward shift in expected policy rates by one percentage point, the predicted crisis probability is 40.8 percent (assuming a real FFR at its sample average). Note that it is not common to observe an upward shift of expected policy rates of this magnitude, nor is it common for the Fed to tighten when the real FFR is already a full percentage point above its natural rate (see footnote 28). As such, these two scenarios can be thought of as tail risks and serve to highlight the potential disruption that can stem from adverse U.S. monetary policy conditions.

Figure 3.9: Panel Model Prediction for the Probability of an EM being in a Crisis in a Given Year

probability; all regressors at sample average (1987 to 2014) unless indicated otherwise



Source: author's calculations.

Additional insights can be gained by looking at the determinants of each type of crisis separately. The corresponding estimation results are presented in Tables 3.11 to 3.13 of the appendix and are summarized in Figure 3.10. As in the count model, the three Fed policy variables seem to matter across the different types of crises, although the evidence is strongest in the case of currency crises. For sovereign default episodes, the estimated coefficients all have the expected sign, but only exceed a 15% threshold of statistical significance.

Figure 3.10: Summary of Panel Model Estimation Results

Determinant	All Crises	Currency Crises	Sovereign Default	Banking Crises
Stance of U.S. Monetary Policy				
Direction of U.S. Monetary Policy				
Surprises of U.S. Monetary Policy				

Consistent statistically robust evidence
Some statistically robust evidence
No statistically robust evidence

Source: author's illustration.

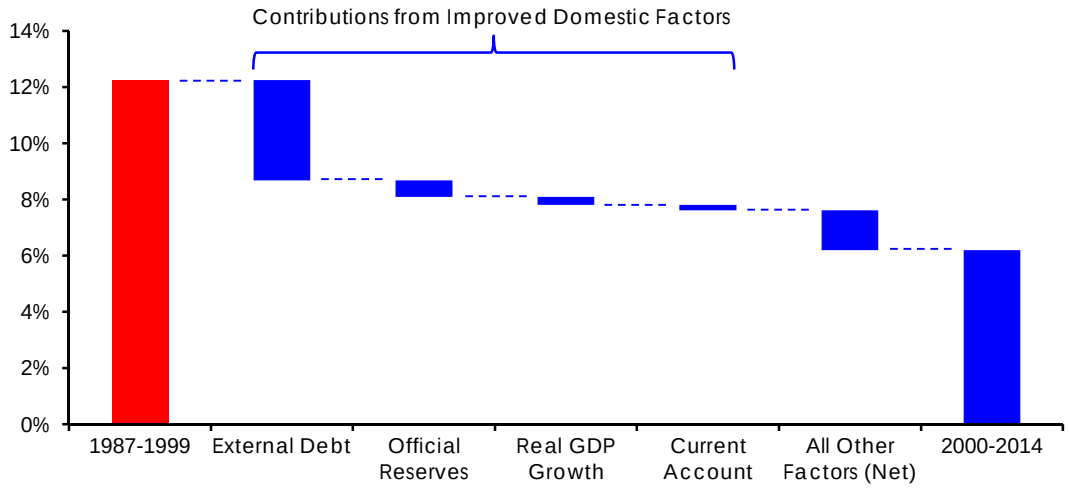
A notable development highlighted in Section 3.3 is the substantial decline in the frequency of emerging market crises during the past 15 years relative to the 1980s and 1990s. In fact, the unconditional probability of a country experiencing a crisis declined from 12.2% in the period from 1987-1999 to 6.2% in the period from 2000 to 2014. The panel estimations can be used to gain

insights about the drivers behind this increased resilience. Specifically, the contributions of various explanatory variables to the observed reduction in the likelihood of a crisis can be attributed to the change in the sample means of those same variables from the pre-2000 period to the post-2000 period. For example, the average ratio of external debt to annual exports declined from 236% in the period from 1987-1999 to 123% in 2000-2014. This decline would be expected to explain some of the reduced crisis frequency in the recent period. The corresponding decline in the estimated crisis probability can be derived using the estimated coefficients from the baseline specification (Table 3.4, regression 4) for all explanatory variables.[29]

The results of this exercise are illustrated in Figure 3.11. The estimates suggest that the decline in the observed probability of crisis is primarily due to sharply reduced external debt stocks (estimated to have reduced the average crisis probability by 3.6 percentage points), a substantially higher reserve coverage (-0.6 pp), stronger real GDP growth (-0.3 pp), and improved current account balances (-0.2 pp).

Figure 3.11: Decomposition of Factors that Explain Reduced Crisis Probabilities in 2000-2014

crisis probability in percent



Source: author's illustration.

[29] This is calculated as follows. The unconditional crisis probabilities for the two periods (12.2% and 6.2%) are based on the observed number of crises in the 27 countries. The total decline in the crisis probability (6 percentage points) is allocated proportionately to the estimated raw contributions from the individual explanatory variables. The raw contributions are calculated as the product of (1) the change in the sample mean of each explanatory variable and (2) the estimated coefficient from regression 4 in Table 4.

3.5.3. Robustness Checks and Additional Estimations

A number of robustness checks were conducted to test the sensitivity of the baseline estimation results. For example, I estimate the same regressions using a panel probit model rather than a logit model, thus assuming a somewhat different probability distribution for the incidence of crises. Both distributions are commonly used in the literature (although the logit distribution is typically preferred in similar studies, such as Bussière and Fratzscher (2006) and Gourinchas and Obstfeld (2012)). The only difference in the probit specification is that country fixed effects cannot be included because this would bias the estimation results (Greene 2008a). Nonetheless, the results from the probit model are substantively identical to those from the logit model, meaning that all three U.S. monetary policy variables are consistently highly statistically significant (see Table 3.14 in the appendix).

In a second robustness check, I vary the definition of the dependent variable to indicate whether a country experiences a crisis episode in any of the next three years rather than just looking at the next year. Indeed, for the purpose of early warning exercises it is useful to consider whether a crisis occurs over a more extended period of time and not just in any particular year, as discussed in Bussière and Fratzscher (2006) and Gourinchas and Obstfeld (2012). In this specification, the Fed rate expectations variable is no longer statistically significant (while the other estimation results are essentially the same; see Table 3.15 in the Appendix for details). This result is plausible in that a shift in rate expectations by definition reflects a market surprise, which can quickly trigger a stress event in emerging markets, but which would be unlikely to have a significant effect beyond a 12-month time horizon. The result thus corroborates the intuition that the role of shifts in market expectations is to trigger crisis at a particular point in time rather than adding to the underlying crisis vulnerability of emerging markets.

In a further robustness check, I exclude observations for the dependent variable in the three years immediately following a crisis year to address the issue of "post-crisis bias" discussed in Demirgüç-Kunt and Detragiache (1997) and Bussière and Fratzscher (2006). In essence, models geared towards explaining or predicting the incidence of crises aim to capture the causal link from various economic variables to the occurrence of crises. But once there is a crisis the causality is likely to run the other way: The occurrence of a crisis is likely to shape the trajectory of economic determinants, potentially resulting in a post-crisis bias. When excluding post-crisis observations, the estimated coefficients of the monetary policy variables and their significance level is marginally lower compared to the baseline, but otherwise the results are essentially unchanged (see Table 3.16 in the Appendix).

It is worth noting that in a setting where the dependent variable captures only one particular type of crisis (e.g., banking crises in the case of Demirgüç-Kunt and Detragiache (1997)), it seems compelling to systematically exclude post-crisis observations since there are no two crisis episodes of the same type in two consecutive years and only very few incidences of a second crisis of the same type occurring within a three-year window. By contrast, in the present study I consider three different types of crises which do frequently occur in consecutive years. Therefore, the baseline specification does not exclude post-crisis observations.

Finally, I tested if the choice of exchange rate regimes prior to the start of a crisis would help explain the crisis probability, focusing on fixed exchange rates. I tested this with a dummy variable for countries with pegged exchange rates, using the de facto classification from Ghosh et al. (2015). The estimated coefficient on this variable was close to zero and not statistically significant.

3.6. Conclusion

This chapter has provided new empirical evidence on the role of U.S. monetary policy in bringing about crises in emerging markets. While the existing literature has focused predominantly on domestic factors as the root cause of crises in emerging markets, the results of this study highlight the important role played by the Federal Reserve. In particular, there tend to be more crises (1) during Fed tightening cycles, (2) when the federal funds rate is above its natural rate and (3) when market participants come to anticipate faster future Fed tightening.

Empirical results were obtained from two separate econometric models. First, a negative binomial count model was used to analyze the overall incidence of emerging market crises. Second, a panel logit model was estimated to analyze the likelihood of crises at the country level, controlling for domestic economic conditions. The results from both models provide strong support for the notion that U.S. monetary policy has been an important determinant of EM crisis episodes over the past several decades.

Estimation results were obtained both for the aggregate incidence of crises and for each type of crisis, with the strongest effects found for currency crises, followed by banking crises. Moreover, the panel model provided additional insights as to how improved domestic fundamentals in emerging markets have reduced the frequency of crises during the past 15 years. Reduced external debt ratios are estimated to have played the biggest role, followed by greater holdings of official reserves, stronger output growth, and improved current account balances.

At the current juncture (as of summer 2016), these results have mixed implications for the outlook for financial stability in EMs. On the one hand, the Fed has recently embarked on a new monetary tightening cycle, which market participants and members of the Federal Open Market Committee expect to continue for several years. This suggests that there is an increased risk of crisis episodes in the near term. On the other hand, the real federal funds rate is likely to be below its natural rate at the current juncture, which would tend to reduce the likelihood of crises. A major unknown is how expectations for future policy rate increases will shift over the coming quarters and years.

From a policy perspective, the findings of this study highlight the need for EM policymakers to monitor and respond to changing conditions in the external environment. While some aspects of these conditions are known or predictable (such as the stance of Fed policy and whether a tightening cycle is imminent) other factors are unknown and warrant close surveillance (notably the surprise element of Fed policy). Policymakers need to be ready to lean against the wind in the face of external shocks, making use of prudent monetary, fiscal, and exchange rate policies to safeguard domestic financial stability. For example, EM central banks should maintain ample reserve buffers to stabilize the exchange rate if needed, and governments should avoid excessive borrowing from foreign creditors.

This study also has implications for policymaking by the Federal Reserve. In particular, the results highlight the risks associated with the Fed being "behind the curve" in tightening U.S. monetary policy, given (1) the increased likelihood of emerging market crises in the context of upward shifts in market expectations for Fed policy and (2) the adverse effects of a highly restrictive stance of U.S. monetary policy. The role of shifts in monetary policy expectations also serves to highlight the importance of effective Fed communication regarding its policy intentions, particularly in the early stages of a tightening cycle. Thus far, the current Fed policy tightening process provides a positive example in this regard. The Fed's first rate hike in December 2015 did not take markets by surprise and futures-implied policy interest rates actually declined in the following months, helping to ease pressures on emerging markets.

A promising avenue for future research could be to delve into the transmission channels of how the three aspects of Fed policy can trigger financial instability and crises in emerging markets. For example, the onset of a Fed tightening cycle may affect emerging markets through a combination of higher borrowing costs, reduced capital flows, and heightened risk aversion. A better understanding of the way in which U.S. monetary policy is transmitted could help in the calibration of macroeconomic policies so that external shocks to financial stability can be mitigated.

Another useful extension of the analysis presented in this study would be to examine the role of

spillovers from U.S. monetary policy to emerging markets using less stringent concepts of financial instability than the standard definitions of crisis episodes. For example, it would be of interest whether periods of Fed tightening lead to a higher level of EM asset price volatility and investor risk aversion even in the absence of a crisis event. The same question arises for the stance and the surprise element of U.S. monetary policy, both of which may affect EM financial stability even during relatively tranquil times.

3.7. Appendix to Chapter 3

3.7.1. Additional Count Model Regression Estimates

Table 3.5: Estimation Results for the Total Number of EM Crises as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	0.971 ***	0.349	-0.025	0.097
	(0.226)	(0.298)	(0.541)	(0.343)
Number of EM countries in crisis in prior year	0.058 **	0.091 ***	0.092 ***	0.134 ***
(lagged dependent variable)	(0.030)	(0.035)	(0.032)	(0.041)
Stance of U.S. monetary policy in prior year	**0.175 ***	**0.481 ***	**0.422 ***	**0.512 ***
(real fed funds rate minus natural rate)	(0.104)	(0.110)	(0.126)	(0.101)
Direction of U.S. monetary policy	**0.141**	**1.011 **	**1.035 **	**1.515 ***
(dummy for Fed tightening cycle)	(0.307)	(0.427)	(0.430)	(0.413)
Surprise element of U.S. monetary policy		**0.659 ***	**0.618 **	**0.355 *
(interaction of tightening dummy and Eurodollar futures)		(0.228)	(0.242)	(0.206)
Upward shift in U.S. interest rate expectations		-0.215 *	-0.172	-0.045
(Eurodollar futures)		(0.120)	(0.128)	(0.128)
Change in global risk aversion			0.018	
(VXO index)			(0.020)	
Change in EM current account balance in prior year				-1.007 ***
				(0.303)
Adjusted R^2	0.29	0.28	0.33	0.58
Number of Observations	41	28	28	28
Standard Error of Regression	2.99	2.88	2.80	2.20

Table 3.6: Estimation Results for EM Currency Crises as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	0.560 ***	0.243	-1.006	0.125
	(0.212)	(0.282)	(0.753)	(0.304)
Number of EM countries in crisis in prior year	-0.026	-0.017	-0.016	0.040
(lagged dependent variable)	(0.081)	(0.079)	(0.071)	(0.079)
Stance of U.S. monetary policy in prior year	**0.116**	**0.441 *** **	**0.263 ** **	**0.463 *** **
(real fed funds rate minus natural rate)	(0.094)	(0.140)	(0.120)	(0.142)
Direction of U.S. monetary policy	**-0.086**	**-0.019**	**0.105**	**0.157**
(dummy for Fed tightening cycle)	(0.381)	(0.134)	(0.089)	(0.190)
Surprise element of U.S. monetary policy		**0.561**	**0.741**	**0.927 * **
(interaction of tightening dummy and Eurodollar futures)		(0.494)	(0.539)	(0.522)
Upward shift in U.S. interest rate expectations		0.588 *	0.528	0.288
(Eurodollar futures)		(0.312)	(0.334)	(0.311)
Change in global risk aversion			0.056 **	
(VXO index)			(0.023)	
Change in EM current account balance in prior year				-0.863 **
				(0.358)
Adjusted R^2	0.01	0.06	0.25	0.20
Number of Observations	41	28	28	28
Standard Error of Regression	1.63	1.70	1.52	1.57

Table 3.7: Estimation Results for EM Sovereign Default Crises as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	-0.189	-0.706	-0.286	-0.720
	(0.308)	(0.483)	(0.791)	(0.497)
Number of EM countries in crisis in prior year	0.095	0.100	0.102	0.116
(lagged dependent variable)	(0.067)	(0.168)	(0.184)	(0.184)
Stance of U.S. monetary policy in prior year	**0.322 *** **	**0.410 ** **	**0.474 ** **	**0.414 ** **
(real fed funds rate minus natural rate)	(0.122)	(0.178)	(0.188)	(0.173)
Direction of U.S. monetary policy	**0.139**	**0.369**	**0.355**	**0.459**
(dummy for Fed tightening cycle)	(0.301)	(0.567)	(0.565)	(0.621)
Surprise element of U.S. monetary policy		**0.068**	**0.115**	**0.018**
(interaction of tightening dummy and Eurodollar futures)		(0.262)	(0.292)	(0.316)
Upward shift in U.S. interest rate expectations		-0.288	-0.337	-0.254
(Eurodollar futures)		(0.176)	(0.230)	(0.210)
Change in global risk aversion			-0.021	
(VXO index)			(0.029)	
Change in EM current account balance in prior year				-0.173
				(0.504)
Adjusted R^2	0.38	0.20	0.18	0.21
Number of Observations	41	28	28	28
Standard Error of Regression	1.07	1.05	1.08	1.07

Table 3.8: Estimation Results for EM Banking Crises as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	-0.849 **	-1.586 ***	-1.710 *	-1.682 ***
	(0.354)	(0.612)	(0.894)	(0.619)
Number of EM countries in crisis in prior year	0.294 **	0.343 ***	0.370 ***	0.476 ***
(lagged dependent variable)	(0.129)	(0.127)	(0.117)	(0.148)
Stance of U.S. monetary policy in prior year	**0.352 *** **	**0.803 *** **	**0.776 *** **	**0.812 *** **
(real fed funds rate minus natural rate)	(0.136)	(0.231)	(0.233)	(0.213)
Direction of U.S. monetary policy	**0.631**	**1.980 *** **	**2.023 *** **	**2.257 *** **
(dummy for Fed tightening cycle)	(0.415)	(0.721)	(0.704)	(0.710)
Surprise element of U.S. monetary policy		**1.021 ** **	**1.051 ** **	**0.395**
(interaction of tightening dummy and Eurodollar futures)		(0.474)	(0.460)	(0.373)
Upward shift in U.S. interest rate expectations		-0.288	-0.312	0.049
(Eurodollar futures)		(0.235)	(0.241)	(0.288)
Change in global risk aversion			0.004	
(VXO index)			(0.025)	
Change in EM current account balance in prior year				-1.438 ***
				(0.344)
Adjusted R^2	0.30	0.49	0.49	0.61
Number of Observations	41	28	28	28
Standard Error of Regression	1.15	1.02	1.02	0.89

Table 3.9: Robustness Checks – Regressions with Dummy for First Year of Fed Tightening Only

Panel A: Estimation Results for the Number of EM Countries in Crisis as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	0.818 ***	0.229	-0.209	0.141
	(0.214)	(0.271)	(0.382)	(0.289)
Number of EM countries in crisis in prior year (lagged dependent variable)	0.068	0.109 *	0.111 **	0.141 **
	(0.048)	(0.057)	(0.050)	(0.061)
Stance of U.S. monetary policy in prior year (real fed funds rate minus natural rate)	**0.177 ***	**0.457 *****	**0.398 *****	**0.457 *****
	(0.097)	(0.092)	(0.089)	(0.091)
Year when Fed tightening cycle begins (Dummy)	**0.165**	**0.913 *****	**0.909 *****	**1.119 *****
	(0.324)	(0.352)	(0.348)	(0.333)
Faster than expected start of Fed tightening cycle (interaction of Dummy and Eurodollar futures)		**0.892 *****	**0.899 *****	**0.672 *****
		(0.201)	(0.188)	(0.234)
Upward shift in U.S. interest rate expectations (Eurodollar futures)		-0.226 ***	-0.198 ***	-0.170 *
		(0.086)	(0.071)	(0.097)
Change in global risk aversion (VXO index)			0.021 *	
			(0.011)	
Change in EM current account balance in prior year				-0.460 *
				(0.247)
Adjusted R^2	0.31	0.45	0.52	0.54
Number of Observations	41	28	28	28
Standard Error of Regression	2.03	1.64	1.54	1.51

Panel B: Estimation Results for the Total Number of EM Crises as Dependent Variable

	(1)	(2)	(3)	(4)
Constant	0.991 ***	0.455 *	0.172	0.342
	(0.197)	(0.256)	(0.417)	(0.268)
Number of EM countries in crisis in prior year (lagged dependent variable)	0.055 *	0.074 **	0.075 **	0.107 ***
	(0.031)	(0.034)	(0.032)	(0.039)
Stance of U.S. monetary policy in prior year (real fed funds rate minus natural rate)	**0.175 ***	**0.494 *****	**0.448 *****	**0.479 *****
	(0.104)	(0.101)	(0.119)	(0.093)
Year when Fed tightening cycle begins (Dummy)	**0.261**	**1.122 *****	**1.108 ** **	**1.439 *****
	(0.410)	(0.433)	(0.433)	(0.384)
Faster than expected start of Fed tightening cycle (interaction of Dummy and Eurodollar futures)		**0.822 *****	**0.814 *****	**0.413**
		(0.228)	(0.225)	(0.290)
Upward shift in U.S. interest rate expectations (Eurodollar futures)		-0.193 **	-0.168 *	-0.069
		(0.098)	(0.100)	(0.114)
Change in global risk aversion (VXO index)			0.014	
			(0.015)	
Change in EM current account balance in prior year				-0.791 ***
				(0.281)
Adjusted R^2	0.30	0.35	0.37	0.59
Number of Observations	41	28	28	28
Standard Error of Regression	2.97	2.74	2.70	2.18

Table 3.10: Robustness Checks – Count Model Estimates Based on Poisson Distribution

	(1)	(2)	(3)	(4)
Constant	0.783 ***	0.115	-0.334	-0.104
	(0.227)	(0.306)	(0.451)	(0.369)
Number of EM countries in crisis in prior year	0.071	0.139 **	0.137 **	0.188 ***
(lagged dependent variable)	(0.045)	(0.062)	(0.054)	(0.069)
Stance of U.S. monetary policy in prior year	**0.192 ** **	**0.432 *** **	**0.378 *** **	**0.470 *** **
(real fed funds rate minus natural rate)	(0.089)	(0.101)	(0.094)	(0.097)
Direction of U.S. monetary policy	**0.128**	**0.866 ** **	**0.915 ** **	**1.242 *** **
(dummy for Fed tightening cycle)	(0.230)	(0.358)	(0.360)	(0.361)
Surprise element of U.S. monetary policy		**0.706 *** **	**0.691 *** **	**0.527 ** **
(interaction of tightening dummy and Eurodollar futures)		(0.257)	(0.259)	(0.207)
Upward shift in U.S. interest rate expectations		-0.246 **	-0.209 ***	-0.164
(Eurodollar futures)		(0.099)	(0.081)	(0.114)
Change in global risk aversion			0.021	
(VXO index)			(0.015)	
Change in EM current account balance in prior year				-0.664 **
				(0.275)
Adjusted R^2	0.32	0.35	0.41	0.51
Number of Observations	41	28	28	28
Standard Error of Regression	2.03	1.78	1.70	1.56

3.7.2. Additional Panel Logit Model Regression Estimates

Table 3.11: Estimation Results for Currency Crises, Panel Logit Model

	(1)	(2)	(3)	(4)
Constant	-2.334 ***	-3.875	-4.032 ***	-4.516
	(0.721)	(2.388)	(1.514)	(2.867)
Stance of U.S. monetary policy in prior year	**0.465 *** **		**0.959 *** **	**0.871 *** **
(real fed funds rate minus natural rate)	(0.143)		(0.321)	(0.330)
Direction of U.S. monetary policy	**0.695**		**2.176 ** **	**2.085 ** **
(dummy for Fed tightening cycle)	(0.454)		(0.985)	(1.001)
Surprise element of U.S. monetary policy	**0.714 * **		**1.728 *** **	**1.708 ** **
(interaction of Dummy and Eurodollar futures)	(0.400)		(0.661)	(0.697)
Upward shift in U.S. interest rate expectations	-0.050		-0.392	-0.449
(Eurodollar futures)	(0.180)		(0.448)	(0.470)
Country fixed effects	-0.770	0.298	-0.407	0.006
	(0.680)	(1.503)	(1.079)	(1.658)
Real effective exchange rate appreciation in prior year		0.036 **	0.018	0.028
		(0.018)	(0.020)	(0.020)
Domestic credit growth in prior year		0.068 *	0.041	0.048
		(0.036)	(0.034)	(0.037)
External debt in prior year		0.005		0.003
		(0.003)		(0.003)
Current account balance in prior year		-0.102 *	-0.146	-0.127 **
		(0.058)	(0.052)	(0.061)
Reserves in prior year		-0.207		-0.130
		(0.165)		(0.166)
Domestic deposit rate in prior year		0.035		0.037
		(0.032)		(0.032)
Real GDP growth in prior year		0.063		0.011
		(0.073)		(0.066)
McFadden R^2	0.05	0.13	0.20	0.23
Number of Observations	756	357	357	357
Standard Error of Regression	0.23	0.22	0.21	0.21

Table 3.12: Estimation Results for Sovereign Default Episodes, Panel Logit Model

	(1)	(2)	(3)	(4)
Constant	-3.659 ***	-4.578 **	-8.466 ***	-8.114 **
	(1.004)	(2.250)	(3.255)	(3.590)
Stance of U.S. monetary policy in prior year	**0.441 ****		**-0.140**	**-0.100**
(real fed funds rate minus natural rate)	(0.186)		(0.363)	(0.331)
Direction of U.S. monetary policy	**0.292**		**2.091**	**2.125**
(dummy for Fed tightening cycle)	(0.578)		(1.488)	(1.399)
Surprise element of U.S. monetary policy	**0.081**		**1.639 ****	**1.615 ****
(interaction of Dummy and Eurodollar futures)	(0.448)		(0.666)	(0.658)
Upward shift in U.S. interest rate expectations	-0.269		-1.718 ***	-1.670 ***
(Eurodollar futures)	(0.221)		(0.604)	(0.604)
Country fixed effects	-0.175	1.147	1.976	1.978
	(1.052)	(1.324)	(1.553)	(1.556)
Real effective exchange rate appreciation in prior year		0.027 *	0.032 *	0.033 *
		(0.015)	(0.018)	(0.017)
Domestic credit growth in prior year		0.074 *	0.110 **	0.102 *
		(0.042)	(0.051)	(0.055)
External debt in prior year		0.007 **	0.010 ***	0.010 **
		(0.003)	(0.003)	(0.004)
Current account balance in prior year		0.198 ***	0.280 ***	0.266 ***
		(0.075)	(0.089)	(0.093)
Reserves in prior year		-0.619 **	-0.854 **	-0.840 **
		(0.262)	(0.350)	(0.329)
Domestic deposit rate in prior year		0.180 ***	0.272 ***	0.269 ***
		(0.041)	(0.066)	(0.064)
Real GDP growth in prior year		-0.051		-0.047
		(0.090)		(0.088)
McFadden R^2	0.04	0.32	0.44	0.44
Number of Observations	756	348	357	357
Standard Error of Regression	0.17	0.14	0.14	0.14

Table 3.13: Estimation Results for Banking Crises, Panel Logit Model

	(1)	(2)	(3)	(4)
Constant	-2.801 ***	-3.981 ***	-4.129 **	-5.351 **
	(0.755)	(1.362)	(1.657)	(2.348)
Stance of U.S. monetary policy in prior year	**0.813 *** **		**1.283 *** **	**1.376 *** **
(real fed funds rate minus natural rate)	(0.209)		(0.370)	(0.450)
Direction of U.S. monetary policy	**1.362 ** **		**2.755 ** **	**2.980 ** **
(dummy for Fed tightening cycle)	(0.628)		(1.095)	(1.200)
Surprise element of U.S. monetary policy	**0.795**		**-0.200**	**-0.325**
(interaction of Dummy and Eurodollar futures)	(0.600)		(0.578)	(0.636)
Upward shift in U.S. interest rate expectations	-0.173		-0.239	-0.082
(Eurodollar futures)	(0.178)		(0.345)	(0.270)
Country fixed effects	-1.317 *	-1.179	-2.139	-1.915
	(0.685)	(0.995)	(1.211)	(1.346)
Real effective exchange rate appreciation in prior year		0.023		0.018
		(0.023)		(0.025)
Domestic credit growth in prior year		0.092 **	0.107 **	0.102 **
		(0.047)	(0.045)	(0.049)
External debt in prior year		0.003		-0.002
		(0.003)		(0.004)
Current account balance in prior year		-0.066		-0.053
		(0.086)		(0.069)
Reserves in prior year		0.059		0.214 *
		(0.090)		(0.126)
Domestic deposit rate in prior year		0.066 *	0.079 *	0.088 **
		(0.035)	(0.043)	(0.034)
Real GDP growth in prior year		0.024		-0.044
		(0.098)		(0.126)
McFadden R^2	0.10	0.14	0.32	0.36
Number of Observations	756	357	357	357
Standard Error of Regression	0.18	0.17	0.16	0.16

Table 3.14: Estimation Results for Panel Probit Model, All Types of Crises

	(1)	(2)	(3)	(4)
Constant	-1.447 ***	-1.961 ***	-2.513 ***	-2.325 ***
	(0.103)	(0.335)	(0.324)	(0.432)
Stance of U.S. monetary policy in prior year	**0.241 *** **		**0.336 *** **	**0.326 *** **
(real fed funds rate minus natural rate)	(0.053)		(0.095)	(0.100)
Direction of U.S. monetary policy	**0.326 ***		**0.879 *** **	**0.874 *** **
(dummy for Fed tightening cycle)	(0.172)		(0.334)	(0.331)
Surprise element of U.S. monetary policy	**0.274 ***		**0.653 *** **	**0.634 *** **
(interaction of Dummy and Eurodollar futures)	(0.157)		(0.253)	(0.257)
Upward shift in U.S. interest rate expectations	-0.086		-0.299 **	-0.299 **
(Eurodollar futures)	(0.069)		(0.140)	(0.144)
Real effective exchange rate appreciation in prior year		0.017 *		0.012
		(0.009)		(0.199)
Domestic credit growth in prior year		0.043 **	0.034 **	0.035 *
		(0.018)	(0.022)	(0.063)
External debt in prior year		0.003 ***	0.003 ***	0.003 ***
		(0.001)	(0.001)	(0.007)
Current account balance in prior year		0.001		-0.005
		(0.023)		(0.819)
Reserves in prior year		-0.044		-0.025
		(0.043)		(0.573)
Domestic deposit rate in prior year		0.039 **	0.033 **	0.038 **
		(0.016)	(0.041)	(0.023)
Real GDP growth in prior year		0.009		-0.016
		(0.027)		(0.550)
McFadden R^2	0.29	0.28	0.28	0.28
Number of Observations	756	357	357	357
Standard Error of Regression	63.19	25.87	24.08	23.97

Table 3.15: Estimation Results for Panel Logit Model, Three-Year Ahead Crisis Window

	(1)	(2)	(3)	(4)
Constant	-0.310	-2.557 ***	0.330	-2.718 ***
	(0.445)	(0.950)	(0.657)	(0.897)
Stance of U.S. monetary policy in prior year	**0.433 *** **		**0.302 *** **	**0.443 *** **
(real fed funds rate minus natural rate)	(0.070)		(0.077)	(0.121)
Direction of U.S. monetary policy	**0.749 *** **		**0.511 ** **	**0.752 * **
(dummy for Fed tightening cycle)	(0.232)		(0.251)	(0.397)
Surprise element of U.S. monetary policy	**0.016**		**-0.036**	**0.072**
(interaction of Dummy and Eurodollar futures)	(0.186)		(0.203)	(0.289)
Upward shift in U.S. interest rate expectations	-0.002		-0.038	-0.070
(Eurodollar futures)	(0.090)		(0.095)	(0.160)
Country fixed effects	-1.127 **	0.078	-0.946	-0.056
	(0.443)	(0.621)	(0.458)	(0.587)
Real effective exchange rate appreciation in prior year		0.041 **	-0.002	0.040 ***
		(0.017)	(0.004)	(0.015)
Domestic credit growth in prior year		0.035		0.037
		(0.031)		(0.023)
External debt in prior year		0.007 ***	0.001 **	0.006 ***
		(0.002)	(0.001)	(0.002)
Current account balance in prior year		-0.007		-0.013
		(0.038)		(0.039)
Reserves in prior year		-0.105 *		-0.055
		(0.063)		(0.058)
Domestic deposit rate in prior year		0.072 ***	0.018 *	0.072 ***
		(0.024)	(0.010)	(0.026)
Real GDP growth in prior year		0.057		0.030
		(0.037)		(0.039)
McFadden R^2	0.07	0.15	0.10	0.19
Number of Observations	756	357	713	357
Standard Error of Regression	0.42	0.39	0.40	0.38

Table 3.16: Estimation Results for Panel Logit Model, Excluding Post-Crisis Observations

	(1)	(2)	(3)	(4)
Constant	-1.326 *	-3.343 *	-3.464 *	-3.469 *
	(0.722)	(1.793)	(1.915)	(2.020)
Stance of U.S. monetary policy in prior year	**0.631 *** **		**0.711 *** **	**0.711 *** **
(real fed funds rate minus natural rate)	(0.146)		(0.254)	(0.248)
Direction of U.S. monetary policy	**1.004 ** **		**1.649 ** **	**1.747 ** **
(dummy for Fed tightening cycle)	(0.472)		(0.740)	(0.710)
Surprise element of U.S. monetary policy	**0.723**		**1.269 ** **	**1.206 * **
(interaction of Dummy and Eurodollar futures)	(0.446)		(0.606)	(0.652)
Upward shift in U.S. interest rate expectations	-0.194		-0.447	-0.427
(Eurodollar futures)	(0.193)		(0.325)	(0.338)
Country fixed effects	-1.536 **	-0.117	-0.294	-0.605
	(0.705)	(1.080)	(1.330)	(1.254)
Real effective exchange rate appreciation in prior year		0.058 **	-0.006	0.040
		(0.029)	(0.008)	(0.025)
Domestic credit growth in prior year		0.147 ***	0.117 **	0.141 ***
		(0.053)	(0.048)	(0.053)
External debt in prior year		0.008 ***	0.007 **	0.007 **
		(0.003)	(0.003)	(0.003)
Current account balance in prior year		0.084 *		0.077
		(0.050)		(0.052)
Reserves in prior year		-0.159	-0.042	-0.098
		(0.123)	(0.106)	(0.111)
Domestic deposit rate in prior year		0.041		0.039
		(0.030)		(0.033)
Real GDP growth in prior year		0.016		-0.045
		(0.073)		(0.071)
McFadden R^2	0.09	0.14	0.20	0.22
Number of Observations	551	263	263	263
Standard Error of Regression	0.28	0.29	0.28	0.28

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