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THREE ESSAYS ON THE IDENTIFICATION OF CURRENCY RISK, ITS DETERMINANTS AND ITS ECONOMIC IMPACT

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To my family, my friends and my wonderful wife Annemarie

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Chapter 1

Introduction

1.1 Motivation

Many emerging markets share a long tradition of currency crises.[1] Episodes like the Latin American crisis in the 1980s, Mexico 1994/1995, Asia 1997, Russia 1998, Brazil 1999 and Argentina 2001/2002 have been extensively studied by the academic literature and inspired the evolution of three generations of currency crisis models. Although the period between 2000 and 2007 was characterized by relatively low pressure on emerging market currencies (Aizenman et al., 2012), many were hit hard during the global financial crisis (Dooley and Hutchison, 2009; Aizenman and Hutchison, 2012). Recently, many emerging currency markets again experienced severe turmoil.[2]

However, currency risk is not an exclusive feature of emerging markets. In 1992, speculative pressure on the British pound forced the United Kingdom to withdraw from the European Exchange Rate Mechanism. More recently, investors have raised doubts about the integrity of the eurozone, anticipating the potential exit(s) of one or several of its members. Such a scenario would most likely present a severe shock to financial markets and might even spark the break-up of the entire eurozone. In his famous speech on July 26th 2012, ECB president Mario Draghi acknowledged that high yields on EMU sovereign bonds partly also reflect the "risk of convertibility" (Draghi, 2012), i.e. the risk of redenomination either due to a single country's withdrawal from the EMU or the entire eurozone's break-up. Although the integrity of the eurozone has been preserved so far,

[1] For example, between 1900 and 2010, Argentina experienced 43 currency crises, i.e. years characterized by a depreciation of the Argentine Peso against the U.S. dollar by more than 15%. Turkey experienced 30 currency crises since the foundation of the Republic in 1923 (Reinhart and Rogoff, 2011).
[2] Over the course of 2018, the Argentine Peso and the Turkish Lira lost 50.0%, respectively 28.7% of their value against the U.S. dollar.

doubts about some countries' commitment to EMU membership continue to exist. Borri (2019) documents a recent surge in Italian redenomination risk, potentially arising from the ongoing dispute between the Italian government and the European Commission about the government's fiscal deficit. In the 2019 European parliament election, the Eurosceptic *Lega* gained the highest share in the Italian popular vote. Similarly, in France, the Eurosceptic *Rassemblement national* received most of the votes. In April 2017, its leading candidate Marine Le Pen had suggested potential benefits of a French eurozone exit: *"The French are overwhelmingly convinced that the euro is a burden. Returning to an adapted national currency will create millions of jobs and give us back our freedom."(Le Pen, 2017)*

The exposure to financial losses and economic costs potentially resulting from (sharp) devaluations of the domestic currency incentivizes financial investors and policy makers to monitor currency risk closely and in real-time. For investors seeking diversification through international investments, currency risk is a common risk factor (e.g. De Santis and Gérard, 1998). Currency crises in particular are typically accompanied by severe economic costs. For example, Hutchison and Noy (2005) estimate that real output declines by 5% - 8% over the two to four years following the outbreak of a currency crisis. Effects are more pronounced for emerging markets compared to developed countries (Hutchison and Noy, 2002). At the level of individual companies, Forbes (2002) documents that large devaluations of the domestic currency significantly affect company performance, although effects are quite heterogeneous between different crisis episodes and depend heavily on company-characteristics. A complete assessment of the costs associated with currency crises might even extent beyond purely economic costs. For example, Funke et al. (2016) show that political uncertainty and populism increase in the aftermath of financial crises. Hernández and Kriesi (2015) document that populist radical right, radical left and non-mainstream parties in Western Europe benefited most from the economic hardship associated with the global financial crisis and the euro crisis. Algan et al. (2017) demonstrate that the euro crisis not only resulted in a higher voting share of populist parties, but also in an erosion of trust in national and European political institutions.

The potentially severe economic and political costs arising from currency crises and large depreciations of the domestic currency highlight the strong need for tools that allow policy makers and investors to monitor currency risk in real-time. Only if such high-frequency measures of currency risk are available, policy makers and investors will be able to respond to currency risk and the risk of currency crises in a timely manner.

1.2 Outline of this thesis and contribution to the literature

This thesis uses financial market data to derive real-time measures of currency risk and studies how it is determined by domestic and external factors. Existing studies of currency risk traditionally focus on the evolution of macro fundamental variables in proximity to currency crises (e.g. Eichengreen et al., 1995; Frankel and Rose, 1996; Kaminsky and Reinhart, 1999; Bussière and Fratzscher, 2006). However, these approaches do not allow for real-time identification of currency risk since the relevant macro data only becomes available with some publication lag. Therefore, these studies offer interesting insights in the causes of currency crises, but they do not allow policy makers or investors to respond to currency risk immediately.

Consequently, an alternative strand of literature emerged that aims to identify currency risk based on financial market data, which allows for a forward-looking real-time identification of currency risk. Analyzing prices of currency forwards or currency options might be one obvious alternative to identify currency risk. However, existing literature documents a forward discount anomaly, i.e. currency forwards tend to predict exchange rate movements in the opposite direction (e.g. Engel, 1996). Frankel and Poonawala (2010) show that this bias exists for emerging market currencies as well, although it is significantly smaller compared to major currencies. Other papers study the pricing of currency options (e.g. Campa and Chang, 1998; Campa et al., 1998; Carr and Wu, 2007). These studies mostly focus on major currencies. While some papers also study emerging market currency options (e.g. Campa et al., 2002), for many emerging market currencies, especially smaller ones and those with peg arrangements, no currency options are available. Even for the countries with available currency options, option prices might not provide unbiased measures of currency risk. In many emerging markets, the domestic central bank intervenes in the foreign exchange market to manipulate the value of the currency (e.g. Menkhoff, 2013; Fratzscher et al., 2019). In fact, many central banks do not only intervene in the spot, but also in the forward and option segments of the foreign exchange market (e.g. Mandeng, 2003; Keefe and Rengifo, 2015; Nedeljkovic and Saborowski, 2019).

A third strand of literature studies the pricing of American Depositary Receipts (ADRs) to identify currency risk. ADRs are U.S. dollar-denominated negotiable certificates that represent ownership of a fixed number of underlying shares, which are denominated in their respective local currency. The law of one price implies that, since ADRs and their underlying shares can be converted into each other, their prices should equal when expressed in the same currency and adjusted for their fixed conversion ratio (Gagnon and Karolyi, 2010). Various studies analyze deviations from the law of one price during financial crises (e.g. Bailey et al., 2000; Melvin, 2003; Bin et al., 2004; Auguste et al., 2006; Pasquariello, 2008).

This thesis builds on the idea that ADR prices reflect investors' exchange rate expectations. Arquette et al. (2008) document that the price spread between Chinese securities and their cross-listed ADRs and H-shares is driven by exchange rate expectations drawn from forward rates. Eichler (2011) shows that price discounts on Chinese cross-listed stocks can predict the yuan-U.S. dollar exchange rate more accurately than the random walk and forward exchange rates. Several papers study the capital control episode in Argentina 2001/02 and find that ADRs traded at a price discount relative to their corresponding underlying stocks prior to the devaluation of the peso (e.g. Melvin, 2003; Kadiyala and Kadiyala, 2004; Levy Yeyati et al., 2004; Auguste et al., 2006; Eichler et al., 2009). Melvin (2003), Levy Yeyati et al. (2004) and Auguste et al. (2006) relate these ADR discounts to capital control circumvention premia. Local residents were willing to pay a premium on domestic stocks that could be converted into ADRs and then cashed into U.S. dollars. Kadiyala and Kadiyala (2004), on the other hand, relate this relative discount to investors' expectations of the true exchange rate. Moreover, Eichler et al. (2009) study the determinants of currency crisis expectations, finding that falling commodity prices and currency overvaluation, as well as rising sovereign default risk, drive ADR investors' currency crisis expectations. Furthermore, Maltritz and Eichler (2010) employ an options-based approach to disentangle the probabilities of currency crises from expected devaluations.

This thesis contributes to the strand of literature mentioned above by analyzing the pricing of ADRs in various contexts to derive real-time measures of currency risk. Chapter 2 is co-authored by Prof. Dr. Stefan Eichler and was published in the *Journal of International Financial Markets, Institutions and Money* in 2018. It studies currency risk in a sample of 21 emerging market economies between 1994 and 2014. First, a country-specific index of domestic macroeconomic stress that captures three potential dimensions of currency risk (export commodity prices, sovereign risk and fragility in the domestic banking system) is constructed. Then, this macroeconomic stress index is introduced into the ADR pricing framework. Investors will price macroeconomic stress in ADR returns if they perceive significant currency risk. Currencies depreciate significantly more in the same and the following year after significant currency risk is identified. Also, currency crises are significantly more frequent in these years. Next, inflation and the fiscal balance are identified as the main determinants of currency risk. Interaction models show that their impact is particularly strong if the domestic sovereign's rating is poor, foreign reserves and capital account openness are low and the currency is managed.

This chapter contributes to the literature that studies the pricing of ADRs to derive real-time measures of currency risk. In particular, it modifies the methodology of existing studies in a way that allows for the identification of currency risk within a significantly broader sample of countries and years. Instead of analyzing price spreads that can only persist if arbitrage is limited, e.g. during periods of capital controls, this chapter studies whether domestic macroeconomic stress (capturing three potential sources of currency risk) significantly affects ADR returns. Consequently, the analysis in this chapter is not restricted to periods with limitations on capital flows. In addition, this chapter links the literature that extracts financial market data to identify currency risk to the traditional strand of currency crisis literature that studies macro fundamental variables as determinants of currency risk. Therefore, it combines the advantages of both approaches. In the first stage, currency risk is extracted from ADR returns. This methodology provides a valuable tool to policy makers and investors since it allows a real-time response to currency risk. The second stage investigates the macro fundamental variables that determine currency risk, providing additional interesting insights to investors and policy makers.

Chapter 3 is also co-authored by Prof. Dr. Stefan Eichler. This chapter introduces a country-specific measure of eurozone exit risk for each of the five GIIPS countries

(Greece, Ireland, Italy, Portugal and Spain) over the period from January 2008 to June 2015. Since currency union membership is a special case of currency peg, the risk that a country withdraws from the eurozone also reflects currency risk. ADR investors are exposed to potential losses associated with a eurozone exit, most importantly due to the redenomination of the underlying stocks into the new devaluated currency, the introduction of capital controls, or the closing of the domestic stock exchange.

The identification of eurozone exit risk in this study is methodologically similar to the one presented in the second chapter. Again, a country-specific indicator is introduced into the ADR pricing framework. In the spirit of second-generation currency crisis models, this indicator comprises three dimensions that proxy the domestic government's incentives to leave the eurozone. These include sovereign risk, financial fragility (stemming from distress in the domestic banking sector) and real fragility (stemming from low current growth and a poor growth outlook). Next, this chapter studies the economic impact of eurozone exit risk on European banks outside the GIIPS countries and on domestic non-financial companies in the GIIPS countries. European banks respond negatively to the exit risk of Greece, Ireland and Portugal. Bank-specific bilateral credit risk exposure to the respective GIIPS country is one driving channel for banks' eurozone exit risk exposure. Increases in Greek and Irish exit risk affect banks with higher bilateral credit risk exposure to the respective country more negatively. In addition, eurozone exit risk has a significantly negative impact on domestic non-financial companies in the GIIPS countries. The exit risk exposure of these domestic non-financial firms is lower for companies characterized by a low ratio of short-term debt to cash and a larger firm size.

Chapter 3 of this thesis expands a small number of existing studies that propose measures of euro redenomination risk, respectively eurozone exit risk (most importantly, De Santis, 2018; Krishnamurthy et al., 2018). Using ADRs to identify eurozone exit risk allows this study to contribute to the literature by providing a measure of eurozone exit risk that is available for all five GIIPS countries over a significantly longer time period (from January 2008 to June 2015). This is a prerequisite for the principal contribution of this chapter: the analysis of the economic impact of eurozone exit risk on European banks and domestic companies in the GIIPS countries. It thereby contributes to a larger strand of literature that studies the general economic impact of the euro crisis, like for example the sovereign-bank nexus (e.g. Acharya et al., 2014; Acharya and Steffen, 2015; Fratzscher and Rieth, 2018) or its consequences on the real economy (e.g. Martin and Philippon, 2017; Meinen and Roehe, 2017). In addition, chapter 3 adds to a strand of literature that uses theoretical models to study specific aspects of eurozone exit risk (e.g. Kriwoluzky et al., 2015; Eijffinger et al., 2018). Finally, this chapter expands the work of Forbes (2002) who studies how large devaluations affect company performance and how this impact depends on company-characteristics.

Chapter 4 studies the impact of US monetary policy on managed exchange rates and currency peg regimes. For currencies that are managed, the domestic central bank intervenes in the foreign exchange market to manipulate the domestic currency's value. Analyzing the pricing of ADRs around FOMC meetings offers a unique opportunity to identify changes in investors' expectations about the future value of the underlying currency arising from US monetary policy. The impact of US monetary surprises (i.e. unanticipated changes in the FED Funds Rate) differs significantly dependent on the exchange rate regime. For managed exchange rate regimes, US monetary surprises lead to lower abnormal ADR returns, reflecting decreases in the fundamental values of these currencies caused by US monetary policy shocks. Countries that peg their currency to the U.S. dollar must mimic US policy rate increases if they want to maintain the currency peg. However, standard currency crises models of interest rate defense predict that raising the domestic policy rate is costly. Lahiri and Végh (2007) state that increasing the domestic policy rate is associated with output costs, fiscal costs and a deterioration of the domestic banking system. Consequently, domestic policy makers might be reluctant to mimic US policy rate increases if such a move is associated with high economic costs. Accordingly, positive US monetary surprises lead to lower abnormal ADR returns (reflecting a higher currency peg breakdown probability) if the costs of mimicking the policy rate increase are high. High costs are proxied by low current real GDP growth relative to past growth, a high fiscal deficit and a weak state of the domestic banking sector.

Chapter 4 contributes to three strands of literature. First, it supplements existing studies that document a significant impact of US monetary policy on financial markets (e.g. Thorbecke, 1997; Bernanke and Kuttner, 2005; Lucca and Moench, 2015). Second, it adds to the strand of literature investigating the transmission of global shocks and US monetary policy in particular (e.g. Kim, 2001; Ehrmann and Fratzscher, 2009; Hausman and Wongswan, 2011; Dedola et al., 2017). Finally, it contributes to the currency crisis literature, especially second-generation currency crisis models and models of an interest rate defense of currency pegs (e.g. Obstfeld, 1994; Bensaid and Jeanne, 1997; Lahiri and Végh; 2007) by providing empirical support for their main prediction. This chapter also links various strands of the currency risk literature by investigating how currency risk might emerge from the interaction of exogenous shocks (in this case US monetary policy) with domestic factors (the current state of the domestic economy).

1.3 Supplementary information – individual contributions

In accordance with *§10 (3) 5 PromO2018*, the following section identifies the individual contribution of Ingmar Rövekamp (the author of this thesis) to Chapter 2 and Chapter 3 which both have been co-authored by Prof Dr. Stefan Eichler.

Ingmar Rövekamp and Prof. Dr. Stefan Eichler jointly developed the research question and the general research design of Chapter 2. Ingmar Rövekamp further worked out the contribution of this chapter based on his literature research. In addition, he was solely responsible for conducting the empirical analysis. For the first part of this chapter, which deals with the identification of currency risk, he decided to use panel regressions with fixed effects and introduced interaction terms that allow to identify ADR-underlying pair specific effects. He also proposed most of the additional variables included in these regressions (e.g. financial disintegration as suggested by Pasquariello, 2008, the return of the US market and the Fama & French factors) to control for other potential sources of deviations from the law of one price. In addition, he promoted the use of weekly data following Bae et al. (2008) to reduce the bias potentially resulting from non-synchronous trading hours. Prof. Dr. Stefan Eichler contributed to the empirical analysis of this first part of the chapter with his suggestion to conduct a principal component analysis to summarize three different dimensions of macroeconomic stress (commodity prices, sovereign risk and fragility in the banking sector) into one variable. He also proposed analyzing the relative importance of the explanatory variables in the ADR pricing equation by comparing their standardized coefficients and semi-partial R^2. Ingmar Rövekamp contributed to the calculation of the country-specific macroeconomic stress index by identifying the specific variables that describe the economic concepts proposed by Prof. Dr. Stefan Eichler. Furthermore, Ingmar Rövekamp suggested testing the predictive power of the ADR-based currency risk measure by comparing exchange rate returns, the relative frequency of devaluations and currency crises in the current and the upcoming year between years with and without significant currency risk. He also proposed using a binary variable that indicates the presence of significant currency risk and employing a logit regression framework to study the fundamental determinants of currency risk. In addition, he also proposed most of the explanatory variables used in this second part of the empirical analysis. It was also his idea to conduct a robustness check using lagged values of the explanatory variables. Prof. Dr. Stefan Eichler contributed to this second part of the empirical analysis in this chapter with the idea to test political variables and to estimate the interaction models in the final part of this chapter. Ingmar Rövekamp suggested using the Ilzetzki et al. (2019) exchange rate regime classification to distinguish peg regimes versus managed regimes.

For Chapter 3, Ingmar Rövekamp and Prof. Dr. Stefan Eichler again jointly developed the research question and the general research design. Ingmar Rövekamp worked out the contribution by identifying the various strands of literature to which this chapter adds. In particular, he identified the advantages of the eurozone exit risk indicator that is introduced in this chapter over existing approaches of redenomination risk in the eurozone by comparing them conceptually. Ingmar Rövekamp was also solely responsible for conducting the empirical analysis of Chapter 3. For the first part of this chapter that deals with the identification of eurozone exit risk of the GIIPS countries, it was his idea to employ a rolling panel regression framework with fixed effects. He also promoted the inclusion of various control variables to account for other potential sources of deviations from the law of one price (e.g. financial disintegration following Pasquariello, 2008, or limits to arbitrage, following Gagnon and Karolyi, 2010). Prof. Dr. Stefan Eichler contributed to this part of the analysis by proposing to use the semi-partial R^2 as statistical concept to identify eurozone exit risk. Similar to his contribution to

Chapter 2, he furthermore suggested using principal component analysis to construct a country-specific indicator that captures three different dimensions of a country's incentives to leave the eurozone. Ingmar Rövekamp proposed to study the economic impact of eurozone exit risk on European banks. In addition, it was his idea to test bilateral credit risk exposure as a channel for the exit risk exposure of European banks. He decided to use bank level data provided by the European Banking Authority (EBA). Prof. Dr. Stefan Eichler contributed to the analysis of the economic impact of eurozone exit risk with his idea to study the impact on domestic non-financial companies. For both sections, Ingmar Rövekamp designed the respective panel regression models that allowed analyzing the impact of eurozone exit risk on European banks and non-financial companies in the GIIPS countries and he selected the necessary control variables.

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Chapter 2

A market-based measure for currency risk in managed exchange rate regimes

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Chapter 3

Eurozone exit risk

Abstract: *We introduce a novel indicator of eurozone exit risk based on American Depositary Receipts (ADRs). We exploit ADR investors' exposure to potential losses associated with a eurozone exit, e.g. due to redenomination of underlying stocks into the new devaluated currency, capital controls or trading halts. We are the first to analyze the effects of eurozone exit risk on banks and non-financial firms. European banks are negatively affected by exit risk of Greece, Ireland and Portugal, channeled through bilateral credit risk. Non-financial firms in the GIIPS countries respond negatively to domestic exit risk, while a lower ratio of short-term debt to cash and larger company size reduce this exposure.*

3.1 Introduction

We introduce a novel indicator of eurozone exit risk based on American Depositary Receipts (ADRs). Our measure exploits ADR investors' exposure to potential losses associated with a eurozone exit, most importantly due to the redenomination of the underlying stocks into the new devaluated currency, the introduction of capital controls, or the closing of the domestic stock exchange. Existing indicators of euro redenomination risk are composite measures of the risk of a breakup of the entire eurozone and the risk of an exit from the eurozone (for example, Krishnamurthy et al., 2018; De Santis, 2018). Our indicator identifies the exit risk for the individual country. In contrast to indicators of redenomination risk, our exit risk indicator is available for all five GIIPS countries over a significantly longer sample period from January 2008 to June 2015. We further contribute to the existing literature by analyzing the effects of eurozone exit risk on banks and non-financial firms. We study how eurozone exit risk affects European banks outside the GIIPS countries and how this exposure is channeled through their bilateral credit risk exposure to the respective GIIPS country. We study how non-financial firms in the GIIPS countries are affected by domestic exit risk and analyze which company-specific factors determine their exit risk exposure.

ADRs represent ownership of a specific number of underlying shares in the home market (in our case, the eurozone countries) on which the ADR is written. The ADR and the underlying stocks provide the same ownership rights. They only differ with respect to their currency denomination and trading location: ADRs trade in the United States and are denominated in U.S. dollars, while underlying shares trade on the European market and are denominated in the domestic currency – the euro. In the course of eurozone exit, domestic shares would be redenominated into the new domestic currency, which would most probably devalue sharply against the U.S. dollar. Since ADRs by definition continue to be denominated in U.S. dollars, this would cause redenomination losses to ADR investors.[26] Assuming rational expectations, ADR investors estimate the expected value of their overall losses due to eurozone exit and account for this risk when pricing ADRs. We identify eurozone exit risk empirically by the fraction of ADR returns explained by a country-specific index of observable financial and economic vulnerabilities that represent the government's incentive to exit the eurozone and that can be monitored by ADR investors in real-time.

ADRs are an ideal laboratory to derive eurozone exit risk. After controlling for company-specific factors, the U.S. dollar/euro spot and forward exchange rate, financial and economic vulnerabilities in the other GIIPS countries, the U.S. market, financial disintegration, limits to arbitrage, liquidity and regulatory differences between ADR and

[26] Other losses to ADR investors associated with a eurozone exit might result from the introduction of capital controls or trading halts in the exiting country. It is important to note that for our empirical approach it is not necessary to distinguish between different types of losses for ADR investors associated with a eurozone exit.

underlying stocks, the exposure of ADR investors to potential eurozone exit losses can explain the remaining return differential between ADRs and their underlying stocks. We do not attribute the entire ADR underlying return differential to eurozone exit risk, but only the part that remains unexplained by the various control variables and that correlates with the country-specific indicator representing incentives to leave the eurozone.

There are a few papers on redenomination risk related to our study. In their study on the effects of the ECB's unconventional measures, Krishnamurthy et al. (2018) exploit the contractual differences between CDS and bonds to measure the risk of currency redenomination of euro denominated bonds.[27] De Santis (2018) uses the differences in euro and U.S. dollar denominated sovereign CDS premia as an indicator of redenomination risk. Klose and Weigert (2014) use data from the prediction market platform Intrade and study how euro area break-up risk affects sovereign bond yields of Ireland, Italy, Portugal and Spain. Bayer et al. (2018) construct term structures of redenomination risk for France, Germany and Italy by comparing yields on domestic law sovereign bonds (that would be redenominated) and corporate bonds issued under another country's jurisdiction (that can be expected to be repaid in euros), after controlling for their respective default risk using CDS data.

A redenomination of euro denominated bonds into a new national currency can occur after the breakup of the entire eurozone or the unilateral exit of a country from the eurozone. Existing redenomination indicators are composite measures of both types of risk. Our measure aims to isolate country-specific eurozone exit risk by exploiting the correlation of ADR returns with country-specific incentives to leave the eurozone, while

[27] For Italy, for example, CDS do not cover losses caused by the redenomination from euros into a new national currency and thus purely reflect default risk of the underlying bond. Yields of euro denominated bonds, on the contrary, reflect default risk and redenomination risk. Sovereign bond yields above the CDS premium would thus indicate redenomination risk. For Portugal and Spain, CDS cover losses from both default and redenomination. Consequently, the authors use the difference between CDS premiums and the yields from U.S. dollar denominated bonds (which are purely driven by default risk).

controlling for the overall financial vulnerability of the entire crisis countries bloc. Moreover, existing studies (except for Krishnamurthy et al., 2018) cannot consider Greece for reasons of data availability, while we study all five GIIPS countries over the period from January 2008 to June 2015.[28]

We find significantly higher eurozone exit risk for the five crisis countries (Greece, Ireland, Italy, Portugal and Spain) as compared to Germany, which we include as a placebo test. Moreover, exit risk of GIIPS countries shows remarkable time series variation, while it is neglectable and stable in Germany.

To the best of our knowledge, we are the first to analyze the economic effects of eurozone exit risk on banks and non-financial firms using stock market data. We identify a significant negative unconditional impact of Portuguese exit risk on stock returns of 28 European banks outside the GIIPS countries. In addition, we find that higher bilateral credit risk exposure (taken from the 2011 EBA stress test) is associated with a larger exposure to the eurozone exit risk of Greece and Ireland. A higher exposure to the exiting country makes the bank more vulnerable to increases in eurozone exit risk by increasing expected losses due to redenomination, write-downs of loans, or bond portfolio losses in the case of eurozone exit. For example, for Royal Bank of Scotland Group plc, the bank outside the GIIPS countries with the highest bilateral credit risk exposure to Ireland (10.58% of total assets), monthly stock returns decrease by about 0.71%, given a one

[28] Krishnamurthy et al. (2018) suggest a measure of redenomination risk for Italy, Portugal and Spain between January 2010 and December 2012. For Greece, they offer an alternative measure based on the yield differential between domestic EUR-denominated and foreign law U.S. dollar-denominated sovereign bonds. However, this yield differential does not only cover redenomination risk, but also domestic sovereign segmentation effects and is negative for a substantial fraction of their sample. Also, their time-series of Greek redenomination risk only covers the period up to August 2011. De Santis (2018) identifies redenomination risk for Italy, Spain and France for a sample period from September 13, 2011 to November 12, 2013. Data provided by the betting platform Intrade used in Klose and Weigert (2014) becomes unavailable after December 2013. In addition, it only proxies the risk of one country leaving the eurozone, therefore it does not allow to identify country-specific estimates of euro exit risk. Bayer et al. (2018) focus on France, Germany and Italy and derive term structures of redenomination risk for the period from January 2010 to September 2014.

standard deviation increase in Irish exit risk, while for ING Groep NV, a bank with no credit risk exposure to Ireland, there is no significant effect. These findings suggest that several European banks do not sufficiently hedge their exposure to the eurozone exit risk of the GIIPS countries, underlining an underexplored risk factor relevant for banking regulation.

Moreover, we analyze the exposure of 355 non-financial stocks to domestic eurozone exit risk in the GIIPS countries. We find that domestic exit risk significantly negatively affects returns of these stocks, with effects being particularly strong for a subsample period from January 2008 to the end of July 2012 when Mario Draghi delivered his famous “whatever it takes” speech. Especially for this subsample period, the effect is also highly economically significant, as a one standard deviation increase in our eurozone exit risk measure is associated with a reduction in monthly stock returns by about 0.60%. Looking at the cross-sectional differences of euro exit risk exposures, we conclude that companies with a higher ratio of short-term debt to cash are more exposed to eurozone exit risk. Investors appear to anticipate higher risks of debt rollover, liquidity driven defaults, or hikes in borrowing costs associated with eurozone exit risk particularly for companies with higher debt to cash ratios. Also, larger companies are less exposed to domestic eurozone exit risk. This result suggests that larger companies are better able to stand shocks associated with eurozone exit due to their broader diversification and their larger flexibility to receive funding following the disintegration of the domestic financial system following eurozone exit (Forbes, 2002a).

Our paper adds to several strands of the literature. A few papers study the empirical and theoretical implications of euro-area break-up risk and redenomination risk in the eurozone. Within a New Keynesian small open economy framework, Kriwoluzky et al. (2015) show that exit expectations lead to increases in sovereign and corporate refinancing cost and thus have adverse effects on economic activity. Their model rationalizes our empirical findings that non-financial firms are, on average, negatively exposed to eurozone exit risk, while a higher ratio of short-term debt to cash increases this exposure by increasing the dependency on external financing. Eijffinger et al. (2018) model the endogenous decision to default on sovereign debt and to exit the eurozone. In their model, the decision of eurozone exit is driven by uncertain exit costs. Eurozone members learn about exit costs when a country actually leaves the eurozone. Their results reveal that a low perceived eurozone exit cost for one country, e.g. Greece, is associated with a large increase in sovereign yield spreads of other vulnerable countries, constituting a contagion mechanism in the eurozone. Steiner et al. (2019) analyze the euro area crisis in a policy trilemma framework, where the three policy goals currency union, unlimited capital movements between eurozone member countries and stable/autonomous monetary policy cannot be achieved at one time. They find that the ECB‘s entry into LTROs and „whatever it takes“ occurred after peak in redenomination risk in November 2011, implying that the ECB implemented unconventional measures (partly) to avert the breakup of the euro area. Borri (2019) analyzes the spillovers of redenomination risk applying a CoVAR methodology to quanto CDS. He finds significant spillovers of redenomination risk only for Belgium, Ireland, Italy and Spain, while spillovers are negligible in other countries.

We further contribute to a strand of the literature investigating cross sectional heterogeneity in the effect of large currency depreciation on firm performance in emerging markets (Forbes, 2002a; Forbes, 2004; Desai et al., 2008). These studies generally find a positive effect of large depreciations on firm performance and find that foreign sales, company debt and firm size significantly affect this performance (Forbes, 2002a).

Furthermore, there is a broad literature on other important aspects of the euro area crisis. Several papers look at the drivers of and contagion in sovereign default risk in the eurozone (e.g. Aizenman et al., 2013; Ang and Longstaff, 2013; Corsetti et al., 2013; Costantini et al., 2014; Benzoni et al., 2015). Other papers focus on the bank-sovereign risk nexus (e.g. Acharya et al., 2014; Acharya and Steffen, 2015; Popov and van Horen, 2015; Bocola, 2016; Brunnermeier et al., 2016; Engler and Große Steffen, 2016; Gaballo and Zetlin-Jones, 2016; Fratzscher and Rieth, 2018). A third strand of literature relates to the effects of policy measures implemented during the eurozone crisis, especially the (unconventional) monetary policy measures of the ECB (e.g. Drechsler et al., 2016; Eser and Schwaab, 2016; Koijen et al., 2017; Krishnamurthy et al., 2018; Acharya et al., 2019). Others focus on the real effects of the eurozone crisis (e.g. Martin and Philippon, 2017; Meinen and Roehe, 2017).

Our paper also relates to studies investigating the pricing of ADRs during currency crises. Several studies document that the returns on U.S. dollar denominated ADRs are negatively affected by currency crises as the devaluation of the local currency depresses the U.S. dollar value of the underlying stock (Bailey et al., 2000; Kim et al., 2000; Bin et al., 2004). Pasquariello (2008) reveals that the outbreak of financial crises is associated with a disintegration of the local capital market as the pricing dynamics of ADRs and their underlying stocks change. Another strand of the literature shows how capital controls can lead to price wedges between ADRs and their underlyings, with underlyings being typically overpriced (Melvin, 2003; Levy Yeyati et al., 2004; Auguste et al., 2006; Arquette et al., 2008; Levy Yeyati et al., 2009). Several papers use ADRs to derive exchange rate forecasts (e.g. Eichler et al., 2009) and to show that financial fragility measures affect the relative pricing of ADRs and their underlyings during the eurozone crisis (Eichler, 2011).

The paper is organized as follows: Section 3.2 introduces the methodology and data and provides some descriptive evidence. Section 3.3 analyzes the exposure of European banks to eurozone exit risk. Section 3.4 looks at the exit risk exposure of non-financial stocks in the GIIPS countries and investigates the channels establishing this risk exposure. Section 3.5 concludes.

3.2 Methodology and data

3.2.1 ADR pricing and eurozone exit risk

An American Depositary Receipt (ADR) represents ownership of a specific number of underlying shares in the home market on which the ADR is written. While the underlying stock is traded on the stock exchange of the respective eurozone country and is denominated in euros, the ADR trades in the United States and is denominated in U.S. dollars.

Since the ADR provides the same rights to the owner as the underlying stock (e.g. dividend claims and voting rights), and the ADR and underlying stock can be converted into each other at a fixed conversion ratio, the exchange rate adjusted prices of both stocks should be equal (Gagnon and Karolyi, 2010):

$$P_{ADR\,i,t} = \frac{P_{UND\,i,t} * \gamma_i}{S_t} \qquad (3.1)$$

with $P_{ADR_{i,t}}$ and $P_{UND_{i,t}}$ representing the prices of the ADR and its corresponding underlying stock, respectively, γ_i a fixed conversion parameter and S_t the EUR/USD spot exchange rate. For a fully credible eurozone membership of the country from where the underlying originates, ADR returns are thus governed by the returns of the underlying stock and the exchange rate:

$$ret_{i,t}^{ADR} = \alpha_i + \beta_1 ret_{i,t}^{UND} + \beta_2 ret_{j,t}^{S} + \varepsilon_{i,t} \quad (3.2)$$

If ADR investors do anticipate some risk that a country may leave the eurozone, ADR returns should reflect such risk. We aim to identify eurozone exit risk by introducing a country-specific indicator *VUL* into the ADR pricing framework which captures fundamental vulnerabilities measuring the government's incentives to leave the eurozone (such as sovereign default risk or fragility in the banking sector and in the real economy in the country under consideration). A more detailed description on how we derive this indicator follows in section 3.2.2. Our identification strategy bases on the assumption that if ADR investors perceive eurozone exit risk, they will monitor financial and economic vulnerabilities that drive the government's incentive to leave the eurozone and incorporate this information in ADR returns. The fraction of ADR returns that remains unexplained by the return of the underlying, the return of the EUR/U.S. dollar exchange rate and the numerous control variables, will then correlate with such an indicator. On the contrary, if no eurozone exit risk is perceived, such a vulnerability indicator would not affect ADR returns since there is no reason why these financial and economic vulnerabilities should affect ADR pricing (given our large set of control variables that already account for issues that are either company specific or related to the external value of the euro, financial and economic vulnerabilities in the other GIIPS countries, liquidity, financial disintegration, limits to arbitrage and time-invariant regulatory issues).

To derive an indicator of eurozone exit risk based on ADR data for a specific country, we estimate the following equation in a rolling panel regression framework containing all ADRs from the respective country from our sample, with an estimation window of 60 trading days:

$$ret_{i,j,t}^{ADR} = \alpha_{i,T} + \beta_{1,j,T}\, ret_{i,j,t}^{UND} + \beta_{2,j,T}\, ret_t^S + \beta_{j,T}^{exit\,risk}\, VUL_{j,t} \quad (3.3)$$

$$+ \textstyle\sum_{l=3}^{L} \beta_{l,j,T} X_{l,i,j,t} + \varepsilon_{i,j,t}$$

where i is the ADR-underlying stock pair index, j represents the country in which the underlying stock is traded, and T denotes the day for which the respective rolling regressions window is estimated. $VUL_{j,t}$ denotes the country-specific indicator describing financial and economic vulnerabilities that drive the incentive to exit the eurozone. $\sum_{l=3}^{L} X_{l,i,j,t}$ captures the set of control variables, $\alpha_{i,T}$ is the ADR-underlying stock pair fixed effect, and $\varepsilon_{i,j,t}$the error term. Table A3.1 in the appendix of this chapter reports the variables and their sources used in equation (3.3).

To estimate eurozone exit risk, we compute the semi-partial R^2 of $VUL_{j,t}$ drawn from the rolling panel regressions in equation (3.3). The semi-partial R^2 indicates how much of the variation in the ADR returns from countries that might potentially leave the eurozone is unexplained by the control variables in equation (3.3) and can be explained by the information contained in $VUL_{j,t}$ – additional to that information already contained in the return of the EUR/USD spot exchange rate, the return of the respective underlying of the ADR and the various control variables. We hypothesize that the more probable it is that a specific country exits the eurozone, the higher will be the impact of $VUL_{j,t}$ on ADR returns, as identified by a higher semi-partial R^2.

The exposure of ADR investors to potential losses associated with a eurozone exit (e.g. due to the currency redenomination and the potential price loss of the underlying stock in U.S. dollar terms) can help explain the remaining return differential between the ADR and its underlying stocks (after controlling for underlying stock, EUR/USD spot and future exchange rates, financial and economic vulnerabilities in the other GIIPS countries, U.S. market returns, financial disintegration, limits to arbitrage, liquidity and differences in regulation between the ADR and its underlying stock).

We include various control variables in equation (3.3) to account for potential deviations between actual ADR returns and returns predicted by the return of the underlying and the EUR/USD spot exchange rate that might not relate to eurozone exit risk. First, we control for investors' expectations of the future external value of the euro by including the return of a CME composite continuous EUR/USD futures index. Second, we account for financial and economic vulnerabilities of the respective other four GIIPS countries. These vulnerabilities shape the incentive of other GIIPS countries to leave the eurozone and thus drive ADR investors' perception of eurozone break-up risk. Our analysis allows us to disentangle country-specific euro exit risk from eurozone break-up risk and ensures that our results are not driven by the fact that the country-specific vulnerability indicators correlate between the GIIPS countries.

In addition, we control for the return of the US market and include weekday dummies. Pasquariello (2008) shows that the law of one price between ADRs and their underlyings substantially weakens following financial disintegration of the domestic market from global financial markets in times of financial turmoil. We control for financial integration by including the international CAPM beta as an explanatory variable,[29] thus ensuring that our results are not driven by financial disintegration of the domestic economy during the euro crisis. Also, we follow Gagnon and Karolyi (2010) and include the change in the bid-ask spreads of both the ADR and the underlying as well as the change in idiosyncratic risk of the ADR-underlying stock pair[30] as additional

[29] The financial integration indicator is obtained by regressing the excess return (over the 3M T-Bills rate) of the local stock index (in USD) of the respective eurozone country on the excess return of the MSCI World index (in USD) using a rolling regressions framework over the past 30 trading days.
[30] The ADR-underlying stock pair specific measure of idiosyncratic risk is the standard deviation of the residuals from regressing the difference between USD returns of the ADR and its underlying on contemporaneous as well as one day lagged and leading values of the US stock market, the respective

explanatory variables to control for limits to arbitrage. Finally, we include ADR-underlying pair fixed effects to control for time-invariant idiosyncratic stock characteristics as well as for differences between ADRs and their underlying stocks with respect to regulation (e.g. due to taxation). We cannot directly use the residuals from equation (3.3) without including $VUL_{j,t}$ as our measure of euro exit risk because they would capture all other potential sources of deviations from the law of one price which are not related to a eurozone exit and which we cannot control for. By considering the semi-partial R^2 of $VUL_{j,t}$ we only account for deviations from the law of one price that are not yet captured by the other control variables in our regression and that are theoretically linked to the eurozone exit of the country from where the underlying originates. Also, it is important to state that a positive semi-partial R^2 of $VUL_{j,t}$ does not result in persistent deviations of the law of one price which by definition cannot exist in the absence of restrictions on capital flows.

3.2.2 Construction of the country-specific financial and economic vulnerability indicator

It is important to stress that our country-specific financial and economic vulnerability indicator does not measure eurozone exit risk per se, but rather the incentive of the domestic government to leave the eurozone. Following the second generation of currency crisis models, a country opts to abandon a currency peg/to exit a currency union if the expected benefits outweigh the expected costs (Obstfeld, 1994). Our financial and economic vulnerability indicator proxies the potential benefits of a eurozone exit/cost of staying within the eurozone. Since the political decision to leave the eurozone also

domestic stock market and the change in the EUR/USD exchange rate using a rolling window of 30 trading days, see eq. (1) in Gagnon and Karolyi (2010).

depends on country- and time-dependent political preferences and the costs of an exit,[31] we obtain eurozone exit risk by exploring the exposure of ADR returns to this country-specific financial and economic vulnerability indicator (while the vulnerability indicator itself does not identify eurozone exit risk for the reasons mentioned above).

Shambaugh (2012) characterizes the euro crisis as a combination of three interlocking crises: a banking crisis, a sovereign debt crisis and a growth crisis. With our indicator we intent to capture these three dimensions of financial and economic vulnerabilities that represent incentives to leave the eurozone. A more fragile banking sector may be recapitalized and restructured more effectively outside the eurozone. Therefore, lower returns of a country-specific bank index proxy a higher incentive to leave the eurozone. Higher sovereign default risk (as indicated by higher sovereign bond spreads) indicates that the domestic government is less able to avert sovereign default within the eurozone, and would rather opt to exit the eurozone in order to minimize the real value of its public debt. Eijffinger et al. (2018) provide a theoretical model for a government's endogenous decision to leave the eurozone based on its incentive to partially default on its public debt by introducing a new devalued domestic currency. Larger economic fragility (as indicated by higher intraday volatility of stock market returns) increases the incentive to leave the eurozone and restore the competitiveness of the domestic economy through external devaluation (rather than the long-lasting process of internal devaluation). The relationship between stock market volatility and real economic activity has been well documented in the literature (e.g. Errunza and Hogan, 1998; Engle et al., 2013).

[31] Eijffinger et al. (2018) highlight that the cost of leaving the eurozone are unknown until the first country leaves the union. Therefore, they cannot be monitored by ADR investors in a way similar to the incentive to leave the eurozone.

To obtain a single variable that comprises the different incentives to leave the eurozone, we calculate the first principal component out of three market-based factors: the 10-year sovereign bond yield spread (relative to Germany),[32] the returns of the country's bank stock index, and the intraday volatility of the local stock index. Intraday stock market volatility is calculated using five-minute ticks from Thomson Reuters Tick History. Data on bank indices are also taken from Thomson Reuters Tick History. Sovereign yield spreads are taken from Thomson Reuters Eikon.

These measures are available at high frequency and thus can be used in an asset pricing framework of ADRs. ADR investors can monitor them in real time when assessing eurozone exit risk. This would not be the case for macro data (e.g. inflation or productivity) that are not available in high frequency and cannot be monitored in real time.

Since we expect each of these three factors to have a distinct influence on each of the countries in our sample, we conduct the PCA for each country separately so that the eigenvectors are allowed to vary between countries. We obtain the country-specific financial and economic vulnerability index (VUL) by multiplying the respective values of each of the three variables considered with the corresponding values of the eigenvector derived from the PCA:

$$VUL_{j,t} = \lambda_{SMV_j} * SMV_{j,t} + \lambda_{\Delta Bank_j} * \Delta Bank_{j,t} + \lambda_{\Delta SYS_j} * \Delta Sov_{j,t} \qquad (3.4)$$

where $SMV_{j,t}$ depicts intraday stock market volatility of country j on day t, $\Delta Bank_{j,t}$ the daily return in the respective country's banking index and $\Delta Sov_{j,t}$ the daily change in the respective country's sovereign yield spread against Germany for a maturity

[32] For Germany, we use CDS with maturity of ten years instead.

of ten years. Table 3.1 shows the resulting values of the eigenvectors and the number of observations by country. The Kaiser-Meyer-Olkin criterion exceeds the critical threshold of 0.50 for all countries in our sample. Also, we conduct Bartlett's test of sphericity rejecting the null of the correlation matrix being equal to the identity matrix at the 1% level for every country in our sample. Both conditions necessary for the reduction of the data from three dimensions into one single principal component are therefore met. Figure A3.1 to Figure A3.6 in the appendix of this chapter illustrate the evolution of the country-specific vulnerability indicators over time.

Table 3.1: Eigenvectors of $VUL_{j,t}$

Country	λ_{SMV_j}	$\lambda_{\Delta Bank_j}$	$\lambda_{\Delta Sov_j}$	Observations
Greece	0.40	-0.65	0.64	1,841
Ireland	0.28	-0.69	0.67	1,815
Italy	0.31	-0.68	0.66	1,853
Portugal	0.41	-0.69	0.60	1,902
Spain	0.31	-0.69	0.65	1,865
Germany[33]	0.37	-0.68	0.63	1,843

Notes: Eigenvectors of country-specific financial and economic vulnerability indicator $VUL_{j,t}$, resulting from principal component analysis of intraday stock market volatility, daily return of the country-specific bank index and the daily change in the sovereign yield spread as described in 3.2.2.

3.2.3 Data and results

Our panel consists of 17 level II and III ADRs from the five GIIPS countries: Greece, Ireland, Italy, Portugal, and Spain as well as Germany over the period January 1st 2008 to June 30th 2015.[34] Table A3.2 in the appendix of this chapter lists the ADRs used in the analysis. As a placebo test, we also apply our approach to Germany for which we would not expect any sizable risk to leave the eurozone.

We identify potential pairs of ADRs and underlying stocks using information from the ADR databases of JP Morgan and the Bank of New York Mellon, as well as from

[33] Since the sovereign yield spread is zero by definition for Germany, we use data from CDS with ten years maturity instead.
[34] Our sample ends when the Greek stock market was closed in the course of introducing capital controls.

Thomson Reuters DATASTREAM. Following standard practice in the literature (e.g. Gagnon and Karolyi, 2010), we consider Level II and Level III ADRs only, thus excluding Level I ADRs as well as SEC Regulation S shares and private placements under SEC Rule 144a.

We check for correct matches of ADRs with their respective underlying stock by regressing ADR returns on the return of their underlying and the USD/EUR exchange rate, making sure that the estimated coefficients are significant. We exclude observations with abnormal ADR returns below the 1st and above the 99th percentiles to ensure that our analysis is not driven by extreme outliers.

Prices of ADRs and their respective underlyings, the EUR/USD spot exchange rate, S&P 500 and domestic stock indices are taken from Thomson Reuters Tick History. To guarantee the most synchronous match possible between prices, we consider the last value available prior to 3:00 pm UTC for each day because at that time the U.S. and all eurozone stock markets operate in regular mode. The only exception is Greece during DST, where we use the final prices prior to 2:00 pm UTC as otherwise an overlap of trading hours with the U.S. stock markets would not be guaranteed.

Figure 3.1 to Figure 3.6 illustrate the evolution of our eurozone exit risk measure, i.e. the semi-partial R^2 of $VUL_{j,t}$ estimated within the rolling regressions framework as described in section 3.2.1, over the sample period from January 1st, 2008 to June 30th, 2015 by country.

Figure 3.1: Greek eurozone exit risk

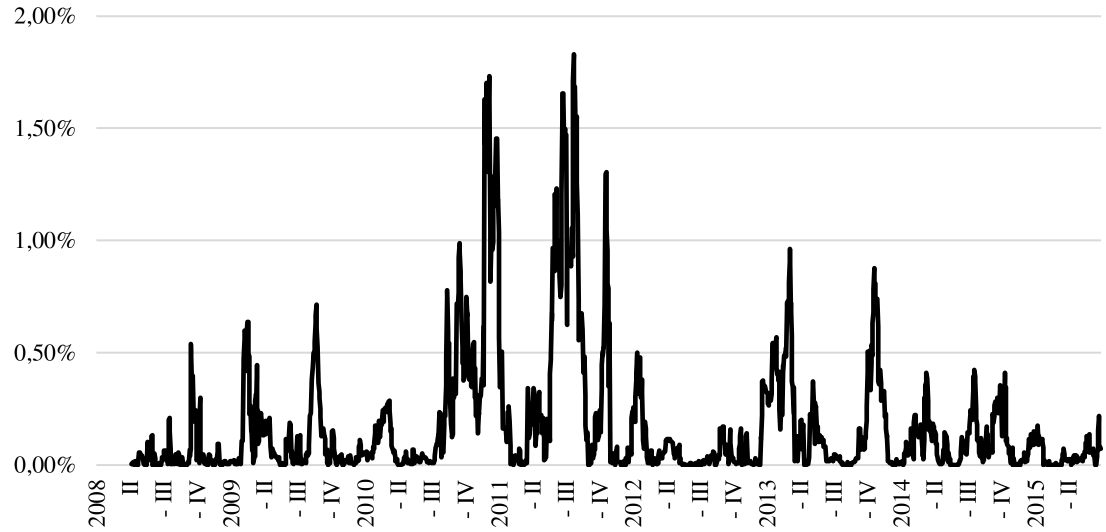


Figure 3.2: Irish eurozone exit risk

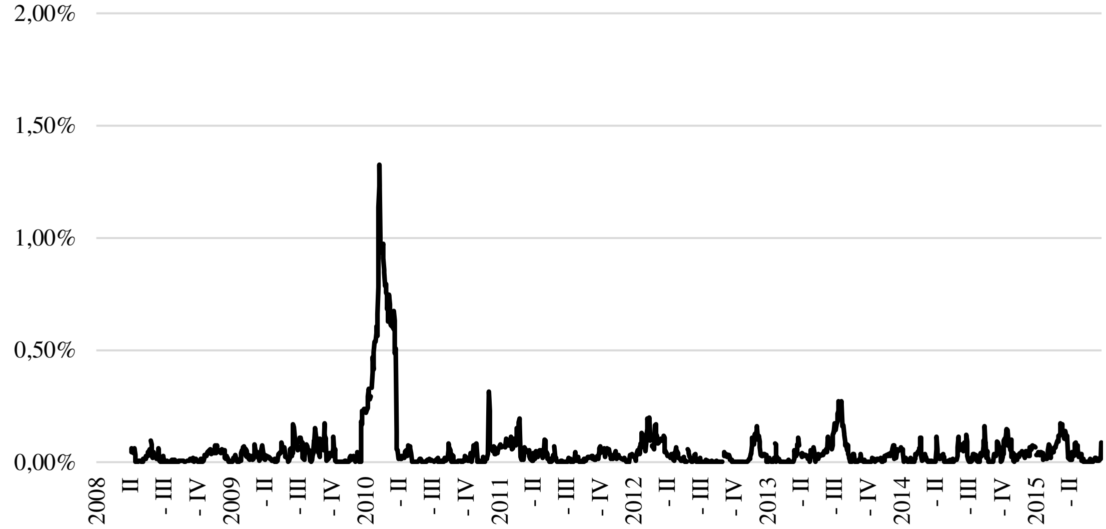


Figure 3.3: Italian eurozone exit risk

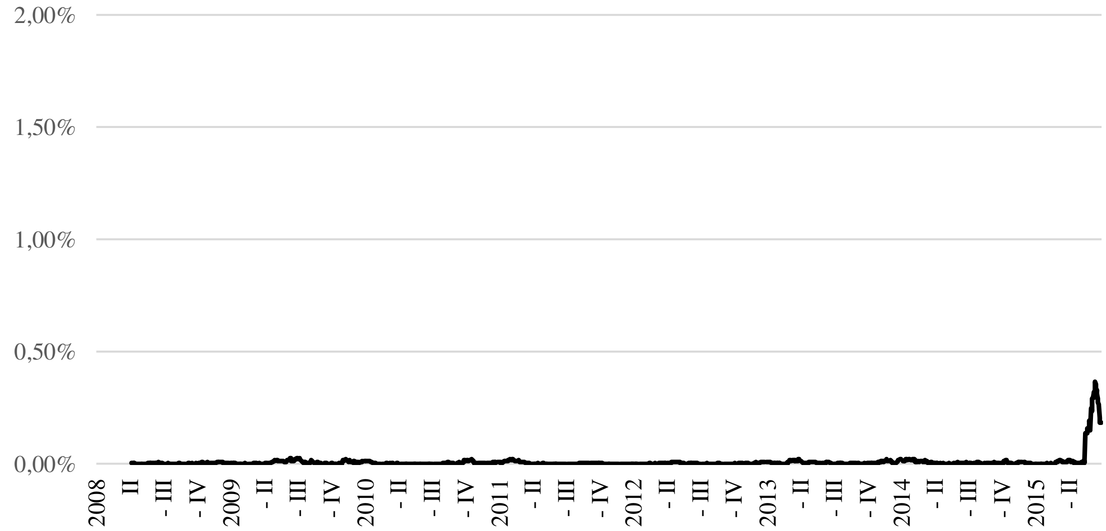


Figure 3.4: Portuguese eurozone exit risk

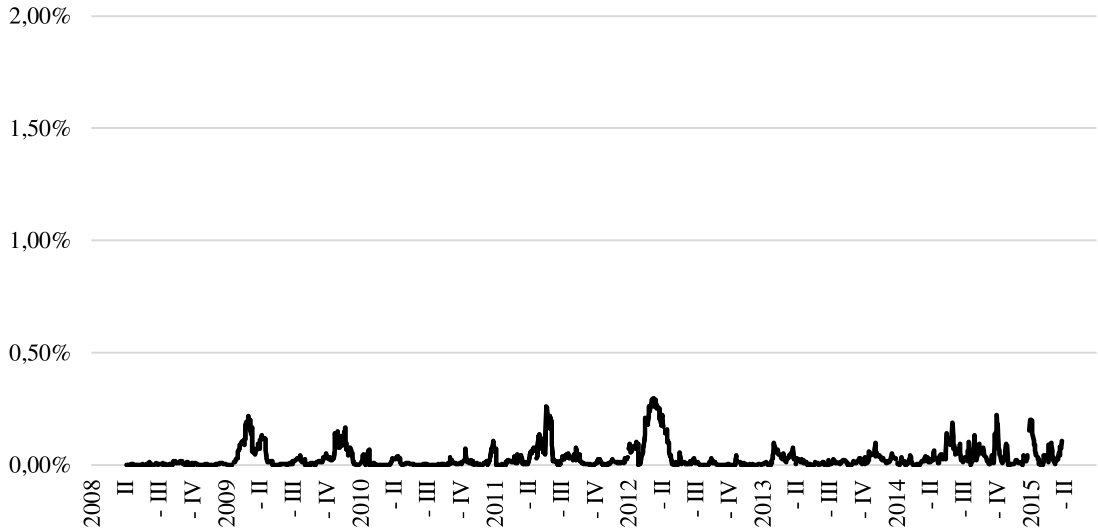


Figure 3.5: Spanish eurozone exit risk

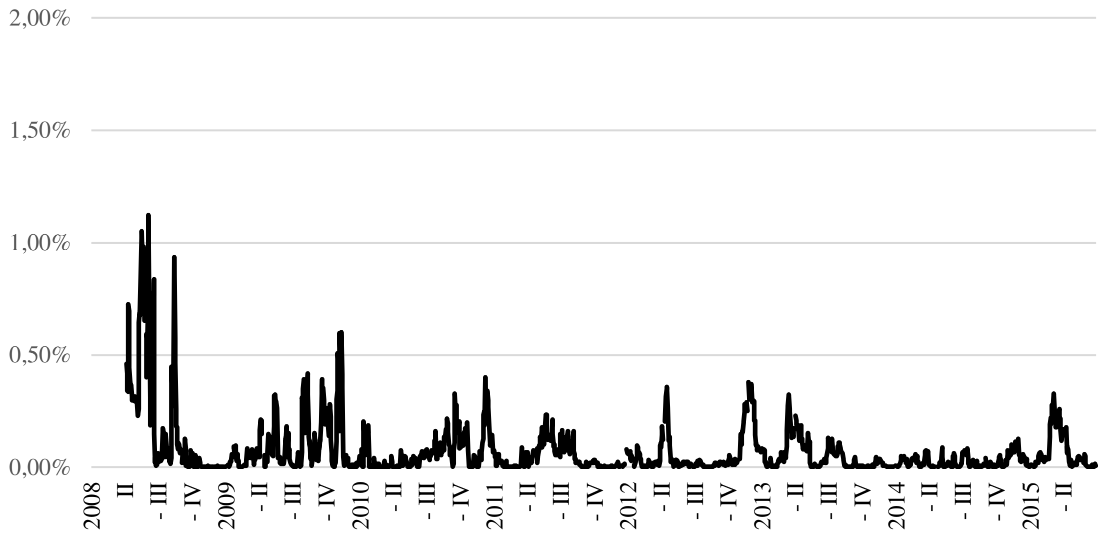
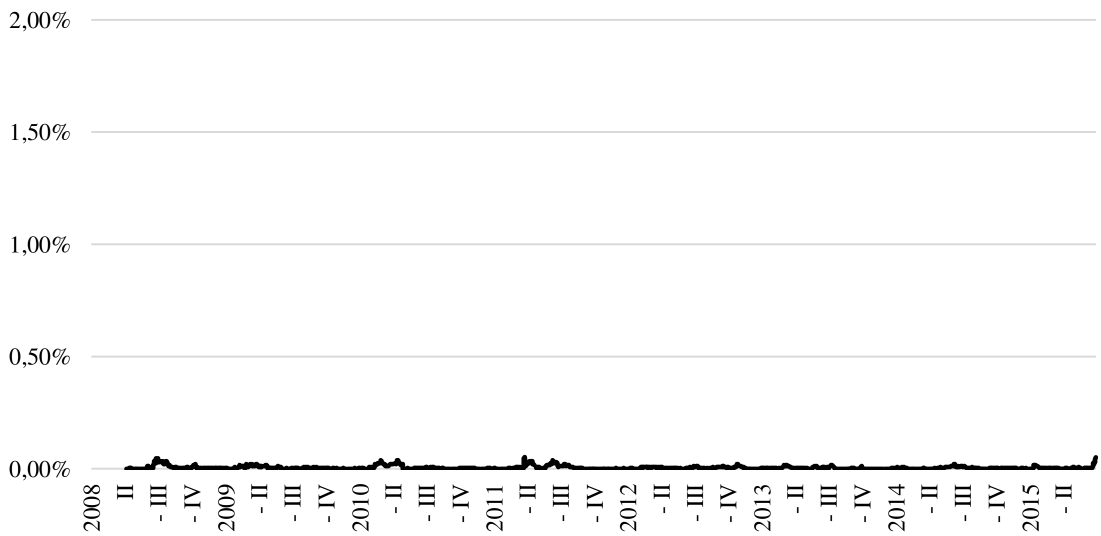


Figure 3.6: German eurozone exit risk



The eurozone exit risk indicator shows remarkable time series variation for the crisis countries. Our indicator for the whole sample reaches its maximum for Greece at the end of July 2011, when a preliminary draft for the second bail-out package for Greece worth 109 bln. euro was approved at an EU summit. During that time, about 1.83% of the total variation of ADR returns was explained by Greek exit risk.[35] Table 3.2 shows summary statistics of our exit risk measure by country.

Table 3.2: Descriptive statistics of eurozone exit risk by country (in percentage points)

	Greece	Ireland	Italy	Portugal	Spain	Germany
Mean	0.18	0.05	0.01	0.03	0.07	0.00
Standard Deviation	0.28	0.12	0.03	0.05	0.13	0.01
Min	0.00	0.00	0.00	0.00	0.00	0.00
Max	1.83	1.33	0.37	0.30	1.12	0.05

Notes: Country-specific eurozone exit risk is identified as the semi-partial R² of the country-specific financial and vulnerability indicator $VUL_{j,t}$ from eq. (3.3) using a rolling panel regressions window approach of 60 trading days, including all ADRs from the respective country (as described in section 3.2.1): $ret_{i,j,t}^{ADR} = \alpha_{i,T} + \beta_{1,j,T} ret_{i,j,t}^{UND} + \beta_{2,j,T} ret_t^{S} + \beta_{j,T}^{exit\ risk} VUL_{j,t} + \sum_{l=3}^{L} \beta_{l,j,T} * X_{l,i,j,t} + \varepsilon_{i,j,t}$

With a mean of about 0.18%, exit risk is significantly higher for Greece compared to other countries over the entire period from 2008 to June 2015. Exit risk for Spain is the second highest with an average of about 0.07%. Relatively high values of Spanish exit risk materialized during 2008 and 2009. In 2009, Spain ran a fiscal deficit of 11.4% of GDP. In June 2012, Spain was finally granted 100 bln. euro of rescue loans to recapitalize its banking system. Irish eurozone exit risk soars in the first quarter of 2010, reaching its peak on February 10th, 2010 with about 1.33%.[36]

For Portugal and Italy, our estimates of euro exit risk are relatively small compared to Greece and Spain, with an average of 0.03% and 0.01% respectively. However, regressing the country-specific exit risk estimates on country dummies using a

[35] Please note that this percentage cannot be directly transformed into the probability that Greece would leave the eurozone.

[36] On February 19th, 2010, the Irish government was forced to take a 16% direct stake in Bank of Ireland. In May and June of the same year, the Irish government was forced to take a 18% stake of Anglo Irish Bank and doubled its stake in the Bank of Ireland to 36%. In 2010, Ireland ran a record fiscal deficit of 32% of GDP and on November 21, 2010, Ireland applied for financial aid from the EU and the IMF.

simple pooled OLS regression approach reveals that our exit risk measure is significantly higher for each of the five GIIPS countries as compared to Germany, which we include as a placebo test. Table 3.3 displays the results:

Table 3.3: Results from regressing eurozone exit risk on country dummies

	Exit risk
Greece	0.16***
	(0.01)
Ireland	0.05***
	(0.00)
Italy	0.01*
	(0.00)
Portugal	0.02***
	(0.00)
Spain	0.06***
	(0.00)
Constant	0.01***
	(0.00)
Observations	10,651
R^2	0.12

Notes: Results are obtained by estimating a pooled OLS model, regressing the estimates of country-specific eurozone exit risk obtained from estimating eq. (3.3) as described in section 3.2.1 on country dummies with Germany as the benchmark country. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Moreover, Table 3.2 reveals that euro exit risk is much more volatile for the GIIPS countries than for Germany. Thus, the country-specific incentive to leave the eurozone appears to be priced in the ADRs of GIIPS countries (in different intensities) indicating exit risk, while this is not the case for Germany. Our results indicate that ADR investors do not perceive a significant risk that Germany opts to leave the eurozone. Here, it is important to distinguish between the two concepts of country-specific eurozone exit risk and overall eurozone break-up risk. Of course, German ADRs should also be affected by redenomination risk in the sense that if the whole eurozone broke up and Germany introduced its own currency, it would probably appreciate against the U.S. dollar and we should therefore observe positive ADR returns. However, we do not identify this within our empirical framework since we control for this break-up risk component by including the vulnerability indicator of the five GIIPS countries as a control variable for Germany.

Also, the unexplained fraction of ADR returns does not correlate with the German financial and economic vulnerability indicator. For Italy, our result of a low eurozone exit risk may also be explained by the systemic importance of Italy and the fact that we account for financial vulnerabilities of the remaining four GIIPS countries.

3.3 Exposure to eurozone exit risk in the banking sector

In this section, we test whether eurozone exit risk has an impact on the stocks of European banks outside the GIIPS countries. The eurozone exit of one country would negatively affect a bank in another country if this bank has direct exposure to the country in question, e.g. in the form of sovereign exposure or private credit exposure. The eurozone exit of the respective country would cause balance sheet losses to the bank, e.g. due to redenomination losses, write-downs on loans (e.g. due to liquidity driven defaults in the exiting country) or price losses on bond holdings in the exiting country. At the same time, there are most likely also indirect effects of euro exit risk of the GIIPS countries. The decision of a country to leave the eurozone might lead to severe financial distress in the entire European banking system. Therefore, the GIIPS countries' exit risk might even affect banks without direct exposure to the respective country.

We test whether bilateral asset holdings of banks can help explain the exit risk exposure of individual banks. We would expect that banks with higher credit exposure to the crisis countries should be affected more severely than banks with little to no credit exposure. To test this empirically, we consider all listed banks outside the GIIPS countries that were subject to the 2011 EU-wide stress test conducted by the European Banking Authority (EBA). Our sample includes 28 banks from 14 countries in the EU, including non-eurozone banks. Table A3.3 in the appendix of this chapter provides an overview together with bilateral credit risk information for these banks.

We consider “Total Exposure at Default” (EAD) as provided by the EBA Stress Test Results 2011 with the information code “33021". This includes exposure “for securitisation transactions, counterparty credit risk, sovereigns, guaranteed by sovereigns, public sector entities, central banks, equities, etc.” (EBA 2011). We scale this exposure variable by dividing it by “Total Assets” (information code “30029”).

To test for the impact of the eurozone exit risk of the five GIIPS countries on European bank stocks outside the GIIPS countries and to investigate the relevance of bilateral asset claims (as measured using holdings of sovereign bonds and credit claims) for the exposure to eurozone exit risk of the GIIPS countries, we estimate panel regressions with monthly stock returns of the 28 banks in our sample. Using a panel regression framework allows us to simultaneously include the changes in exit risk of all five GIIPS countries as well as their interaction with the bilateral credit exposure of the respective bank to the respective GIIPS country. Our regression equation looks as follows:

$$ret_{i,t}^{bank} = \alpha_i + \sum_{j=1}^{5} \beta_{exit\,risk\,x\,EAD,j} \Delta exit\ risk_{j,t}\ x\ EAD_{i,j} + \beta_{exit\,risk,j}\, \Delta exit\ risk_{j,t} + \sum_{l=1}^{L} \beta_{l,t}\, X_{l,t} + \varepsilon_{i,t} \quad (3.5)$$

where $\Delta exit\ risk_{j,t}$ denotes the change in log exit risk of the respective GIIPS country, $\sum_{l=1}^{L} X_{l,t}$ represents a set of control variables (returns of the VSTOXX, EUR/USD exchange rate, the respective home country stock index, the EUROSTOXX Banks, Δ sovereign yield spread of the respective country and the first principal component of the Δ of sovereign yield spreads of the GIIPS countries). We include bank fixed effects in all specifications and additional year (quarter) fixed effects in specifications (6) and (7). Table 3.4 summarizes the results.

Table 3.4: Results for the panel of individual bank stock returns: Interaction between Δ Exit Risk and EAD

	(1)	(2)	(3)	(4)
Δ Exit Risk Greece	0.0004	0.0004	0.0004	0.0001
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Δ Exit Risk Greece x EAD Greece	-0.0078**	-0.0079**	-0.0079**	-0.0085**
	(0.0033)	(0.0031)	(0.0031)	(0.0031)
Δ Exit Risk Ireland	-0.0001	-0.0001	-0.0001	0.0009
	(0.0008)	(0.0008)	(0.0008)	(0.0009)
Δ Exit Risk Ireland x EAD Ireland	-0.0409***	-0.0410***	-0.0410***	-0.0410**
	(0.0147)	(0.0147)	(0.0147)	(0.0149)
Δ Exit Risk Italy	-0.0009	-0.0009	-0.0009	-0.0005
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Δ Exit Risk Italy x EAD Italy	0.0289	0.0289	0.0287	0.0284
	(0.0477)	(0.0477)	(0.0477)	(0.0478)
Δ Exit Risk Portugal	-0.0019***	-0.0019***	-0.0019***	-0.0015***
	(0.0006)	(0.0006)	(0.0006)	(0.0005)
Δ Exit Risk Portugal x EAD Portugal	0.1248	0.1240	0.1234	0.1279
	(0.3072)	(0.3060)	(0.3062)	(0.3037)
Δ Exit Risk Spain	-0.0006	-0.0006	-0.0006	-0.0005
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Δ Exit Risk Spain x EAD Spain	-0.0326	-0.0326	-0.0325	-0.0325
	(0.0310)	(0.0310)	(0.0309)	(0.0312)
Return Stock Index	0.7978***	0.7975***	0.7981***	0.8448***
	(0.0498)	(0.0501)	(0.0493)	(0.0573)
Return EUROSTOXX Banks	0.4428***	0.4425***	0.4458***	0.4937***
	(0.0526)	(0.0526)	(0.0581)	(0.0571)
Δ Sovereign Spread		-0.0275	-0.0289	-0.0798
		(0.1278)	(0.1277)	(0.1293)
Return Exchange Rate			0.0199	-0.0542
			(0.0617)	(0.0621)
Return VSTOXX				0.0746***
				(0.0130)
Δ Sovereign Spread GIIPS				
Constant	-0.0043***	-0.0043***	-0.0043***	-0.0040***
	(0.0006)	(0.0006)	(0.0005)	(0.0005)
Observations	2,363	2,363	2,363	2,363
Number of banks	28	28	28	28
Bank FE	YES	YES	YES	YES
Year FE	NO	NO	NO	NO
Quarter FE	NO	NO	NO	NO
R^2	0.56	0.56	0.56	0.57

Notes: This table reports the panel estimation results of the regression model outlined in eq. (3.5): $ret_{i,t}^{bank} = \alpha_i + \sum_{j=1}^{5} \beta_{exit\ risk\ x\ EAD,j} \Delta exit\ risk_{j,t}\ x\ EAD_{i,j} + \beta_{exit\ risk,j} \Delta exit\ risk_{j,t} + \sum_{l=1}^{L} \beta_{l,t} X_{l,t} + \varepsilon_{i,t}$ where the monthly bank stock returns of non-GIIPS banks are regressed on the changes in log eurozone exit risk of the five GIIPS countries, the interactions between the change in log eurozone exit risk of the respective country and the credit risk exposure of the respective bank to the respective country, a set of control variables (returns of the VSTOXX, EUR/USD exchange rate, the respective home country stock index, the EUROSTOXX Banks, Δ sovereign yield spread of the respective country and the first principal component of the Δ of sovereign yield spreads of the GIIPS countries), bank fixed effects and quarter/year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 3.4: Results for the panel of individual bank stock returns: Interaction between Δ Exit Risk and EAD (continued)

	(5)	(6)	(7)
Δ Exit Risk Greece	-0.0002	-0.0003	0.0001
	(0.0004)	(0.0005)	(0.0005)
Δ Exit Risk Greece x EAD Greece	-0.0083**	-0.0081***	-0.0076**
	(0.0030)	(0.0029)	(0.0030)
Δ Exit Risk Ireland	0.0009	0.0010	0.0008
	(0.0009)	(0.0009)	(0.0008)
Δ Exit Risk Ireland x EAD Ireland	-0.0408**	-0.0407**	-0.0412**
	(0.0149)	(0.0150)	(0.0151)
Δ Exit Risk Italy	-0.0005	-0.0004	0.0003
	(0.0007)	(0.0007)	(0.0008)
Δ Exit Risk Italy x EAD Italy	0.0283	0.0286	0.0287
	(0.0479)	(0.0479)	(0.0470)
Δ Exit Risk Portugal	-0.0016***	-0.0017***	-0.0019***
	(0.0006)	(0.0005)	(0.0005)
Δ Exit Risk Portugal x EAD Portugal	0.1284	0.1273	0.1372
	(0.3057)	(0.3052)	(0.3003)
Δ Exit Risk Spain	-0.0003	-0.0002	0.0003
	(0.0006)	(0.0005)	(0.0008)
Δ Exit Risk Spain x EAD Spain	-0.0326	-0.0325	-0.0318
	(0.0313)	(0.0318)	(0.0321)
Return Stock Index	0.8523***	0.8459***	0.8255***
	(0.0589)	(0.0614)	(0.0598)
Return EUROSTOXX Banks	0.4737***	0.4876***	0.4679***
	(0.0552)	(0.0563)	(0.0548)
Δ Sovereign Spread	-0.0494	-0.0471	-0.0017
	(0.1257)	(0.1264)	(0.1241)
Return Exchange Rate	-0.0602	-0.0582	-0.0706
	(0.0605)	(0.0596)	(0.0709)
Return VSTOXX	0.0806***	0.0846***	0.0683***
	(0.0135)	(0.0140)	(0.0124)
Δ Sovereign Spread GIIPS	-0.0022*	-0.0026*	-0.0013
	(0.0011)	(0.0013)	(0.0016)
Constant	-0.0041***	-0.0011	0.0038
	(0.0005)	(0.0064)	(0.0057)
Observations	2,363	2,363	2,363
Number of banks	28	28	28
Bank FE	YES	YES	YES
Year FE	NO	YES	NO
Quarter FE	NO	NO	YES
R^2	0.57	0.57	0.58

Notes: This table reports the panel estimation results of the regression model outlined in eq. (3.5): $ret_{i,t}^{bank} = \alpha_i + \sum_{j=1}^{5} \beta_{exit\ risk\ x\ EAD,j} \Delta exit\ risk_{j,t}\ x\ EAD_{i,j} + \beta_{exit\ risk,j}\ \Delta exit\ risk_{j,t} + \sum_{l=1}^{L} \beta_{l,t} X_{l,t}\ + \varepsilon_{i,t}$ where the monthly bank stock returns of non-GIIPS banks are regressed on the changes in log eurozone exit risk of the five GIIPS countries, the interactions between the change in log eurozone exit risk of the respective country and the credit risk exposure of the respective bank to the respective country, a set of control variables (returns of the VSTOXX, EUR/USD exchange rate, the respective home country stock index, the EUROSTOXX Banks, Δ sovereign yield spread of the respective country and the first principal component of the Δ of sovereign yield spreads of the GIIPS countries), bank fixed effects and quarter/year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

We find strong evidence that Portuguese exit risk has a significant negative unconditional impact on European bank stocks outside the GIIPS countries. Results are not only statistically, but also economically highly significant. A one standard deviation increase in Portuguese exit risk decreases monthly stock returns by about 0.45% - 0.57%. Testing for bilateral credit risk exposure as a conditioning channel, we identify a significant negative interaction between exit risk and bilateral credit risk exposure of the respective non-GIIPS bank to Greece and Ireland, indicating that banks with a higher bilateral credit risk exposure to these two countries are significantly more affected by Greek and Irish exit risk.[37] Figure 3.7 and Figure 3.8 illustrate the marginal effects of changes in Greek (Irish) exit risk on bank stock returns over the 5% to 95% range of bilateral credit risk exposure to Greece (Ireland).

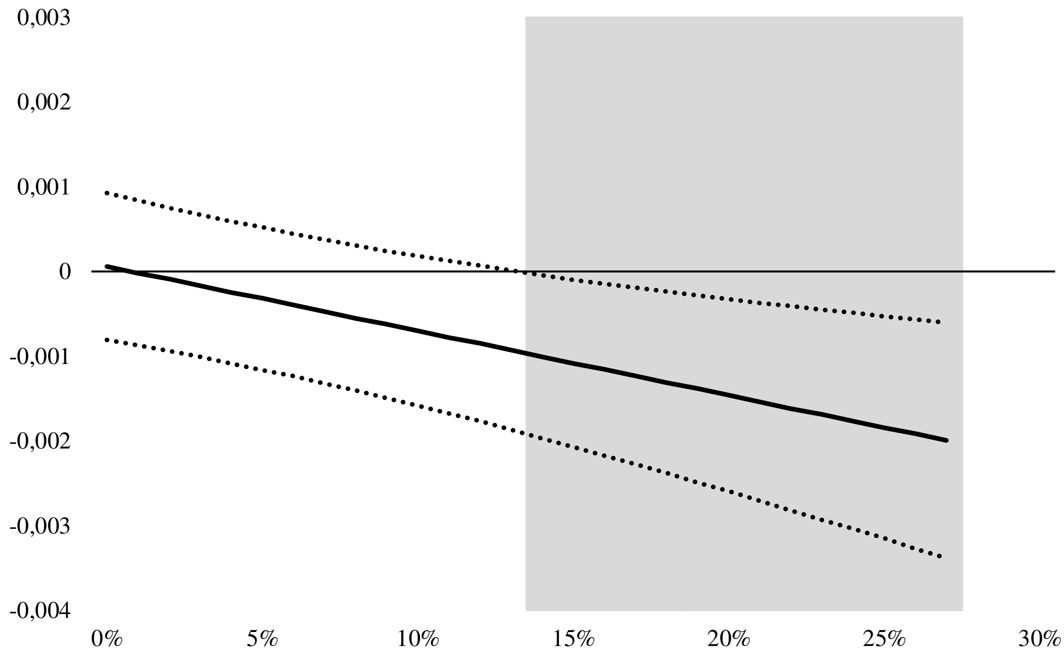
For Greece and Ireland, we find that banks with little or no direct bilateral credit risk exposure do not respond significantly to exit risk. However, banks' exit risk exposure increases in their bilateral credit risk exposure, meaning that banks with higher bilateral credit risk exposure respond more negatively to the exit risk of the respective country. We use two examples of banks to illustrate the magnitude of this effect.

The Dutch-based ING Groep NV is one example for a bank without direct bilateral credit risk exposure to Ireland. Therefore, there is no statistically significant impact of Irish exit risk on stock returns. However, for Royal Bank of Scotland Group plc, the bank with the highest bilateral credit risk exposure to Ireland outside the GIIPS countries (10.58% of total assets), monthly stock returns decrease by about 0.71%, given a one standard deviation increase in Irish exit risk.

[37] One potential explanation why we identify an unconditional impact of Portuguese exit risk, but no significant interaction with bilateral credit risk exposure might be that banks outside the GIIPS country have very little credit risk exposure to Portugal in general so there is not a lot of cross-sectional variation.

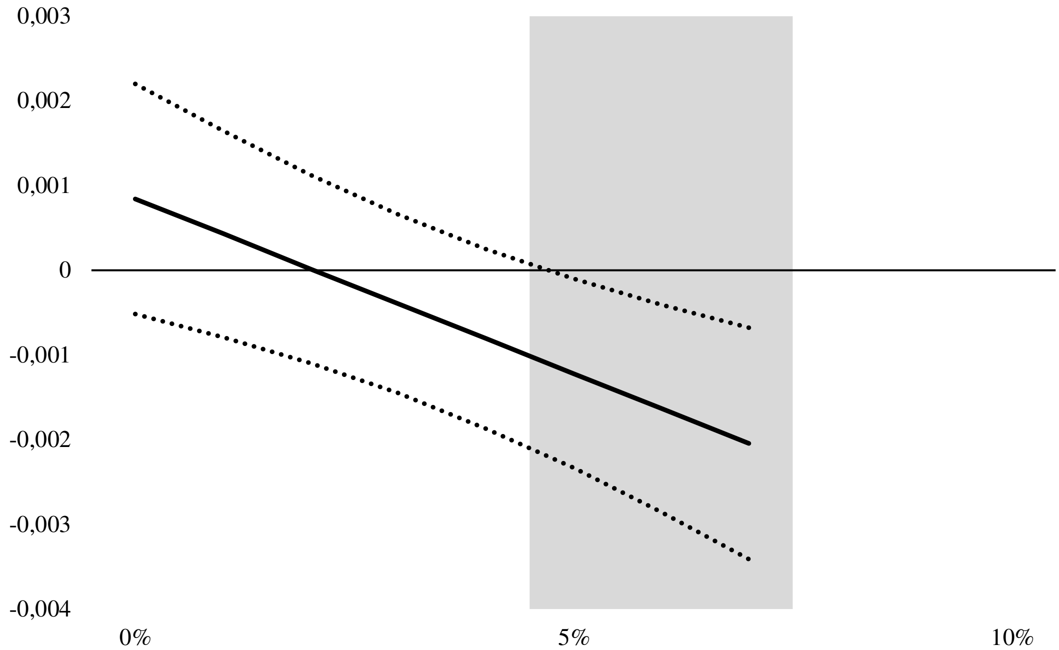
We do not find significant evidence that banks located in non-GIIPS countries are affected by eurozone exit risk of Italy and Spain. A possible explanation may be that banks are sufficiently hedged against the exit risk of these countries. Moreover, our findings suggest that several European banks do not sufficiently hedge their exposure to the eurozone exit risk of Greek, Ireland and Portugal. Our analysis therefore provides valuable insights for banking regulation.

Figure 3.7: Marginal effects of Δ Exit Risk Greece over the 5% to 95% range of EAD Greece



Notes: This figure reports the marginal effect (solid line) of the change in log eurozone exit risk of Greece on non-GIIPS bank stock returns conditional on the level of bilateral asset holdings of the bank in Greece to total banking assets and the 90% confidence intervals according to Specification 7 of Table 3.4. The 5% to 95% range of EAD Greece is displayed on the x-axis. Grey-shaded areas denote significance at the 10% level.

Figure 3.8: Marginal effects of Δ Exit Risk Ireland over the 5% to 95% range of EAD Ireland



Notes: This figure reports the marginal effect (solid line) of the change in log eurozone exit risk of Ireland on non-GIIPS bank stock returns conditional on the level of bilateral asset holdings of the bank in Ireland to total banking assets and the 90% confidence intervals according to Specification 7 of Table 3.4. The 5% to 95% range of EAD Ireland is displayed on the x-axis. Grey-shaded areas denote significance at the 10% level.

3.4 Exposure to eurozone exit risk in the non-financial sector

Eurozone exit would be associated with a number of macroeconomic shocks, including devaluation of the new domestic currency, disintegration of domestic capital markets, and changes in expected inflation and economic growth. Since these changes in the macroeconomic environment will affect the cash flows of companies, the returns on their stocks will be affected by exit risk. In the following, we empirically investigate the exposure of non-financial firms to domestic eurozone exit risk at the individual company level and study how company-specific characteristics determine this exposure.

Since we are not aware of existing studies empirically investigating the impact of eurozone exit risk on the performance of single companies, we cannot lean on existing hypotheses about the cross-sectional heterogeneity of exit risk exposure among companies. Given that the domestic currency would depreciate sharply after exiting the eurozone, we lean on the literature investigating the impact of currency depreciations on stock performance of companies (e.g. Forbes, 2002a; Desai et al., 2008). We use a similar set of potential company-specific determinants of euro exit risk exposure as in Forbes (2002a), although the hypothesized impact may differ due to our focus on eurozone exit risk, while Forbes (2002a) studies large depreciations in emerging markets.

Our sample consists of 355 non-financial stocks from Greece, Ireland, Italy, Portugal and Spain. We consider all stocks included in the DATASTREAM sector indices. We begin by testing for an unconditional impact of domestic euro exit risk on stock performance. We estimate the following panel regressions with company fixed effects and robust standard errors:

$$ret_{i,j,s,t} = \alpha_{i,j,s} + \beta_{exit\,risk}\,\Delta\,exit\ risk_{j,t} + \sum_{l=1}^{L} \beta_l\,X_{l,j,t} + \varepsilon_{i,j,s,t} \qquad (3.6)$$

We regress the monthly stock return of company i from country j and industry s on the change in log domestic eurozone exit risk, as well as on a set of country-specific control variables (return of the domestic stock market and the change in the domestic sovereign yield spread) and a set of control variables for the whole eurozone (the returns of the VSTOXX, EUROSTOXX, an industry index, and the EUR/USD exchange rate). We include company fixed effects as well as year, quarter, country x year or country x quarter fixed effects to account for the general dynamics of the euro crisis. The left panel of Table 3.5 summarizes the results for all stocks from the GIIPS countries for the full sample from January 2008 to June 2015, the right panel summarizes the results for the subsample from January 2008 to July 2012 when Mario Draghi held his famous "whatever it takes"-speech.

We find robust evidence that stocks in the GIIPS countries are significantly negatively affected by domestic exit risk. Results are not only statistically, but also economically highly significant. For the entire sample period, a one standard deviation increase in domestic Δ exit risk (i.e. 2.85) lowers monthly stock returns by about 0.16% to 0.24%. For the subsample from January 2008 to July 2012, domestic eurozone exit risk had an even larger impact on stock performance: a one standard deviation in domestic Δ exit risk (i.e. 2.45) lowers monthly stock returns by about 0.46% to 0.60%.

Therefore, our findings are in line with the theoretical model of Kriwoluzky et al. (2015) predicting that exit expectations have adverse effects on the real economy. As a robustness check, we include stocks of Financials into our analysis. The number of companies increases to 408. The significant negative impact of domestic exit risk on stock performance remains robust even after including financial stocks, as the Table A3.4 in the appendix of this chapter demonstrates.

Table 3.5: Results for the panel of individual non-financial stocks in the GIIPS countries

	Full Sample					January 2008 to July 2012				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Δ Exit Risk	-0.0008***	-0.0006**	-0.0006**	-0.0006***	-0.0008***	-0.0024***	-0.0019***	-0.0019***	-0.0019***	-0.0022***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Return Stock Index	0.5980***	0.4523***	0.4313***	0.4654***	0.4467***	0.6200***	0.4222***	0.4030***	0.4312***	0.4446***
	(0.0194)	(0.0260)	(0.0269)	(0.0260)	(0.0279)	(0.0184)	(0.0268)	(0.0280)	(0.0269)	(0.0295)
Δ Sovereign Spread		0.0162	0.0537	0.0306	0.0166		-0.0075	0.0373	-0.0123	-0.0224
		(0.0475)	(0.0488)	(0.0480)	(0.0510)		(0.0475)	(0.0488)	(0.0486)	(0.0520)
Return EUROSTOXX		-0.0739	-0.0361	-0.0919**	-0.0598		-0.0196	0.0212	-0.0354	-0.0319
		(0.0461)	(0.0488)	(0.0463)	(0.0495)		(0.0482)	(0.0510)	(0.0487)	(0.0518)
Return Industry Index		0.3226***	0.3113***	0.3281***	0.3235***		0.2427***	0.2417***	0.2501***	0.2573***
		(0.0365)	(0.0372)	(0.0368)	(0.0377)		(0.0391)	(0.0394)	(0.0394)	(0.0398)
Return Exchange rate		-0.2806***	-0.3012***	-0.2904***	-0.3207***		-0.2375***	-0.3086***	-0.2466***	-0.3317***
		(0.0412)	(0.0443)	(0.0417)	(0.0449)		(0.0437)	(0.0480)	(0.0442)	(0.0486)
Return VSTOXX		-0.0142***	-0.0141**	-0.0139***	-0.0124**		-0.0488***	-0.0584***	-0.0484***	-0.0550***
		(0.0049)	(0.0055)	(0.0049)	(0.0055)		(0.0067)	(0.0076)	(0.0067)	(0.0076)
Constant	-0.0036***	-0.0154***	-0.0042	0.0057***	-0.0008	-0.0064***	-0.0166***	-0.0028	-0.0097***	-0.0084
	(0.0001)	(0.0020)	(0.0038)	(0.0019)	(0.0026)	(0.0004)	(0.0020)	(0.0039)	(0.0020)	(0.0057)
Observations	28,593	28,593	28,593	28,593	28,593	16,674	16,674	16,674	16,674	16,674
Number of stocks	355	355	355	355	355	341	341	341	341	341
vvvStock FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO
Quarter FE	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO
Country x Year FE	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
Country x Quarter FE	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES
R^2	0.18	0.20	0.20	0.20	0.22	0.22	0.23	0.24	0.24	0.25

Notes: This table reports the panel estimation results of the regression model outlined in eq. (3.6): $ret_{i,j,s,t} = \alpha_{i,j,s} + \beta_{exit\ risk}\,\Delta\, exit\ risk_{j,t} + \sum_{l=1}^{L}\beta_l\, X_{l,j,t} + \varepsilon_{i,j,s,t}$ where monthly stock returns of non-financial firms in the GIIPS countries are regressed on the change in log domestic eurozone exit risk, as well as on a set of country-specific control variables (return of the domestic stock market and the change in the domestic sovereign yield spread) and a set of control variables for the whole eurozone (the returns of the VSTOXX, EUROSTOXX, an industry index, and the EUR/USD exchange rate), company fixed effects as well as year, quarter, country x year or country x quarter fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

In the next step, we aim to explain the individual exposures to eurozone exit risk with company-specific characteristics, controlling for country and industry membership. Therefore, we follow a two-step estimation strategy. In the first step, we run a time-series regression for each stock in our sample, regressing the return of stock i from country j and sector s on the change in the home country's log exit risk.

$$ret_{i,j,s,t} = \alpha_{i,j,s} + \beta_{exit\ risk,i,j,s}\,\Delta exit\ risk_{j,t} + \varepsilon_{i,j,s,t} \tag{3.7}$$

By running these time-series regressions for each of the stocks in our sample, we obtain one estimate of $\beta_{exit\ risk,i,j,s}$ for each stock. In the next step, we explain the cross-section of estimated $\beta_{exit\ risk,i,j,s}$ with a set of company-specific variables including country and industry fixed effects:

$$\beta_{exit\ risk,i,j,s} = \mu_j + \gamma_s + \sum_{l=1}^{L} \beta_l X_{l,i} + \varepsilon_{i,j,s} \tag{3.8}$$

We account for the following company characteristics: Liquidity (Short-Term Debt/Cash), Size (log Total Assets), Capital Endowment (Equity/Total Assets), Profitability (Return on Assets), Foreign Sales to Total Sales, a Tradables Industry dummy, and Labor Intensity (Total Assets to Employees). All variables are measured as averages over the whole sample period from January 2008 to June 2015. Descriptive evidence and sources of the company-specific variables used are summarized in Table A3.5 in the appendix of this chapter. These company characteristics should determine the effect of eurozone exit risk on company performance as measured by stock returns. For example, companies with a lower level of short-term debt to cash should be better able to manage a probable liquidity shock associated with eurozone exit and therefore should be less negatively exposed to exit risk than more illiquid companies with large short-term debt. Larger companies might also be less affected by domestic exit risk since they might be better able to diversify risks. Forbes (2002a) argues that larger firms are more likely to have access to financing during lending contractions, which might be a realistic scenario in the course of a eurozone exit. Also, small companies might be more likely to go bankrupt due to the economic disruptions that would accompany a eurozone exit, which might lead to higher market shares and higher profitability of large companies in the aftermath of a eurozone exit. Likewise, companies with higher levels of capital and profitability may be better able to manage and survive eurozone exit. For Foreign Sales, the Tradable industry dummy, and labor intensity the hypothesized impact of Eurozone exit is less trivial and can go in both directions. Table 3.6 summarizes the results from the cross-sectional regressions as described in equation (3.8) for all non-financial stocks from the GIIPS countries.

Table 3.6: Company-specific determinants of exit risk exposures of non-financial firms in the GIIPS countries

	(1)	(2)	(3)	(4)	(5)
Short-Term Debt/Cash	-0.000002***	-0.000003***	-0.000003***	-0.000004***	-0.000004***
	(0.000001)	(0.000001)	(0.000001)	(0.000001)	(0.000001)
Log(Total Assets)	0.000460***	0.000470***	0.000386**	0.000403**	0.000336**
	(0.000141)	(0.000161)	(0.000152)	(0.000166)	(0.000169)
Return On Assets	0.002797	0.002554	0.002655	0.002714	0.000576
	(0.006512)	(0.006373)	(0.005572)	(0.005395)	(0.005183)
Equity/Total Assets	-0.001197	-0.001001	-0.000185	0.000051	0.000922
	(0.001516)	(0.001488)	(0.001414)	(0.001428)	(0.001423)
Tradabables	0.000743	0.000781	0.000508	0.000280	0.000181
	(0.000517)	(0.000632)	(0.000482)	(0.000603)	(0.000633)
Total Assets/ Employees	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.000000)	(0.000000)	(0.000000)	(0.000000)	(0.000000)
Foreign Sales/ Total Sales					0.000554
					(0.001018)
Constant	-0.005058**	-0.008013***	-0.005225**	-0.007267***	-0.006522**
	(0.002139)	(0.002493)	(0.002156)	(0.002601)	(0.002612)
Country FE	NO	NO	YES	YES	YES
Industry FE	NO	YES	NO	YES	YES
Observations	355	355	355	355	345
R^2	0.06	0.1	0.21	0.24	0.24

Notes: This table reports the cross-sectional estimation results of the regression model outlined in eq. (3.8): $\beta_{exit\ risk,i,j,s} = \mu_j + \gamma_s + \sum_{l=1}^{L} \beta_l X_{l,i} + \varepsilon_{i,j,s}$ where the company-specific estimates of eurozone exit risk exposure $\beta_{exit\ risk,i,j,s}$ (obtained by estimating a separate time-series regression for each stock as outlined in eq. (3.7)) of non-financial stocks in the GIIPS countries are regressed on averages of the company-specific variables short-term debt/cash, log of total assets, return on assets, equity/total assets, a tradables dummy, total assets/employees, foreign sales/total sales as well as country and industry fixed effects. Robust standard errors are reported in parentheses. Note that in specification 5, the number of observations reduces to 345 since the ratio foreign sales to total sales is not available for ten non-financial firms in our sample. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

We find robust evidence that liquidity and company size significantly determine company-specific eurozone exit risk exposure. There is a significantly negative relation between the ratio of Short-Term Debt/Cash and company-specific exit risk exposure. The more illiquid a company is, i.e. the higher its ratio of Short-Term Debt/Cash, the higher is its exposure to euro exit risk, i.e. the more negatively its returns are affected if euro exit risk rises.[38] High cash reserves serve as an insurance against economic shocks. If a company is low on cash relative to its short-term debt, it will be more vulnerable to the

[38] This finding is also in line with Kriwoluzky et al. (2015) who show that exit expectations lead to increases in corporate refinancing costs.

economic shocks following a eurozone exit. Domestic capital markets will disintegrate following eurozone exit and domestic banks will be more reluctant to lend out new loans to domestic companies. Domestic firms will find it difficult to roll over their short-term debt and to finance their business operations. Therefore, companies with low cash reserves relative to their short-term debt (i.e. with a high ratio of Short-Term Debt/Cash) will be those most likely driven into severe solvency problems or even bankruptcy following a eurozone exit.

In addition, we identify a significant positive relation between company size (measured by log total assets) and exit risk exposure, indicating that larger firms are less negatively affected by domestic exit risk. This might be because larger firms are better able to diversify the risks associated with a eurozone exit risk and are more likely to have access to finance during lending contractions (Forbes, 2002a). Therefore, larger firms are also less likely to face bankruptcy in the aftermath of a eurozone exit. These findings are robust to accounting for country and industry membership and including a large set of additional company-specific variables as controls.

We do not find significant effects for the remaining company characteristics indicating that a reduction of the short-term debt to cash ratio may be the most efficient strategy to shield a company against eurozone exit risk and the associated risk of liquidity driven default.

Similar to our analysis of the unconditional impact of domestic exit risk on stock performance presented above, we include stocks from the financial sector from our analysis as a robustness check. Again, the hypotheses on company-specific determinants of exit risk exposure might be different for financial stocks. In addition, financials might act as outliers with regard to certain company-specific factors such as Total Assets/Total Employees and therefore might have a substantial impact on the results of this analysis.

However, our results remain robust to the inclusion of financial stocks as Table A3.6 in the appendix of this chapter demonstrates.

As a further robustness check, we test whether the negative relation between the ratio of Short-Term Debt/Cash and company-specific exit risk exposure as well as the positive relation with company size also hold using a different econometric approach. Instead of conducting a two-step regression approach as described above, we test an interaction model where we regress the monthly returns of stocks in the GIIPS countries on the change in domestic risk, the same set of company-specific fundamentals that we tested above in the cross-sectional regressions as well as their interaction with the change in log domestic exit risk and a set of additional control variables. As Table A3.7 in the appendix of this chapter demonstrates, the interactions between the change in domestic exit risk and Short-Term Debt/Cash (log Total Assets) are also significantly negative (positive).

3.5 Conclusion

We exploit ADR investors' exposure to potential losses associated with eurozone exit to derive a novel measure of eurozone exit risk. Our exit risk measure is based on the fraction of ADR returns that is explained by the variation in economic incentives to leave the eurozone. Using 17 level II and III ADRs in the period January 2008 to June 2015, we find that our exit risk measure is significantly higher and more volatile for the GIIPS countries than for Germany, which we include as a placebo test. Investigating the determinants of the exposure to euro exit risk for 28 European bank stocks outside the GIIPS countries, we find that Portuguese exit risk has a significant negative unconditional impact on bank stocks. At the same time, banks with higher credit risk exposure to Greece and Ireland are more adversely affected by the exit risk of these countries. This finding offers valuable insights to bank regulators since they suggest that several European banks do not sufficiently hedge their exposure to the eurozone exit risk of these three countries. For non-financial companies in the GIIPS countries, we find that higher domestic euro exit risk exerts a significantly negative impact on stocks returns. Lower short-term debt to cash ratios reduce companies' exposure to eurozone exit risk indicating that investors regard liquidity driven defaults as a realistic scenario after eurozone exit and that a reduction in short-term debt relative to cash may shield companies from eurozone exit risk. Also, larger companies are less negatively affected by eurozone exit risk since they might be better able to diversify risk and to access financial markets after lending contractions associated with eurozone exit.

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Appendix to Chapter 3

Table A3.1: Variables used in the first-stage regressions and their sources

Variable	Description	Source
$return_{i,j,t}^{ADR}$	Daily log return of American Depositary Receipt.	Thomson Reuters Tick History
$return_{i,j,t}^{UND}$	Daily log return of the underlying stock.	Thomson Reuters Tick History
$return_t^S$	Daily log return of the EUR/USD exchange rate.	Thomson Reuters Tick History
$return_t^{SFutures}$	Daily log return of a composite continuous EUR/USD future provided by CME.	Thomson Reuters DATASTREAM
$VUL_{j,t}$	Country specific market-based measure of financial and economic vulnerabilities that proxy the incentive to leave the eurozone. Calculated using PCA as described in 3.2.2.	Own calculation.
$VUL\ GIIPS_{j,t}$	Market-based measure of financial and economic vulnerabilities that proxy the incentive of the respective other four GIIPS countries to leave the eurozone. Calculated using PCA as described in 3.2.2.	Own calculation.
$return_t^{S\&P\ 500}$	Daily log return of the S&P 500.	Thomson Reuters Tick History
$\Delta idiosyncratic\ risk_{i,j,t}$	The ADR-underlying stock pair specific measure of idiosyncratic risk is the standard deviation of the residuals from regressing the difference between USD returns of the ADR and its underlying on contemporaneous as well as one day lagged and leading values of the US stock market, the respective domestic stock market and the change in the EUR/USD exchange rate using a rolling window of 30 trading days, see eq. (1) in Gagnon and Karolyi (2010).	Own calculation.
$\Delta bid - ask_{i,j,t}^{ADR}$	Change in the bid-ask-spread of the ADR.	Thomson Reuters Tick History
$\Delta bid - ask_{i,j,t}^{UND}$	Change in the bid-ask-spread of the underlying stock.	Thomson Reuters Tick History
$\Delta financial\ integration_{j,t}$	Obtained by regressing the excess return (over the interest rate on 3M T-Bills) of the local index (in USD) of the respective eurozone country on the excess return of the MSCI World (in USD) using a rolling regressions framework over the past 30 trading days.	Own calculation.

Figure A3.1: Evolution of the Greek vulnerability indicator calculated as described in section 3.2.2

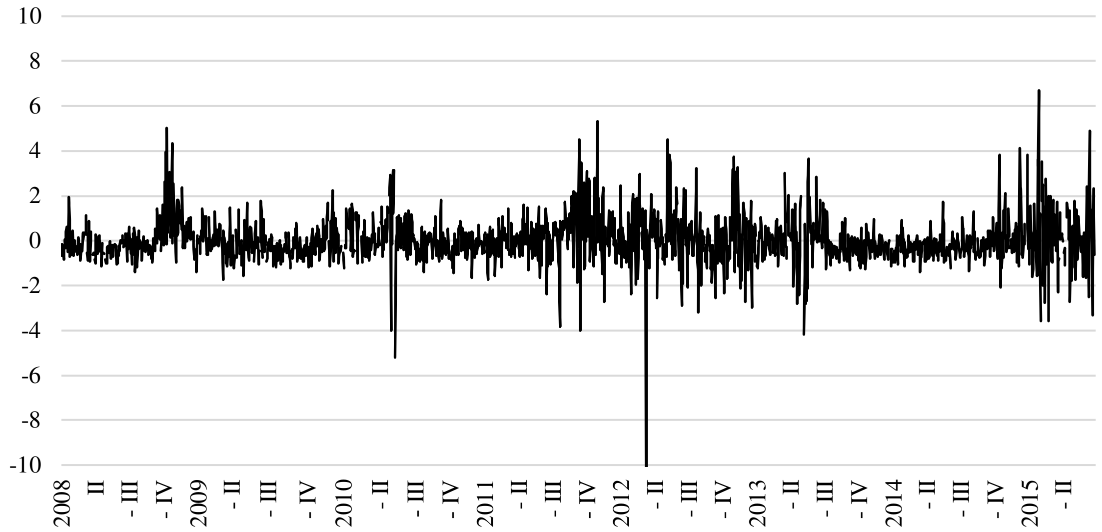


Figure A3.2: Evolution of the Irish vulnerability indicator calculated as described in section 3.2.2

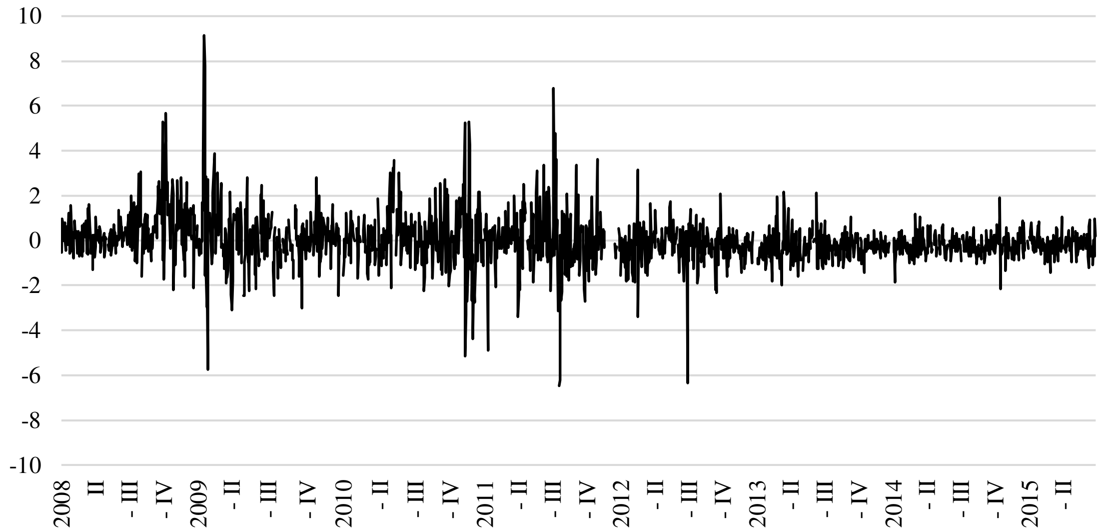


Figure A3.3: Evolution of the Italian vulnerability indicator calculated as described in section 3.2.2

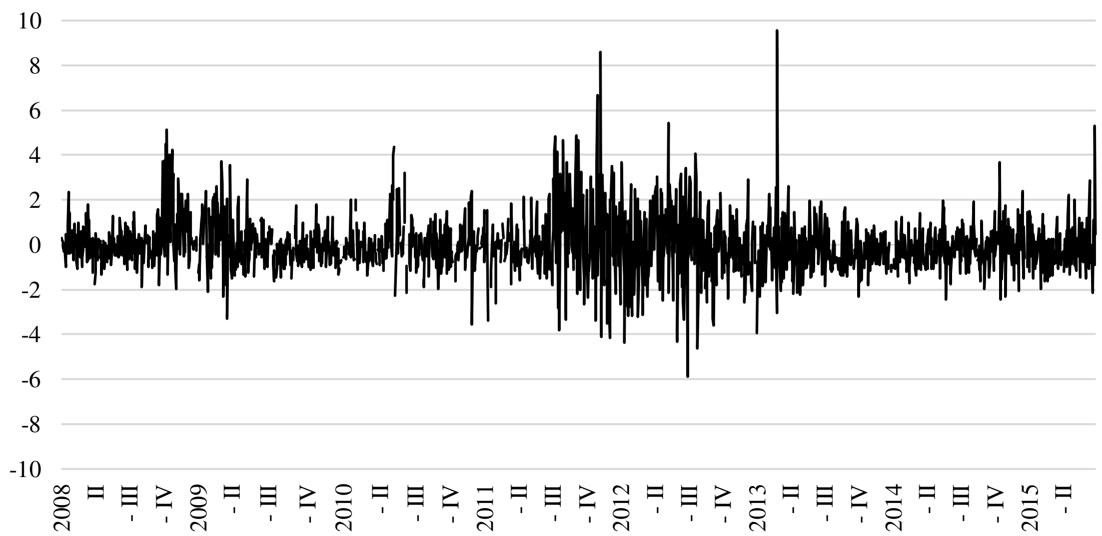


Figure A3.4: Evolution of the Portuguese vulnerability indicator calculated as described in section 3.2.2

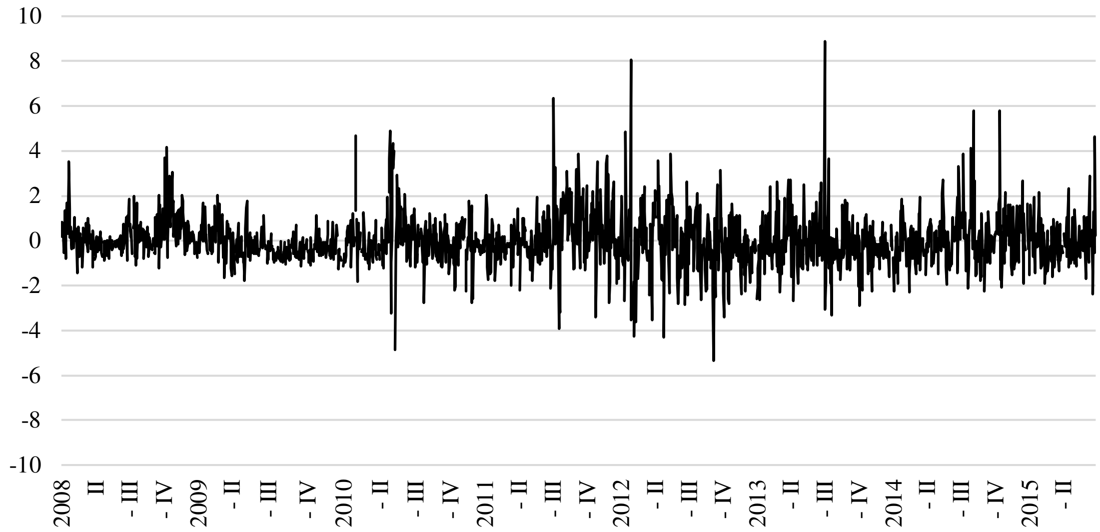


Figure A3.5: Evolution of the Spanish vulnerability indicator calculated as described in section 3.2.2

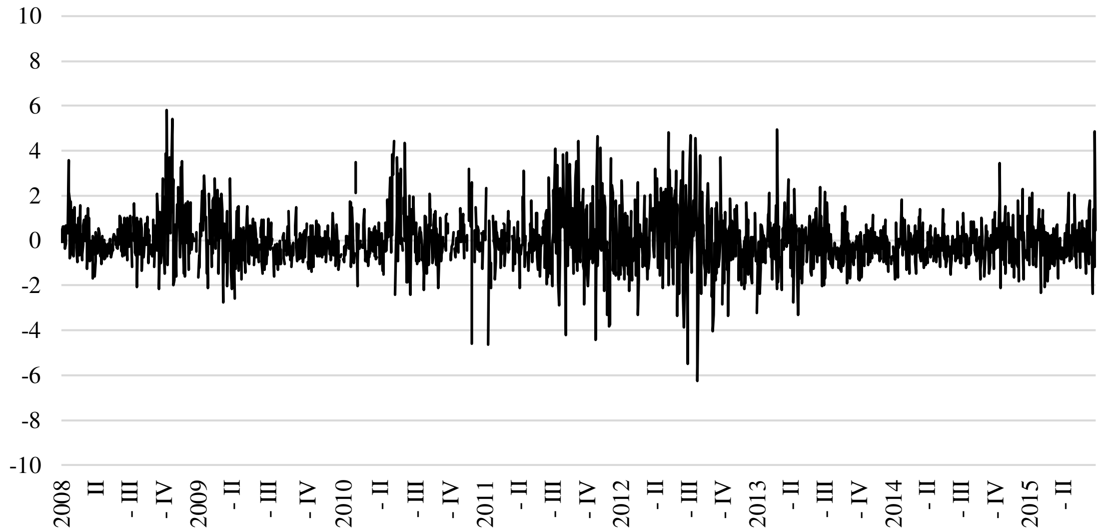


Figure A3.6: Evolution of the German vulnerability indicator calculated as described in section 3.2.2

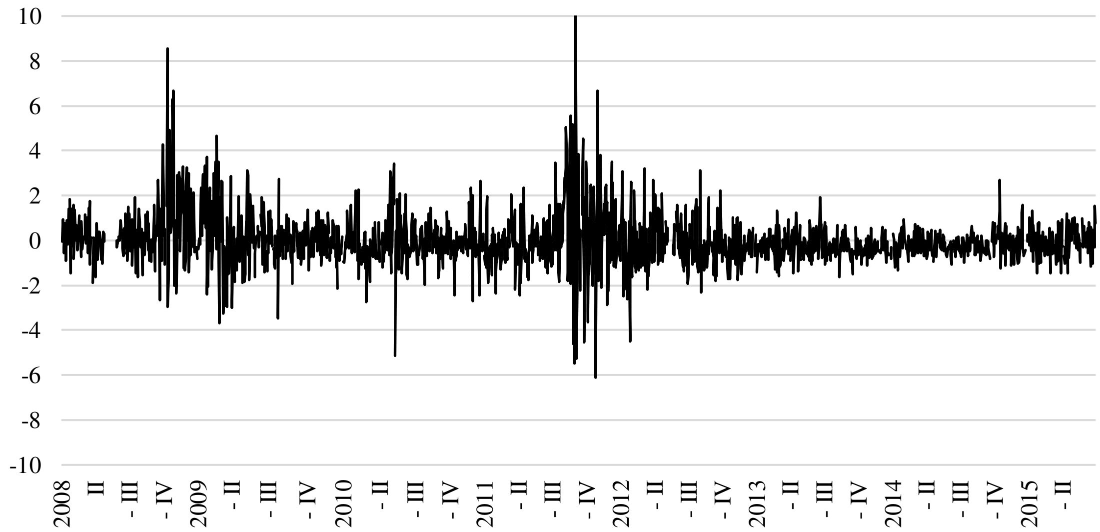


Table A3.2: ADRs in our sample by country

Name_ADR	RIC ADR	Exchange ADR	RIC Underlying	First day	Last day
Germany					
Aixtron SE 1:1	AIXG.O	NASDAQ	AIXGn.DE	01/03/2008	06/30/2015
Fresenius Medical Care AG & Co. KGaA 2:1	FMS	NYSE	FMEG.DE	01/03/2009	06/30/2015
SAP SE 1:1	SAP	NYSE	SAPG.DE	01/03/2008	06/30/2015
Siemens AG 1:1	SIEGY.PK	NYSE	SIEGn.DE	01/03/2008	06/30/2015
Greece					
National Bank of Greece 1:1	NBG.N	NYSE	NBGr.AT	01/03/2008	06/30/2015
Ireland					
CRH plc 1:1	CRH	NYSE	CRH.I	01/03/2008	06/30/2015
Ryanair plc 1:5	RYAAY.O	NASDAQ	RYA.I	01/03/2008	06/30/2015
Italy					
Eni S.p.A. 1:2	E	NYSE	ENI.MI	01/03/2008	06/30/2015
Luxottica S.p.A. 1:1	LUX	NYSE	LUX.MI	01/03/2008	06/30/2015
Telecom Italia S.p.A. 1:10	TI	NYSE	TLIT.MI	01/03/2008	06/30/2015
Portugal					
Pharol SGPS SA 1:1	PTGCY.PK	OTC	PHRA.LS	01/03/2008	03/27/2015
Spain					
Abengoa SA 2:1	ABGB.O	NASDAQ	ABG.MC	10/21/2013	06/30/2015
Banco Santander SA 1:1	SAN	NYSE	SAN.MC	01/03/2008	06/30/2015
BBVA SA 1:1	BBVA.K	NYSE	BBVA.MC	01/05/2010	06/30/2015
Grifols SA 1:1	GRFS.O	NASDAQ	GRLS.MC	06/03/2011	06/30/2015
PRISA SA 1:1	PRIS.N	NYSE	PRS.MC	01/04/2011	09/22/2014
Telefónica SA 1:1	TEF	NYSE	TEF.MC	01/03/2008	06/30/2015

Table A3.3: List of banks in our sample

	EBA Code	EAD (%)				
Bank		GR	IE	IT	PT	ES
Erste Group Bank AG	at001	0.46	0.15	1.01	0.12	0.44
Dexia SA	be004	0.91	0.00	9.11	1.03	6.07
KBC Groep NV	be005	0.20	6.59	2.20	0.08	1.05
Cyprus Popular Bank Public Co. Ltd.	cy006	43.88	0.23	1.12	0.51	0.64
Bank of Cyprus PCL	cy007	26.77	0.12	0.64	0.00	0.21
BNP Paribas SA	fr013	0.43	0.39	6.98	0.41	1.72
Crédit Agricole SA	fr014	1.80	0.45	5.56	0.21	0.99
Société Générale SA	fr016	0.63	0.44	1.99	0.12	1.29
Deutsche Bank AG	de017	0.19	0.96	2.14	0.22	1.69
Commerzbank AG	de018	0.59	0.01	2.49	0.56	2.52
Landesbank Berlin Holding AG	de027	0.37	0.91	2.58	0.21	2.85
Bank of Valetta plc	mt046	0.00	0.00	0.00	0.00	0.00
ING Groep NV	nl047	0.00	0.00	0.00	0.00	0.00
SNS Reaal Groep NV	nl050	0.00	0.00	0.19	0.00	0.67
Averages Non GIIPS Eurozone		5.86	0.79	2.77	0.27	1.55
Danske Bank A/S	dk008	0.00	3.31	0.00	0.00	0.00
Jyske Bank A/S	dk009	0.19	0.00	0.00	0.00	0.00
Sydbank A/S	dk010	0.00	0.00	0.00	0.00	0.00
OTP Bank Nyrt	hu036	0.00	0.00	0.00	0.00	0.00
DNB ASA	no051	0.00	0.00	0.00	0.00	0.00
PKO Bank Polski SA	pl052	0.00	0.1	0.24	0.00	0.00
Nordea Bank AB	se084	0.04	0.17	0.05	0.01	0.09
Skandinaviska Enskilda Banken AB	se085	0.03	0.20	0.08	0.03	0.38
Svenska Handelsbanken AB	se086	0.00	0.00	0.00	0.00	0.00
Swedbank AB	se087	0.00	0.01	0.00	0.00	0.00
Royal Bank of Scotland Group plc	gb088	0.58	10.58	1.74	0.28	3.84
HSBC Holdings plc	gb089	0.24	0.00	0.00	0.00	0.54
Barclays plc	gb090	0.01	0.24	1.52	0.73	2.55
Lloyds Banking Group plc	gb091	0.00	0.00	0.00	0.00	0.00
Averages Non Eurozone		0.07	0.94	0.33	0.07	0.52

Table A3.4: Robustness Check: Results for the panel of individual stocks (including Financials) in the GIIPS countries

	Full Sample					January 2008 to July 2012				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Δ Exit Risk	-0.0008***	-0.0005***	-0.0005**	-0.0006***	-0.0008***	-0.0025***	-0.0019***	-0.0019***	-0.0019***	-0.0023***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Return Stock Index	0.6334***	0.5004***	0.4766***	0.5131***	0.4938***	0.6483***	0.4679***	0.4470***	0.4746***	0.4860***
	(0.0195)	(0.0264)	(0.0270)	(0.0265)	(0.0279)	(0.0183)	(0.0268)	(0.0277)	(0.0268)	(0.0286)
Δ Sovereign Spread		0.0712	0.1035**	0.0838*	0.0612		0.0397	0.0793*	0.0372	0.0164
		(0.0453)	(0.0465)	(0.0457)	(0.0482)		(0.0456)	(0.0468)	(0.0466)	(0.0495)
Return EUROSTOXX		-0.1876***	-0.1498***	-0.2034***	-0.1732***		-0.1123**	-0.0648	-0.1239**	-0.1123**
		(0.0481)	(0.0505)	(0.0483)	(0.0510)		(0.0487)	(0.0514)	(0.0490)	(0.0515)
Return Industry Index		0.4162***	0.4065***	0.4194***	0.4152***		0.3257***	0.3232***	0.3307***	0.3345***
		(0.0388)	(0.0394)	(0.0389)	(0.0395)		(0.0406)	(0.0408)	(0.0407)	(0.0408)
Return Exchange rate		-0.3870***	-0.4035***	-0.3946***	-0.4206***		-0.3224***	-0.3897***	-0.3288***	-0.4084***
		(0.0432)	(0.0459)	(0.0434)	(0.0462)		(0.0448)	(0.0480)	(0.0450)	(0.0482)
Return VSTOXX		-0.0124***	-0.0128**	-0.0122**	-0.0111**		-0.0399***	-0.0483***	-0.0396***	-0.0450***
		(0.0047)	(0.0052)	(0.0047)	(0.0052)		(0.0067)	(0.0075)	(0.0067)	(0.0075)
Constant	-0.0043***	-0.0132***	-0.0033	0.0051***	-0.0017	-0.0074***	-0.0148***	-0.0026	-0.0110***	-0.0131**
	(0.0001)	(0.0019)	(0.0036)	(0.0018)	(0.0024)	(0.0004)	(0.0019)	(0.0036)	(0.0019)	(0.0052)
Observations	32,545	32,545	32,545	32,545	32,545	18,934	18,934	18,934	18,934	18,934
Number of stocks	408	408	408	408	408	387	387	387	387	387
Stock FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO
Quarter FE	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO
Country x Year FE	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
Country x Quarter FE	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES
R^2	0.20	0.22	0.22	0.22	0.24	0.23	0.25	0.26	0.25	0.27

Notes: This table reports the panel estimation results of the regression model outlined in eq. (3.6): $ret_{i,j,s,t} = \alpha_{i,j,s} + \beta_{exit\ risk}\ \Delta\ exit\ risk_{j,t} + \sum_{l=1}^{L} \beta_l X_{l,j,t} + \varepsilon_{i,j,s,t}$ where monthly stock returns of firms in the GIIPS countries (including Financials) are regressed on the change in log domestic eurozone exit risk, as well as on a set of country-specific control variables (return of the domestic stock market and the change in the domestic sovereign yield spread) and a set of control variables for the whole eurozone (the returns of the VSTOXX, EUROSTOXX, an industry index, and the EUR/USD exchange rate), company fixed effects as well as year, quarter, country x year or country x quarter fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A3.5: Sources and descriptive statistics of company-specific variables

Variable	Worldscope Code	Mean	Std. Dev.	Min	Max
All GIIPS Stocks					
Short-Term Debt/Cash	WC03051/WC02005	16.55	106.27	0	1,781.53
Log(Total Assets)	WC08241	13.61	2.36	9.18	20.62
Return On Assets	WC08326	0.03	0.06	-0.44	0.33
Equity/Total Assets	WC02999	0.36	0.23	-0.53	0.97
Foreign Sales/Total Sales	WC08731	0.34	0.32	0	1
Tradabables[39]	WC07021 (SIC-code)	0.43	0.50	0	1
Total Assets/Employees	WC08406	1,874.89	6145.209	16	89,396
All GIIPS Stocks Excluding Financials					
Short-Term Debt/Cash	WC03051/WC02005	15.13	107.13	0	1,781.53
Log(Total Assets)	WC02999	13.27	2.04	9.18	18.86
Return On Assets	WC08326	0.03	0.06	-0.44	0.33
Equity/Total Assets	WC08241	0.38	0.21	-0.53	0.90
Foreign Sales/Total Sales	WC08731	0.38	0.32	0	1
Tradabables[40]	WC07021 (SIC-code)	0.49	0.50	0	1
Total Assets/Employees	WC08406	944.02	2,883.01	16	45,647.58

Table A3.6: Robustness Check: Company-specific determinants of exit risk exposures in the GIIPS countries for all stocks (including financials)

	(1)
Short-Term Debt/Cash	-0.000004***
	(0.000001)
Log(Total Assets)	0.000269*
	(0.000148)
Return On Assets	0.001411
	(0.004885)
Equity/Total Assets	0.000793
	(0.001259)
Tradabables	0.000029
	(0.000619)
Total Assets/Employees	0.000000
	(0.000000)
Foreign Sales/Total Sales	0.000896
	(0.001012)
Constant	-0.005574**
	(0.002421)
Country FE	YES
Industry FE	YES
Observations	392
R^2	0.27

Notes: This table reports the cross-sectional estimation results of the regression model outlined in eq. (3.8): $\beta_{exit\ risk,i,j,s} = \mu_j + \gamma_s + \sum_{l=1}^{L} \beta_l X_{l,i} + \varepsilon_{i,j,s}$ where the company-specific estimates of eurozone exit risk exposure $\beta_{exit\ risk,i,j,s}$ (obtained by estimating a separate time-series regression for each stock as outlined in eq. (3.7)) of stocks in the GIIPS countries (including Financials) are regressed on averages of the company-specific variables short-term debt/cash, log of total assets, return on assets, equity/total assets, a tradables dummy, total assets/employees, foreign sales/total sales as well as country and industry fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

[39] Dummy variable classifying a company as producing either tradable goods (=1) or nontradable goods (=0). Classified according to their two-digit SIC code following Forbes (2002b).

[40] Dummy variable classifying a company as producing either tradable goods (=1) or nontradable goods (=0). Classified according to their two-digit SIC code following Forbes (2002b).

Table A3.7: Robustness Check: Panel regression with interaction of change in log domestic exit risk and company-specific fundamentals

	(1)	(2)
Δ Exit Risk	-0.0092***	-0.0048*
	(0.0023)	(0.0025)
Δ Exit Risk x Short-Term Debt/Cash	-0.0000*	-0.0000**
	(0.0000)	(0.0000)
Δ Exit Risk x Log(Total Assets)	0.0006***	0.0003**
	(0.0001)	(0.0002)
Δ Exit Risk x Return On Assets	0.0055	0.0035
	(0.0037)	(0.0037)
Δ Exit Risk x Equity/Total Assets	-0.0014	-0.0009
	(0.0013)	(0.0014)
Δ Exit Risk x Foreign Sales/Total Sales		-0.0000*
		(0.0000)
Δ Exit Risk x Tradabables	0.0002	0.0002
	(0.0005)	(0.0005)
Δ Exit Risk x Total Assets/Employees	0.0000	0.0000
	(0.0000)	(0.0000)
Short-Term Debt/Cash	-0.0000***	0.0000
	(0.0000)	(0.0000)
Log(Total Assets)	-0.0083**	-0.0132***
	(0.0035)	(0.0038)
Return On Assets	0.0394**	0.0429***
	(0.0190)	(0.0163)
Equity/Total Assets	0.0103	0.0187**
	(0.0091)	(0.0088)
Foreign Sales/Total Sales		-0.0003***
		(0.0000)
Total Assets/Employees	-0.0000***	-0.0000***
	(0.0000)	(0.0000)
Return Stock Index	0.5618***	0.5812***
	(0.0202)	(0.0227)
Return Exchange rate	0.0069	0.0282
	(0.0228)	(0.0246)
Return VSTOXX	-0.0396***	-0.0330***
	(0.0048)	(0.0054)
Δ Sovereign Spread	-0.0026	-0.0010
	(0.0499)	(0.0523)
Constant	0.1154**	0.1823***
	(0.0465)	(0.0517)
Observations	25,699	21,759
Number of stocks	355	345
Stock FE	YES	YES
Country x Year FE	YES	YES
R^2	0.22	0.23

Notes: This table reports the panel estimation results of an interaction model where we regress the monthly returns of non-financial stocks in the GIIPS countries on the change in log domestic risk, the same set of company-specific fundamentals that we tested in the cross-sectional regressions as outlined in. eq. (3.8) as well as their interaction with the change in log domestic exit risk and the returns of the domestic stock index, VSTOXX, the EUR/USD exchange rate and the change in the domestic sovereign spread as additional control variables as well as stock and country x year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Chapter 4

The impact of US monetary policy on managed exchange rates and currency peg regimes

Abstract: *I study the impact of US monetary policy on managed exchange rates and currency peg regimes by analyzing the pricing of American Depositary Receipts (ADRs) around FOMC meetings. I identify a significant negative impact of US monetary surprises on abnormal ADR returns for currencies that are managed, which reflects changes in these currencies' fundamental values due to US monetary policy shocks. In line with currency crises models of interest rate defence like Lahiri and Végh (2007), positive US monetary surprises increase the breakdown probability of currency pegs of countries characterized by low real GDP growth, fiscal deficits and a weak domestic banking sector.*

4.1 Introduction

There is common agreement that US monetary policy has a significant impact on exchange rates (e.g., Dedola et al., 2017; Mueller et al., 2017). However, identifying the effects of US monetary policy shocks on managed exchange rates is nontrivial, since many central banks intervene in the foreign exchange market and thereby manipulate the value of the domestic currency (e.g. Fratzscher et al., 2019). The intervention prevents the official spot exchange rate from fully reflecting the change in the fundamental value of these currencies caused by the US monetary policy shocks.[41] Consequently, existing studies (e.g. Hausman and Wongswan, 2011) might not fully capture the impact of US

[41] For this paper, the fundamental value of a currency refers to the exchange rate that would materialize if there was no intervention by the domestic central bank and the exchange rate was fully determined by market force.

monetary policy shocks on managed exchange rates.

In the extreme case of a currency peg to the U.S. dollar, there is, by definition, no change in the official spot exchange rate as long as the peg regime holds. However, an unexpected US policy rate increase might affect investors' assessment of the stability of the currency peg regime and thus lead to a higher expected peg breakdown probability. To sustain the peg regime, the domestic central bank must mimic increases in the FED Funds Rate.[42] Lahiri and Végh (2007) state that raising the domestic policy rate is associated with fiscal and output costs and leads to a deterioration of the domestic banking system. Second-generation currency crises models predict that domestic policy makers will opt to abandon a currency peg regime if the economic costs of maintaining the peg regime outweigh the benefits (e.g. Obstfeld, 1994; Bensaid and Jeanne, 1997).[43]

I introduce a novel empirical approach to identify the impact of US monetary policy on managed exchange rates and the stability of currency peg regimes. It builds on the idea that prices of American Depositary Receipts (ADRs) reflect investors' exchange rate expectations in managed exchange rate regimes (e.g. Kadiyala and Kadiyala, 2004; Arquette et al., 2008; Eichler et al., 2009; Maltritz and Eichler, 2010; Eichler, 2011). ADR investors consider the impact of US monetary policy on the fundamental value of currencies. A positive (negative) US monetary surprise will decrease (increase) the true fundamental value of any currency relative to the U.S. dollar. If the return of the spot exchange rate does not fully reflect this change in the fundamental value of the currency due to the intervention of the domestic central bank, the new fundamental value will be

[42] While standard textbook models claim that this relation does not necessarily hold if capital flows are restricted, the empirical evidence is ambiguous. For example, Miniane and Rogers (2007) and Dedola et al. (2017) show that restrictions on capital flows do not insulate countries from US monetary policy shocks. I will discuss the role of capital account openness in the robustness check sections of this paper.

[43] This is not an exclusive feature of second-generation currency crises models, but can also be found in augmented first-generation models of interest rate defence (e.g. Flood and Jeanne, 2005; Lahiri and Végh, 2007).

below (above) the current spot exchange rate of the currency. However, the domestic central bank might eventually cease its intervention in the foreign exchange market.[44] Therefore, the risk of a sudden convergence of the spot exchange rate to the true fundamental value of the currency is reflected in abnormal ADR returns (e.g. Eichler and Roevekamp, 2018). In the extreme case of a currency pegged to the U.S. dollar, investors will perceive a higher reluctance of domestic policymakers to maintain the currency peg using an interest rate defence if they anticipate that the domestic government faces high economic costs of mimicking an unexpected US policy rate increase. Consequently, significant negative abnormal ADR returns will reflect a higher peg breakdown probability. For policy makers and investors, it is important to be aware of these differences between the current value of currencies and their true fundamental value. If the domestic central bank stops intervening in the foreign exchange market, there will be a sudden drop in the exchange rate, potentially causing severe losses to investors and real disruptions.

To my best knowledge, I am the first to study deviations from the law of one price of ADRs around FOMC meetings and relate them to the exchange rate regime of the country from where the underlying stock of the ADR originates. I contribute to the existing literature in two ways. First, I introduce a new ADR-based methodology that allows identifying the impact of US monetary surprises on the fundamental values of currencies with managed exchange rate regimes. Second, I test the predictions of currency crises models of interest rate defence by applying this methodology to currencies pegged to the U.S. dollar and study how US monetary policy shocks affect the stability of these

[44] There might be several reasons for that. According to first-generation currency crises models, the domestic central bank is forced to stop its intervention when foreign exchange reserves are depleted. According to second-generation currency crises models, the domestic policy maker will voluntarily decide to abandon a peg regime (and thus stop the intervention in the foreign exchange market), if the costs of maintaining the peg regime outweigh the benefits.

peg regimes, conditional on the current state of the domestic economy. The pricing of ADRs around FOMC meetings offers a unique setting that allows identifying how investors assess the probability that domestic policy makers opt to abandon the currency peg regime in response to the exogenous shock.

I identify increases in the expected peg breakdown probability by negative abnormal ADR returns following positive US monetary surprises. By interacting with macro fundamentals that proxy the three dimensions of costs associated with raising the domestic policy rate following Lahiri and Végh (2007) (i.e. current real GDP growth, the fiscal balance, the current state of the banking system), I identify how investors assess the domestic policy makers' willingness to raise the domestic policy rate. Higher costs of raising the domestic policy rate result in a higher reluctance to maintain the peg regime and thus lead to a higher expected peg breakdown probability.

The empirical approach used in this paper provides a valuable tool to policy makers and investors that are eager to monitor assessments of currency peg stability, the government's willingness to defend the peg regime and the risk of speculative attacks against the domestic currency in real-time. In addition, employing daily data of ADRs allows for a clean identification of the impact of US monetary shocks on managed exchange rate regimes (as compared to existing approaches using macro variables at lower frequency, e.g., Maćkowiak, 2007). One alternative way to identify currency risk could be to use prices of currency options and futures. However, as Nedeljkovic and Saborowski (2019) document, these are also affected by the intervention of the domestic central bank and therefore do not provide unbiased measures of currency risk. In contrast, prices of ADRs are not manipulated by the domestic central bank and can therefore serve as an unbiased measure of currency risk.[45]

[45] Eichler (2011) shows that price discounts of Chinese cross-listed stocks are better able to forecast the yuan/U.S. dollar exchange rate than forward exchange rates, especially at longer horizons.

My paper adds to a large body of literature that studies the effects of US monetary policy shocks on equity markets in the US (e.g., Thorbecke, 1997; Ehrmann and Fratzscher, 2004; Bernanke and Kuttner, 2005; Lucca and Moench, 2015) and their global transmission (e.g., Kim, 2001; Ehrmann and Fratzscher, 2009; Hausman and Wongswan, 2011; Dedola et al., 2017; Han and Wei, 2018; Buch et al., 2019). It also adds to a strand of literature that analyzes deviations from the law of one price of ADRs and their underlying stocks during episodes of financial crises (e.g., Melvin, 2003; Kadiyala and Kadiyala, 2004; Levy Yeyati et al., 2004; Auguste et al., 2006; Arquette et al., 2008; Pasquariello, 2008; Eichler et al., 2009; Levy Yeyati et al., 2009).

My sample includes daily data of 249 level II and level III ADRs from 31 countries over the period from 1996 to 2016, covering 168 FOMC meetings (2,866 observations by country and meeting in total). I find robust evidence that the impact of US monetary surprises on abnormal ADR returns differs significantly depending on the exchange rate regime of the country from where the underlying stock originates. US monetary surprises significantly negatively affect abnormal ADR returns for countries with managed currencies, whereas there is no significant effect for countries with freely floating currencies. A one standard deviation increase in US monetary surprises reduces abnormal ADR returns for countries with managed exchange rates by 12.5 to 13.3 basis points (equivalent to 0.13 to 0.14 standard deviations).[46] These results are robust to the inclusion of various control variables to account for potential sources of deviations from the law of one price other than the exchange rate channel[47] and a variety of robustness checks.

[46] When judging the economic significance of this effect, it must be kept in mind that as long as arbitrage possibilities exist, abnormal ADR returns should not be significantly different from zero. However, it is not the focus of this paper to make a statement about whether profitable arbitrage possibilities exist in the ADR market around FOMC meetings. The economic significance of US monetary surprises is higher than for other control variables included in the analysis, except for the return of the local market.

[47] I control for limits to arbitrage (following Gagnon and Karolyi, 2010) as well as financial (dis-)integration (following Pasquariello, 2008). Furthermore, I include additional control variables that are specific to the domestic economy of the underlying and capture how the unexpected change in the FED Funds Rate affects the economic conditions in the domestic economy. These include the U.S. dollar return of the domestic

Next, I test the predictions of standard currency crises models of interest rate defence with respect to the stability of currency peg regimes. I find that following positive US monetary surprises, abnormal ADR returns are significantly more negative for peg regimes with low current real GDP growth compared to past growth, fiscal deficits and negative returns of the domestic banking index since the previous FOMC meeting. These results indicate that investors perceive high costs of maintaining the currency peg regime by raising the domestic policy rate and thus expect a higher breakdown probability.

The chapter is organized as follows: Section 4.2 presents the methodology, introduces the two central hypotheses of this paper and describes the data. Section 4.3 investigates the impact of US monetary policy on managed exchange rates. Section 4.4 studies how US monetary surprises affect the stability of currency pegs. Section 4.5 concludes.

4.2 Methodology, hypotheses and data

4.2.1 Definition of abnormal ADR returns

American Depositary Receipts (ADRs) represent ownership of a fixed number of underlying shares and provide the same rights (such as dividend claims and voting rights). While ADRs are denominated in U.S. dollars and trade in the United States, their underlying shares are denominated in local currency and trade on the local stock market. Since ADRs and their underlying shares can be converted into each other, the law of one price implies that prices of both should be equal when expressed in the same currency and adjusted for a fixed conversion ratio (Gagnon and Karolyi, 2010):

stock index and changes in the domestic sovereign yield and the domestic money market interest rate (potentially capturing an immediate or expected response of the domestic central bank to the monetary surprise in the US). Finally, I include the return of the US market and the change in the VIX as global control variables.

$$P_{i,j,t}^{ADR,LOOP} = \frac{P_{i,j,t}^{UND} * \gamma_{i,j}}{S_{j,t}} \tag{4.1}$$

with $P_{i,j,t}^{ADR,LOOP}$ and $P_{i,j,t}^{UND}$ representing the prices of ADR i from country j and its corresponding underlying stock on day t, $\gamma_{i,j}$ is a fixed ADR-underlying pair-specific conversion parameter and $S_{j,t}$ is the current spot exchange rate of the respective country from where the underlying originates in local currency units per U.S. dollar. Accordingly, the return of the ADR should equal the U.S. dollar return of the respective underlying:

$$ret_{i,j,t}^{ADR,LOOP} = ret_{i,j,t}^{UND} - ret_{j,t}^{S} \tag{4.2}$$

Abnormal ADR returns represent deviations from the law of one price:

$$AR_{i,j,t}^{ADR} = ret_{i,j,t}^{ADR} - ret_{i,j,t}^{ADR,LOOP} = ret_{i,j,t}^{ADR} - (ret_{i,j,t}^{UND} - ret_{j,t}^{S}) \tag{4.3}$$

Abnormal ADR returns differ from zero if actual ADR returns do not match ADR returns predicted by the returns of the underlying stock and the spot exchange rate.[48] A priori, it is not clear how actual ADR returns deviate from predicted ADR returns around FOMC meetings. Existing literature documents the impact of US monetary surprises on stock prices and exchange rates (e.g., Thorbecke, 1997; Kim, 2001; Ehrmann and Fratzscher, 2004; Bernanke and Kuttner, 2005; Ehrmann and Fratzscher, 2009; Lucca and

[48] The focus of this paper is not to analyze whether profitable arbitrage possibilities around FOMC meetings exist in the ADR market. This question is difficult to answer empirically since it is unclear whether an ADR and its underlying stock can be traded in the exact same instance. In addition, I abstract from differences between bid and ask prices (although I will include the change in the bid-ask-spread of both the ADR and its underlying stock as control variables in the following analysis). Finally, price differences between predicted and actual ADR prices might not be large enough to cover the transaction cost of arbitrage transactions.

Moench, 2015; Mueller et al., 2017). In the following section, I will introduce the two central hypotheses of this paper.

4.2.2 Hypotheses

This paper studies the impact of US monetary surprises on abnormal ADR returns, conditional on the exchange rate regime of the country from where the underlying stock of the ADR originates. I hypothesize that there is a significant difference between countries with a managed exchange rate regime (characterized by some degree of intervention of the domestic central bank in the foreign exchange market) and countries with a freely floating exchange rate regime (characterized by the absence of intervention by the domestic central bank in the foreign exchange market).

There is common agreement that US monetary policy has an immediate effect on exchange rates (e.g., Hausman and Wongswan, 2011; Mueller et al., 2017). Following standard exchange rate models, (unexpected) US policy rate increases ceteris paribus lead to a lower fundamental value (defined as the exchange rate that would materialize if it was fully determined by market force and there was no intervention by the domestic central bank) of any currency relative to the U.S. dollar. However, the actual response of exchange rates to US monetary policy shocks depends on the exchange rate regime. For freely floating regimes, the return of the spot exchange rate – by definition – fully reflects the change in the fundamental value of the currency. However, for managed exchange rates, the return of the spot exchange rate might not fully reflect the change in the currency's fundamental value either due to an immediate intervention of the domestic central bank or market participants' expectation of future intervention. Hausman and Wongswan (2011) support this notion empirically by documenting that currencies with less flexible exchange rate regimes respond less to US monetary policy shocks.

The pricing of ADRs around FOMC meetings presents an ideal laboratory to identify the impact of US monetary policy on managed exchange rates. ADR investors do not only consider the current spot exchange rate, but also take into account their expectations of the future value of the exchange rate (e.g., Kadiyala and Kadiyala, 2004; Arquette et al., 2008; Eichler et al., 2009; Maltritz and Eichler, 2010; Eichler, 2011). A positive (negative) US monetary surprise decreases (increases) the true fundamental value of any currency relative to the U.S. dollar. If the return of the current spot exchange rate does not fully reflect this change in the fundamental value of the currency due to the intervention of the domestic central bank, the new fundamental value will be below (above) the current spot exchange rate. However, the domestic central bank might eventually either be forced to stop its intervention if its foreign reserves are depleted or it might voluntarily opt to switch its exchange rate regime to a more flexible one. Either way, abnormal ADR returns reflect the risk of a sudden convergence of the spot exchange rate to its fundamental value (Eichler and Roevekamp, 2018).

In the case of a positive (negative) US monetary surprise, we should therefore observe negative (positive) abnormal returns for ADRs from countries with managed exchange rate regimes. For freely floating exchange rate regimes however, there is no reason for significant abnormal ADR returns due to this exchange rate channel since the return of the current spot exchange rate by definition fully reflects the change in the fundamental value of the currency (due to the absence of intervention by the domestic central bank).[49] Therefore, ADRs from countries with freely floating exchange rate

[49] The literature has provided empirical evidence of various reasons for deviations from the law of one price of ADRs beyond changes in the (expected) fundamental value of the underlying currency. These include the (dis-)integration of the domestic economy from the world economy (Pasquariello, 2008), capital control circumvention premia (e.g., Melvin, 2003; Auguste et al., 2006) as well as limits to arbitrage (Gagnon and Karolyi, 2010). As I will point out in more detail in the following section, I control for these other sources of deviations from the law of one price.

regimes are included as a placebo test and the first central hypothesis of this paper is as follows:

(H1): *Abnormal returns of ADRs from countries with managed exchange rates respond negatively to US monetary surprises. There are no significant effects for ADRs from countries with floating exchange rates.*

In the extreme case of a currency pegged to the U.S. dollar, there is no change in the current spot exchange rate due to an unexpected FOMC policy rate change as long as the peg regime holds. However, US monetary surprises might affect how investors assess the stability of a currency peg regime. To sustain a currency peg regime to the U.S. dollar, the domestic central bank must mimic policy rate changes by the FED. As predicted by standard currency crises models of interest rate defence, domestic policy makers will opt to abandon a currency peg regime if the economic costs of increasing the domestic policy rate outweigh the benefits of maintaining the currency peg regime. This will be the case if, following a positive US monetary surprise, domestic policy makers perceive high costs of increasing the domestic policy rate (e.g., Bensaid and Jeanne, 1997; Flood and Jeanne, 2005; Lahiri and Végh, 2007). Lahiri and Végh (2007) consider three different dimensions of costs of increasing the domestic policy rate to defend a currency peg: fiscal cost, output cost and a further deterioration of an already weak banking system. Consequently, domestic policy makers might be especially reluctant to mimic US policy rate increases if the country currently runs a fiscal deficit, current real GDP growth is low and the domestic banking system is in a weak state. If investors perceive a high reluctance of domestic policy makers to raise the domestic policy rate, they will expect a higher breakdown probability of the currency peg, which will be reflected in negative abnormal ADR returns. ADR investors have a strong incentive to monitor the breakdown probability of currency peg regimes since once the domestic policy makers opt to abandon the currency peg regime, the resulting sudden depreciation of the domestic currency would lead to severe losses to ADR investors (e.g. Eichler et al., 2009). Therefore, the second central hypothesis of this paper is as follows:

(H2): *Abnormal returns of ADRs from countries with currencies pegged to the U.S. dollar respond negatively to positive US monetary surprises around FOMC meetings if the costs of mimicking the policy rate increase by the FED are high, i.e. current real GDP growth is low, the country runs a fiscal deficit or the domestic banking system is in a weak state.*

H2 hypothesizes a negative impact of positive US monetary surprises on abnormal ADR returns of countries with currencies pegged to the U.S. dollar, conditional on the current state of the economy. Positive US monetary surprises should not lead to significant negative abnormal ADR returns for countries with currencies pegged to the U.S. dollar if their economy currently is in a good state (i.e. characterized by fiscal surpluses, high real GDP growth and a solid state of the domestic banking system). For these countries, investors would not expect domestic policy makers to be reluctant to mimic the US policy rate increase.

4.2.3 Data description

To study the impact of policy rate decisions by the FOMC on abnormal ADR returns as precisely as possible, I calculate daily returns based on intraday data from Thomson Reuters Tick History. I consider the last values prior to 3 p.m. UTC as prices for the respective day.[50] FOMC statements on meeting days are published at approximately 2:15 p.m. ET.

[50] I chose this time because most of the stock markets of the 31 countries in my sample operate in regular mode. Also, Gau and Wu (2017) show that price discovery in foreign exchange markets on days with US announcements is dominant during overlapping trading hours of London and New York.

Following Kuttner (2001), I derive US monetary surprises (i.e., unexpected changes in the FED Funds Rate) from FED Funds Futures that are settled at 4 p.m. CST.[51] Therefore, prices of FED Funds Futures already incorporate the monetary surprise of a FOMC meeting on the respective day, whereas this is not the case for the prices of ADRs and their underlying stocks. Therefore, I match abnormal ADR returns between day $t+1$ (incorporating the FOMC decision) and day t (not incorporating the FOMC decision) to monetary surprises on day t.

I identify potential pairs of ADRs and underlying stocks using information from the ADR databases of JP Morgan and the Bank of New York Mellon, as well as from Thomson Reuters DATASTREAM. Following Gagnon and Karolyi (2010), I exclude Level I ADRs as well as SEC Regulation S shares and private placements under SEC Rule 144a. This yields a sample of 249 level II and III ADRs from 31 countries over the period from 1996 - 2016 (covering 168 FOMC meetings).

4.3 The impact of US monetary surprises on managed exchange rates

4.3.1 Results

Before I test the impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime as outlined in H1, I begin by testing for an unconditional impact of US monetary surprises on abnormal ADR returns, regardless of the exchange rate regime of the underlying currency. Therefore, I estimate the following panel regression:

[51] The payoff of FED Funds Futures is defined as 100$ minus the average effective overnight FED Funds Rate of the respective period of the future contract. Therefore, the futures rate f_t (defined as 100$ minus the price of the respective futures contract) summarizes market participants' expectations on day t about the FED Funds Rate for the rest of the period. Monetary surprises on day t are derived as suggested by eq. (7) in Kuttner (2001): $monetary\, surprise_t = \frac{m}{m-t}(f_{s,t}^{0} - f_{s,t-1}^{0})$, where daily changes in futures rates derived from FED Fund Futures that mature at the end of the month are corrected for the number of remaining days in the respective month $m-t$.

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \sum_{l=2}^{L} \beta_l X_{l,j,t} + \mu_{j,a} + \varepsilon_{j,t} \quad (4.4)$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs from country j for FOMC meeting t[52] and $monetary\ surprise_t$ corresponds to the US monetary surprise of the respective FOMC meeting (calculated using the methodology proposed by Kuttner, 2001). $\sum_{l=2}^{L} X_{l,t}$ represents a large set of control variables, $\mu_{j,a}$ a country x year fixed effect and $\varepsilon_{j,t}$ the error term. Robust standard errors are clustered at the country level (spec. (1) to (4)) or by FOMC meeting (spec. (5)).[53] Table 4.1 summarizes the results of these panel regressions for different specifications including various control variables. The unconditional impact of US monetary surprises (irrespective of the exchange rate regime) on abnormal ADR returns around FOMC meetings is insignificant.

[52] This approach is chosen to avoid potential bias resulting from the different number of ADRs by country in my sample. In the case of the ADR-underlying pair specific variables controlling for limits to arbitrage, I also consider the means of the measures over all ADRs from the respective country and FOMC meeting. For the eurozone, the means of all ADRs from EMU member countries for the respective FOMC meeting are used as aggregate measures. However, treating EMU member countries as individual observations does not significantly alter the results of this paper.

[53] Petersen (2009) shows that inferences in finance panel data sets might depend strongly on whether standard errors are clustered at the cross-sectional or the time dimension. Therefore, I ensure that the results presented in this paper are robust to using standard errors clustered at the country level and by FOMC meeting.

Table 4.1: The unconditional impact of US monetary surprises on abnormal ADR returns around FOMC meetings

	(1)	(2)	(3)	(4)	(5)
Monetary surprise	-1.537	-1.554*	-1.348	-1.349	-1.349
	(1.022)	(0.834)	(0.830)	(0.825)	(0.976)
Return US market		0.216***	0.167***	0.165***	0.165***
		(0.057)	(0.048)	(0.048)	(0.032)
Return local market		-0.173***	-0.176***	-0.173***	-0.173***
		(0.041)	(0.041)	(0.039)	(0.018)
Δ VIX			-0.000**	-0.000**	-0.000**
			(0.000)	(0.000)	(0.000)
Δ CAPM beta			0.002	0.001	0.001
			(0.003)	(0.003)	(0.002)
Δ Sovereign yield			-0.200	-0.195	-0.195
			(0.164)	(0.168)	(0.162)
Δ Interest rate MM			0.001	0.000	0.000
			(0.021)	(0.021)	(0.020)
Δ Bid-ask ADR				0.003	0.003**
				(0.002)	(0.001)
Δ Bid-ask UND				0.021	0.021
				(0.044)	(0.038)
Δ Idiosyncratic risk				0.178	0.178
				(0.347)	(0.264)
Constant	-0.000	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	2,866	2,866	2,866	2,866	2,866
No. of countries	31	31	31	31	31
R^2	0.19	0.26	0.26	0.26	0.26
Country x Year FEs	YES	YES	YES	YES	YES
SEs clustered by	Country	Country	Country	Country	Meeting

Notes: This table reports the panel estimation results of the regression model outlined in eq. (4.4):

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \sum_{l=2}^{L} \beta_l X_{l,j,t} + \mu_{j,a} + \varepsilon_{j,t}$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs of the respective country for the respective FOMC meeting and $monetary\ surprise_t$ corresponds to the monetary surprise of the respective FOMC meeting (following Kuttner, 2001). $\sum_{l=2}^{L} X_{l,t}$ represents a broad set of control variables, $\mu_{j,a}$ a country x year fixed effect and $\varepsilon_{j,t}$ the error term. Control variables include the returns of the US and the local market as well as first differences in VIX, the country-specific CAPM betas, sovereign yields, money market interest rates, bid-ask spreads of the ADR and its underlying as well as ADR-underlying pair specific idiosyncratic risk. Robust standard errors clustered at the country level (spec. (1) to (4)) and clustered by FOMC meeting (spec. (5)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Next, I study the impact of US monetary surprises on abnormal ADR returns around FOMC meetings conditional on the exchange rate regime of the currency underlying the ADR. Analyzing abnormal ADR returns around FOMC meetings can help identify the impact of US monetary policy on investors' assessment of the true fundamental value of currencies, which might not be fully reflected in the current spot exchange rate of managed currencies. Using an interaction model, I distinguish ADRs by the exchange rate regime of their home country. Therefore, I estimate the following panel regression:

$$
\begin{aligned}
AR_{j,t}^{ADR} = \; & \beta_1 monetary\ surprise_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} \\
& + \beta_4 falling_{j,t} + \beta_5 monetary\ surprise_t\ x\ managed_{j,t} \\
& + \beta_6 monetary\ surprise_t\ x\ peg_{j,t} \\
& + \beta_7 monetary\ surprise_t\ x\ falling_{j,t} + \textstyle\sum_{l=1}^{L} \beta_{8,l} X_{l,j,t} \\
& + \textstyle\sum_{l=1}^{L} (\beta_{9,l} X_{l,j,t}\ x\ managed_{j,t}) + \textstyle\sum_{l=1}^{L} (\beta_{10,l} X_{l,j,t}\ x\ peg_{j,t}) \\
& + \textstyle\sum_{l=1}^{L} (\beta_{11,l} X_{l,j,t}\ x\ falling_{j,t}) + \mu_{j,a} + \varepsilon_{j,t}
\end{aligned}
\tag{4.5}
$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs from country j for FOMC meeting t and $monetary\ surprise_t$ corresponds to the US monetary surprise of the respective FOMC meeting (calculated using the methodology proposed by Kuttner, 2001). I distinguish the different exchange rate regimes based on the Ilzetzki et al. (2019) monthly coarse classification of de facto exchange rate regimes. $managed_{j,t}$ is a dummy variable equal to one if the country's exchange rate regimes is classified as "3" in the Ilzetzki et al. (2019) de facto exchange rate classification and the anchor currency is the U.S. dollar, and zero otherwise.[54] $peg_{j,t}$ is a dummy variable equal to one if the country's exchange rate regimes is classified as "1" or "2" in the Ilzetzki et

[54] The Ilzetzki et al. (2019) coarse classification="3" comprises the following items: "Pre announced crawling band that is wider than or equal to +/-2%"; "De facto crawling band that is narrower than or equal to +/-5%"; "Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)" and "Managed floating". 31.51% of the observations are classified as managed regimes with the U.S. dollar as anchor currency. Norway, Sweden (2008/09 – 2016/12), Switzerland (2001/05 – 2011/08 and 2015/02 –2016/12), Turkey (2000/08 – 2001/01) and the United Kingdom (1996/03 – 2008/12) are also classified as "3" in the Ilzetzki et al. (2019) coarse classification for some years, but have the DEM/EUR as their anchor currency. Therefore, for my analysis, I include them into the base category of currencies that are freely floating against the U.S. dollar. However, this decision does not significantly change the results in this section.

al. (2019) de facto exchange rate classification and the anchor currency is the U.S. dollar, and zero otherwise.[55,56] $falling_{j,t}$ is a dummy variable equal to one if the country's exchange rate regimes is classified as "5" in the Ilzetzki et al. (2019) de facto exchange rate classification, and zero otherwise.[57] After including dummy variables for managed regimes, peg regimes and freely falling regimes, freely floating exchange rate regimes (characterized by the absence of intervention of the domestic central bank) represent the base category for the analysis in this section. Therefore, the coefficient of the interaction between $monetary\ surprise_t$ and $managed_{j,t}$ (β_5) measures how the impact of US monetary surprises for managed regimes differs from the impact for freely floating regimes. The marginal effect of US monetary surprises for managed regimes calculates as the sum of the unconditional effect (β_1) and the interaction effect (β_5). The significance of both, the interaction term as well as the marginal effect, will be assessed in the following. Table A4.1 in the appendix of this chapter provides an overview of the currencies in my sample and their exchange rate regime definition. $\sum_{l=1}^{L} X_{l,j,t}$represents a large set of control variables, $\mu_{j,a}$ is a country x year fixed effect and $\varepsilon_{j,t}$ is the error term. Interactions of $monetary\ surprise_t$ and all control variables with the dummy

[55] The Ilzetzki et al. (2019) coarse classification="1" or "2" comprises the following items: "No separate legal tender"; "Pre announced peg or currency board arrangement"; "Pre announced horizontal band that is narrower than or equal to +/-2%"; "De facto peg"; "Pre announced crawling peg"; "Pre announced crawling band that is narrower than or equal to +/-2%"; "De factor crawling peg" and "De facto crawling band that is narrower than or equal to +/-2%". 19.85% of the observations are classified as peg regimes with the U.S. dollar as anchor currency. Denmark, Ireland (from 1996/01 to 1998/12), Italy (from 1996/03 to 1998/12), Sweden (from 2006/09 to 2008/08) and Switzerland (from 2011/09 to 2015/01) are also classified as "1" or "2" for some years in the Ilzetzki et al. (2019) coarse classification, but these currencies have the DEM/EUR as their anchor currency. Therefore, for my analysis, I include them into the base category of currencies that are freely floating against the U.S. dollar. However, this decision does not significantly change the results in this section.

[56] I obtain results similar to those in this section if I use one aggregate category for managed exchange rates (if the Ilzetzki et al. (2019) classification is equal to 1,2 or 3) and test this against freely floating exchange rates as the base category (controlling for freely falling episodes).

[57] This is a residual category for currencies that are "freely falling", i.e. where i) year-on-year inflation exceeds 40% for 12 consecutive months or ii) currencies that depreciate by at least 25% month on month and the rate of depreciation is at least 10% higher than in the previous month. The six months following are also classified as "freely falling episodes". 1.71% of the observations in my sample are classified as "freely falling" episodes.

variables describing the different exchange rate regimes are additionally included to allow for a heterogeneous impact of US monetary surprises and the control variables on abnormal ADR returns between different exchange rate regimes. Again, robust standard errors clustered at the country level (spec. (1) to spec. (4)) and by FOMC meeting (spec. (5)) are reported.

I include various control variables to account for potential sources of deviations from the law of one price other than the exchange rate channel hypothesized in section 4.2.2. The first set of control variables is specific to the ADR-underlying pair. Deviations from the law of one price might emerge if arbitrage possibilities are limited. Therefore, I follow Gagnon and Karolyi (2010) and include the change of the bid-ask-spread of both the ADR and its underlying stock as well as the change in ADR-specific idiosyncratic risk[58] to control for changes in limits to arbitrage around FOMC meetings.

I further include control variables that capture how the economic conditions in the home country of the underlying stock change around the respective FOMC meeting. These include the U.S. dollar return of the domestic stock index, changes in the domestic sovereign yield and the domestic money market interest rate (potentially capturing an immediate or expected response of the domestic central bank to the policy rate change in the US). In addition, I follow Pasquariello (2008) and include the change in the domestic CAPM β with respect to the US market, capturing potential (dis-)integration of the domestic economy from the US economy.[59] Finally, I include the return of the US market and the change in the VIX as global control variables. If there were other reasons for

[58] Following Gagnon and Karolyi (2010), ADR-specific idiosyncratic risk is calculated as the standard deviation of the residuals from regressing the difference between U.S. dollar returns of the ADR and its underlying stock on contemporaneous and one day lagged and leading values of the US stock market, the respective domestic stock market and the change in the EUR/USD exchange rate using a rolling window of 30 trading days, see eq. (1) in Gagnon and Karolyi (2010).
[59] Computed as the daily change in the CAPM beta of the U.S. dollar returns of the local stock index of the respective country with respect to the US market, estimated using a rolling regressions framework of 30 trading days.

deviations from the law of one price of ADRs around FOMC meetings beyond the ones that I control for, they would only affect my results if they significantly interacted with the exchange rate regime.

Table A4.2 in the appendix of this chapter gives an overview over the variables and their sources and Table A4.3 provides descriptive statistics. Figure A4.1 in the appendix presents a histogram of US monetary surprises around FOMC meetings. Table 4.2 summarizes the results from estimating equation (4.5). Table 4.3 and Table 4.4 report the corresponding marginal effects of $monetary\ surprise_t$ for each exchange rate regime separately.

The interaction between $monetary\ surprise_t$ and $managed_{j,t}$ and the resulting marginal effects of US monetary surprises for managed regimes are significantly negative at least at the 5% level throughout a variety of different specifications. Both results are robust to the inclusion of the additional control variables described above and to clustering standard errors by FOMC meeting instead of country. These results are in line with H1, suggesting a strong negative impact of US monetary surprises on abnormal ADR returns for countries with managed exchange rates, whereas there is no significant impact for countries with freely floating exchange rates. Also for peg regimes, the effect of US monetary surprises is insignificant on average. However, I will study them more closely in the second part of my analysis.[60] Positive (negative) US monetary surprises decrease (increase) the fundamental value of managed exchange rates below (above) the current spot exchange rate which does not fully reflect the new fundamental value due to the intervention of the domestic central bank. After controlling for other potential sources of deviations from the law of one price, these findings indicate that ADR returns reflect the

[60] Also for the observations classified as "freely falling", there is no significant impact of US monetary surprises when including the full set of control variables. In the remainder of this paper, results of this category, which only represent a small number of specific crisis episodes (1.71%), will not be discussed in detail.

risk that the actual spot exchange rate will converge to the fundamental value of the exchange rate if the domestic central bank ceases its intervention in the foreign exchange market. The relation for managed regimes is also economically significant, i.e. a one standard deviation increase in $monetary\ surprise_t$ decreases abnormal ADR returns by about 12.5 - 13.3 basis points (equivalent to 0.13 - 0.14 standard deviations). Table 4.5 shows that for managed regimes, the economic significance of $monetary\ surprise_t$ exceeds that of the other variables (expressed in standard deviations of abnormal ADR returns for one standard deviation of the respective variable) except for the return of the local market.

Table 4.2: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime

	(1)	(2)	(3)	(4)	(5)
Monetary surprise	0.287	0.090	0.279	0.295	0.295
	(0.712)	(0.654)	(0.676)	(0.693)	(0.709)
Managed regime	0.002	0.002	0.001	0.001	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)
Peg regime	0.002	0.001	-0.000	0.001	0.001
	(0.007)	(0.006)	(0.008)	(0.008)	(0.007)
Freely falling regime	0.006	0.007	0.007	0.008	0.008
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Monetary surprise x managed regime	-4.588**	-4.670**	-4.734**	-4.781**	-4.781***
	(1.920)	(2.008)	(1.975)	(1.909)	(1.484)
Monetary surprise x peg regime	-4.723	-2.516	-1.847	-1.634	-1.634
	(2.893)	(2.415)	(2.305)	(2.306)	(1.963)
Monetary surprise x freely falling regime	18.360***	10.827*	10.070*	6.927	6.927
	(4.242)	(5.803)	(5.496)	(7.327)	(5.602)
Return US market		0.156**	0.137**	0.137**	0.137***
		(0.071)	(0.065)	(0.066)	(0.041)
Return local market		-0.119*	-0.120*	-0.117*	-0.117***
		(0.061)	(0.062)	(0.062)	(0.020)
Δ VIX			-0.000	-0.000	-0.000
			(0.000)	(0.000)	(0.000)
Δ CAPM beta			0.005	0.005	0.005*
			(0.005)	(0.005)	(0.002)
Δ Sovereign yield			-0.554	-0.534	-0.534
			(0.340)	(0.322)	(0.374)
Δ Interest rate MM			0.001	-0.010	-0.010
			(0.048)	(0.053)	(0.073)
Δ Bid-ask ADR				-0.001	-0.001
				(0.003)	(0.003)
Δ Bid-ask UND				-0.061	-0.061
				(0.061)	(0.051)
Δ Idiosyncratic risk				0.481	0.481
				(0.377)	(0.440)
Constant	-0.001	-0.001	-0.001	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Observations	2,866	2,866	2,866	2,866	2,866
No. of countries	31	31	31	31	31
R^2	0.20	0.28	0.29	0.30	0.30
Country x Year FEs	YES	YES	YES	YES	YES
SEs clustered by	Country	Country	Country	Country	Meeting

Notes: This table reports the panel estimation results of the regression model outlined in eq. (4.5):

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} + \beta_4 falling_{j,t} + \beta_5 monetary\ surprise_t\ x\ managed_{j,t} + \beta_6 monetary\ surprise_t\ x\ peg_{j,t} + \beta_7 monetary\ surprise_t\ x\ falling_{j,t} + \sum_{l=1}^{L} \beta_{8,l} X_{l,j,t} + \sum_{l=1}^{L} (\beta_{9,l} X_{l,j,t}\ x\ managed_{j,t}) + \sum_{l=1}^{L} (\beta_{10,l} X_{l,j,t}\ x\ peg_{j,t}) + \sum_{l=1}^{L} (\beta_{11,l} X_{l,j,t}\ x\ falling_{j,t}) + \mu_{j,a} + \varepsilon_{j,t}$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs of the respective country for the respective FOMC meeting and $monetary\ surprise_t$ corresponds to the monetary surprise of the respective FOMC meeting (following Kuttner, 2001). $managed_{j,t}$, $peg_{j,t}$ and $falling_{j,t}$ are dummy variables describing the respective exchange rate regimes according to the Ilzetzki et al. (2019) classification as described in section 4.3.1. $\sum_{l=1}^{L} X_{l,t}$ represents a broad set of control variables, $\mu_{j,a}$ a country x year fixed effect and $\varepsilon_{j,t}$ the error term. Control variables include the returns of the US and the local market as well as first differences in VIX, the country-specific CAPM betas, sovereign yields, money market interest rates, bid-ask spreads of the ADR and its underlying as well as ADR-underlying pair specific idiosyncratic risk. Please note that for limitations with respect to space, this table only reports the unconditional effects as well as interactions with $monetary\ surprise_t$. The coefficients of the interactions with the other control variables are available upon request. Robust standard errors clustered at the country level (spec. (1) to (4)) and clustered by FOMC meeting (spec. (5)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 4.3: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects by exchange rate regime based on specification (1) – (3)

	(1)				(2)				(3)			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-4.302**	-4.436	0.287	18.646***	-4.580**	-2.426	0.090	10.917*	-4.455**	-1.568	0.279	10.349*
	(1.828)	(2.803)	(0.712)	(4.220)	(1.873)	(2.313)	(0.654)	(5.748)	(1.815)	(2.187)	(0.676)	(5.435)
Return US market					0.125*	0.396***	0.156**	0.168**	0.079	0.273**	0.137**	0.202
					(0.071)	(0.130)	(0.071)	(0.070)	(0.086)	(0.112)	(0.065)	(0.160)
Return local market					-0.162***	-0.195*	-0.119*	-0.269**	-0.170***	-0.198*	-0.120*	-0.266**
					(0.034)	(0.108)	(0.061)	(0.129)	(0.034)	(0.102)	(0.062)	(0.119)
Δ VIX									-0.000	-0.001***	-0.000	0.000
									(0.000)	(0.000)	(0.000)	(0.002)
Δ CAPM beta									-0.001	0.002	0.005	-0.003
									(0.002)	(0.003)	(0.005)	(0.028)
Δ Sovereign yield									-0.516	-0.250	-0.554	0.311
									(0.411)	(0.248)	(0.340)	(0.872)
Δ Interest rate MM									-0.005	-0.001	0.001	-0.018
									(0.024)	(0.022)	(0.048)	(0.167)
Δ Bid-ask ADR												
Δ Bid-ask UND												
Δ Idiosyncratic risk												
Observations	2,866				2,866				2,866			
No. of countries	31				31				31			
R^2	0.20				0.28				0.29			
Country x Year FEs	YES				YES				YES			
SEs clustered by	Country				Country				Country			
Observations	2,866				2,866				2,866			

Notes: This table reports the marginal effects by exchange rate regime based on specifications (1) to (3) of the interaction model presented in Table 4.2. Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 4.4: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects by exchange rate regime based on specification (4) – (5)

	(4)				(5)			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-4.485**	-1.339	0.295	7.222	-4.485***	-1.339	0.295	7.222
	(1.746)	(2.181)	(0.693)	(7.296)	(1.316)	(2.297)	(0.709)	(5.530)
Return US market	0.078	0.275**	0.137**	0.136	0.078	0.275***	0.137***	0.136
	(0.088)	(0.110)	(0.066)	(0.233)	(0.054)	(0.073)	(0.041)	(0.186)
Return local market	-0.171***	-0.190*	-0.117*	-0.228**	-0.171***	-0.190***	-0.117***	-0.228**
	(0.036)	(0.098)	(0.062)	(0.093)	(0.026)	(0.038)	(0.020)	(0.099)
Δ VIX	-0.000	-0.001***	-0.000	0.001	-0.000	-0.001***	-0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Δ CAPM beta	-0.001	0.002	0.005	0.001	-0.001	0.002	0.005*	0.001
	(0.002)	(0.003)	(0.005)	(0.022)	(0.002)	(0.005)	(0.002)	(0.018)
Δ Sovereign yield	-0.496	-0.224	-0.534*	0.460	-0.496	-0.224	-0.534	0.460
	(0.410)	(0.271)	(0.322)	(0.954)	(0.303)	(0.189)	(0.374)	(0.768)
Δ Interest rate MM	-0.004	-0.002	-0.010	0.028	-0.004	-0.002	-0.010	0.028
	(0.021)	(0.022)	(0.053)	(0.110)	(0.037)	(0.024)	(0.073)	(0.110)
Δ Bid-ask ADR	0.000	0.013***	-0.001	0.003***	0.000	0.013***	-0.001	0.003**
	(0.002)	(0.002)	(0.003)	(0.001)	(0.000)	(0.004)	(0.003)	(0.001)
Δ Bid-ask UND	0.067	-0.031	-0.061	0.082**	0.067	-0.031	-0.061	0.082
	(0.075)	(0.070)	(0.061)	(0.040)	(0.075)	(0.068)	(0.051)	(0.083)
Δ Idiosyncratic risk	0.811*	-0.292	0.481	-3.248***	0.811*	-0.292	0.481	-3.248
	(0.428)	(0.686)	(0.377)	(0.704)	(0.489)	(0.413)	(0.440)	(2.458)
Observations	2,866				2,866			
No. of countries	31				31			
R^2	0.30				0.31			
Country x Year FEs	YES				YES			
SEs clustered by	Country				Meeting			
Observations	2,866				2,866			

Notes: This table reports the marginal effects by exchange rate regime based on specifications (4) and (5) of the interaction model presented in Table 4.2. Robust standard errors clustered at the country level (spec. (4)) and clustered by FOMC meeting (spec. (5)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 4.5: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Standardized marginal effects by exchange rate regime based on specification (5)

	(5)			
	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-0.132***	-0.034	0.005	0.313
Return US market	0.106	0.273***	0.100***	0.213
Return local market	-0.325***	-0.232***	-0.204***	-0.487**
Δ VIX	0.000	-0.156***	0.000	0.231
Δ CAPM beta	-0.013	0.016	0.046*	0.013
Δ Sovereign yield	-0.052	-0.036	-0.088	0.037
Δ Interest rate MM	-0.002	-0.002	-0.01	0.014
Δ Bid-ask ADR	0.000	0.086***	-0.059	0.015**
Δ Bid-ask UND	0.075	-0.016	-0.043	0.050
Δ Idiosyncratic risk	0.078*	-0.030	0.034	-0.357
Observations	2,866			
No. of countries	31			

Notes: This table reports standardized marginal effects by exchange rate regime based on specification (5) of the interaction model presented in Table 4.2. **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

4.3.2 Robustness checks

In this section, I present a variety of tests to demonstrate the robustness of the results in the previous section. I begin by considering additional variables that might affect ADR pricing around FOMC meetings. I add four different variables as additional controls to equation (4.5). For each of these additional variables, I test for their unconditional effect on abnormal ADR returns as well as their interactions with $monetary\ surprise_t$ and the other control variables that were already included in equation (4.5).

As described in section 4.2.3, I use last prices available prior to 3 p.m. UTC to calculate daily returns of ADRs, their underlying stocks as well as the spot exchange rates against the U.S. dollar. While for most of the countries in my sample (European and Latin American countries) domestic stock markets operate in regular mode at that time, most Asian markets are already closed. I include the dummy variable $synchronous\ trading_j$ (equal to one if the country's stock market operates in regular mode at 3 p.m. UTC, zero otherwise) as the first additional variable into my model.

Next, I ensure that results hold regardless of differences in capital account openness between the countries in my sample. Although Miniane and Rogers (2007) and Dedola et al. (2017) document that countries with restrictions on capital flows are not insulated from US monetary policy shocks, I will use two different concept to account for a potential impact of capital account openness on my results. First, I use the Chinn and Ito (2006) index of de jure capital account openness. Second, I follow Lane and Milesi-Ferretti (2017) and use the sum of FDI and portfolio equity assets and liabilities relative to nominal GDP as a measure of de facto capital account openness. Low values of this Lane and Milesi-Ferretti (2017) ratio indicate low capital account openness and low financial integration. In two separate specifications, I account for capital account openness by including these two additional variables as well as their interactions with $monetary\ surprise_t$ and the other control variables from equation (4.5).

Third, I include log GDP per capita (in constant U.S. dollar) of the respective country as an additional variable to validate that my results are not affected by omitted macro variables such as the development status of the respective countries that might be correlated with the exchange rate regime.

Finally, I test whether differences in the level of liquidity between currencies drive my results. Some managed emerging market currencies might be characterized by a relatively low level of liquidity. The significant negative impact of US monetary surprises on abnormal ADR returns for managed regimes might result from the fact that actual returns of the spot exchange rate do not yet incorporate the effect of the US monetary surprise due to their low trading activity. To account for the heterogeneity in the level of liquidity between the different currencies in my sample, I include the bid-ask-spread of the spot exchange rate of the respective currency against the U.S. dollar as an additional control variable. Table 4.6 and Table 4.7 present the marginal effects of this interaction model, additionally controlling for synchronous trading, capital account openness (as identified by the Chinn and Ito, 2006, index in Table 4.6 and the Lane and Milesi-Ferretti, 2007, index in Table 4.7), real GDP per capita and liquidity in the spot exchange rate of the respective currency. Again, the marginal effects of US monetary surprises on abnormal ADR returns for managed regimes remain significantly negative at least at the 5% level.

I continue by discussing the role of US unconventional monetary policy and its potential impact on my results. The global financial crisis of 2007/2008 and the unconventional monetary policy measures implemented by the FED in its aftermath affect a significant fraction of the sample of this paper. Several recent papers study the global transmission of US unconventional monetary policy (e.g., Bauer and Neely, 2014; Bowman et al., 2015; Neely, 2015; Anaya et al., 2017).

One concern with the identification of the impact of US monetary policy on managed exchange rate regimes in this paper might be that the distribution of US monetary surprises during the zero lower bound (ZLB) period from December 2008 to December 2015 differs from the rest of the sample. In the empirical approach used for the analysis in this paper as described in equation (4.5), country x year fixed effects are included to control for the general conditions of the global economy as well as the state of the respective local economy. I thereby account for the possibility that financial crises (such as the Asian Crisis 1997/1998, the burst of the dotcom bubble 2000/2001 and the global financial crisis of 2007/2008) and other major macro events affect my results.

Table 4.6: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects of the robustness check controlling for synchronous trading, capital account openness following Chinn and Ito (2006), real GDP per capita and liquidity of the exchange rate

	(1)				**(2)**			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-4.472**	-0.085	-0.299	16.277**	-4.472***	-0.085	-0.299	16.277***
	(1.846)	(1.526)	(0.820)	(7.108)	(1.251)	(2.279)	(0.777)	(6.090)
Ret. US market	0.067	0.179**	0.126***	-0.025	0.067	0.179***	0.126***	-0.025
	(0.061)	(0.074)	(0.043)	(0.486)	(0.059)	(0.065)	(0.047)	(0.182)
Ret. local market	-0.139***	-0.137***	-0.122***	-0.158	-0.139***	-0.137***	-0.122***	-0.158
	(0.041)	(0.050)	(0.035)	(0.100)	(0.029)	(0.036)	(0.023)	(0.101)
Δ VIX	-0.001**	-0.001	-0.000	-0.001	-0.001*	-0.001***	-0.000	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Δ CAPM beta	-0.001	-0.005	0.003	0.028	-0.001	-0.005	0.003	0.028**
	(0.002)	(0.005)	(0.004)	(0.020)	(0.002)	(0.005)	(0.002)	(0.013)
Δ Sovereign yield	-0.387	-0.137	0.025	2.176***	-0.387	-0.137	0.025	2.176***
	(0.537)	(0.462)	(0.449)	(0.704)	(0.350)	(0.319)	(0.494)	(0.725)
Δ Interest rate MM	0.004	-0.097	0.044	0.198	0.004	-0.097	0.044	0.198
	(0.064)	(0.087)	(0.096)	(0.168)	(0.062)	(0.085)	(0.083)	(0.127)
Δ Bid-ask ADR	0.006***	0.242	-0.001	0.012**	0.006***	0.242	-0.001	0.012**
	(0.001)	(0.290)	(0.003)	(0.005)	(0.002)	(0.181)	(0.003)	(0.005)
Δ Bid-ask UND	0.000	-0.050	-0.046	-0.010	0.000	-0.050	-0.046	-0.010
	(0.082)	(0.090)	(0.039)	(0.093)	(0.082)	(0.091)	(0.063)	(0.102)
Δ Idiosyncratic risk	0.750	-0.138	0.474	-1.215	0.750	-0.138	0.474	-1.215
	(0.569)	(0.750)	(0.514)	(1.647)	(0.602)	(0.646)	(0.475)	(1.715)
Observations	2,838				2,838			
No. of countries	31				31			
R^2	0.36				0.36			
Country x Year FEs	YES				YES			
SEs clustered by	Country				Meeting			

Notes: This table reports the marginal effects of a robustness check of the regression model outlined in eq. (4.5) where additional variables as well as their interactions with $\text{monetary surprise}_t$ and the control variables are included as described in section 4.3.2:

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} + \beta_4 falling_{j,t} + \beta_5 monetary\ surprise_t\ x\ managed_{j,t} + \beta_6 monetary\ surprise_t\ x\ peg_{j,t} + \beta_7 monetary\ surprise_t\ x\ falling_{j,t} + \sum_{l=1}^{L}\beta_{8,l}X_{l,j,t} + \sum_{l=1}^{L}(\beta_{9,l}X_{l,j,t}\ x\ managed_{j,t}) + \sum_{l=1}^{L}(\beta_{10,l}X_{l,j,t}\ x\ peg_{j,t}) + \sum_{l=1}^{L}(\beta_{11,l}X_{l,j,t}\ x\ falling_{j,t}) + \sum_{n=1}^{N}\beta_{12,n}Y_{n,j,t} + \sum_{n=1}^{N}\beta_{13,n} monetary\ surprise_t\ x\ Y_{n,j,t} + \sum_{n=1}^{N}\sum_{l=1}^{L}(\beta_{14,n,l}Y_{n,j,t}\ x\ X_{l,j,t}) + \mu_{j,a} + \varepsilon_{j,t}$$

These additional variables include a synchronous trading dummy (equal to one if the domestic stock market operates in regular mode at 3 p.m. UTC, zero otherwise), capital account openness (as measured by the Chinn-Ito, 2006, index), log real GDP per capita and the bid-ask-spread of the exchange rate. Robust standard errors clustered at the country level (spec. (1)) and clustered by FOMC meeting (spec. (2)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 4.7: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects of the robustness check controlling for synchronous trading, capital account openness following Lane and Milesi-Ferretti (2017), real GDP per capita and liquidity of the exchange rate

	(1)				**(2)**			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-4.302***	1.257	-0.935	14.458*	-4.302***	1.257	-0.935	14.458**
	(1.489)	(1.467)	(0.778)	(7.768)	(1.285)	(2.882)	(0.786)	(5.817)
Ret. US market	0.076	0.125	0.170***	-0.199	0.076	0.125*	0.170***	-0.199
	(0.062)	(0.079)	(0.047)	(0.475)	(0.056)	(0.076)	(0.054)	(0.184)
Ret. local market	-0.137***	-0.086**	-0.145***	-0.102	-0.137***	-0.086**	-0.145***	-0.102
	(0.038)	(0.044)	(0.038)	(0.085)	(0.029)	(0.037)	(0.025)	(0.093)
Δ VIX	-0.000	-0.002***	0.000	-0.003	-0.000	-0.002***	0.000	-0.003
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.002)
Δ CAPM beta	-0.003	0.001	0.005	0.026	-0.003	0.001	0.005*	0.026**
	(0.002)	(0.004)	(0.005)	(0.016)	(0.002)	(0.005)	(0.003)	(0.011)
Δ Sovereign yield	-0.293	-0.354	-0.321	4.569*	-0.293	-0.354	-0.321	4.569***
	(0.562)	(0.496)	(0.434)	(2.578)	(0.344)	(0.327)	(0.501)	(1.511)
Δ Interest rate MM	0.066	-0.069	0.152*	0.464*	0.066	-0.069	0.152**	0.464***
	(0.074)	(0.092)	(0.086)	(0.274)	(0.080)	(0.087)	(0.076)	(0.168)
Δ Bid-ask ADR	-0.028*	0.706**	-0.061**	-0.031	-0.028***	0.706***	-0.061***	-0.031**
	(0.017)	(0.351)	(0.031)	(0.022)	(0.010)	(0.194)	(0.018)	(0.014)
Δ Bid-ask UND	0.001	-0.042	-0.102**	-0.257	0.001	-0.042	-0.102*	-0.257**
	(0.085)	(0.082)	(0.049)	(0.179)	(0.081)	(0.099)	(0.057)	(0.115)
Δ Idiosyncratic risk	0.821	-0.225	0.606	-2.270**	0.821	-0.225	0.606	-2.270
	(0.592)	(1.032)	(0.422)	(0.899)	(0.604)	(0.798)	(0.544)	(1.963)
Observations	2,667				2,667			
No. of countries	31				31			
R^2	0.38				0.38			
Country x Year FEs	YES				YES			
SEs clustered by	Country				Meeting			

Notes: This table reports the marginal effects of a robustness check of the regression model outlined in eq. (4.5) where additional variables as well as their interactions with $monetary\ surprise_t$ and the control variables are included as described in section 4.3.2:

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} + \beta_4 falling_{j,t} + \beta_5 monetary\ surprise_t\ x\ managed_{j,t} + \beta_6 monetary\ surprise_t\ x\ peg_{j,t} + \beta_7 monetary\ surprise_t\ x\ falling_{j,t} + \sum_{l=1}^{L} \beta_{8,l} X_{l,j,t} + \sum_{l=1}^{L} (\beta_{9,l} X_{l,j,t}\ x\ managed_{j,t}) + \sum_{l=1}^{L} (\beta_{10,l} X_{l,j,t}\ x\ peg_{j,t}) + \sum_{l=1}^{L} (\beta_{11,l} X_{l,j,t}\ x\ falling_{j,t}) + \sum_{n=1}^{N} \beta_{12,n} Y_{n,j,t} + \sum_{n=1}^{N} \beta_{13,n} monetary\ surprise_t\ x\ Y_{n,j,t} + \sum_{n=1}^{N} \sum_{l=1}^{L} (\beta_{14,n,l} Y_{n,j,t}\ x\ X_{l,j,t}) + \mu_{j,a} + \varepsilon_{j,t}$$

These additional variables include a synchronous trading dummy (equal to one if the domestic stock market operates in regular mode at 3 p.m. UTC, zero otherwise), capital account openness (as measured by Lane and Milesi-Ferretti, 2017, index), log real GDP per capita and the bid-ask-spread of the exchange rate. Robust standard errors clustered at the country level (spec. (1)) and clustered by FOMC meeting (spec. (2)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Gürkaynak et al. (2007) suggest using the first difference in the one-month Eurodollar deposit rate as an alternative to identify US monetary surprises. Using this measure, I also identify a significant negative impact of daily changes in the Eurodollar rate on abnormal ADR returns for managed exchange rate regimes, whereas there is no significant effect for freely floating exchange rates. Table 4.8 shows the marginal effects of the interaction model using changes in the Eurodollar rate.

In addition, I ensure that the significant negative impact of US monetary surprises on abnormal ADR returns for countries with managed exchange rates also holds if all observations from the ZLB period are excluded. Table 4.9 displays the corresponding marginal effects of this interaction model.

As additional robustness checks, I ensure that my results are not driven by outliers. First, I re-estimate specification (5) from equation (4.5), dropping single countries or meetings one at a time. Second, I exclude all observations below the 1^{st} and above the 99^{th} percentiles of abnormal ADR returns. In all these cases, the results remain significant.

Table 4.8: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects of the robustness check using changes in the one-month Eurodollar deposit rate following Gürkaynak et al. (2007)

	(1)				(2)			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Δ Eurodollar	-1.248**	0.394	-0.221	-1.911	-1.248**	0.394	-0.221	-1.911
	(0.590)	(1.886)	(0.344)	(4.252)	(0.501)	(0.996)	(0.227)	(5.563)
Ret. US market	0.093	0.270**	0.142**	0.074	0.093*	0.270***	0.142***	0.074
	(0.088)	(0.122)	(0.067)	(0.170)	(0.052)	(0.075)	(0.041)	(0.172)
Ret. local market	-0.178***	-0.185*	-0.120**	-0.257**	-0.178***	-0.185***	-0.120***	-0.257***
	(0.034)	(0.108)	(0.061)	(0.100)	(0.027)	(0.043)	(0.020)	(0.098)
Δ VIX	-0.000	-0.001***	-0.000	0.001	-0.000	-0.001***	-0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Δ CAPM beta	-0.001	0.002	0.004	-0.002	-0.001	0.002	0.004*	-0.002
	(0.002)	(0.003)	(0.005)	(0.024)	(0.002)	(0.005)	(0.003)	(0.019)
Δ Sovereign yield	-0.424	-0.240	-0.442	0.647	-0.424	-0.240	-0.442	0.647
	(0.370)	(0.265)	(0.284)	(0.760)	(0.305)	(0.191)	(0.379)	(0.764)
Δ Interest rate MM	-0.003	-0.001	-0.021	0.053	-0.003	-0.001	-0.021	0.053
	(0.021)	(0.022)	(0.052)	(0.101)	(0.038)	(0.024)	(0.066)	(0.113)
Δ Bid-ask ADR	-0.000	0.014***	-0.001	0.004***	-0.000	0.014***	-0.001	0.004***
	(0.003)	(0.002)	(0.003)	(0.001)	(0.000)	(0.003)	(0.003)	(0.001)
Δ Bid-ask UND	0.069	-0.027	-0.059	0.097**	0.069	-0.027	-0.059	0.097
	(0.076)	(0.072)	(0.058)	(0.043)	(0.075)	(0.070)	(0.051)	(0.092)
Δ Idiosyncratic risk	0.968**	-0.280	0.476	-3.597***	0.968**	-0.280	0.476	-3.597
	(0.464)	(0.679)	(0.389)	(0.900)	(0.494)	(0.413)	(0.439)	(2.618)
Observations	2,825				2,825			
No. of countries	31				31			
R^2	0.30				0.30			
Country x Year FEs	YES				YES			
SEs clustered by	Country				Meeting			

Notes: This table reports the marginal effects of a robustness check of the regression model outlined in eq. (4.5) where instead of the US monetary surprise based on FED Funds Futures following Kuttner (2001), the Δ in the one-month Eurodollar deposit rate (following Gürkaynak et al., 2007) is used:

$$AR_{j,t}^{ADR} = \beta_1 \Delta Eurodollar_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} + \beta_4 falling_{j,t} + \beta_5 \Delta Eurodollar_t \ x \ managed_{j,t} + \beta_6 \Delta Eurodollar_t x \ peg_{j,t} + \beta_7 \Delta Eurodollar_t \ x \ falling_{j,t} + \sum_{l=1}^{L} \beta_{8,l} X_{l,j,t} + \sum_{l=1}^{L} (\beta_{9,l} X_{l,j,t} \ x \ managed_{j,t}) + \sum_{l=1}^{L} (\beta_{10,l} X_{l,j,t} \ x \ peg_{j,t}) + \sum_{l=1}^{L} (\beta_{11,l} X_{l,j,t} \ x \ falling_{j,t}) + \sum_{n=1}^{N} \beta_{12,n} Y_{n,j,t} + \sum_{n=1}^{N} \beta_{13,n} \Delta Eurodollar_t \ x \ Y_{n,j,t} + \sum_{n=1}^{N} \sum_{l=1}^{L} (\beta_{14,n,l} Y_{n,j,t} \ x \ X_{l,j,t}) + \mu_{j,a} + \varepsilon_{j,t}$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs of the respective country for the respective FOMC meeting and $\Delta Eurodollar_t$ corresponds to the monetary surprise of the respective FOMC meeting as identified by the Δ in the one-month Eurodollar deposit rate (following Gürkaynak et al., 2007). $managed_{j,t}$, $peg_{j,t}$ and $falling_{j,t}$ are dummy variables describing the respective exchange rate regimes according to the Ilzetzki et al. (2019) classification as described in section 4.3.1. $\sum_{l=1}^{L} X_{l,t}$ represents a broad set of control variables, $\mu_{j,a}$ a country x year fixed effect and $\varepsilon_{j,t}$ the error term. Control variables include the returns of the US and the local market as well as first differences in VIX, the country-specific CAPM betas, sovereign yields, money market interest rates, bid-ask spreads of the ADR and its underlying as well as ADR-underlying pair specific idiosyncratic risk. Robust standard errors clustered at the country level (spec. (1)) and clustered by FOMC meeting (spec. (2)) are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table 4.9: The impact of US monetary surprises on abnormal ADR returns conditional on the exchange rate regime: Marginal effects of the robustness check without observations from the zero lower bound period (December 2008 – December 2015)

	(1)				**(2)**			
	Managed	Peg	Freely floating	Freely falling	Managed	Peg	Freely floating	Freely falling
Monetary surprise	-5.553***	-1.358	0.013	5.828	-5.553***	-1.358	0.013	5.828
	(2.005)	(1.979)	(0.782)	(6.911)	(1.436)	(2.109)	(0.669)	(6.247)
Ret. US market	-0.124	0.218***	0.181***	0.137	-0.124*	0.218**	0.181***	0.137
	(0.113)	(0.068)	(0.055)	(0.190)	(0.073)	(0.098)	(0.046)	(0.197)
Ret. local market	-0.172***	-0.205***	-0.138**	-0.244***	-0.172***	-0.205***	-0.138***	-0.244**
	(0.055)	(0.071)	(0.057)	(0.083)	(0.042)	(0.050)	(0.026)	(0.103)
Δ VIX	-0.001*	-0.001**	0.000	0.002	-0.001*	-0.001*	0.000	0.002
	(0.001)	(0.001)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.002)
Δ CAPM beta	-0.003	0.002	0.006	-0.009	-0.003	0.002	0.006*	-0.009
	(0.003)	(0.006)	(0.007)	(0.023)	(0.002)	(0.005)	(0.004)	(0.021)
Δ Sovereign yield	-0.436	0.098	-0.781*	0.167	-0.436	0.098	-0.781	0.167
	(0.542)	(0.354)	(0.432)	(1.008)	(0.427)	(0.251)	(0.531)	(0.753)
Δ Interest rate MM	-0.009	0.002	-0.027	-0.018	-0.009	0.002	-0.027	-0.018
	(0.057)	(0.021)	(0.033)	(0.102)	(0.043)	(0.021)	(0.070)	(0.109)
Δ Bid-ask ADR	0.000	0.012***	-0.001	0.004***	0.000	0.012***	-0.001	0.004***
	(0.002)	(0.002)	(0.003)	(0.001)	(0.000)	(0.004)	(0.002)	(0.001)
Δ Bid-ask UND	0.036	-0.036	-0.091	0.081***	0.036	-0.036	-0.091	0.081
	(0.070)	(0.077)	(0.064)	(0.031)	(0.077)	(0.080)	(0.065)	(0.086)
Δ Idiosyncratic risk	0.782	0.032	0.516	-2.430***	0.782	0.032	0.516	-2.430
	(0.718)	(0.900)	(0.530)	(0.757)	(0.606)	(0.492)	(0.530)	(2.737)
Observations	1,700				1,700			
No. of countries	31				31			
R²	0.33				0.33			
Country x Year FEs	YES				YES			
SEs clustered by	Country				Meeting			

Notes: This table reports the marginal effects of a robustness check of the regression model outlined in eq. (4.5) where all observations from the zero lower bound period (from December 2008 to December 2015) are excluded:

$$AR_{j,t}^{ADR} = \beta_1 monetary\ surprise_t + \beta_2 managed_{j,t} + \beta_3 peg_{j,t} + \beta_4 falling_{j,t} + \beta_5 monetary\ surprise_t\ x\ managed_{j,t} + \beta_6 monetary\ surprise_t\ x\ peg_{j,t} + \beta_7 monetary\ surprise_t\ x\ falling_{j,t} + \sum_{l=1}^{L} \beta_{8,l} X_{l,j,t} + \sum_{l=1}^{L} (\beta_{9,l} X_{l,j,t}\ x\ managed_{j,t}) + \sum_{l=1}^{L} (\beta_{10,l} X_{l,j,t}\ x\ peg_{j,t}) + \sum_{l=1}^{L} (\beta_{11,l} X_{l,j,t}\ x\ falling_{j,t}) + \sum_{n=1}^{N} \beta_{12,n} Y_{n,j,t} + \sum_{n=1}^{N} \beta_{13,n} monetary\ surprise_t\ x\ Y_{n,j,t} + \sum_{n=1}^{N} \sum_{l=1}^{L} (\beta_{14,n,l} Y_{n,j,t}\ x\ X_{l,j,t}) + \mu_{j,a} + \varepsilon_{j,t}$$

where $AR_{j,t}^{ADR}$ represents the mean of abnormal returns over all ADRs of the respective country for the respective FOMC meeting and $monetary\ surprise_t$ corresponds to the monetary surprise of the respective FOMC meeting (following Kuttner, 2001). $managed_{j,t}$, $peg_{j,t}$ and $falling_{j,t}$ are dummy variables describing the respective exchange rate regimes according to the Ilzetzki et al. (2019) classification as described in section 4.3.1. $\sum_{l=1}^{L} X_{l,t}$ represents a broad set of control variables, $\mu_{j,a}$ a country x year fixed effect and $\varepsilon_{j,t}$ the error term. Control variables include the returns of the US and the local market as well as first differences in VIX, the country-specific CAPM betas, sovereign yields, money market interest rates, bid-ask spreads of the ADR and its underlying as well as ADR-underlying pair specific idiosyncratic risk Robust standard errors clustered at the country level (spec. (1)) and clustered by FOMC meeting (spec. (2)) are reported in parentheses.
*, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

4.4 US monetary policy and currency peg stability

4.4.1 Results

Positive US monetary surprises might lead to a higher expected probability that a currency peg regime to the U.S. dollar breaks down. As predicted by standard currency crises models of interest rate defence (e.g., Bensaid and Jeanne, 1997; Flood and Jeanne, 2005; Lahiri and Végh, 2007), domestic policy makers will opt to abandon a currency peg regime if the economic costs of mimicking a policy rate increase in the US outweigh the benefits of maintaining the peg regime. Increasing the domestic policy rate is costly if current real GDP growth is low, the country runs a fiscal deficit and the domestic banking system is in a weak state (Lahiri and Végh, 2007).

The previous section documented a significant negative impact of US monetary surprises on abnormal ADR returns for managed exchange rate regimes. For peg regimes, the impact of US monetary surprises unconditional of the current state of the domestic economy was insignificant. Now, I focus on the effect of positive US monetary surprises on currency peg regimes, conditional on the current state of the domestic economy, to identify how investors assess the domestic government's willingness to defend the currency peg regime by raising the domestic policy rate. As before, I use the continuous measure of US monetary surprises derived from Fed Funds Futures (following Kuttner, 2001). However, I now distinguish between positive and negative US monetary surprises by defining the following two continuous variables:

$$pos\ MS_t = \begin{cases} monetary\ surprise_t & if\ monetary\ surprise_t \geq 0 \\ 0 & otherwise \end{cases} \tag{4.6}$$

$$neg\ MS_t = \begin{cases} 0 & if\ monetary\ surprise_t \geq 0 \\ monetary\ surprise_t & otherwise \end{cases} \tag{4.7}$$

According to H2, positive US monetary surprises might have a significant negative impact on abnormal ADR returns from countries with currencies pegged to the U.S. dollar if investors perceive that domestic policy makers will be reluctant to mimic unexpected US policy rate increases because they associate high economic costs with raising the domestic policy rate. There are two differences between the panel regression model that I estimate in this section and the one from the previous section: First, I now distinguish between positive and negative US monetary surprises. Second, I additionally interact with macro variables that proxy the three dimensions of costs associated with increasing the domestic policy rate suggested by Lahiri and Végh (2007): current real GDP growth, the fiscal balance and the current state of the domestic banking system:

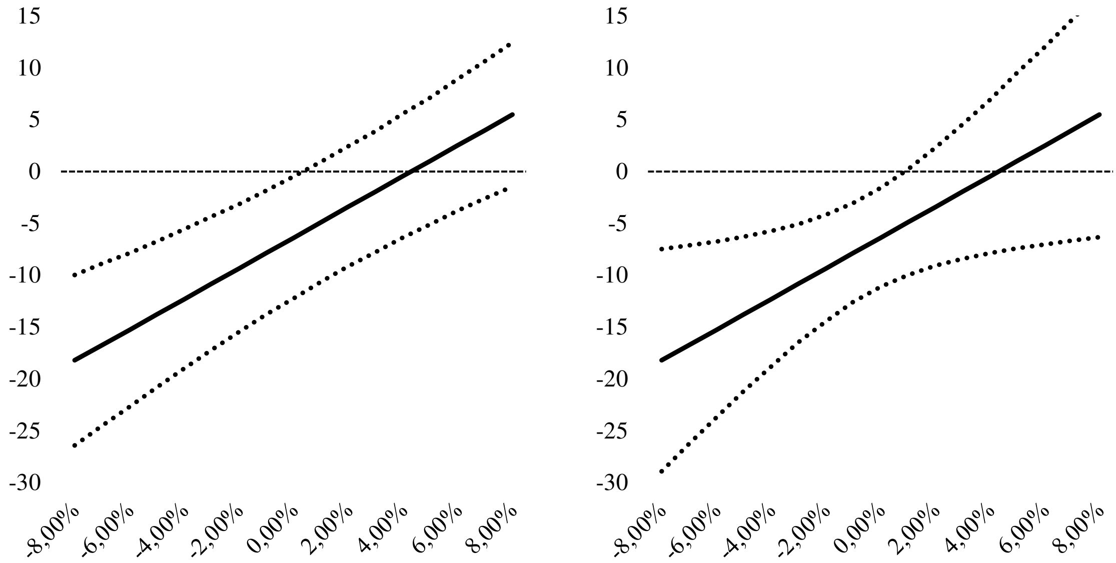
$$
\begin{aligned}
AR_{j,t}^{ADR} = \quad & \beta_1 pos\ MS_t + \beta_2 neg\ MS_t + \beta_3 managed_{j,t} + \beta_4 peg_{j,t} \qquad (4.8) \\
& + \beta_5 falling_{j,t} + \beta_6 macro_{j,t} + \beta_7 macro_{j,t}\ x\ managed_{j,t} \\
& + \beta_8 macro_{j,t}\ x\ peg_{j,t} + \beta_9 macro_{j,t}\ x\ falling_{j,t} \\
& + \beta_{10} pos\ MS_t\ x\ managed_{j,t} + \beta_{11} pos\ MS_t\ x\ peg_{j,t} \\
& + \beta_{12} pos\ MS_t\ x\ falling_{j,t} + \beta_{13} pos\ MS_t\ x\ macro_{j,t} \\
& + \beta_{14} pos\ MS_t\ x\ macro_{j,t}\ x\ managed_{j,t} \\
& + \beta_{15} pos\ MS_t\ x\ macro_{j,t}\ x\ peg_{j,t} \\
& + \beta_{16} pos\ MS_t\ x\ macro_{j,t}\ x\ falling_{j,t} + \beta_{17} neg\ MS_t\ x\ managed_{j,t} \\
& + \beta_{18} neg\ MS_t\ x\ peg_{j,t} + \beta_{19} neg\ MS_t\ x\ falling_{j,t} \\
& + \beta_{20} neg\ MS_t\ x\ macro_{j,t} \\
& + \beta_{21} neg\ MS_t\ x\ macro_{j,t}\ x\ managed_{j,t} \\
& + \beta_{22} neg\ MS_t\ x\ macro_{j,t}\ x\ peg_{j,t} \\
& + \beta_{23} neg\ MS_t\ x\ macro_{j,t}\ x\ falling_{j,t} + \textstyle\sum_{l=1}^{L} \beta_{24,l} X_{l,j,t} \\
& + \textstyle\sum_{l=1}^{L} \beta_{25,l} X_{l,j,t}\ x\ managed_{j,t} + \sum_{l=1}^{L} \beta_{26,l} X_{l,j,t}\ x\ peg_{j,t} \\
& + \textstyle\sum_{l=1}^{L} \beta_{27,l} X_{l,j,t}\ x\ falling_{j,t} + \sum_{l=1}^{L} \beta_{28,l} X_{l,j,t}\ x\ macro_{j,t} \\
& + \textstyle\sum_{l=1}^{L} \beta_{29,l} X_{l,j,t}\ x\ macro_{j,t}\ x\ managed_{j,t} \\
& + \textstyle\sum_{l=1}^{L} \beta_{30,l} X_{l,j,t}\ x\ macro_{j,t}\ x\ peg_{j,t} \\
& + \textstyle\sum_{l=1}^{L} \beta_{31,l} X_{l,j,t}\ x\ macro_{j,t}\ x\ falling_{j,t} + \gamma_j + \mu_a + \varepsilon_{j,t}
\end{aligned}
$$

where $AR_{j,t}^{ADR}$ represents the average abnormal return of all ADRs from country j for FOMC meeting t and $pos\ MS_t$ ($neg\ MS_t$) denotes positive (negative) continuous US monetary surprises as defined above. $managed_{j,t}$, $peg_{j,t}$ and $falling_{j,t}$ are the same dummy variables based on the Ilzetzki et al. (2019) monthly coarse de facto exchange rate regime classification as used in equation (4.5), $macro_{j,t}$ is a continuous variable proxying one of the three cost dimensions of raising the domestic policy rate following Lahiri and Végh (2007). At first, I will test each of the three cost dimensions (output costs, fiscal costs, deterioration of the domestic banking system) in a separate specification. In the next section, I will present a robustness check where I include all three macro variables simultaneously. $\sum_{l=1}^{L} X_{l,j,t}$ represents the same set of control variables as used in equation (4.5), γ_j is a country fixed effect, μ_a a year fixed effect and $\varepsilon_{j,t}$ the error term.

In the following, I test H2 by assessing the marginal effects of positive US monetary surprises on abnormal ADRs from countries with currencies pegged to the U.S. dollar over the 5^{th} to 95^{th} percentiles of the macro fundamental variable tested in the respective specification. Figure 4.1 to Figure 4.3 illustrate the marginal effects of positive and negative US monetary surprises and their 90% confidence intervals. Diagrams in the left column display confidence intervals based on standard errors clustered at the country level, whereas diagrams in the right column display confidence intervals based on standard errors clustered by FOMC meeting. Table A4.4 in the appendix of this chapter provides descriptive statistics over the respective macro fundamentals for the countries with currencies pegged to the U.S. dollar in my sample.

Lahiri and Végh (2007) name output cost as one of three cost dimensions associated with raising the domestic policy rate to defend a currency peg. Increasing the domestic policy rate leads to a credit crunch and to an output contraction. Therefore, policy makers from countries that experience relatively low real GDP growth might be reluctant to increase the domestic policy rate since this would further deter economic growth. To account for country-specific growth dynamics, I define relative GDP growth as current real GDP growth minus average real GDP growth in the respective country over the past ten years. Figure 4.1 illustrates the marginal effects and 90% confidence intervals of positive US monetary surprises on abnormal ADR returns of countries with currencies pegged to the U.S. dollar over the 5th to 95th percentile of relative GDP growth.

Figure 4.1: Marginal effects of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of relative GDP growth



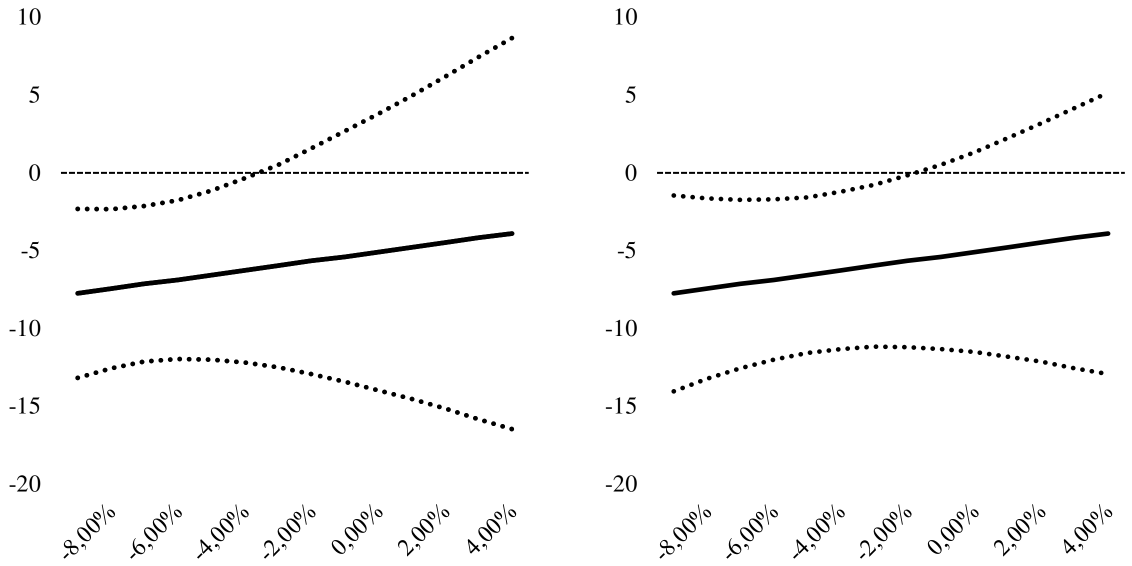
Notes: Marginal effects and 90% confidence intervals of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of relative GDP growth obtained by estimating the panel regression model outlined in eq. (4.6) robust standard errors clustered at the country level (left diagram) or by FOMC meeting (right diagram). GDP growth is defined as the respective country's current real GDP growth minus the country's average real GDP growth over the past ten years.

If relative GDP growth is equal to or below zero, i.e. current real GDP growth is equal or lower compared to the country's average over the past ten years, positive US monetary surprises significantly reduce abnormal ADR returns from countries with currencies pegged to the U.S. dollar as hypothesized by H2. Effects are stronger (i.e. the impact is more negative), the lower current relative to past real GDP growth. These results indicate that investors will perceive domestic policy makers to be reluctant to mimic unexpected US policy rate increases if current economic growth is relatively low. Since raising the domestic policy rate would further deter economic growth, negative abnormal ADR returns reflect an increase in the expected peg breakdown probability for these countries.

Results are also economically significant. For a country that currently experiences a strong recession, i.e. where current real GDP growth is 8% below average real GDP growth over the past ten years, a one standard deviation increase in positive US monetary surprises reduces abnormal ADR returns by 0.36% (about 0.35 standard deviations). On the other hand, if current real GDP growth exceeds past growth, there are no significant effects of US monetary surprises. Thus, investors do not perceive domestic policy makers to be reluctant to mimic US policy rate increases if current real GDP growth is relatively high.

Fiscal cost represent the second cost dimension associated with increasing the domestic policy rate to defend a currency peg suggested by Lahiri and Végh (2007). If the government currently runs a fiscal deficit, raising the domestic policy rate will be costly since it will increase the government's borrowing cost and thus further deteriorate its financial situation (e.g. Lahiri and Végh, 2003; Flood and Jeanne, 2005; Lahiri and Végh, 2007). I proxy fiscal cost by the fiscal balance relative to GDP. Consequently, positive US monetary surprises should have a significant negative impact on abnormal ADR returns of countries with currencies pegged to the U.S. dollar if these countries run fiscal deficits. Figure 4.2 illustrates the marginal effects of positive US monetary surprises on abnormal ADR returns of countries with currencies pegged to the U.S. dollar over the 5^{th} to 95^{th} percentile of the fiscal balance relative to GDP.

Figure 4.2: Marginal effects of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of the fiscal balance



Notes: Marginal effects and 90% confidence intervals of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of the fiscal balance obtained by estimating the panel regression model outlined eq. (4.6) using robust standard errors clustered at the country level (left diagram) or by FOMC meeting (right diagram).

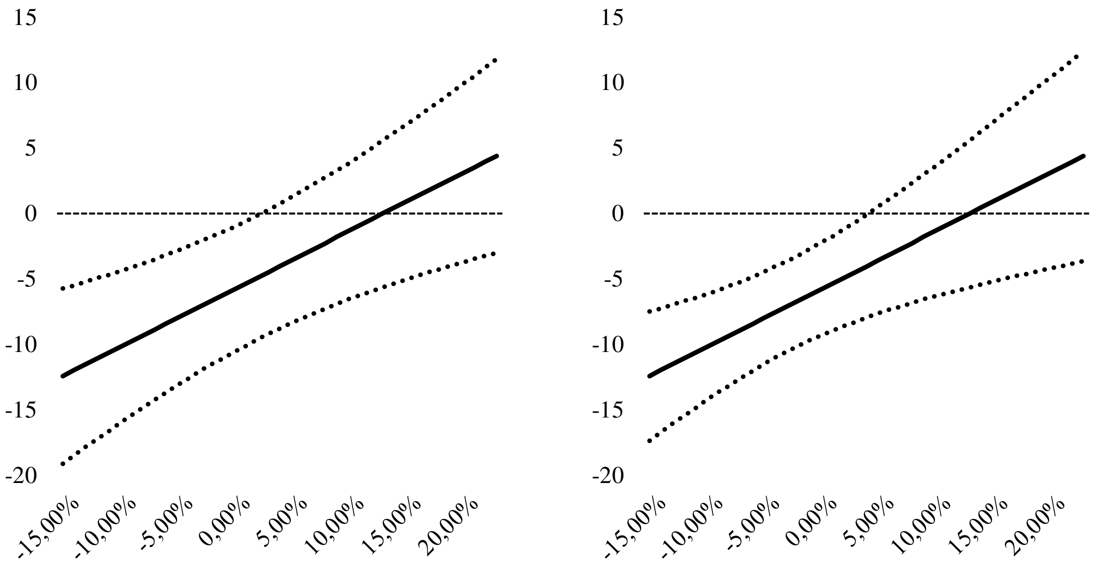
Results of this second interaction model are also in line with H2. Unanticipated increases in the US policy rate significantly reduce abnormal ADR returns from countries with governments that currently run fiscal deficits equal to or larger than 4% (2%) of GDP.[61,62] For countries that manage to generate fiscal surpluses or that face only minor deficits there are no significant effects.

Finally, I study the impact of US monetary surprises on the stability of currency peg regimes to the U.S. dollar, conditional on the soundness of the domestic banking system. Policy makers take the health of the domestic banking system into consideration when deciding on policy rate changes (e.g., Eichler et al., 2018). Raising the domestic policy rate will be costly if it induces a further deterioration of an already weak banking system (Lahiri and Végh, 2007). Therefore, domestic policy makers will be reluctant to

[61] In this case, the exact threshold depends on the clustering of standard errors.
[62] First-generation currency crises models provide an alternative explanation for this finding. According to these models, the fiscal balance serves as a proxy for the overall stability of the peg regime. Persistent deficits of the domestic government are inconsistent with a peg regime if the domestic central bank refinances the fiscal deficit.

increase the domestic policy rate if the current state of the domestic banking system is already fragile. I proxy banking sector stability by the return of the respective country's banking index since the previous FOMC meeting. Figure 4.3 illustrates the results of this interaction model.

Figure 4.3: Marginal effects of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of the return of the domestic banking index since the previous FOMC meeting



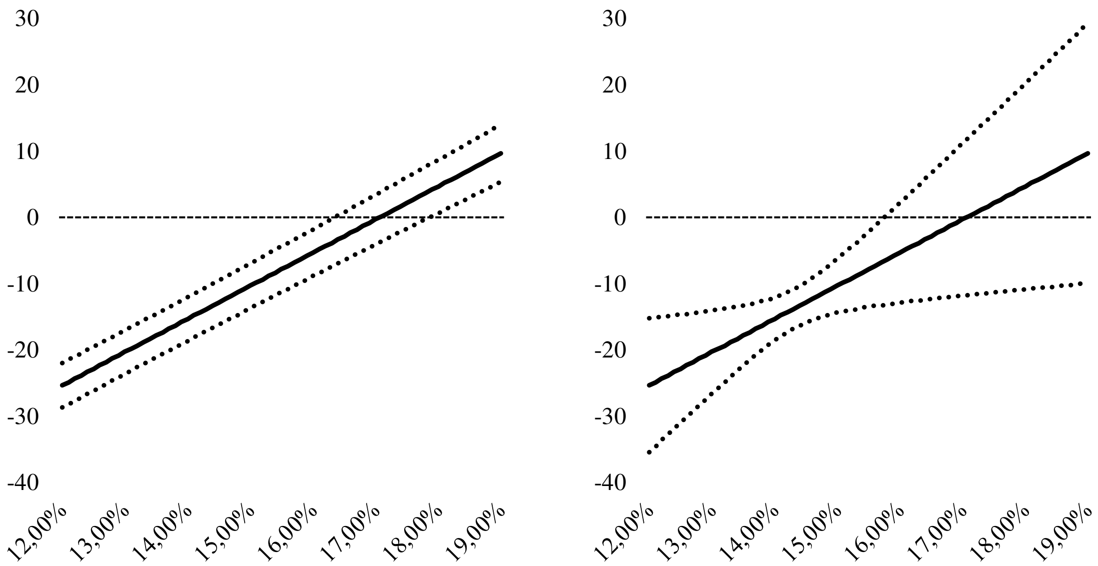
Notes: Marginal effects and 90% confidence intervals of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of the return of the domestic banking index since the previous FOMC meeting obtained by estimating the panel regression model outlined in eq. (4.6) robust standard errors clustered at the country level (left diagram) or by FOMC meeting (right diagram).

The more fragile the current state of the domestic banking sector (i.e. the lower the domestic banking index's returns since the previous FOMC meeting), the more negative the impact of positive US monetary surprises on abnormal ADR returns for peg regimes. This result indicates that investors will perceive domestic policy makers to be reluctant to mimic US policy rate increases if the domestic banking system already is in a weak state. On the other hand, investors do not anticipate domestic policy makers to be reluctant to raise the domestic policy rate if the domestic banking system is in a sound state (characterized by relatively high returns of the domestic banking index).

4.4.2 Robustness checks

In this section, I present a couple of checks to demonstrate the robustness of the results regarding the impact of US monetary policy on the stability of currency pegs. I start by using capital adequacy, defined as the ratio of capital to risk-weighted assets, as an alternative concept to proxy the soundness of the domestic banking system. Figure 4.4 illustrates the marginal effects of US monetary surprises of an alternative interaction model where I include the ratio of capital to risk-weighted assets instead of the return of the domestic banking index since the previous FOMC meeting.

Figure 4.4: Marginal effects of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of capital to risk-weighted assets in the domestic banking sector



Notes: Marginal effects and 90% confidence intervals of positive US monetary surprises for peg regimes to the U.S. dollar over the 5th to 95th percentiles of capital to risk-weighted assets in the domestic banking sector obtained by estimating the panel regression model outlined in eq. (4.6) using robust standard errors clustered at the country level (left diagram) or by FOMC meeting (right diagram).

The results regarding the impact of US monetary surprises on currency peg stability conditional on the soundness of the domestic banking system are robust to using this alternative measure. The impact of positive US monetary surprises is stronger for countries with a weaker current state of their domestic banking system (characterized by a lower capital adequacy ratio). Effects are insignificant for countries with a wellcapitalized banking system (with a ratio of capital to risk-weighted assets equal to or above 15.8%).

As additional robustness check, I include binary variables to distinguish high costs of raising the domestic policy rate (countries with below-average real GDP growth, fiscal deficits and negative returns of the domestic banking index since the last FOMC meeting) instead of the continuous variables used so far. For each of the three cost dimensions, I construct a dummy variable equal to one if the respective variable is above zero, zero otherwise. Table 4.10 summarizes the marginal effects of US monetary surprises and the additional control variables for currencies pegged to the U.S. dollar for high vs. low costs of raising the domestic policy rate for the three dimensions of costs suggested by Lahiri and Végh (2007).

The results from this interaction model using binary macro variables are in line with the results of the interaction model using continuous macro variables presented above. Positive US monetary surprises significantly reduce abnormal ADR returns if relative GDP growth is negative, i.e. current real GDP growth is below the country's average over the past ten years, the country runs a fiscal deficit and the return of the domestic banking index since the previous FOMC meeting is negative. At the same time, there is no significant impact of positive US monetary surprises if investors perceive low costs of mimicking the US policy rate increases (if the three macro variables are positive). Table A4.5 in the appendix of this chapter shows that these results also hold using standard errors clustered by FOMC meeting instead of at the country level.

Table 4.10: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-10.943***	-2.939	-8.396*	-2.067	-10.166***	-2.774
	(3.559)	(3.858)	(4.632)	(5.544)	(3.893)	(4.418)
Neg. MS	3.126	4.344*	2.798	1.931	7.396***	1.842
	(3.584)	(2.523)	(2.628)	(3.786)	(2.275)	(2.768)
Return US market	0.302***	0.206***	0.188*	0.494***	0.283***	0.249**
	(0.111)	(0.075)	(0.104)	(0.141)	(0.081)	(0.112)
Return local market	-0.206**	-0.211**	-0.161**	-0.330***	-0.219*	-0.141*
	(0.083)	(0.089)	(0.069)	(0.127)	(0.112)	(0.074)
Δ VIX	-0.001***	-0.002***	-0.002***	-0.000	-0.001*	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Δ CAPM beta	-0.001	0.012**	0.004	0.006	0.009*	-0.002
	(0.004)	(0.006)	(0.003)	(0.005)	(0.005)	(0.005)
Δ Sovereign yield	-0.848	0.152	-0.154	0.028	0.066	-0.408
	(1.148)	(0.166)	(0.974)	(0.121)	(0.147)	(0.788)
Δ Interest rate MM	0.010	0.027	-0.022	0.433***	-0.013	-0.014
	(0.048)	(0.052)	(0.034)	(0.073)	(0.016)	(0.149)
Δ Bid-ask ADR	0.016***	0.683***	0.018***	0.033	0.016***	0.876***
	(0.002)	(0.230)	(0.002)	(0.106)	(0.003)	(0.253)
Δ Bid-ask UND	-0.012	0.036	-0.075	0.288***	-0.082	0.068
	(0.101)	(0.098)	(0.087)	(0.100)	(0.099)	(0.077)
Δ Idiosyncratic risk	0.042	-0.362	-0.162	0.417	-0.323	0.016
	(0.545)	(1.075)	(0.637)	(0.656)	(0.609)	(1.025)
Observations	2,866		2,853		2,866	
No. of countries	31		31		31	
R^2	0.19		0.19		0.20	
Country FEs	YES		YES		YES	
Year FEs	YES		YES		YES	
SE clustered by	Country		Country		Country	

Notes: This table reports the marginal effects of a regression model similar to that outlined in eq. (4.6), with the only difference that instead of the continuous macro variables used in the baseline specification I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise. Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

For these binary interaction models, I also ensure that the results are robust to accounting for differences in capital openness. Similar to the robustness checks presented in section 4.3.2, I use the Chinn and Ito (2006) index of de jure capital account openness and the Lane and Milesi-Ferretti (2017) index of de facto capital account openness. In three different specifications, I drop observations with a score of zero in the Chinn-Ito (2006) index of de jure capital account openness[63] (Table A4.6 in the appendix of this chapter), additionally control for the Chinn-Ito (2006) index (Table A4.7 in the appendix) and additionally control for the Lane and Milesi-Ferretti (2017) index (Table A4.8 in the appendix). In all three cases, the results remain robust.

Finally, I use the following alternative specification where I include all three binary macro variables (relative GDP growth, the fiscal balance and the return of the domestic banking index) simultaneously:

[63] This affects Chile between 1996 – 1998 and Argentina 2012 – 2015.

$$
\begin{aligned}
AR_{j,t}^{ADR} = \; & \beta_1 pos\ MS_t + \beta_2 neg\ MS_t + \beta_3 managed_{j,t} + \beta_4 peg_{j,t} \\
& + \beta_5 falling_{j,t} + \beta_6 pos\ MS_t\ x\ managed_{j,t} + \beta_7 pos\ MS_t\ x\ peg_{j,t} \\
& + \beta_8 pos\ MS_t\ x\ falling_{j,t} + \beta_9 neg\ MS_t\ x\ managed_{j,t} \\
& + \beta_{10} neg\ MS_t\ x\ peg_{j,t} + \beta_{11} neg\ MS_t\ x\ falling_{j,t} \\
& + \textstyle\sum_{l=1}^{3} (\beta_{12,l} macro_{l,j,t} + \beta_{13,l} macro_{l,j,t}\ x\ managed_{j,t} \\
& + \beta_{14,l} macro_{l,j,t}\ x\ peg_{j,t} + \beta_{15,l} macro_{l,j,t}\ x\ falling_{j,t} \\
& + \beta_{16,l} pos\ MS_t\ x\ macro_{l,j,t} \\
& + \beta_{17,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} \\
& + \beta_{18,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} \\
& + \beta_{19,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t} \\
& + \beta_{20,l} neg\ MS_t\ x\ macro_{l,j,t} \\
& + \beta_{21,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} \\
& + \beta_{22,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} \\
& + \beta_{23,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t}) \\
& + \gamma_j + \mu_a + \varepsilon_{j,t}
\end{aligned} \tag{4.9}
$$

Table A4.9 (standard errors clustered at the country level) and Table A4.10 (standard errors clustered by FOMC meeting) in the appendix of this chapter show that the results presented in the previous section are also robust to the inclusion all three dimensions of costs associated with increasing the domestic policy rate as suggested by Lahiri and Végh (2007) at the same time.

4.5 Conclusion

I study the impact of US monetary policy on managed exchange rates by analyzing the pricing of American Depositary Receipts around FOMC meetings. For a sample of 249 level II and level III ADRs from 31 countries over the period from 1996 to 2016 (covering 168 FOMC meetings), I identify a significant negative impact of US monetary surprises on abnormal ADR returns for countries with managed exchange rates. My findings indicate changes in the fundamental value of managed currencies caused by US monetary surprises.

I further test the predictions of standard currency crises models of interest rate defence with respect to the stability of currency pegs vis-à-vis the U.S. dollar. In line with Lahiri and Végh (2007), I identify a significant negative impact of US monetary surprises on abnormal returns of ADRs from countries with currencies pegged to the U.S. dollar if current real GDP growth is below past growth, the country faces a fiscal deficit and the domestic banking index has lost in value since the previous FOMC meeting. These results demonstrate that investors perceive a low willingness of domestic policy makers to defend these currency pegs due to high costs associated with increasing the domestic policy rate. Investors therefore expect a higher peg breakdown probability, which is reflected in negative abnormal ADR returns. Analyzing abnormal ADR returns around FOMC meetings thus provides a valuable tool to policy makers eager to monitor how investors assess the fundamental value of currencies as well as currency peg stability, the costs of defending the peg and the risk of speculative attacks.

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Appendix to Chapter 4

Table A4.1: Countries in the sample by exchange rate regime classification

Managed regimes with U.S. dollar as anchor currency (31.51%)		Peg regimes with U.S. dollar as anchor currency (19.85%)		Freely floating regimes (46.93%)		Freely falling (1.71%)	
Brazil	1999/10 – 2002/12	Argentina	1998/08 – 2001/11	Australia	1996/03 – 2016/12	Argentina	2001/12 – 2002/08
	2008/10 – 2016/12		2002/12 – 2015/10				2016/01 – 2016/12
Chile	2002/06 – 2016/12	Brazil	1998/08 – 1998/12	Brazil	2003/01 – 2008/09	Brazil	1999/02 – 1999/08
Colombia	2012/03 – 2016/12	China	2002/01 – 2016/12	Denmark	2003/06 – 2016/12	Indonesia	1997/08 – 1999/02
India	2009/03 – 2012/09	Hong Kong	1996/11 – 2016/12	EMU	1999/01 – 2016/12	Russia	2014/12 – 2016/01
Indonesia	1999/05 – 2007/06	India	1998/08 – 2009/01	France	1996/03 – 1998/12	Turkey	2001/03 – 2003/01
	2014/03 – 2016/12		2012/12 – 2016/12				
Israel	2002/05 – 2016/07	Indonesia	1997/02 – 1997/07	Germany	1997/12 – 1998/12		
			2007/08 – 2014/01				
Korea	2003/10 – 2016/12	Peru	2012/09 – 2016/11	Greece	1999/11 – 2000/12		
Mexico	1996/07 – 2016/12	Philippines	1999/12 – 2004/12	Ireland	1996/01 – 1998/12		
Peru	2004/05; 2005/09	Russia	2004/03 – 2008/06	Italy	1996/03 – 1998/12		
Philippines	1998/02 – 1999/10			Japan	1996/03 – 2016/12		
	2005/02 – 2016/12						
Russia	2009/01 – 2014/10			Netherlands	1996/03 – 1998/12		
	2016/03 – 2016/12						
South Africa	1998/05 – 1999/12			Norway	2001/06 – 2016/12		
Turkey	2008/09 – 2016/12			South Africa	2000/02 – 2016/12		
				Spain	1996/03 – 1998/12		
				Sweden	2006/09 – 2016/12		
				Switzerland	2001/05 – 2016/12		
				Turkey	2000/08 – 2001/01		
					2003/05 – 2008/08		
				United Kingdom	1996/03 – 2016/12		

Please note: I code Denmark, Ireland (from 1996/01 to 1998/12), Italy (from 1996/03 to 1998/12), Sweden (from 2006/09 to 2008/08) and Switzerland (from 2011/09 to 2015/01) which are coded as "1" or "2" in the Ilzetzki et al. (2019) classification with the Deutsche mark/euro as their anchor currency as "freely floating regimes" for my analysis. Similarly, I code Norway, Sweden (from 2008/09 to 2016/12), Switzerland (from 2001/05 to 2011/08 and 2015/02 –2016/12), Turkey (from 2000/08 to 2001/01) and the United Kingdom (from 1996/03 to 2008/12) which are coded as "3" in the Ilzetzki et al. (2019) classification with the Deutsche mark/euro as their anchor currency as "freely floating regimes" for my analysis.

Table A4.2: Description of variables and their sources

Variable	Variable Description	Frequency	Source
AR^{ADR} (%)	Mean of daily abnormal returns of all ADRs from the respective country for the respective FOMC meeting, calculated as described in eq. (4.3).	By meeting.	Thomson Reuters Tick History, own calculation.
Monetary surprise (%)	US monetary surprise of the respective FOMC meeting calculated following the method by Kuttner (2001), derived from FED Funds Futures.	By meeting.	DATASTREAM, own calculation.
Managed regime (dummy)	Dummy equal to one if the Ilzetzki et al. (2019) monthly coarse exchange rate classification is equal to 3 and the Ilzetzki et al. (2019) anchor currency is the U.S. dollar, zero otherwise.	Monthly.	Ilzetzki et al. (2019)
Peg regime (dummy)	Dummy equal to one if the Ilzetzki et al. (2019) monthly coarse exchange rate classification is equal to 1 or 2 and the Ilzetzki et al. (2019) anchor currency is the U.S. dollar, zero otherwise.	Monthly.	Ilzetzki et al. (2019)
Freely falling regime (dummy)	Dummy equal to one if the Ilzetzki et al. (2019) monthly coarse exchange rate classification is equal to 6, zero otherwise.	Monthly.	Ilzetzki et al. (2019)
Return US market (%)	Log daily return of the S&P 500.	By meeting.	Thomson Reuters Tick History
Return local market (%)	Log daily U.S. dollar return of the local stock market of the respective country.	By meeting.	Thomson Reuters Tick History
Δ VIX	Daily change in the VIX index.	By meeting.	Thomson Reuters Tick History
Δ CAPM beta	Daily change in the CAPM beta of the U.S. dollar returns of the local stock index of the respective country with respect to the US market, calculated using a rolling regressions framework of 30 trading days.	By meeting.	Thomson Reuters Tick History, own calculation.
Δ Sovereign yield (%)	Daily change in the sovereign yield of the respective country.	By meeting.	DATASTREAM
Δ Interest rate MM (%)	Daily change in the money market interest rate of the respective country.	By meeting.	DATASTREAM
Δ Bid-ask ADR (%)	Mean of daily changes in the bid-ask spread of all ADRs from the respective country for the respective FOMC meeting.	By meeting.	Thomson Reuters Tick History
Δ Bid-ask UND (%)	Mean of daily changes in the bid-ask spread of all underlying stocks from the respective country for the respective FOMC meeting.	By meeting.	Thomson Reuters Tick History
Δ Idiosyncratic risk (%)	Mean of daily changes in idiosyncratic risk of all ADRs from the respective country for the respective FOMC meeting. ADR-specific idiosyncratic risk is calculated following Gagnon and Karolyi (2010) as the standard deviation of the residuals from regressing the difference between U.S. dollar returns of the ADR and its underlying stock on contemporaneous and one day lagged and leading values of the US stock market, the respective domestic stock market and the change in the EUR/USD exchange rate using a rolling window of 30 trading days, see eq. (1) in Gagnon and Karolyi (2010).	By meeting.	Thomson Reuters Tick History, own calculation.

Table A4.2: Description of variables and their sources (continued)

Variable	Variable Description	Frequency	Source
Synchronous trading (dummy)	Dummy equal to one if stock market of the respective country operates in regular mode at 3 p.m. UTC, zero otherwise.	Time-invariant.	Own calculation.
Ka open	Chinn-Ito (2006) index of de jure capital account openness.	Annually.	Chinn and Ito (2006)
LMF open	Lane and Milesi-Ferretti (2017) index of de facto capital account openness.	Annually.	Lane and Milesi-Ferretti (2017)
Log real GDP per capita	Log GDP per capita in constant U.S. dollars of the respective country.	Annually.	WDI (indicator code "NY.GDP.PCAP.KD"), own calculation.
Bid-ask exchange rate	Bid-ask-spread of the exchange rate of the currency underlying the ADR vis-à-vis the U.S. dollar.	By meeting.	Thomson Reuters Tick History
Δ Eurodollar	First difference in the one-month Eurodollar deposit rate (following Gürkaynak et al., 2007).	By meeting.	DATASTREAM
Pos. MS	US monetary surprise of the respective FOMC meeting calculated following the method by Kuttner (2001), derived from FED Funds Futures if the respective US monetary surprise is positive, zero otherwise.	By meeting.	DATASTREAM, own calculation.
Neg. MS	US monetary surprise of the respective FOMC meeting calculated following the method by Kuttner (2001), derived from FED Funds Futures if the respective US monetary surprise is negative, zero otherwise.	By meeting.	DATASTREAM, own calculation.
Rel. GDP growth	The respective country's current real GDP growth minus the country's average real GDP growth over the past ten years.	Annually.	WDI (indicator code "NY.GDP.MKTP.KD.ZG"), own calculation.
Fiscal balance (% of GDP)	Government net lending relative to GDP.	Annually.	WEO (indicator code "GGXCNL_NGDP").
Return bank (%)	Return of the domestic banking index of the respective country since the previous FOMC meeting.	By meeting.	DATASTREAM, own calculation.
Capital to risk-weighted assets	Ratio of capital to risk-weighted assets of the banking sector of the respective country.	Annually.	IMF Financial Soundness Indicators.

Table A4.3: Descriptive statistics over all countries and FOMC meetings

Variable	Mean	Standard deviation	5%	95%
AR^{ADR}	-0.08%	1.03%	-1.83%	1.51%
Monetary surprise	-0.00pp	0.03pp	-0.05pp	0.04pp
Managed regime	0.32	0.46	0	1
Peg regime	0.20	0.40	0	1
Freely falling regime	0.02	0.13	0	0
Return US market	0.04%	1.32%	-2.31%	2.11%
Return local market	0.15%	1.82%	-2.69%	2.80%
Δ VIX	-0.35	2.00	-3.16	3.05
Δ CAPM beta	-0.01	0.12	-0.17	0.13
Δ Sovereign yield	-0.01pp	0.13pp	-0.13pp	0.11pp
Δ Interest rate MM	-0.02pp	0.81pp	-0.22pp	0.17pp
Δ Bid-ask ADR	0.43pp	20.28pp	-0.47pp	0.51pp
Δ Bid-ask UND	-0.01pp	0.79pp	-0.58pp	0.61pp
Δ Idiosyncratic risk	0.00pp	0.11pp	-0.12pp	0.14pp
Synchronous trading	0.59	0.49	0	1
Ka open	0.69	0.33	0.17	1
LMF open	154.19%	592.27%	17.14%	586.79%
Log real GDP per capita	9.67	1.19	7.41	11.24
Bid-ask exchange rate	0.11%	0.21%	0.01%	0.37%
Δ Eurodollar	-0.00pp	0.07pp	-0.06pp	0.05pp

Figure A4.1: Histogram of US monetary surprises by FOMC meeting

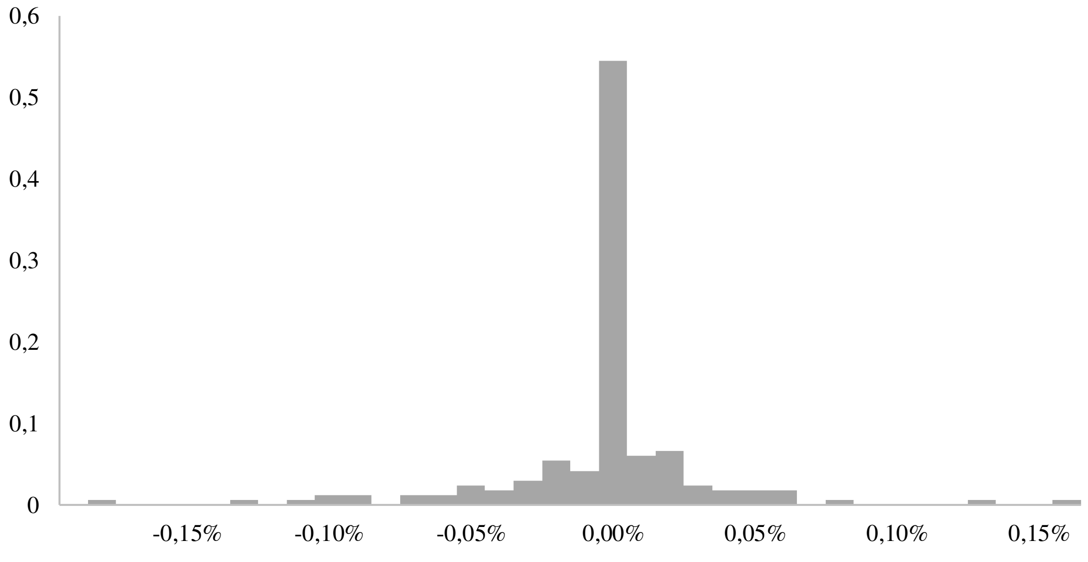

Table A4.4: Descriptive statistics for regimes pegged to the U.S. dollar

Variable	Mean	Standard deviation	5%	95%
Pos. MS	0.01pp	0.02pp	0.00pp	0.05pp
Neg. MS	-0.01pp	0.03pp	-0.06pp	0.00pp
Rel. GDP growth	0.13%	3.96%	-7.57%	7.54%
Fiscal balance	-1.86%	3.96%	-9.06%	4.14%
Return bank	1.26%	11.99%	-16.49%	21.69%
Capital to RWA	15.65%	2.21%	12.32%	19.16%

Table A4.5: Robustness check using standard errors clustered by FOMC meeting: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-10.943**	-2.939	-8.396**	-2.067	-10.166***	-2.774
	(4.468)	(3.202)	(3.398)	(6.419)	(3.598)	(4.675)
Neg. MS	3.126	4.344	2.798	1.931	7.396**	1.842
	(2.547)	(3.737)	(2.809)	(2.854)	(3.376)	(2.913)
Return US market	0.302***	0.206*	0.188**	0.494***	0.283**	0.249***
	(0.096)	(0.115)	(0.082)	(0.112)	(0.114)	(0.094)
Return local market	-0.206***	-0.211***	-0.161***	-0.330***	-0.219***	-0.141**
	(0.058)	(0.066)	(0.052)	(0.096)	(0.068)	(0.067)
Δ VIX	-0.001***	-0.002***	-0.002***	-0.000	-0.001*	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Δ CAPM beta	-0.001	0.012**	0.004	0.006	0.009	-0.002
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)
Δ Sovereign yield	-0.848	0.152	-0.154	0.028	0.066	-0.408
	(0.790)	(0.123)	(0.770)	(0.138)	(0.144)	(0.702)
Δ Interest rate MM	0.010	0.027	-0.022	0.433***	-0.013	-0.014
	(0.044)	(0.040)	(0.030)	(0.089)	(0.021)	(0.129)
Δ Bid-ask ADR	0.016***	0.683***	0.018***	0.033	0.016***	0.876***
	(0.002)	(0.248)	(0.002)	(0.120)	(0.002)	(0.287)
Δ Bid-ask UND	-0.012	0.036	-0.075	0.288**	-0.082	0.068
	(0.081)	(0.104)	(0.068)	(0.142)	(0.078)	(0.089)
Δ Idiosyncratic risk	0.042	-0.362	-0.162	0.417	-0.323	0.016
	(0.429)	(0.673)	(0.410)	(0.967)	(0.467)	(0.612)
Observations	2,866		2,853		2,866	
No. of countries	31		31		31	
R^2	0.19		0.19		0.20	
Country FEs	YES		YES		YES	
Year FEs	YES		YES		YES	
SE clustered by	Meeting		Meeting		Meeting	

Notes: This table reports the marginal effects of a regression model similar to that outlined in eq. (4.6), with the only difference that instead of the continuous macro variables used in the baseline specification I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise. Robust standard errors clustered by FOMC meeting are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A4.6: Robustness check excluding observations with a Chin-Ito (2008) index score of zero: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-11.493***	-2.939	-8.918**	-2.003	-10.666***	-2.784
	(3.125)	(3.847)	(4.449)	(5.545)	(3.714)	(4.612)
Neg. MS	2.177	4.351*	1.844	1.907	8.027***	0.479
	(3.523)	(2.525)	(2.517)	(3.831)	(2.222)	(2.728)
Return US market	0.315**	0.206***	0.196*	0.494***	0.283***	0.258**
	(0.125)	(0.075)	(0.115)	(0.140)	(0.086)	(0.116)
Return local market	-0.256***	-0.212**	-0.197***	-0.331***	-0.232**	-0.209***
	(0.067)	(0.089)	(0.063)	(0.127)	(0.114)	(0.031)
Δ VIX	-0.002**	-0.002***	-0.002***	-0.000	-0.001**	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Δ CAPM beta	-0.001	0.012**	0.004	0.006	0.010**	-0.002
	(0.004)	(0.006)	(0.003)	(0.005)	(0.005)	(0.005)
Δ Sovereign yield	0.670	0.152	1.245	0.026	0.145	0.696
	(1.411)	(0.162)	(1.020)	(0.119)	(0.136)	(0.939)
Δ Interest rate MM	-0.031	0.027	-0.048	0.436***	-0.019	0.160
	(0.055)	(0.052)	(0.040)	(0.074)	(0.020)	(0.160)
Δ Bid-ask ADR	0.016***	0.683***	0.017***	0.032	0.016***	0.897***
	(0.002)	(0.227)	(0.002)	(0.105)	(0.003)	(0.267)
Δ Bid-ask UND	-0.064	0.035	-0.115	0.288***	-0.087	0.068
	(0.076)	(0.099)	(0.073)	(0.100)	(0.101)	(0.103)
Δ Idiosyncratic risk	0.170	-0.370	-0.088	0.409	-0.256	-0.089
	(0.545)	(1.075)	(0.673)	(0.661)	(0.603)	(1.025)
Observations	2,840		2,827		2,840	
No. of countries	31		31		31	
R^2	0.20		0.20		0.21	
Country FEs	YES		YES		YES	
Year FEs	YES		YES		YES	
SE clustered by	Country		Country		Country	

Notes: This table reports the marginal effects of a regression model similar to that outlined in eq. (4.6), with the only difference that instead of the continuous macro variables used in the baseline specification I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise. As a robustness check, all observations with a Chinn-Ito (2006) index score of zero are excluded. Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A4.7: Robustness check additionally controlling for the Chinn-Ito (2006) index: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-11.017***	-3.398	-8.576**	-3.910*	-8.665***	-3.682
	(3.125)	(3.513)	(4.167)	(2.219)	(3.170)	(3.607)
Neg. MS	3.423	7.289**	3.443	2.449	9.229***	1.884
	(2.988)	(2.868)	(2.233)	(4.423)	(3.114)	(2.137)
Return US market	0.312***	0.141	0.140	0.509***	0.268***	0.251**
	(0.115)	(0.091)	(0.099)	(0.117)	(0.092)	(0.111)
Return local market	-0.217***	-0.181*	-0.145**	-0.340**	-0.202*	-0.177***
	(0.066)	(0.099)	(0.066)	(0.136)	(0.114)	(0.061)
Δ VIX	-0.001*	-0.002***	-0.002***	-0.000	-0.001*	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Δ CAPM beta	-0.003	0.007	-0.003	0.004	0.005	-0.006
	(0.007)	(0.005)	(0.004)	(0.007)	(0.007)	(0.006)
Δ Sovereign yield	-0.500	0.506	0.385	0.260	0.360	0.408
	(1.101)	(0.369)	(0.830)	(0.680)	(0.250)	(0.612)
Δ Interest rate MM	0.004	0.113	-0.092	0.310***	-0.022	0.187
	(0.099)	(0.189)	(0.099)	(0.077)	(0.059)	(0.225)
Δ Bid-ask ADR	0.027***	0.710***	0.025**	0.002	0.020*	0.901***
	(0.002)	(0.231)	(0.012)	(0.135)	(0.010)	(0.241)
Δ Bid-ask UND	-0.015	-0.024	-0.073	0.259***	-0.048	0.045
	(0.078)	(0.115)	(0.086)	(0.078)	(0.085)	(0.087)
Δ Idiosyncratic risk	0.887	-0.720	-0.311	0.365	-0.643	0.230
	(0.628)	(1.170)	(0.857)	(0.563)	(0.853)	(0.900)
Observations	2,866		2,853		2,866	
No. of countries	31		31		31	
R^2	0.21		0.20		0.21	
Country FEs	YES		YES		YES	
Year FEs	YES		YES		YES	
SE clustered by	Country		Country		Country	

Notes: This table reports the marginal effects of a regression model similar to that outlined in eq. (4.6), with the only difference that instead of the continuous macro variables used in the baseline specification I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise. As a robustness check, I additionally control for the Chinn-Ito (2006) index by including this variable unconditionally, but also interacted with $pos\ MS_t$, $neg\ MS_t$ as well as the other control variables. Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A4.8: Robustness check additionally controlling for the Lane and Milesi-Ferretti (2017) index: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-10.872***	-3.650	-9.280**	1.274	-10.483***	0.674
	(4.128)	(3.663)	(4.495)	(2.997)	(3.727)	(3.387)
Neg. MS	2.101	3.505	2.836	4.474	8.021***	0.865
	(3.615)	(2.768)	(2.328)	(7.052)	(3.039)	(2.581)
Return US market	0.290**	0.176**	0.102	0.362***	0.277***	0.231**
	(0.113)	(0.080)	(0.116)	(0.139)	(0.070)	(0.116)
Return local market	-0.169**	-0.214**	-0.063	-0.239	-0.195*	-0.120
	(0.066)	(0.086)	(0.078)	(0.191)	(0.103)	(0.078)
Δ VIX	-0.001***	-0.002**	-0.002***	-0.001	-0.001	-0.002***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Δ CAPM beta	-0.000	0.013**	0.004	0.006	0.008	0.001
	(0.004)	(0.006)	(0.003)	(0.009)	(0.005)	(0.004)
Δ Sovereign yield	-0.826	0.112	0.018	-0.065	-0.085	-0.136
	(1.138)	(0.165)	(0.864)	(0.154)	(0.143)	(0.748)
Δ Interest rate MM	-0.018	0.252***	0.135	0.374***	0.023	0.076
	(0.083)	(0.082)	(0.121)	(0.100)	(0.045)	(0.183)
Δ Bid-ask ADR	0.023***	0.698***	0.033***	0.590***	0.024***	0.972***
	(0.007)	(0.243)	(0.002)	(0.174)	(0.005)	(0.211)
Δ Bid-ask UND	-0.002	0.040	-0.078	0.295***	-0.110	0.060
	(0.107)	(0.143)	(0.113)	(0.113)	(0.100)	(0.084)
Δ Idiosyncratic risk	-0.010	-0.396	-0.661	0.053	-0.405	0.044
	(0.572)	(1.128)	(0.714)	(1.557)	(0.592)	(1.002)
Observations	2,695		2,682		2,695	
No. of countries	31		31		31	
R^2	0.21		0.21		0.22	
Country FEs	YES		YES		YES	
Year FEs	YES		YES		YES	
SE clustered by	Country		Country		Country	

Notes: This table reports the marginal effects of a regression model similar to that outlined in eq. (4.6), with the only difference that instead of the continuous macro variables used in the baseline specification I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise. As a robustness check, I additionally control for the Lane and Milesi-Ferretti (2017) index by including this variable unconditionally, but also interacted with $pos\ MS_t, neg\ MS_t$ as well as the other control variables. Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A4.9: Robustness check including all three macro variables in one specification simultaneously: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	High growth	Fiscal deficit	Fiscal surplus	Neg. return bank	Pos. return bank
Pos. MS	-10.570***	-3.037	-8.324**	-2.459	-9.869***	-4.510
	(3.490)	(3.729)	(3.484)	(3.550)	(3.523)	(4.321)
Neg. MS	-0.147	-0.901	-1.043	0.858	5.671**	-4.955
	(4.955)	(2.804)	(2.650)	(2.494)	(2.240)	(3.607)
Return US market	0.165***	0.165***	0.165***	0.165***	0.165***	0.165***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Return local market	-0.182***	-0.182***	-0.182***	-0.182***	-0.182***	-0.182***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Δ VIX	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ CAPM beta	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Δ Sovereign yield	-0.158	-0.158	-0.158	-0.158	-0.158	-0.158
	(0.141)	(0.141)	(0.141)	(0.141)	(0.141)	(0.141)
Δ Interest rate MM	0.005	0.005	0.005	0.005	0.005	0.005
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Δ Bid-ask ADR	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Bid-ask UND	-0.014	-0.014	-0.014	-0.014	-0.014	-0.014
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Δ Idiosyncratic risk	0.325	0.325	0.325	0.325	0.325	0.325
	(0.320)	(0.320)	(0.320)	(0.320)	(0.320)	(0.320)
Observations	2,853					
No. of countries	31					
R^2	0.15					
Country FEs	YES					
Year FEs	YES					
SE clustered by	Country					

Notes: This table reports the marginal effects of the regression model outlined in eq. (4.9). I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise and that I include all macro variables at the same time.

$$AR_{j,t}^{ADR} = \beta_1 pos\ MS_t + \beta_2 neg\ MS_t + \beta_3 managed_{j,t} + \beta_4 peg_{j,t} + \beta_5 falling_{j,t} + \beta_6 pos\ MS_t\ x\ managed_{j,t} + \beta_7 pos\ MS_t\ x\ peg_{j,t} + \beta_8 pos\ MS_t\ x\ falling_{j,t} + \beta_9 neg\ MS_t\ x\ managed_{j,t} + \beta_{10} neg\ MS_t\ x\ peg_{j,t} + \beta_{11} neg\ MS_t\ x\ falling_{j,t} + \sum_{l=1}^{3} (\beta_{12,l} macro_{l,j,t} + \beta_{13,l} macro_{l,j,t}\ x\ managed_{j,t} + \beta_{14,l} macro_{l,j,t}\ x\ peg_{j,t} + \beta_{15,l} macro_{l,j,t}\ x\ falling_{j,t} + \beta_{16,l} pos\ MS_t\ x\ macro_{l,j,t} + \beta_{17,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} + \beta_{18,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} + \beta_{19,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t} + \beta_{20,l} neg\ MS_t\ x\ macro_{l,j,t} + \beta_{21,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} + \beta_{22,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} + \beta_{23,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t}) + \gamma_j + \mu_a + \varepsilon_{j,t}$$

Robust standard errors clustered at the country level are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.

Table A4.10: Robustness check including all three macro variables in one specification simultaneously and using standard errors clustered by FOMC meeting: Marginal effects of positive US monetary surprises and control variables for peg regimes to the U.S. dollar: High vs. low costs of raising the domestic policy rate following Lahiri and Végh (2007)

	Low growth	**High growth**	**Fiscal deficit**	**Fiscal surplus**	**Neg. return bank**	**Pos. return bank**
Pos. MS	-10.570***	-3.037	-8.324***	-2.459	-9.869***	-4.510
	(3.771)	(2.642)	(2.956)	(5.365)	(3.624)	(4.532)
Neg. MS	-0.147	-0.901	-1.043	0.858	5.671	-4.955
	(3.192)	(3.024)	(2.949)	(2.876)	(3.534)	(3.253)
Return US market	0.165***	0.165***	0.165***	0.165***	0.165***	0.165***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Return local market	-0.182***	-0.182***	-0.182***	-0.182***	-0.182***	-0.182***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Δ VIX	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ CAPM beta	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Δ Sovereign yield	-0.158	-0.158	-0.158	-0.158	-0.158	-0.158
	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)
Δ Interest rate MM	0.005	0.005	0.005	0.005	0.005	0.005
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Δ Bid-ask ADR	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Bid-ask UND	-0.014	-0.014	-0.014	-0.014	-0.014	-0.014
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Δ Idiosyncratic risk	0.325	0.325	0.325	0.325	0.325	0.325
	(0.278)	(0.278)	(0.278)	(0.278)	(0.278)	(0.278)
Observations	2,853					
No. of countries	31					
R^2	0.15					
Country FEs	YES					
Year FEs	YES					
SE clustered by	Meeting					

Notes: This table reports the marginal effects of the regression model outlined in eq. (4.9). I now use binary macro variables that are equal to one if the respective macro variable is >0, zero otherwise and that I include all macro variables at the same time.

$$AR_{j,t}^{ADR} = \beta_1 pos\ MS_t + \beta_2 neg\ MS_t + \beta_3 managed_{j,t} + \beta_4 peg_{j,t} + \beta_5 falling_{j,t} + \beta_6 pos\ MS_t\ x\ managed_{j,t} + \beta_7 pos\ MS_t\ x\ peg_{j,t} + \beta_8 pos\ MS_t\ x\ falling_{j,t} + \beta_9 neg\ MS_t\ x\ managed_{j,t}$$
$$+\beta_{10} neg\ MS_t\ x\ peg_{j,t} + \beta_{11} neg\ MS_t\ x\ falling_{j,t} + \sum_{l=1}^{3}(\beta_{12,l} macro_{l,j,t} + \beta_{13,l} macro_{l,j,t}\ x\ managed_{j,t} + \beta_{14,l} macro_{l,j,t}\ x\ peg_{j,t} + \beta_{15,l} macro_{l,j,t}\ x\ falling_{j,t}$$
$$+\beta_{16,l} pos\ MS_t\ x\ macro_{l,j,t} + \beta_{17,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} + \beta_{18,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} + \beta_{19,l} pos\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t}$$
$$+\beta_{20,l} neg\ MS_t\ x\ macro_{l,j,t} + \beta_{21,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ managed_{j,t} + \beta_{22,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ peg_{j,t} + \beta_{23,l} neg\ MS_t\ x\ macro_{l,j,t}\ x\ falling_{j,t}) + \gamma_j + \mu_a + \varepsilon_{j,t}$$

Robust standard errors clustered by FOMC meeting are reported in parentheses. *, **, and *** indicate the 10%, 5%, and 1% levels of significance, respectively.