EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 835 / NOVEMBER 2007

# US SHOCKS AND GLOBAL EXCHANGE RATE CONFIGURATIONS

by Marcel Fratzscher

EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 835 / NOVEMBER 2007

# US SHOCKS AND GLOBAL EXCHANGE RATE CONFIGURATIONS[1]

by Marcel Fratzscher[2]


In 2007 all ECB publications feature a motif taken from the €20 banknote.

This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=1030209.

*1 Paper prepared for the 46th Panel of Economic Policy. I would like to thank the editor, Philippe Martin, and an anonymous referee for comments. I am also grateful for comments and discussions to Geert Bekaert, Thierry Bracke, Matthieu Bussiere, Menzie Chinn, Michael Ehrmann, Charles Engel, Jon Faust, Michael Fidora, Steve Kamin, Nelson Mark, Frank Moss, Chiara Osbat, Georges Pineau, Roberto Rigobon, Michael Sager, Lucio Sarno, Bernd Schnatz, Jay Shambaugh, Martin Skala, Frank Smets, Roland Straub, Christian Thimann, Frank Warnock, Shang-Jin Wei, Atze Winkler and Jon Wongswan as well as seminar participants at the ECB, HEI Geneva and the NBER IFM Summer Institute 2007. The views expressed in this paper are those of the author and do not necessarily reflect those of the European Central Bank.*

*2 European Central Bank, Kaiserstrasse 29, D-60311 Frankfurt am Main, Germany; e-mail: Marcel.Fratzscher@ecb.int*

**Address**
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

**Postal address**
Postfach 16 03 19
60066 Frankfurt am Main, Germany

**Telephone**
+49 69 1344 0

**Website**
http://www.ecb.europa.eu

**Fax**
+49 69 1344 6000

**Telex**
411 144 ecb d



*The statement of purpose for the ECB Working Paper Series is available from the ECB website, http://www.ecb.europa.eu/pub/scientific/wps/date/html/index.en.html*

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

# CONTENTS

**Abstract**

The paper analyses the heterogeneity in the link between macroeconomic fundamentals and exchange rates. For a set of important US-specific economic shocks, it shows that such shocks have exerted a remarkably heterogeneous effect on global exchange rate configurations over the past 25 years. Despite a significant decline over time, this heterogeneity remains high as primarily currencies of a few industrialized countries provide the largest contribution to the adjustment of the effective US dollar exchange rate. The paper finds that this heterogeneity is not only due to policy choices of inflexible exchange rate regimes, but to an important extent due to market forces, in particular business cycle synchronization and the degree of financial integration – foremost in portfolio investment – but not to trade. The findings have implications for a potential unwinding of global imbalances and future exchange rate adjustment, as well as for monetary policy choices in emerging market economies.

JEL No.: F31; F4; G1.

Keywords: Exchange rate; US dollar; cross-rates; shocks; heterogeneity; global distribution; transmission channels.

# Non-technical summary

The debate about global current account imbalances continues to have a tight grip on the academic and policy work in the area of international macroeconomics and finance. Although there is substantial disagreement about from which side of the globe the larger part of the adjustment will need to come – the countries with trade surpluses or those with deficits – there appears to be a widespread view that a reduction in the large current account dispersion across economies will require significant changes in the global configuration of exchange rates. In particular, it has widely been argued that a significant US dollar depreciation will be an inevitable part of the adjustment process.

How may such a US dollar adjustment occur concretely? The answer is highly uncertain, in particular as many of the major current account surplus countries – in Emerging Asia, foremost China, and the oil-exporting countries – continue to have fixed exchange rate regimes vis-à-vis the US dollar and show no sign of fundamentally altering this policy choice in the foreseeable future. What will an adjustment therefore imply for those exchange rates that are flexible; will they have to adjust more or the US dollar change less overall? In short, a key question is what global exchange rate configurations will be in a world in which global current account imbalances are adjusting.

The paper analyses empirically how US macroeconomic and monetary policy shocks have affected global exchange rate configurations among 64 currencies historically over the past 25 years; and what channels may account for the heterogeneity in the response pattern to such US shocks. It argues that taking such a cross-sectional view provides an important complementary perspective to the usual time-series approaches because it underlines that relevant fundamentals are correlated highly unevenly across countries. Thus a given shock has fundamentally different effects on bilateral versus effective exchange rates. Moreover, a cross-sectional analysis sheds light on the role of "global" economic fundamentals, such as real and financial linkages, for the determination of bilateral exchange rates as well as cross-rates.

Two key elements constitute the paper's intended contribution. First, the empirical results show that there is a remarkably high degree of heterogeneity in the effects of US macroeconomic shocks on currencies, with important implications for cross-rates and thus effective exchange rate movements. This result holds also when analyzing only de facto flexible currencies. For instance, the Canadian dollar and the Mexican peso are found to be largely unresponsive to US shocks, while the euro and the Swiss franc are among the currencies most affected by US shocks.

The second main point of the paper relates to the determinants of this heterogeneity and of the channels through which US shocks are transmitted to exchange rates.

The empirical findings of the paper indicate that it is in particular the finance channel and also the similarity in the business cycle, but not the trade channel through which US shocks are transmitted to exchange rates. In particular, countries which hold internationally a relatively large size of portfolio investment over GDP, both in equity and debt securities, see their exchange rates react significantly more strongly to US shocks than those with little financial exposure.

What the findings of the paper suggest is that under very different degrees of financial integration and also if today's fixed exchange rates, foremost in Emerging Asia and among oil-exporting countries, remain inflexible for the foreseeable future, a US-led adjustment could have highly asymmetric effects on global exchange rate configurations. As a counter-argument, it may also imply that an exchange rate adjustment may do little to existing current account imbalances when half of US trade and two thirds of the US deficit are with countries that have inflexible exchange rate regimes or are not highly integrated financially. The empirical results of the paper also imply that currency flexibility is a necessary but not sufficient condition for countries to contribute to an adjustment of global exchange rate configurations. Exchange rates are responsive to foreign shocks only to the extent that market mechanisms are in place that enable a transmission, in particular well-developed financial markets and financial integration with global markets.

# 1 Introduction

The debate about global current account imbalances continues to have a tight grip on the academic and policy work in the area of international macroeconomics and finance. Although there is substantial disagreement about from which side of the globe the larger part of the adjustment will need to come – the countries with trade surpluses or those with deficits – there appears to be a widespread view that a reduction in the large current account dispersion across economies will require significant changes in the global configuration of exchange rates. In particular, it has widely been argued that a significant US dollar depreciation will be an inevitable part of the adjustment process (e.g. Obstfeld and Rogoff 2005; Blanchard, Giavazzi and Sa 2005; Krugman 2006).

How may such a US dollar adjustment occur concretely? The answer is highly uncertain, in particular as many of the major current account surplus countries – in Emerging Asia, foremost China, and the oil-exporting countries – continue to have inflexible exchange rate regimes vis-à-vis the US dollar and show no sign of fundamentally altering this policy choice in the foreseeable future. What will an adjustment therefore imply for those exchange rates that are flexible; will they have to adjust more or the US dollar change less overall? In short, a key question is what global exchange rate configurations will be in a world in which global current account imbalances are adjusting.

The paper analyses empirically how US macroeconomic and monetary policy shocks have affected global exchange rate configurations among 64 currencies historically over the past 25 years; and what channels may account for the heterogeneity in the response pattern to such US shocks. Why is it important to focus on this heterogeneity? The paper argues that taking such a cross-sectional view provides an important complementary perspective to the usual time-series approaches because it underlines that relevant fundamentals are correlated highly unevenly across countries. Thus a given shock has fundamentally different effects on bilateral versus effective exchange rates. Moreover, a cross-sectional analysis sheds light on the role of "global" economic fundamentals, such as real and financial linkages, for the determination of bilateral exchange rates as well as cross-rates. The paper takes a finance approach, in the vein of the work of Andersen et al. (2003), to achieve identification of macroeconomic and monetary policy shocks that are truly exogenous and specific to the US economy. Yet it adopts a macro approach for analyzing the determinants of this cross-sectional heterogeneity; in particular the role of trade versus financial integration, as well as the role of the business cycle synchronization.[1]

[1] By analysing the underlying factors of the responsiveness of exchange rates to fundamentals,

Two key elements constitute the paper's intended contribution. First, the empirical results show that there is a remarkably high degree of heterogeneity in the effects of US macroeconomic shocks on currencies, with important implications for cross-rates and thus effective exchange rate movements. This result holds also when analyzing only de facto flexible currencies. For instance, the Canadian dollar and the Mexican peso are found to be unresponsive or appreciate only slightly against the US dollar in response to negative US macroeconomic shocks, but *depreciate* substantially overall in effective terms due to the much larger appreciation of other industrialized countries' currencies vis-a-vis the US dollar.

By contrast, the euro and the Swiss franc are among the currencies most affected by US shocks. In fact, their reaction in effective terms to US shocks are higher even than that of the effective US dollar exchange rate. As a rule of thumb, the findings indicate that a negative US shock that depreciates the US dollar by 1% in effective terms induces, on average, an effective appreciation of the euro by 1.2%. Thus the analysis sheds light on the reaction of cross-rates to US shocks, and more generally how individual effective exchange rates react in contrast to bilateral rates.

Moreover, the paper attempts to quantify the contributions of individual exchange rates to changes in the US dollar nominal effective exchange rate (NEER). Currencies of industrialized countries generally have contributed more to the adjustment of the US dollar NEER than their weights in the NEER basket, while emerging market (EME) currencies mostly contribute substantially less. Interestingly, movements in the US dollar-euro are not only the largest contributor to the adjustment of the effective US dollar exchange rate, but the contribution of the euro has increased since the late 1990s.

The second main point of the paper relates to the determinants of this heterogeneity and of the channels through which US shocks are transmitted to exchange rates. A first candidate is trade: higher bilateral trade with the United States may imply that e.g. a negative demand shock in the US affects close trading partners in a similar way, thus having little impact on the bilateral exchange rate. However, trade interdependence could also work in the opposite direction: a negative US shock that reflects a shift in competitiveness or relative supply may benefit those that trade intensely with the United States; hence leading to a US dollar depreciation against these currencies. The effect of US shocks should thus depend on the nature of the shocks. A related channel is that of business cycle interdependence. A US shock may, ceteris paribus, have a weaker effect on bilateral exchange rates of economies with a high degree of business cycle comovements with the US.

---

the present paper draws on the important conceptual work by Hau and Rey (2006), Lane and Milesi-Ferretti (2003, 2005), and Tille (2003).

As an alternative channel, the paper investigates the role of the finance channel. The possibility of portfolio diversification and rebalancing by investors implies that asset prices in countries with a high degree of financial integration and openness may be affected relatively more by US shocks. For instance, a slowdown of the US economy that is associated with lower expected asset returns may induce a portfolio reallocation towards those assets that are a relatively close substitute for US assets, in turn inducing a shift in the nominal exchange rate of the two countries.

The empirical findings of the paper indicate that it is in particular the finance channel and also the similarity in the business cycle, but not the trade channel through which US shocks are transmitted to exchange rates. In particular, countries which hold internationally a relatively large size of portfolio investment over GDP, both in equity and debt securities, see their exchange rates react significantly more strongly to US shocks than those with little financial exposure. Other types of financial assets, such as FDI and bank loans, are found to exert no significant effect on the transmission process. Overall, these findings suggest that the large response of currencies, such as the euro, to US shocks stems from their economies' high degree of financial exposure. The transmission is unrelated to trade, either the trade balance or the trade intensity.

There are no studies to date that systematically analyze the link between economic fundamentals and exchange rates from a cross-sectional perspective. The paper is related to a few studies that investigate similar issues, in particular the work by Forbes and Chinn (2004). Using a factor model, they find that both trade and financial linkages are important to explain the cross-country comovements of equity returns. More recently, Hausman and Wongswan (2006), Wongswan (2006) and Ehrmann and Fratzscher (2006) analyze the transmission of US monetary policy shocks primarily to equity markets, though the first also includes other asset prices such as exchange rates and interest rates. Finally, Warnock (2006) investigates how a US dollar adjustment may affect the value of cross-border assets for a broad set of countries, underlining in particular the large exposure of European countries.

The paper is also linked conceptually to two important strands of the recent literature on exchange rate economies. First, it is linked to the recent strand of the literature that analyses the exchange rate from the perspective of an asset price, which prices in all available information and reflects the present discounted value of expected future fundamentals (Engel, Mark and West 2007). From such a perspective, an exchange rate may be indistinguishable from a random walk, and changes in currency values reflect changes to expectations about future fundamentals (Engel and West 2006). A second, related recent literature has concentrated on Taylor-rule fundamentals, starting from the observation that exchange rates tend to be part

of the objective function of central banks (Clarida, Gali and Gertler 1998), and in turn exchange rates are influenced by expectations of inflation, output and the endogenous reaction of monetary policy.[2] The present paper is linked to these strands as it adopts precisely this approach by focusing on changes to expectations about fundamentals and their impact on exchange rates.

Several limitations and caveats should be stressed at the outset. The paper takes a US perspective, analyzing only US shocks while ignoring many other factors that obviously influence exchange rates. Importantly, the objective is not to *explain* overall exchange rate movements of the past, but merely to analyze the cross-sectional effect of specific shocks – i.e. shocks that can be identified cleanly through the empirical approach used. Therefore, the paper does not rule out nor say anything about other sources of exchange rate changes.

The findings of the paper have implications for the above-mentioned debate on the adjustment of global current account imbalances as understanding how US shocks have affected exchange rates in the past should help us gauge how they may do so in the future. The empirical results of the paper also have implications for the choice of exchange rate regimes and for the conduct of monetary policy, in particular for EMEs that are still in the process of developing financial markets and integrating globally.

The paper is organized as follows. Section 2 presents the data and gives some stylized facts on exchange rates and trade and financial integration. Section 3 provides the benchmark results for the transmission of US shocks to exchange rates. Time variations and relative contributions of individual exchange rates to the adjustment of the US dollar effective exchange rate are provided in section 4. Section 5 then investigates the transmission channels, in particular the role of monetary policy and of trade versus financial integration. Conclusions and a discussion of implications follow in section 6.

[2] Some features of exchange rate behavior, such as the level persistence and volatility, can to some extent be accounted for by such Taylor-rule models (Engel and West 2005), in particular when allowing for learning by agents (Mark 2005). Moreover, Clarida and Waldman (2007) argue that expectations of an endogenous reaction of monetary policy to shocks influence the link between fundamentals and exchange rates, while Goldberg and Klein (2006) and Gürkaynak, Sack and Swanson (2005) emphasize the role of the precise objective function and the degree of credibility of central banks. Finally, also the microstructure work on exchange rates makes a related point in that exchange rates are closely linked to order flow, which in turn has been found to be connected to economic fundamentals (Evans and Lyons 2002 and 2005, Dominguez 2003).

# 2 Data

Three types of data are needed for the empirical analysis, which are discussed in this section: US macroeconomic and monetary policy shocks; bilateral and effective exchange rates of the US dollar, and the measures of trade and financial integration.

## 2.1 Macroeconomic and monetary policy shocks

The empirical analysis is conducted using exchange rate returns and shocks at a daily frequency for the period of January 1980 to June 2006. The key difficulty of measuring the effect of macroeconomic shocks is to ensure that such shocks are truly exogenous. For this purpose, the paper follows the example of Andersen et al. (2003) and Ehrmann and Fratzscher (2005b) and uses the news of US macroeconomic and monetary policy announcements. A shock is defined as the difference between the actual figure of a macroeconomic announcement and the market expectations prior to its release. Table 1 provides summary statistics for the 13 variables, including the variables' means and standard deviations.

As to the specific sources, US monetary policy shocks stem from Gürkaynak, Sack and Swanson (2005) and are the changes of the Fed funds futures in the 30-minute window around FOMC announcements. Table 1 shows that there are 177 policy surprises in the sample, with the mean surprises being 5.7 basis points. Some policy announcements have been excluded from the sample, in particular those related to the 11 September 2001 event.

Macroeconomic releases are sourced from S&P and Bloomberg, while the expectations of these releases come from Money Market Services (MMS) International and Bloomberg. Most of these releases are monthly in frequency, with the exception of quarterly advance GDP announcements and monetary policy announcements which nowadays usually occur 8 times per year. Some of the macroeconomic series go back to 1980, others begin slightly later, while the monetary policy variable starts only in 1990. The quality of the survey data is high, with expectations having been shown in the literature to be largely unbiased and efficient.

Table 1 shows that many of the variables are measured in different units. Instead of normalizing each variable's surprises by its standard deviation – which allows a better comparison in the coefficient estimates across variables – US shocks are not normalized in this way in the benchmark specification so that the size of coefficients can be interpreted in a meaningful way.

## 2.2 Trade versus finance and the US dollar

The exchange rate data are daily percentage returns for 64 bilateral exchange rates. For most of these currencies daily data exists going back to 1980, though in particular for some countries with hyperinflation in the 1980s, the series start at a later date. Moreover, for the euro its synthetic exchange rate is used prior to 1999.

Movements in the nominal effective exchange rate (NEER), i.e. a weighted average across bilateral exchange rate changes, are a useful summary measure of the overall adjustment of a currency and the competitiveness of an economy. The US dollar NEER comes from the Federal Reserve and is based on annual trade weights for the 26 main trading partners of the US reaching back to 1973; NEERs for other currencies stem from the BIS.[3]

Trade integration is measured through bilateral trade stemming from the IMF's Direction of Trade, using both the overall intensity of trade as well as the bilateral trade balance. Various proxies are used to measure financial integration, in particular reflecting the different types of capital (portfolio investment, FDI and other investment/bank loans). Financial integration based on portfolio investment comes from the Coordinated Portfolio Investment Survey (CPIS) of the IMF and is defined as the sum of bilateral portfolio investment (equity plus debt) assets and liabilities over total US external portfolio investment assets and liabilities. There are several caveats and a number of papers have discussed the difficulties and drawbacks of the CPIS data in detail (e.g. Lane and Milesi-Ferretti 2003, Daude and Fratzscher 2006). One shortcoming is that the CPIS has only a limited time series, providing annual data for 2001-2004, and a smaller country sample for 1997. Moreover, financial centres are often very important as counterparts so that the true source or destination for a significant share of global portfolio investment cannot be determined. The CPIS data also excludes some important countries, such as China and Taiwan, and focuses primarily on private portfolio investment. Nevertheless, this source offers the best available bilateral portfolio investment data for a broader cross-section of countries.

Similar to portfolio investment, also financial integration through FDI and other investment/loans may matter for the transmission of US shocks. For FDI, UNCTAD data on bilateral FDI stocks between the US and partner countries is used. The UNCTAD data has annual data in US dollars for around 90 reporting countries

[3]Note that using real effective exchange rates, though preferable from a macro perspective of changes to countries' competitiveness, does not make any meaningful difference for the empirical findings, given the daily frequency of the analysis. Moreover, the analysis of the paper has also been conducted using finance-weighted NEERs, with the weights based on portfolio investment stemming from the Coordinated Portfolio Investment Survey (CPIS) of the IMF. These results are not shown here for reasons of brevity but are available upon request.

from 1980 onwards. For other investment, primarily bank loans, BIS data from the International Locational Banking Statistics (ILB) are employed. The database includes private-sector assets and liabilities of banks in 32 reporting countries vis-à-vis banking and non-banking institutions in more than 100 partner countries. The reported assets and liabilities are mostly loans and deposits, but one potential caveat is that it may in some instances include other transactions under portfolio or direct investment (BIS 2003), so that inter-bank claims are used instead.

# 3 Global distribution of US shocks

The paper now turns to the benchmark model and results for the effects of US shocks (section 3.1) and then to the overall heterogeneity in the effects (section 3.2). Subsequently, the section will present various robustness tests (section 3.3).

## 3.1 Benchmark model and results for US dollar and euro

The empirical methodology to estimate the effect of macroeconomic and monetary policy shocks on asset prices, using high frequency, i.e. daily or intra-daily data, follows the standard approach in the literature:

$$e_t = \alpha_0 + \sum_k \beta_k s_{k,t} + \gamma e_{t-1} + \delta X_t + \varepsilon_t \tag{1}$$

with $e_t$ as the exchange rate return – the first difference of the log exchange rate, $s_{t,k}$ as the vector of $k$ US macroeconomic and monetary policy shocks, and $X_t$ as a vector of controls, such as day-of-the-week effects. For daily data, the inclusion of lagged exchange rate returns $e_{t-1}$ is hardly ever relevant as most markets are efficient so that lagged returns are statistically insignificant.

It is important to account for the heteroskedasticity in the data. Many papers studying the impact of macroeconomics news or other events on asset prices use ARCH-type of models. However, the problem is that the simultaneous inclusion of a larger number of independent variables – here 13 shocks in total – creates problems with the convergence of the maximum likelihood estimator. In such a setting, it is more appropriate to use a weighted last-square estimator as employed by Andersen et al. (2003) and Ehrmann and Fratzscher (2005b). Moreover, as the present paper is not concerned with the effect on the conditional variance of asset prices, the precise modelling of the conditional second moment is less relevant as long as the heteroskedasticity (as well as the skewness and the kurtosis) are accounted for.

The prior is that better than expected US news should lead to an appreciation of the US dollar. Note that an increase in $e_t$ is defined to reflect an appreciation of the foreign currency or NEER under consideration. Higher values for all US shocks, except for the unemployment rate, imply "good" news for the US economy. This implies that the coefficients, except the one for the unemployment rate, should be negative for all bilateral exchange rates vis-à-vis the US dollar and for the NEERs of foreign currencies.

Table 2 shows the benchmark results based on equation (1) for the US dollar–euro exchange rate as well as the NEERs of the US dollar and euro. Overall, most of the US shocks have a statistically significant and economically meaningful effect on the US dollar–euro. For instance, a 100 basis point (b.p.) tightening shock of US monetary policy causes a 4.2% depreciation of the euro against the US dollar (first row, first column, Table 2). As to the real activity indicators, a stronger performance of the US economy in all cases appreciates the US dollar, and for four of the six indicators significantly so. For instance, a 1 percentage point higher GDP growth depreciates the euro by 0.6%, while a 1 p.p. higher unemployment rate appreciates the euro by 1% against the US dollar.

The same applies to the confidence/forward-looking variables, where a better than expected performance in all three cases depreciates the euro against the US dollar. As to the trade balance, a higher monthly US trade deficit of USD 10 billion depreciates the US dollar by 1.4%. Finally, the expected effect of shocks to CPI inflation and PPI inflation on the exchange rate is unclear. On the one hand, higher than expected inflation may be interpreted by markets as a better than expected performance of the US economy and also raise expectations of monetary policy tightening, thus appreciating the US dollar. On the other hand, if higher inflation is interpreted to mainly imply lower future growth, e.g. due to tighter monetary policy, the exchange rate may depreciate. In fact, US positive US inflationary shocks tend to appreciate the US dollar. This is in line with the findings of Engel and West (2005), whose analysis is based on Taylor-rule type of fundamentals and implies that the positive inflationary shocks should indeed appreciate the domestic currency. Moreover, Clarida and Waldman (2007) argue along similar lines but also stress that exchange rate reactions to inflation shocks across countries reflects differences in the market perception of monetary policy objectives and strategies.

Turning to the NEERs, the US dollar NEER is found to react much less to US shocks than the bilateral US dollar–euro exchange rate. The results suggest that this difference mostly comes from the relatively large reaction of the euro as compared to other currencies included in the US dollar NEER. Comparing the reaction of the US dollar NEER with and without including the euro reveals that the US dollar

NEER does not react at all to US shocks, except in one of 13 cases, when the euro is excluded from the NEER.

Interestingly, the reaction of the euro NEER (column 4) to US shocks is about as strong in magnitude as the US dollar NEER itself. In fact, the euro NEER depreciates more than the US dollar NEER appreciates in response to positive US shocks for 7 of the 13 variables in the model. It implies that many currencies in the US dollar NEER react much less to US shocks than the euro. For instance, if all currencies in the US dollar NEER responded equally to US shocks, then the euro NEER would react only by one fifth as much as the US dollar–euro bilateral exchange rate, i.e. equal to the weight of the US in the euro area trade-weighted NEER.

## 3.2 Heterogeneity of effects of US dollar shocks

To provide an overall perspective of the cross-sectional heterogeneity of the responses, Table 3 shows the reactions of the 26 main currencies in the basket of the US dollar trade-weighted NEER to a "negative" one-standard deviation shock to each of the 13 macroeconomic and monetary policy shocks,[4] scaled so that together they reflect a 1% depreciation of the US dollar NEER.

The results of Table 3 show a remarkably high degree of heterogeneity in the reaction of exchange rates to US shocks. The exchange rates against which the US dollar responds the strongest are the euro and the Swiss franc. Thus, a 1% nominal effective depreciation of the US dollar due to US shocks implies a 3.2% depreciation of the US dollar against the euro, but only a 1.9%, 1.7% and 0.6% drop of the US dollar against the Japanese yen, the UK pound and the Canadian dollar. Two examples illustrate the importance of the distributional effects of US shocks. While the Canadian dollar appreciates slightly against the US dollar due to negative US macroeconomic shocks, it actually depreciates in effective terms (see column 2). Interestingly, the currencies of 4 of the 5 Latin American currencies even tend to slightly appreciate in response to some positive US shocks, thus underlining the strong heterogeneity and implications for cross rates. Moreover, the Chinese renminbi (RMB) hardly reacts to US shocks, and interestingly the RMB NEER in fact moves one-for-one with the US dollar NEER.

Against the euro, negative US dollar shocks in the past have not only implied a fall in the bilateral US dollar exchange rate, but also in effective terms. As a

[4] A "negative" shock is implied to mean that the shock is expected to depreciate the US dollar. To gain an idea of the order of magnitude of the effects involved, it should be noted that a negative one-standard deviation shock to each of the 13 macroeconomic and monetary policy variables in the past has induced a roughly 2% depreciation of the US dollar NEER.

rule of thumb, Table 3 indicates that a 1% negative US dollar shock has induced an appreciation of the euro by 3.2% bilaterally against the US dollar and by 1.2% in effective terms. Note that if all currencies appreciated equally vis-à-vis the US dollar, a 1% effective depreciation of the US dollar would imply that the euro appreciates by only 0.18% in effective terms, given that the US dollar accounts for only about 18% in the euro's effective exchange rate basket. Hence most of the euro's effective changes in response to US shocks are explained not by the move of the US dollar against the euro, but by the relatively smaller US dollar move again other currencies.

Focusing on the effects of individual US shocks, Table 4 provides the benchmark results for NEERs of some selected countries, and Tables 5.A-C for bilateral exchange rate responses of de facto flexible currencies.[5] Both tables are large and contain a lot of information. To focus on a few interesting cases, look at the reaction of the Canadian dollar in the second column of Table 5.A. It is striking that the Canadian dollar reacts significantly to US shocks in only two cases, and even in these two cases it moves substantially less than other currencies. For a US monetary policy shock, a 100 b.p. US tightening depreciates the Canadian dollar by 0.86%, which is only between one half and one quarter of the magnitude of the reaction of the euro, the Swiss franc, the Danish krona, the UK pound or the Japanese yen.

Another revealing example is Mexico, shown in the fifth column of Table 5.B. The Mexican peso hardly reacts to US shocks, and in fact depreciates in response to a positive US shocks only in one case (GDP). More generally, most Latin American currencies hardly react to US shocks and even tend to appreciate due to a rise in US interest rates, although only the reaction of the Brazilian real is statistically significant. Similarly, most Asian currencies also hardly show any response to US shocks. As the result shown in Table 5 are only for flexible exchange rates, it should be noted that a lack of exchange rate reaction here does not stem from the fact that many EMEs had fixed exchange rate regimes at some point in the past.

By contrast, many currencies of Central and Eastern European countries react significantly to US shocks (Table 5.C). For instance, the Czech koruna and the Hungarian forinth are among the most sensitive exchange rates as most US shocks exert a significant effect on these currencies. However, the size of the response is in most cases substantially smaller than that of the US dollar–euro exchange rate.

[5] It should be stressed that all the currencies shown in Tables 5.A to 5.C are included only during periods when they were de facto flexible. The definition of "de facto flexibility" is based on the classification by Reinhart and Rogoff (2004), including freely floating and managed floating regimes, and has been updated through 2006. Note that there is a potential endogeneity issue as the choice of regime could in part be motivated by the sensitivity of individual currencies to US shocks. An alternative to de facto regimes is to use de jure classifications, e.g. based on the IMF AREAER, though in practice there is a high correlation between de jure and de fact regimes.

As it is hard to digest the large amount of information provided in Table 5, it may be useful to plot the cross-sectional distribution of exchange rate responses. Figure 1.A (for all 64 currencies) and Figure 1.B (only for flexible exchange rates) plot the distribution of the effect of the US shocks, with the horizontal axis showing the coefficient $\beta_k$ of model (1) and the vertical axis giving the frequency, i.e. how many of the currencies are in a particular coefficient bin. The figures make two important points. First, they confirm that there is remarkably high degree of heterogeneity in the response pattern of exchange rates to most US dollar shocks. The second point is that this heterogeneity is not mainly the results in differences in exchange rate regimes, but applies about equally also when analyzing only currencies that are flexible vis-a-vis the US dollar.

## 3.3 Robustness and extensions

This sub-section provides a number of extensions and robustness checks.

First, many factor, originating not only in the US but also in the partner country as well as in third countries, affect exchange rates. Many of these cannot be captured in an econometric analysis, so that the explanatory power of empirical models is mostly rather small. This point has been made by Andersen et al. (2003) and Ehrmann and Fratzscher (2005b) for selected exchange rates. Hence it should be stressed that the objective of the analysis cannot be to *explain* all exchange rate movements of the past, but merely to understand the cross-sectional distribution of well-identified shocks.

Nevertheless, it is useful to check whether the inclusion of other relevant factors influences the parameters estimates found for the 13 US shocks. In principle, this should not be the case as a shock is the surprise component of the release and thus should be orthogonal to any other shocks occurring on the same or other days. Nevertheless, the benchmark model (1) is extended to include a broad set of euro area macroeconomic and monetary policy shocks, i.e. for the three largest economies (Germany, France and Italy) and for the euro area as an aggregate.[6] Table 6 shows two key results. A first one is that several euro area variables indeed exert a statistically significant effect on the bilateral euro-dollar exchange rate, and mostly with the expected sign, i.e. a positive euro area shocks leads to an appreciation of the euro.[7] The second finding is that the estimates for the effects of US shocks are hardly

[6] The length of the available data series is much shorter for the euro area and its individual countries, stretching back only to 1993 for Germany and France, mostly to 1997 for Italy and to 1999 for euro area aggregates.

[7] Note, however, that for the 38 euro area shocks included only those 10 shocks are shown in

changed when controlling for other shocks, such as euro area news. This confirms the hypothesis that the analyzed shocks are orthogonal to and are not systematically related to other factors occurring at the same time.

Second, a related point focuses on the *persistence* of the effects of shocks. In the benchmark model (1), shocks are assumed to only have a contemporaneous impact on exchange rates. However, it may be possible that important macro shocks exert an influence on asset prices for several days or weeks. Such an argument would be consistent with the finding of Evans and Lyons (2005) that macroeconomic news affect order flow in some cases for several days. However, for almost all of the 64 currencies analyzed, there is no systematic statistical evidence that US shocks have an impact on bilateral US dollar exchange rate beyond the same day. This is consistent with the evidence by Andersen et al. (2003) and suggests that market efficiency in the US dollar market for most currencies is sufficiently large so that relevant information are priced in within the same day.

Third, I test for *asymmetries* in the effects of US shocks. Specifically, it is asked whether large shocks or negative shocks have a higher relevance for exchange rates than smaller or positive shocks. This possibility has a sound theoretical footing as e.g. negative news may alter market fundamentals in a different way from positive news (e.g. Veronesi 1999). However, when testing this hypothesis, I find that negative and also large US shocks in a few cases indeed have a slightly larger effect on exchange rates than positive and small ones, but that these differences are hardly ever statistically significant.[8]

Fourth, another potentially relevant issue is that of *endogeneity*. It may be that some FX markets are less deep and always exhibit a larger volatility than others. Hence a higher responsiveness of individual currencies to US shocks may merely reflect a difference in market structure and liquidity. However, two findings refute this argument. The first one is that the empirical results change little when controlling for overall market volatility in model (1) (akin to a GARCH-in-mean specification). The second one is that if anything, this issue of endogeneity should magnify the cross-country differences found above. In particular, those currencies that react the strongest to US shocks - namely foremost European currencies - have among the most liquid and least volatile FX markets.

---

the table that are statistically significant. The other 28 shocks, which are not shown for brevity reasons, are not found to exter a statistically significant effect on the euro-dollar exchange rate.

[8] Results are available upon request.

# 4 Evolution over time in heterogeneity and in contributions to US dollar adjustment

This section asks of how the heterogeneity in the response pattern across currencies has evolved over time (section 4.1) and how much each currency has contributed to the movements of the US dollar effective exchange rate (section 4.2).

## 4.1 Evolution of heterogeneity over time

How has the heterogeneity in the responses to US shocks across currencies evolved over time? It is difficult to form a theoretical prior about time variations because the evolution may largely depend on the determinants of the transmission, an issue to which I will turn in detail in section 5. However, there are a number of factors that point towards a likely reduction in this heterogeneity over time.

In particular, as more countries move towards flexible exchange rate regimes, differences in regimes should become less of a driver in the response patterns to US shocks. Figure 2 shows that indeed the share of currencies that is de facto floating vis-a-vis the US dollar has increased substantially since the early 1990s. A similar pattern is present for the weight of floaters in the basket of the US dollar NEER. However, an interesting point to note is the significant drop in the weight of floaters since 2000, which primarily reflects the rising weight of China. Moreover, also increased global financial and real integration may imply a lower degree in the heterogeneity of the transmission process to exchange rates. However, the heterogeneity may not fall and even rise to the extent that such integration is asymmetric across countries and regions.

Figure 3 pictures the evolution of the heterogeneity in the response patterns - measured as the standard deviation across the transmission coefficients $\beta_k$ of model (1) for each shock at any point in time. The figure shows strong evidence that the heterogeneity of the reactions of the 64 currencies to US shocks has mostly declined substantially over time. For several of the macroeconomic shocks - such as for employment, unemployment, ISM and retail sales - there even is a convergence path in that the strongest decline in the heterogeneity occurred in the 1980s and early 1990s, while it has stabilized since the mid- to late 1990s. Figure 3.B indicates that the reduction in heterogeneity is not just the result of changes in exchange rates regimes, but holds almost equally when analyzing only de facto floating currencies. This suggests that other factors than exchange rate regime choices must play a role in determining the response of currencies to US shocks, an issue to be discussed in detail in section 5.

## 4.2 Contributions of currencies to effective US dollar adjustment

Which currencies drive the movements in the effective US dollar exchange rate? Or more precisely, how much do individual currencies contribute to the overall adjustment of the US dollar NEER? This sub-section attempts to quantify the relative contributions of each currency using a simple benchmark measure.

As a simple benchmark, the *conditional contribution* of each bilateral exchange rate to the change in the US dollar NEER is measured as

$$\frac{|w_{i,t}\widehat{e}_{i,t}|}{\sum_i |w_{i,t}\widehat{e}_{i,t}|} \tag{2.a}$$

with $w_{i,t}$ as the weight of currency $i$ in the basket of the US dollar NEER at time $t$, and $\hat{e}_{i,t}$ as the fitted value from estimation of model (1), i.e. the reaction of bilateral exchange rate $i$ to US shocks at time $t$. A corresponding *unconditional contribution* measure can be constructed not just for US shocks, but for the overall daily movements in bilateral exchange rates $e_{i,t}$:

$$\frac{|w_{i,t}e_{i,t}|}{\sum_i |w_{i,t}e_{i,t}|} \tag{2.b}$$

There is one important difference between the conditional measure (2.a) and the unconditional measure (2.b). This difference is that the conditional one measures how individual currencies react to US shocks; i.e. the *causality* can be identified and comes purely from US-specific shocks. By contrast, the unconditional measure does not yield any information about what drives the change in the bilateral exchange rates, i.e. the source of the change could either lie in the US or it could come from the partner country or even stem from third countries.

Figure 4 shows the *evolution over time* in the conditional contribution (dark/red line), the unconditional contribution (light/green line) and the trade weight (dashed/blue line) for 16 of the 26 main currencies in the US NEER over the period 1980-2006, using time-varying weights and recursive parameters estimates of model (1). There are some large and striking changes in the contributions to movements in the US NEER. Overall, most currencies of advanced economies are overweight, i.e. their contributions to changes of the US NEER are larger than their weights in the basket. However, many of these currencies have seen both their conditional and unconditional contributions decline over time, whereas those of most EMEs have generally

risen – partly reflecting the move to more flexible exchange rate regimes.

Interestingly, the euro-US dollar exchange rate not only provides the largest contribution, but the share of its conditional contribution has increased over time, from 32% in the 1980s to about 40% today (top left plot of Figure 4). By contrast, the unconditional contribution of the bilateral euro-US dollar exchange rate has declined, in line with the slight drop in the trade share of the euro in the US NEER.

This increase in the conditional contribution of the euro and the rising gap to the unconditional contribution is striking. Different factors are likely to have contributed to this pattern. One of these is that the impact of US shocks on the euro may have become stronger over time. Indeed Figure 5 provides the time-varying parameter estimates for the US dollar-euro exchange rate – based on a recursive estimation of model (1). The figure shows that the effect of several important US shocks – those to employment, unemployment, GDP and the ISM indicator – on the USD/EUR have increased over time, in particular in the last few years.

By contrast, the contribution of currencies of other advanced economies has decreased somewhat over time. For instance, the conditional contributions of the UK pound and the Japanese yen have declined significantly between the 1980s and today – from 8% to 6% for the pound and from 25% to 11% for the yen. The Canadian dollar is a particular outlier among advanced economies' currencies. It generally moves less against the US dollar and in particular reacts much less to US shocks than other exchange rates – reflected in contributions much below its trade share in Figure 4. Interestingly, Canada's unconditional contribution has started to increase sharply in recent years, while the conditional contribution, i.e. the reaction to US shocks, has not changed much. Both of these characteristics suggest that what has driven the relative increase in the Canadian dollar's movements against the US dollar in recent years are factors unrelated to the US, such as the sharp increase in commodity prices inducing some decoupling of the Canadian dollar.[9]

Moreover, most EMEs provide only very low contributions to the adjustment of the US dollar NEER. China's trade weight is increasing rapidly to more than 15%, but given its fixed exchange rate regime its share of the US dollar NEER adjustment is basically nil. Other EMEs have increased their contributions after the floating of their exchange rates. Their contributions nevertheless are still often substantially less than their weights in the US dollar NEER.[10]

[9] Of course, not all important US shocks affecting exchange rates may be captured in the 13 shocks included here. However, given that the contributions are relative measures – i.e. relative to other currencies – such an omission should affect the contributions only to the extent that they exert asymmetric effects, i.e. affect individual currencies more than others.

[10] An interesting note is the sharp increase in the unconditional contributions for Malaysia and

As a sensitivity check, note that all results shown here are robust to using alternative time frequencies for the construction of the contribution measures (2.a) and (2.b). This frequency issue could be relevant given that different currencies exhibit very different degrees of volatility. For instance, a volatile currency could be given a higher contribution based on (2.b), not because it moves in a particular direction, but simply because of higher daily volatility. The magnitude of this problem should be reduced when moving to a lower time frequency, such as monthly or quarterly frequency. However, the results are mostly robust to the use of alternative time frequencies.

In summary, the contributions to the adjustment of the US dollar NEERs are highly uneven, in particular with many currencies of advanced economies carrying a larger share of the adjustment than their weights in the US basket. The euro in particular has seen its share of the contribution rise over the past decade, in contrast to that of other currencies of advanced economies. Many countries with fixed exchange rate regimes, such as China, have seen their trade weights rise rapidly over the past 25 years, but not always their contributions to adjustments of the US dollar NEER.

# 5 Channels and determinants

I now turn to analyzing the channels and determinants of the large degree of heterogeneity in the reaction of bilateral exchange rates to US shocks. Section 5.1 focuses on the role of other asset price responses, while Section 5.2 looks mainly at the importance of trade integration and financial integration as well as other factors.

## 5.1 The role of monetary policy

The paper has so far shown that there is a considerable degree of heterogeneity across countries in the way exchange rates react to US shocks. One potential explanation for this heterogeneity is that it reflects and matches the response of other asset prices and/or economic policies. In particular, countries where monetary policy reacts relatively strongly to US shocks may see their currencies vis-a-vis the US dollar respond less compared to those where short-term interest rates are less sensitive.

Thailand during the Asian crisis, while the conditional contributions remained relatively stable and increased more gradually. This again underlines the difference between these two measures, with the conditional one identifying the US as the source of exchange rate movements, while changes in the unconditional could stem from the individual countries themselves.

This relation between (short-term) interest rates and the exchange rate can be formalized in an uncovered interest rate parity (UIP) framework where $E_t e_{t+n} = (r_{t,n} + r^*_{t,n}) + \rho_{t,n}$ , with $E_t$ as the expectations at time $t$ of the change of the exchange rate $e_{t+n}$ over horizon $n$, $r_{t,n}$ and $r^*_{t,n}$ as domestic and US interest rates of maturity $n$, and $\rho_{t,n}$ as a risk premium. UIP has of course widely been shown not to hold and a sizeable forward discount bias to be present in the data. As argued in Faust et al. (2007), it nevertheless constitutes a useful starting point to think of the link between the reactions of monetary policy rates and exchange rates. For instance, under constant risk premia and unchanged expectations of the future exchange rate, the exchange rate should respond relatively more strongly to an exogenous shock if also interest rate differentials react more substantially. In fact, much of the above-discussed recent literature on the link between exchange rates and Taylor rule fundamentals (Engel and West 2005, Mark 2005, Clarida and Waldman 2007) has emphasized the endogeneity of monetary policy to exogenous shocks, such as to inflation or output.

On the one hand, this argument suggests that countries whose interest rates react significantly, and move in the same direction as and closely with US interest rates, may experience less of a response of their bilateral exchange rates vis-à-vis the US dollar. On the other hand, a number of studies have emphasized that countries that are highly dependent on the US economy may see both their exchange rates and their interest rate react more strongly to US shocks than less dependent and integrated countries (Frankel et al. 2004, Ehrmann and Fratzscher 2006).

Hence it is ultimately an empirical question if and which of these two effects dominates. I conduct two tests to get at this hypothesis. The first is to modify model (1) and extend it in the following way:

$$e_{i,t} = \alpha_i + \sum_k [\beta^1_k s_{k,t} + \beta^2_k s_{k,t}(r_{i,t} - r^*_t)] + \delta(r_{i,t} - r^*_t) + \varepsilon_{i,t} \qquad (3)$$

with $r_t$ and $r^*_t$ as domestic interest rates and US interest rates, respectively.[11] The null hypothesis is $H_0 : \beta^2 = 0$ for each of the US shocks $s_{k,t}$, which would imply that the effect of a US shock on countries' exchange rates is *independent* of the reaction of countries' short-term interest rates. Note that, unlike model (1), model (3) is estimated in a panel framework, with the subscript $i$ indicating the individual countries' currencies. The model is estimated using country fixed effects $\alpha_i$, although

[11] All interest rates are short-term, i.e. mostly three-month T-bill or interbank rates. The argument presupposes that US short-term rates also react sizeably to US shocks, which in most cases holds true, though the results for the US alone are not shown here for brevity reasons.

it should be stressed that the inclusion of fixed effects does not affect the parameters of interest in any meaningful way.

Table 7 shows the coefficients $\beta^1$ and $\beta^2$ for each of the US shocks. The country sample is reduced to 43 countries, which had both de facto flexible currencies and for which short-term interest rates are available. The key point that stands out from the table is that in all cases we cannot reject that $\beta^2 = 0$. Moreover, the fact that the sign of $\beta^2$ changes across different shocks underlines that this result is not driven by insufficient statistical power to reject that $\beta^2 = 0$.

The second test is to estimate the model of equation (1) above for each individual country separately not only for exchange rate responses $e_t$ but also for the reaction of interest rates differentials $(r_t + r_t^*)$ to US shocks. Figure 6 plots the exchange rate responses (horizontal axis) against the reaction of short-term interest rate differentials (vertical axis) for each country. The figure confirms visually the results of model (3) and Table 7 in that there is no apparent correlation between exchange rate and interest rate response patterns.

As to the interpretation, the finding of this section not only confirms the well-known fact that UIP does not hold empirically (e.g. Engel 1996), but it also underlines that the significant heterogeneity in the response pattern of exchange rates to US shocks is still present when controlling for differences in the response patterns of monetary policy across countries. This is consistent with the literature that shows that the transmission mechanism of US shocks to foreign interest rates is strong even for relatively "autonomous" economies, such as the euro area (Goldberg and Klein 2006; Ehrmann and Fratzscher 2005a; Faust et al. 2007). At the same time, the finding suggests that we need to look for other factors to explain this heterogeneity. Figure 6 distinguishes between currencies of countries that have a high degree of financial integration (light/green dots in Figure 6; with financial integration measured as a country's total financial assets plus liabilities as a ratio of GDP - as explained in detail in section 2.2), and those that have a low degree of financial integration (red/dark diamonds). What this figure implies is that countries with a high degree of financial integration experience in several cases a stronger reaction of their exchange rates - but not necessarily of their interest rates - to US shocks than countries with a low degree of financial integration. This serves as motivation to analyze the role of real and financial integration in the transmission mechanism, an issue to which I turn next.

## 5.2 The role of real and financial integration

As the final part of the analysis, the paper now turns to the role of macroeconomic factors as determinants of the transmission process of US shocks to exchange rates. As motivated in the Introduction and in Section 3, important determinants of the transmission are likely to be real interdependence, trade integration and financial integration of individual countries globally and with the United States.

The hypothesis of interest is whether currencies of countries with a high degree of real interdependence, large trade integration or high financial integration are more sensitive to US macroeconomic and monetary policy shocks than countries that are less dependent or integrated. There are various reasons of why real/trade integration and financial integration may determine the exchange rate response of a country to US shocks. As to trade, higher bilateral trade with the United States may mean that a negative demand shock in the US affects close trading partners in a more similar way, thus having little impact on the bilateral exchange rate. However, trade interdependence could also work in the opposite direction: a negative US shock that mainly induces a shift in competitiveness or relative supply may benefit those that trade intensely with the United States; hence leading to a US dollar depreciation. The effect of US shocks may thus depend on the nature of the shocks. A related channel is that of business cycle interdependence. A US shock should, ceteris paribus, have a weaker effect on bilateral exchange rates of economies with a high degree of business cycle comovements with the US. However, business cycle comovements are not necessarily highly correlated with the trade intensity between two economies.

As to finance, the possibility of portfolio diversification by investors may imply that asset prices in countries with a high degree of financial openness and integration may be affected relatively more by US shocks. Hence exchange rate adjustments may be largest for countries with a high degree of financial integration with the United States or overall financial openness and exposure.

Turning to the empirical evidence, the correlation between integration variables, on the one hand, and the exchange rate response, on the other hand, may give us a first idea about the correlation between these two sets of variables. Figure 6 plots for all countries on the horizontal axis the exchange rate response to particular shocks, based on the estimation of model (1) above, against on the vertical axis (a) the degree of financial integration with the rest of the world, defined for each country as its sum of financial assets and liabilities over GDP (first row), (b) trade with the rest of the world, defined as the sum of exports and imports over GDP (second row), and (c) business cycle correlation, defined as GDP growth correlation with the US (third row).

The evidence of the figure shows that there is quite a robust relationship between

financial integration and the response pattern of exchange rates: the higher the degree of financial integration, the stronger (i.e. the more negative) is the response of exchange rates to a positive shock to US economic activity or a tightening of US monetary policy. The same robust relationship holds for business cycle correlation of countries with the United States. By contrast, there appears to be no substantial positive or negative relationship between trade integration and the response pattern of exchange rates.

To test the hypothesis of the determinants of exchange rate responses formally, model (1) is extended in the following way:

$$e_{i,t} = \alpha_i + \sum_k \beta_k^1 s_{k,t} + \beta_k^2 s_{k,t} Z_{i,t} + \delta Z_{i,t} + \varepsilon_{i,t} \tag{4}$$

with $Z_{i,t}$ as a vector of determinants, including various measures of financial integration, real integration and other controls. The null hypothesis is $H_0 : \beta^2 < 0$. Similar to (3), model (4) is estimated in a panel framework for individual countries' currencies, and allows for country fixed effects $\alpha_i$. Note that some of the integration variables, such as financial integration, are time-invariant due to data availability so that in these cases $Z_{i,t}$ should rather be $Z_i$ and $\delta$ drops out from the model as country-specific, time-invariant variables are captured by the country fixed effects $\alpha_i$.

Table 8 starts by analyzing the role of exchange rate regimes, market liquidity and de jure capital account openness of countries for the $Z_{i,t}$ vector of determinants. The first set of columns for the exchange rate regime shows that countries with de facto flexible exchange rate regimes ($Z_{i,t} = 1$), as defined in section 2, see their currencies react significantly and often substantially more strongly to US shocks than countries with inflexible regimes ($Z_{i,t} = 0$), with $\beta^2$ - termed "Interaction" in the table - being negative and statistically significant for several of the US shocks. An important point to emphasize is that, as in the previous sections, the aim of the analysis is to focus on de facto flexible currencies. Hence all subsequent estimations are conducted only for de facto floating currencies, which implies that the number of currencies included drops to the 45 flexible currencies in the sample.

Another possibility is that differences in exchange rate responses to common shocks is due to differences in market liquidity or to capital account openness. As there is no available data on the liquidity of FX markets for such a broad set of countries, I use equity market capitalization as well as FX volatility - defined as the standard deviation of weekly exchange rate movements for each currency and each year - as two proxies for market liquidity. The idea for using these two proxies is that equity market capitalization is in most cases positively correlated with FX market

liquidity. Similarly, more FX market volatility may partly reflect lower FX market liquidity. However, there is no compelling evidence that such market liquidity factors play a role in explaining the response pattern across exchange rates to US shocks as the interaction coefficient $\beta^2$ is in almost no case statistically significant. The same finding applies to capital account openness, though it should be noted that few of the countries and time periods of the sample had closed capital accounts.

Turning to financial integration, Table 9 shows the findings for flexible exchange rates when using various proxies for financial integration – measured, first, as total asset holdings vis-a-vis the rest of the world as a ratio of domestic GDP (labeled as "1 w ROW" in the table); second, the sum of asset plus liabilities vis-a-vis the rest of the world over domestic GDP ("2 w ROW"); and third and fourth, the same measures but only bilaterally vis-a-vis the United States (labeled as measures "1 w US" and "2 w US" in the table). Moreover, the first column shows a price-based measure of financial integration, with $Z_{i,t}$ proxied through weekly equity return correlations for each country and each year with the US.

The main conclusion of Table 9 is that financial integration appears to be a relevant determinant explaining the cross-sectional distribution of exchange rate responses to US shocks. For the majority of the shocks it holds that $\beta^2 < 0$, and statistically significantly so. In particular, what appears to matter most among the financial integration proxies is the bilateral financial integration with the United States, shown in the last set of columns of Table 9. The size of the $\beta^2$ coefficient is in most cases much larger for this bilateral financial integration measure than for the other proxies. Table 10 breaks down this bilateral financial integration with the United States into the individual components - FDI, portfolio investment equity and debt securities, and other investment/bank loans. What stands out from this table is that it is primarily the integration through equity securities and debt securities, but not FDI and loans, that explains the heterogeneity in exchange rate responses.

Turning to the role of real integration and trade integration, Table 11 provides the point estimates for four analogous proxies of trade integration which are analogous to the financial integration measures discussed for Table 9 (measuring exports plus imports over GDP vis-a-vis the rest of the world in columns two and three, and vis-a-vis the US in the last two sets of columns). Moreover, as a proxy for business cycle synchronization, the first set of columns of the table shows the results for the correlation of GDP growth rates between each country i and the US, over the period 1970-2004, as a determinant of the shock transmission.

Exchange rates of countries with a low synchronization of the business cycle with the US do react statistically significantly less strongly to US shocks for 7 out of the 13 shocks. By contrast, trade integration does not appear to matter for the

responsiveness of countries' exchange rates to US dollar shocks. In most cases $\beta^2$ is not statistically significant. However, a note of caution is on order here. What this finding implies is *not* that the trade balance is irrelevant for exchange rates; in fact, changes in the US trade balance exerts a significant and sizeable effect on the US dollar, in line with macroeconomic studies such as Gourinchas and Rey (2006), who find that the trade balance even has predictive power for the exchange rate. Instead, what the results entail is merely that trade affects all bilateral exchange rates equally, in contrast to financial integration.

It should be stressed again that these results are suggestive and one needs to be very cautious in drawing causal implications from the findings. In particular, many of the macroeconomic determinants analyzed are correlated with one another. Ideally, one would therefore like to include the various determinants simultaneously in the model and to control for the ensuing multicollinearity. Given the number of large number of shocks and interaction variables included already in model (4), there are however limitations to how far the model can be extended. For instance, one question that remains is whether business cycle synchronization still raises transmission once financial integration is controlled for.

In summary, despite these caveats and this note of caution, some interesting results emerge from the analysis. In particular, the heterogeneity in the reaction of exchange rates appears to be unrelated to trade, but strongly related to finance and the business cycle. In particular, what seems to matter most is the degree of financial openness and integration.

# 6 Conclusions

We still lack a thorough understanding about the precise role of macroeconomic fundamentals for the determination of exchange rates. The present paper has focused on the *heterogeneity* in this relationship between fundamentals and exchange rates. Using well-identified US macroeconomic and monetary policy shocks, the empirical analysis has shown that the effects of such US shocks on exchange rates exhibit a substantial degree of heterogeneity, altering cross-rates and more generally global exchange rate configurations significantly.

Moreover, the paper has tried to quantify the contributions of individual exchange rates to changes in the US dollar NEER. Currencies of industrialized countries generally contribute more to the adjustment of the US dollar NEER than their weights in the basket, while EME currencies mostly contribute substantially less – including many EMEs with flexible exchange rate regimes. It has been in particular European currencies, those part of a euro currency bloc including EU new member states and

transition economies, and to a lesser extent also the UK pound and the Japanese yen that exhibit the strongest reaction to US shocks while other flexible exchange rates, for instance of Mexico, Canada, and some Asian countries, hardly respond at all to US-specific shocks. Interestingly, movements in the US dollar-euro are not only the largest contributor to the adjustment of the effective US dollar exchange rate, but the contribution of the euro has increased since the late 1990s.

The final part of the paper has shown that it is primarily the degree of countries' financial integration – but not trade integration, neither globally nor bilaterally with the US – that explains the large cross-sectional heterogeneity in exchange rate responses. It is specifically the integration via portfolio investment equity and debt securities that matters for exchange rate sensitivity, suggesting that portfolio diversification and reallocation motives are a central transmission mechanism of global shocks. Moreover, the heterogeneity is not due to the choice of fixed exchange rate regimes, but holds equally when analyzing only de facto flexible regimes. A related key finding is that the sensitivity of exchange rates to foreign shocks is unrelated to the reaction of monetary policy.

What are the implications of these findings? A number of influential studies have argued that an adjustment of global current account imbalances may require a substantial effective depreciation of the US dollar (e.g. Obstfeld and Rogoff 2005; Blanchard, Giavazzi and Sa 2005; Krugman 2006; IMF 2007). A central question for policy-makers is how such a US dollar adjustment may play out for global exchange rate configurations. Thus understanding how US-specific shocks have affected exchange rates in the past should help us gauge how they may do so in the future. What the findings of the paper suggest is that under very different degrees of financial integration and also if today's fixed exchange rates, foremost in Emerging Asia and among oil-exporting countries, remain fixed for the foreseeable future, a US-led adjustment could have highly asymmetric effects on global exchange rate configurations. As a counter-argument, it may also imply that an exchange rate adjustment may do little to existing current account imbalances when half of US trade and two thirds of the US deficit are with countries that have fixed exchange rate regimes or are not highly integrated financially.

The empirical results of the paper also imply that currency flexibility is a necessary but not sufficient condition for countries to contribute to an adjustment of global exchange rate configurations. Exchange rates are responsive to foreign shocks only to the extent that market mechanisms are in place that enable a transmission, in particular well-developed financial markets and financial integration with global markets. Hence, while de jure and de facto exchange rate flexibility is certainly required, it is not a guarantee by itself that FX markets will move in the desired

way.

Finally, the rapid global financial integration process that we are currently observing has implications for the conduct of monetary policy, in particular for EMEs that are still in the process of developing financial markets and integrating globally. On the one hand, rising financial integration means more exposure and more sensitivity of countries to foreign shocks. On the other hand, the finding of the paper that currency responses to foreign shocks are unrelated to the monetary policy reaction underlines that monetary policy cannot shield economies and their exchange rates from the exposure to foreign shocks. But monetary policy can adjust to take this increased exposure into account, in order to achieve domestic objectives such as price stability and economic growth.

# References


[1] Andersen, Torben G., Tim Bollerslev, Francis X. Diebold and Clara Vega. 2003. "Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange," *American Economic Review* 39(1): 38-62.

[2] Blanchard, Olivier, Francesco Giavazzi and Filipa Sa, 2005. "International Investors, The U.S. Current Account, and The Dollar", *Brookings Papers on Economic Activity* 1, 1-65.

[3] Chinn, Menzie and Jeffrey Frankel, 2005. "Will the Euro Eventually Surpass the Dollar as Leading International Reserve Currency? " NBER Working Paper No. 11510.

[4] Clarida, Richard, Jordi Gali and Mark Gertler, 1998. "Monetary policy rules in practice: Some international evidence," *European Economic Review*, 42(6), 1033-1067.

[5] Clarida, Richard, Lucio Sarno, Mark Taylor and Giorgio Valente, 2003. "The Out-of-Sample Success of Term Structure Models as Exchange Rate Predictors: A Step Beyond," *Journal of International Economics* 60, 61-83, 2003

[6] Clarida, Richard and Daniel Waldman, 2007. "Is Bad News About Inflation Good News for the Exchange Rate?" NBER Working Paper No. 13010, April 2007.

[7] Corsetti, Giancarlo, Luca Dedola and Sylvain Leduc, 2004. "Productivity, External Balance and Exchange Rates: Evidence on the Transmission Mechanism Among G7 Countries," ECB Working Paper 308.

[8] Daude, Christian and Marcel Fratzscher, 2006. "The Pecking Order of Cross-Border Investment," ECB Working Paper No. 590, February 2006, forthcoming *Journal of International Economics*.

[9] Dominguez, Kathryn, 2003. "The Market Microstructure of Central Bank Intervention," *Journal of International Economics* Vol. 59(1), 25-45, January 2003.

[10] Ehrmann, Michael and Marcel Fratzscher, 2005a. "Equal size, equal role? Interest rate interdependence between the euro area and the United States," *Economic Journal* 115: 930-50, October 2005.

[11] Ehrmann, Michael and Marcel Fratzscher, 2005b. "Exchange Rates and Fundamentals: New Evidence from Real-Time Data," *Journal of International Money and Finance* 24:2, 317-341.

[12] Ehrmann, Michael and Marcel Fratzscher, 2006. "Global financial transmission of monetary policy shocks," ECB Working Paper No. 616, April 2006.

[13] Engel, Charles and Kenneth West, 2005. "Taylor Rules and the Deutschmark-Dollar Real Exchange Rate," *Journal of Money, Credit and Banking* 38(5), 1175-94.

[14] Engel, Charles and Kenneth West, 2006. "Exchange Rates and Fundamentals," *Journal of Political Economy* 113, 485-517.

[15] Engel, Charles, Nelson Mark and Kenneth West, 2007. "Exchange Rate Models Are Not as Bad as You Think," forthcoming *NBER Macroeconomics Annual.*

[16] Evans, Martin D. and Richard K. Lyons, 2002. "Order Flow and Exchange Rate Dynamics," *Journal of Political Economy*, 170-180.

[17] Evans, Martin D. and Richard K. Lyons, 2005. "Do Currency Markets Absorb News Quickly?" *Journal of International Money and Finance* 24:2, 197-219.

[18] Faust, Jon, John Rogers, Shing-Yi Wang and Jonathan Wright, 2007. "The high-frequency response of exchange rates and interest rates to macroeconomic announcements," *Journal of Monetary Economics* 54:4, 1051-1068.

[19] Faust, Jon, John Rogers, and Jonathan Wright, 2003. "Exchange Rate Forecasting: The Errors We've Really Made," *Journal of International Economics* 60, 35-60.

[20] Fleming, Michael and Eli Remolona, 1999. "Price Formation and Liquidity in the U.S. Treasury Market: The Response to Public Information," *Journal of Finance* 54: 1901-1915.

[21] Forbes, Kristin and Menzie Chinn, 2004. "A Decomposition of Global Linkages in Financial Markets Over Time", *Review of Economics and Statistics* 86(3): 705-722.

[22] Fratzscher, Marcel, Luciana Juvenal and Lucio Sarno, 2007. "Asset prices, exchange rates and the current account," ECB Working Paper Series No. 790.

[23] Goldberg, Linda and Michael Klein, 2006. "Establishing Credibility: Evolving Perceptions of the European Central Bank," Revised version of NBER Working Paper 11792.

[24] Gourinchas, Pierre-Olivier and Helene Rey, 2006. "International Financial Adjustment," mimeo, December 2006.

[25] Gürkaynak, Refet, Sack, Brian and Eric Swanson, 2005. "Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1: 55-94.

[26] Hau, Harald and Helene Rey, 2006. "Exchange Rates, Equity Prices and Capital Flows," *Review of Financial Studies* 19 (1), 273-317.

[27] Hausman, Joshua and Jon Wongswan, 2006. "Global Asset Prices and FOMC Announcements," Board of Governors of the Federal Reserve System International Finance Discussion Paper No. 886, November 2006.

[28] International Monetary Fund, 2007. *World Economic Outlook*, April 2007, Chapter 3.

[29] Klein, Michael and Jay Shambaugh, 2006. "The Nature of Exchange Rate Regimes," NBER Working Paper No. 12729.

[30] Krugman, Paul, 2006. "Will There Be a Dollar Crisis?" mimeo, Princeton University.

[31] Lane, Philip and Gian Maria Milesi-Ferretti, 2003. "International Financial Integration," *IMF Staff Papers*, Vol. 50 Special Issue, pp. 82–113 (Washington: International Monetary Fund).

[32] Lane, Philip and Gian Maria Milesi-Ferretti, 2005. "Financial Globalization and Exchange Rates," IMF Working Paper 05/03, January.

[33] Mark, Nelson, 1995. "Exchange rates and fundamentals: evidence on long-horizon predictability." *American Economic Review* 85, 201-218.

[34] Mark, Nelson, 2005. "Changing Monetary Policy Rules, Learning and Real Exchange Rate Dynamics," NBER Working Paper No. 11061.

[35] Meese, Richard and Kenneth Rogoff, 1983. "Empirical exchange rate models of the seventies: do they it out of sample?" *Journal of International Economics* 14, 3-24.

[36] Obstfeld, Maurice and Kenneth Rogoff, 2005. "Global Current Account Imbalances and Exchange Rate Adjustments," *Brookings Papers on Economic Activity* 1, 67-146.

[37] Reinhart, Carmen and Kenneth Rogoff, 2004. "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics* 69(1), 1-48, February 2004.

[38] Rigobon, Roberto and Brian Sack, 2006. "Noisy Macroeconomic Announcements, Monetary Policy, and Asset Prices." NBER Working Paper 12420.

[39] Shambaugh, Jay, 2004. "The Effect of Fixed Exchange Rates on Monetary Policy," *Quarterly Journal of Economics* 119:1, pp. 301-352.

[40] Tille, Cédric, 2003, "The Impact of Exchange Rate Movements on U.S. Foreign Debt," *Current Issues in Economics and Finance* 9(1), Federal Reserve Bank of New York.

[41] Veronesi, Pietro, 1999. "Stock market overreaction to bad news in good times: a rational expectations equilibrium model." *Review of Financial Studies* 12, 975-1007.

[42] Warnock, Frank 2006. "How Might a Disorderly Resolution of Global Imbalances Affect Global Wealth?," IMF Working Paper 06/170.

[43] Wongswan, J., 2006. "Transmission of Information Across International Equity Markets," *Review of Financial Studies* 19, 1157-1189.

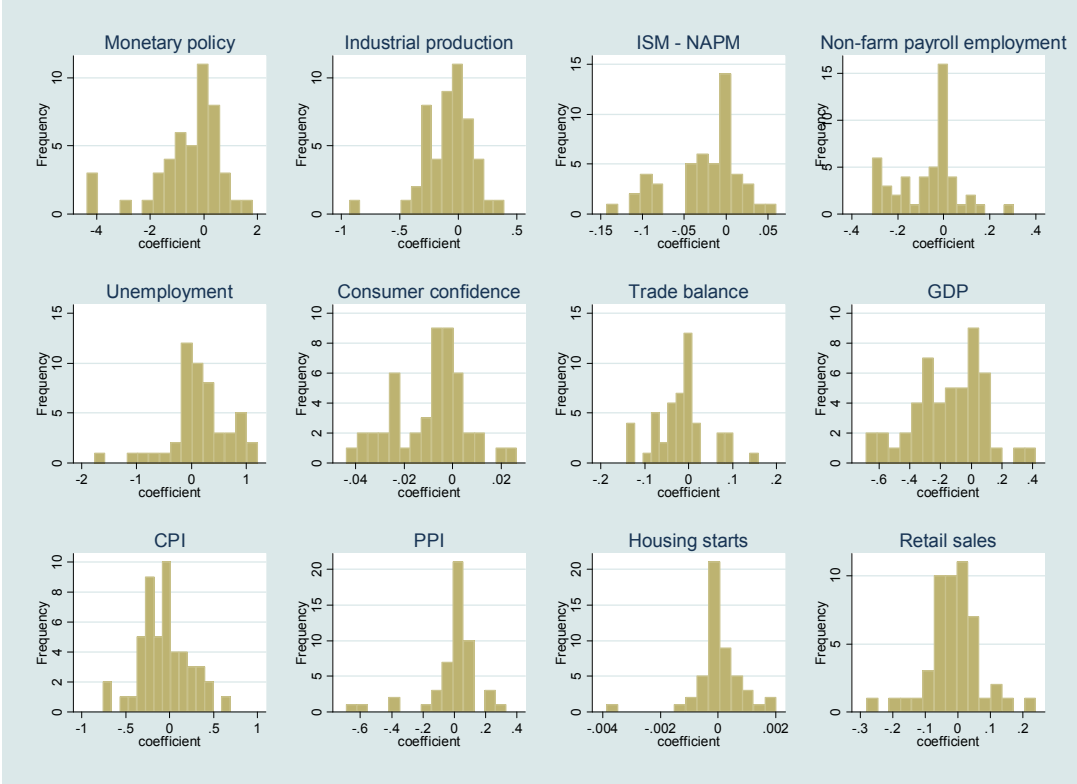
# Appendix

## A. 1: Variable definitions and sources

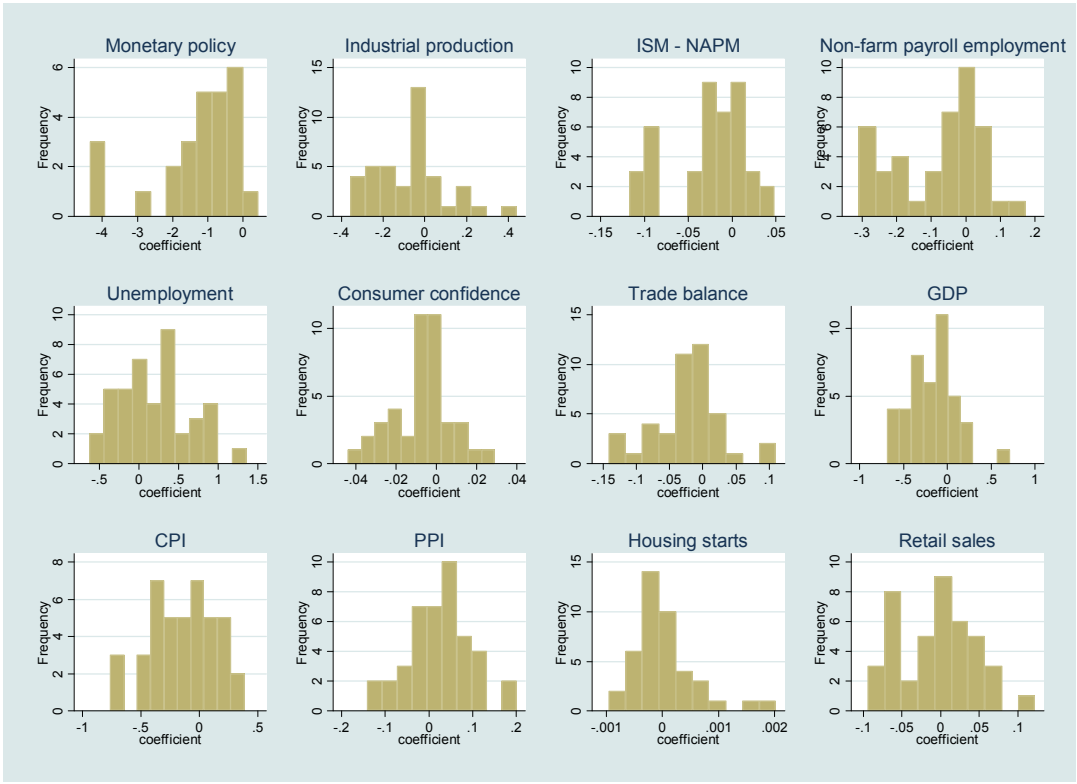
| Variable definition: | Source: |
|---|---|
| **US and euro area macroeconomic news/shocks** – surprise components of macroeconomic announcements on days when they are released, for 12 US macroeconomic variables and 38 euro area variables | Reuters, MMS, S&P International, Bloomberg |
| **US monetary policy shocks** – change of the Fed funds futures rates in the 30 minutes around FOMC policy announcements on FOMC meeting days | Gürkaynak, Sack, and Swanson (2005) |
| **Exchange rates –** Log changes in daily spot exchange rates against the US dollar or NEER | Bloomberg, BIS, Datastream and national sources |
| **Trade –** the sum of imports and exports of goods and services between country *i* and the United States or the rest of the world (ROW), as a ratio of GDPs of country *i* and the US or ROW | IFS, IMF |
| **FDI stocks –** sum of FDI asset and liability holdings between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | UNCTAD |
| **Portfolio equity and portfolio debt stocks –** sum of asset and liability holdings, averaged over 2001-2003, between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | Coordinated Portfolio Investment Survey (CPIS), IMF |
| **Cross-border loans –** sum of asset and liability holdings of claims of banks between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | International Locational Banking Statistics (ILB), BIS |
| **Stock market capitalization** – stock market capitalization relative to domestic GDP | Datastream and IFS |
| **Exchange rate regime –** dummy equal to zero if a country's de facto exchange rate is fixed and one if it is de facto flexible | Shambaugh (2004), Klein and Shambaugh (2006), checked for consistency with Reinhart and Rogoff (2004), author's additions |
| **GDP correlation –** bilateral correlation of annual real GDP growth rates between a particular country and the United States over the period 1980-2003 | IFS, IMF and OECD |

## Figure 1: Distribution of US shocks on bilateral US dollar exchange rates

### A. All exchange rates

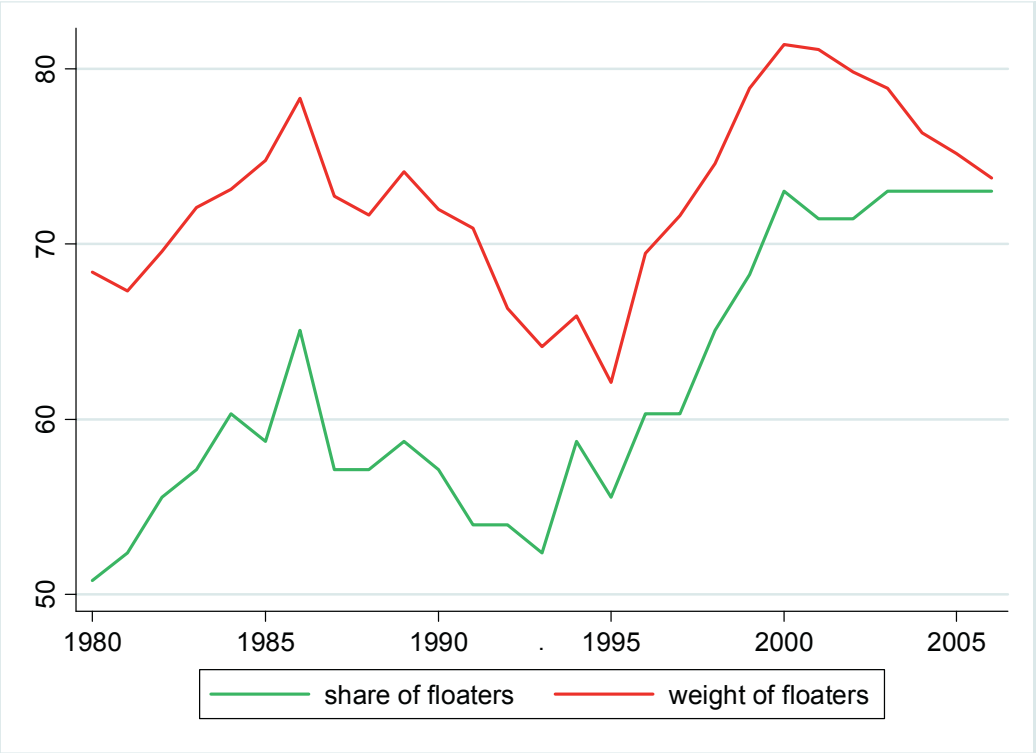



### B. Only *flexible* exchange rates




Notes: The figure shows the distribution of the coefficient β of the effect of US shocks on the 64 bilateral US dollar exchange rates in the sample, based on model (1). The vertical axis shows how many of the exchange rate's responses are in a particular coefficient bin.

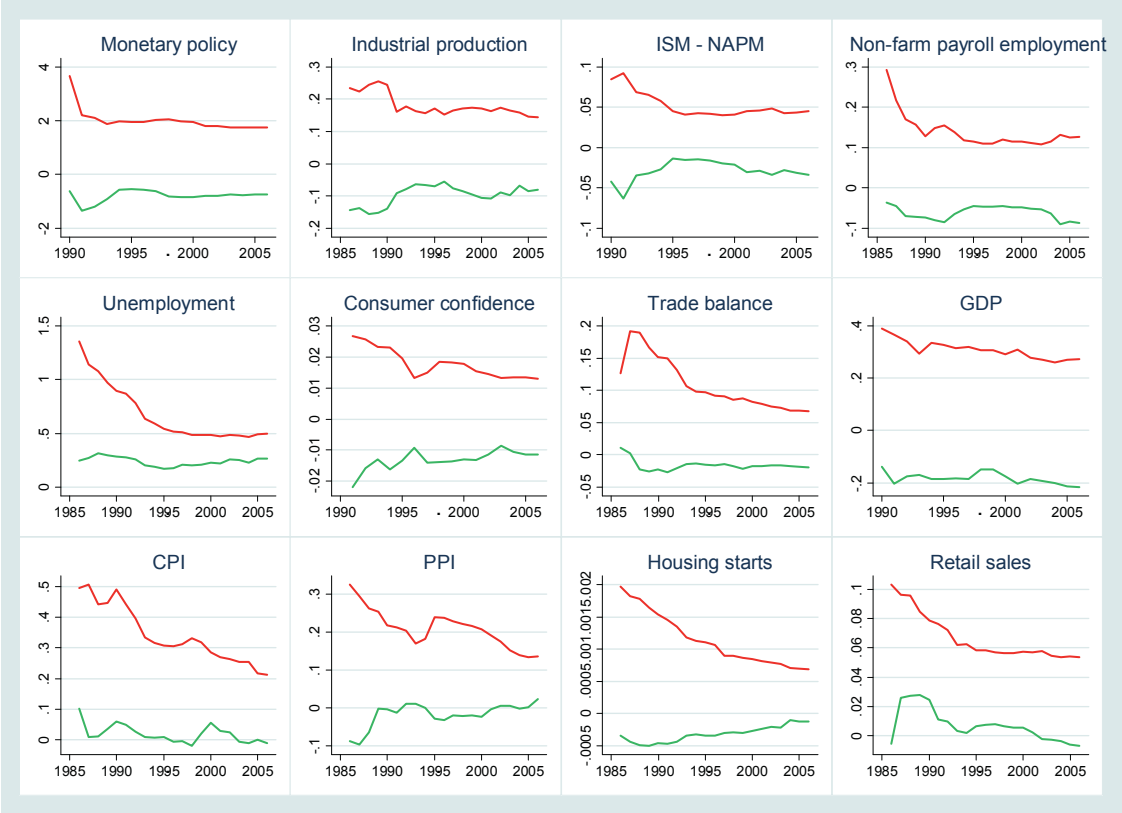
**Figure 2: Share and weight of floating currencies in US dollar NEER (in %)**



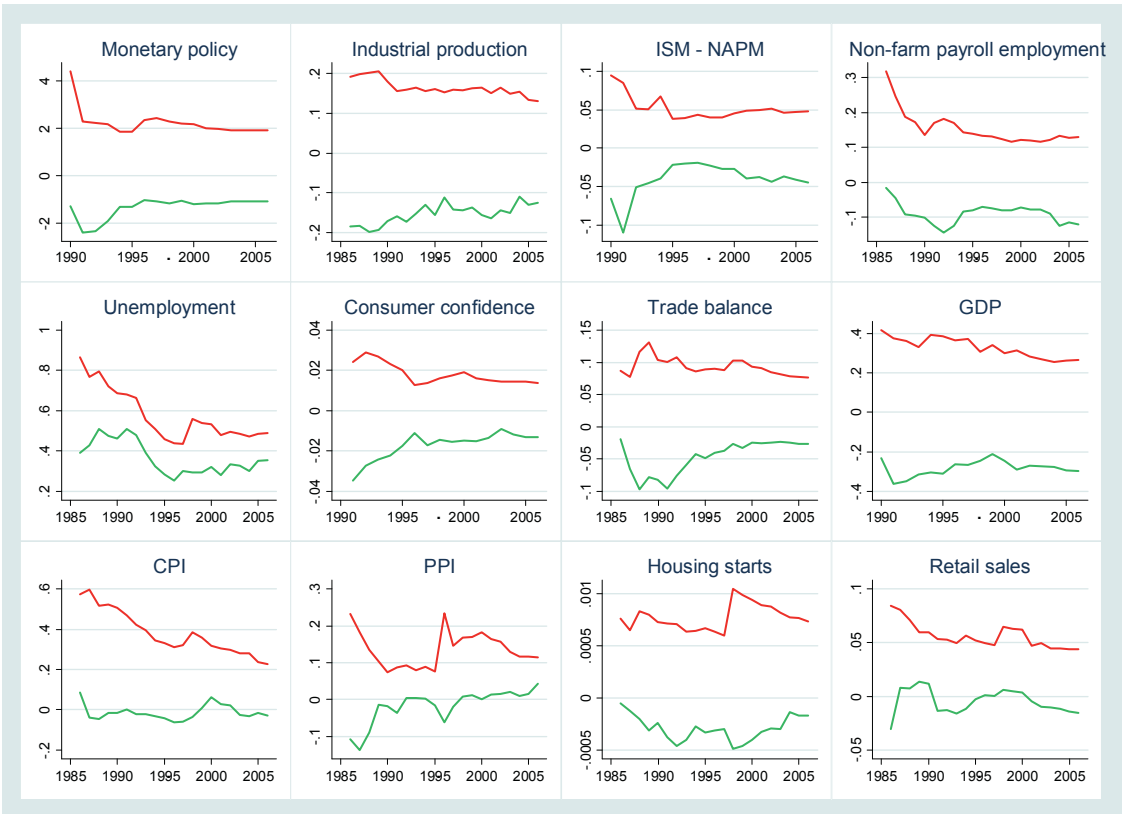

Notes: The light/green line in the figure shows the evolution of the share of floating currencies – defined as countries with either de facto managed floats or de facto free floats – as a percentage of all 64 currencies included in the analysis. The dark/red line shows the combined weight of all de facto floating currencies in the US dollar NEER basket.

## Figure 3: Evolution of mean and heterogeneity of effects of US shocks

### A. All exchange rates

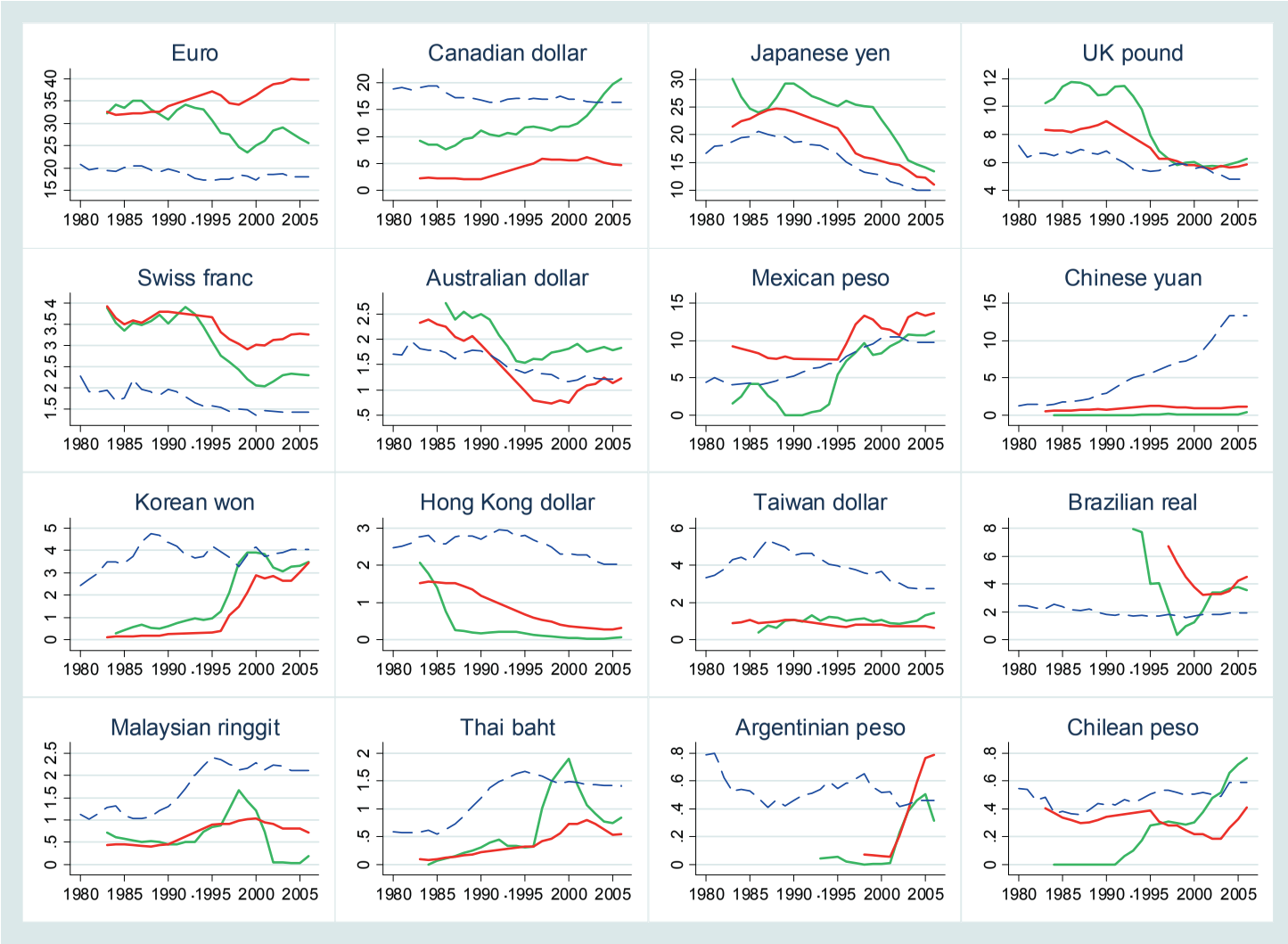



### B. Only *flexible* exchange rates



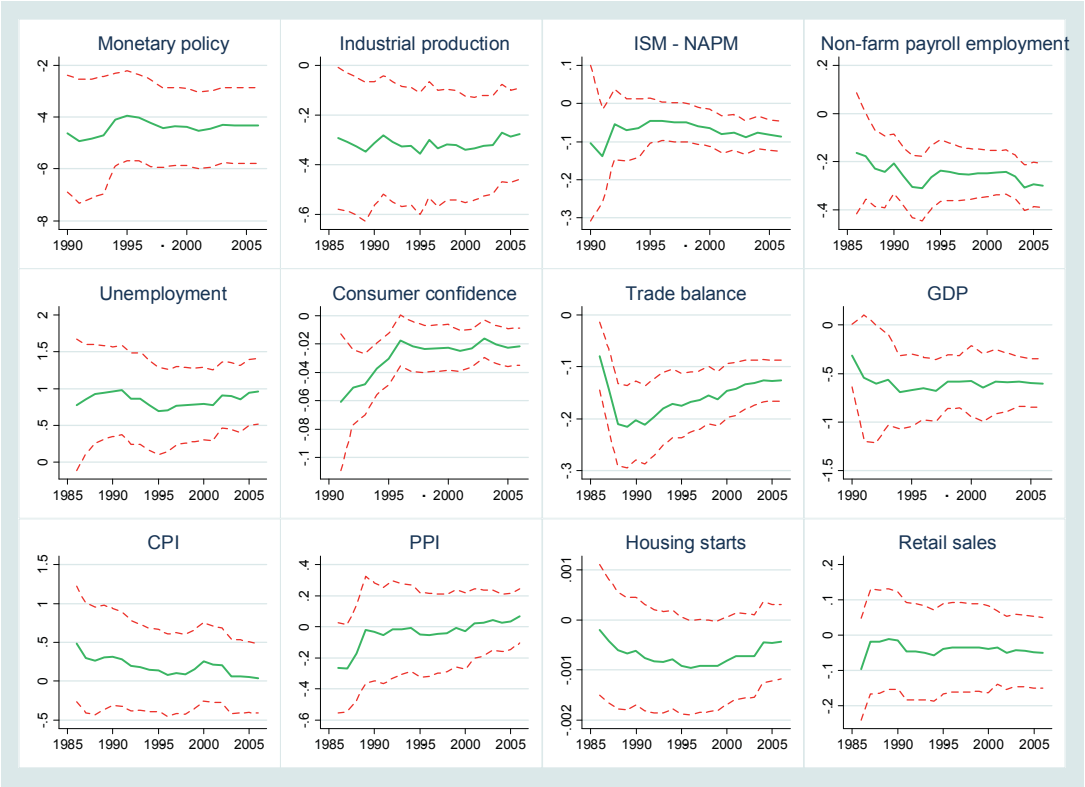

Notes: The figure shows the mean (light/green line) and the standard deviation/heterogeneity (dark/red line) of the coefficients for US shocks across the 64 bilateral US dollar exchange rates in the sample. The coefficients are time-varying, based on a recursive estimation of model (1) for each currency, adding one year of data sequentially.

## Figure 4: Contributions to US dollar NEER adjustment



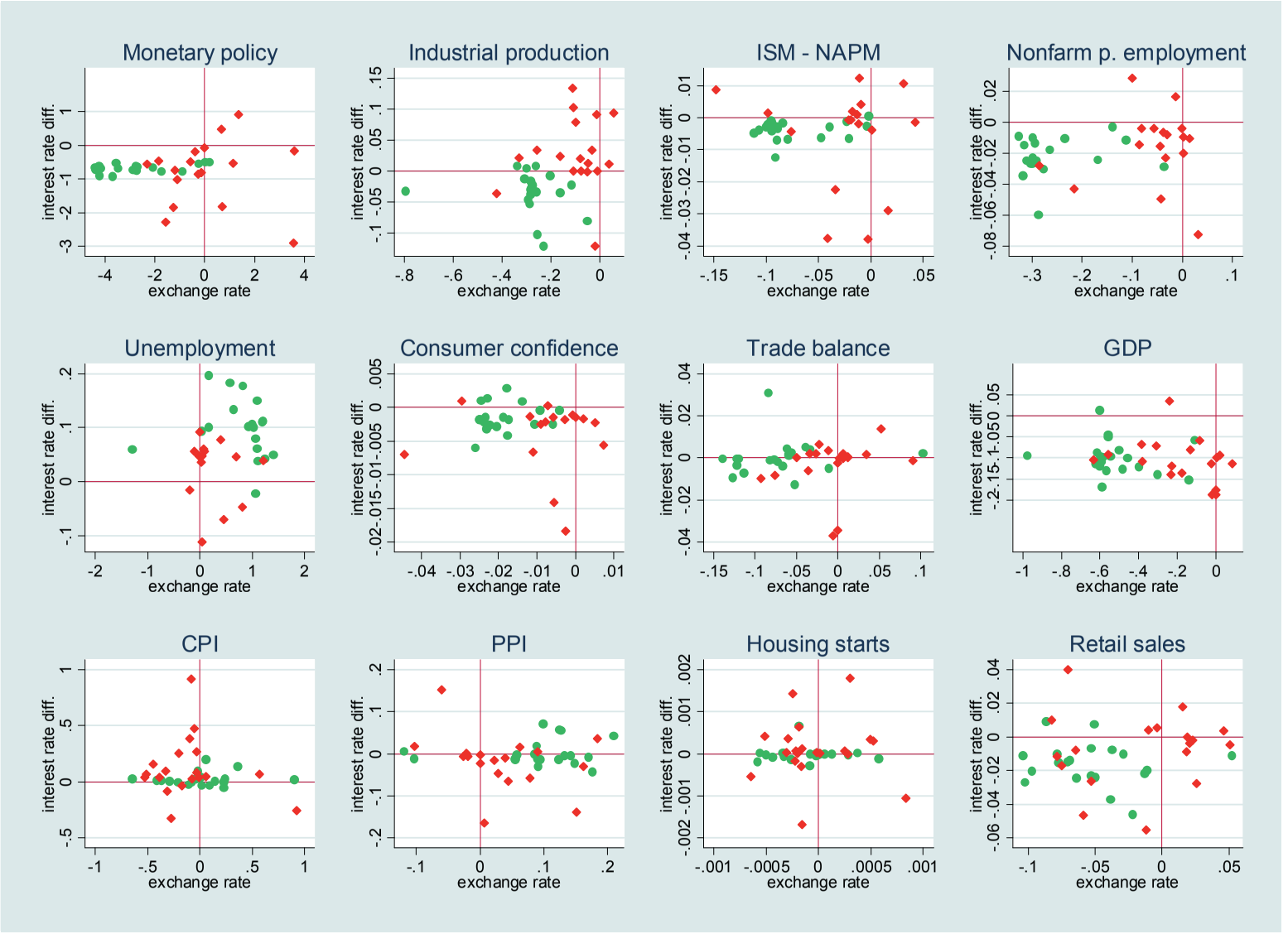

Notes: The figure shows the conditional contribution (2.a) (dark/red line), the unconditional contribution (2.b) (light/green line), as well as the trade weight (dashed/blue line) for 16 of the main currencies in the US NEER over the period 1980-2006, using recursive parameter estimates and time-varying trade weights.

## Figure 5: Time-varying parameters estimates – USD/EUR exchange rate



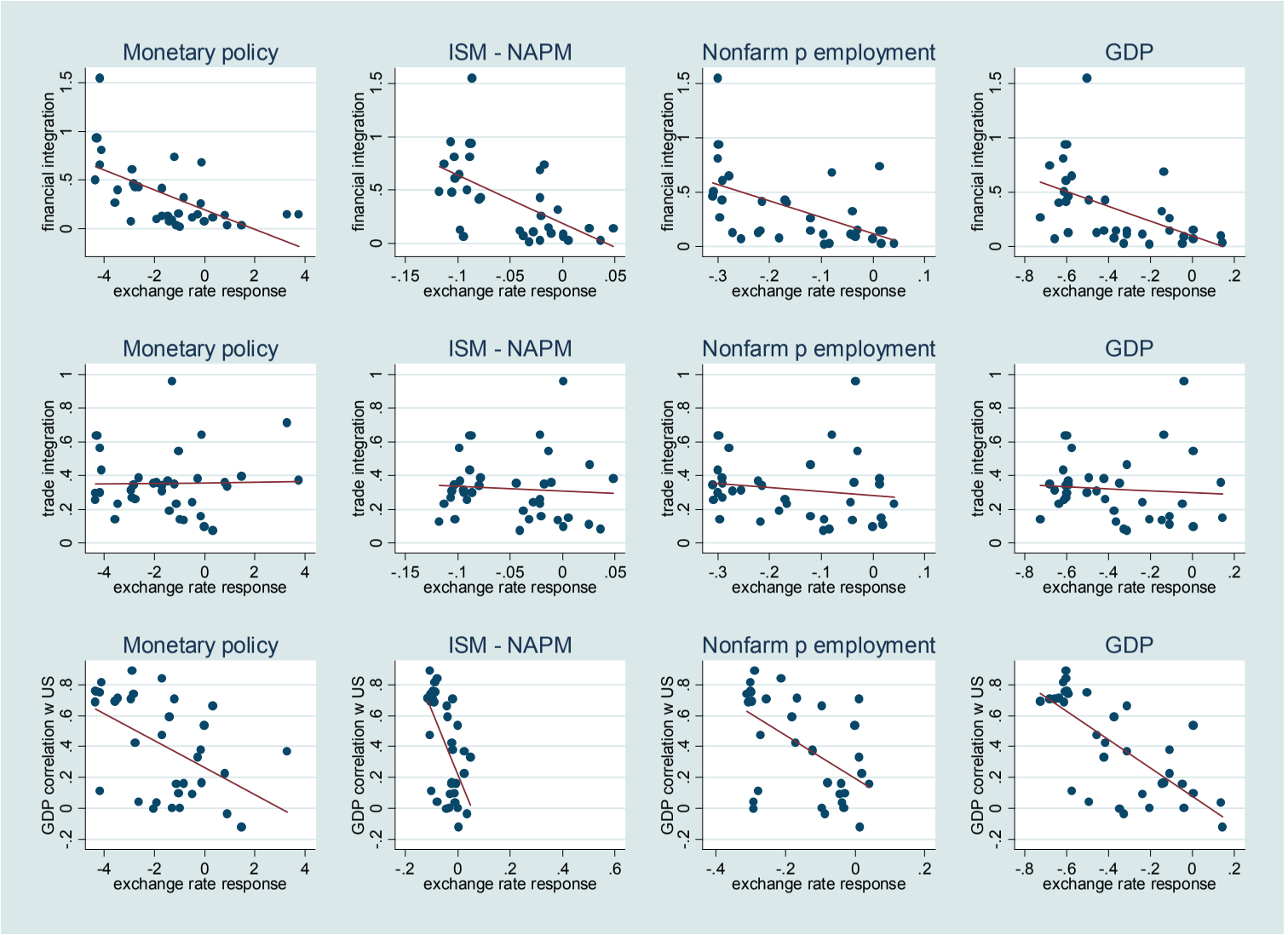

Notes: The figure shows the coefficients for US shocks on the bilateral US dollar-euro exchange rate, estimating model (1) recursively by adding one year of data sequentially.

**Figure 6: Response to US shocks of *interest rate differentials* versus exchange rates**




Notes: The figure shows the coefficients for US shocks on bilateral US dollar exchange rates versus on short-term interest rate differentials (foreign minus US rates). Light/green dots are coefficients for countries with a high degree of financial integration, red/dark diamonds are for countries with a low degree of financial integration.

## Figure 7: Financial vs. real integration and exchange rate response to US shocks




Notes: The figure shows the coefficients for four selected US shocks on bilateral US dollar exchange rates (horizontal axis) against (a) financial integration with the rest of the world, defined for each country as its sum of financial assets and liabilities over GDP (first row), (b) trade with the rest of the world, defined as the sum of exports and imports over GDP (second row), and (c) business cycle correlation, defined as GDP growth correlation with the US (third row).

## Table 1: Summary statistics of macroeconomic surprises and announcements

| | | | Surprise / shock | | Announcement | | Announcement change | |
|---|---|---|---|---|---|---|---|---|
| Variable | Definition / Unit | Obs. | Mean | std. dev. | Mean 1985-2004 | Mean 2005-2006 | Mean | std. dev. |
| **1. Monetary policy** | | | | | | | | |
| Monetary policy | in % | 177 | 0.057 | 0.061 | 5.317 | 5.250 | 0.109 | 0.209 |
| **2. Real activity** | | | | | | | | |
| Industrial production | MoM % change | 272 | 0.209 | 0.164 | 0.161 | 0.300 | 0.486 | 0.644 |
| GDP | Quarterly YoY % change | 65 | 0.337 | 0.322 | 2.050 | 3.217 | 2.972 | 1.236 |
| NF payroll employment | MoM change (100,000) | 257 | 0.636 | 0.508 | 1.018 | 1.529 | 1.326 | 1.753 |
| Unemployment | in % | 263 | 0.105 | 0.096 | 5.706 | 4.750 | 0.115 | 0.156 |
| Retail sales | MoM % change | 272 | 0.457 | 0.497 | 0.302 | 0.406 | 0.945 | 1.497 |
| Workweek | Hours worked per week | 92 | 0.078 | 0.080 | 27.84 | 33.76 | 0.091 | 0.687 |
| **3. Confidence / forward-looking** | | | | | | | | |
| NAPM / ISM | index (around 50) | 196 | 1.590 | 1.268 | 51.57 | 55.74 | 2.713 | 10.23 |
| Consumer confidence | index (around 100) | 179 | 3.889 | 3.124 | 101.3 | 108.6 | 6.533 | 20.73 |
| Housing starts | Monthly, in 1000 | 272 | 72.94 | 59.40 | 1518 | 2035 | 87.81 | 175.1 |
| **4. Prices** | | | | | | | | |
| CPI | MoM % change | 272 | 0.093 | 0.083 | 0.247 | 0.294 | 0.209 | 0.285 |
| PPI | MoM % change | 276 | 0.253 | 0.230 | 0.162 | 0.311 | 0.497 | 0.688 |
| **5. Net exports** | | | | | | | | |
| Trade balance | in USD billion | 274 | 1.367 | 0.985 | -18.11 | -61.31 | 2.823 | 6.600 |

Sources: MMS International, S&P and Bloomberg for macroeconomics variables; Gürkaynak, Sack, Swanson (2005) for the monetary policy variable.

## Table 2: Effects of US shocks on US dollar and euro

| | Bilateral | NEER | | |
|---|---|---|---|---|
| | USD/EUR | USD | USD excl. EUR | EUR |
| **1. Monetary policy** | | | | |
| Monetary policy | -4.262 | 1.344 | 0.613 | -1.108 |
| | (0.884)*** | (0.474)*** | (0.533) | (0.394)*** |
| **2. Real activity** | | | | |
| Industrial production | -0.389 | 0.222 | 0.182 | -0.181 |
| | (0.136)*** | (0.089)** | (0.104)* | (0.090)** |
| GDP | -0.605 | 0.034 | -0.108 | -0.183 |
| | (0.151)*** | (0.098) | (0.122) | (0.100)* |
| NF payroll employment | -0.299 | 0.047 | -0.015 | -0.055 |
| | (0.056)*** | (0.025)* | (0.029) | (0.025)** |
| Unemployment | 0.968 | -0.226 | -0.040 | 0.265 |
| | (0.321)*** | (0.154) | (0.171) | (0.148)* |
| Retail sales | -0.086 | -0.004 | -0.023 | -0.004 |
| | (0.074) | (0.031) | (0.033) | (0.026) |
| Workweek | -0.778 | -0.068 | -0.280 | -0.156 |
| | (0.931) | (0.287) | (0.471) | (0.348) |
| **3. Confidence / forward-looking** | | | | |
| NAPM / ISM | -0.087 | 0.008 | -0.011 | -0.025 |
| | (0.024)*** | (0.014) | (0.017) | (0.013)* |
| Consumer confidence | -0.022 | 0.006 | 0.002 | -0.009 |
| | (0.008)*** | (0.005) | (0.006) | (0.004)** |
| Housing starts | -0.001 | 0.001 | 0.000 | 0.000 |
| | (0.001)* | (0.000)* | (0) | (0) |
| **4. Prices** | | | | |
| CPI | 0.139 | 0.231 | 0.324 | 0.084 |
| | (0.344) | (0.177) | (0.213) | (0.185) |
| PPI | 0.090 | 0.066 | 0.101 | -0.051 |
| | (0.118) | (0.069) | (0.079) | (0.058) |
| **5. Net exports** | | | | |
| Trade balance | -0.144 | 0.035 | 0.008 | -0.026 |
| | (0.025)*** | (0.012)*** | (0.014) | (0.012)** |
| Observations | 5537 | 5525 | 5525 | 5525 |

Notes: Coefficient estimates are based on model (1). ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 3: Effect of US shocks – contributions to a 1% US NEER change (in %)

| | Bilateral exchange rates | NEER |
|---|---|---|
| **Industrialised countries:** | | |
| Euro area | 3.19 | 1.23 |
| Canada | 0.56 | -0.69 |
| Japan | 1.87 | 1.01 |
| UK | 1.74 | -0.48 |
| Switzerland | 3.22 | 0.62 |
| Australia | 0.87 | -1.01 |
| Sweden | 1.18 | 0.49 |
| **Emerging market countries:** | | |
| China | 0.05 | -0.99 |
| Mexico | -1.29 | -0.62 |
| Korea | 0.38 | -0.48 |
| Taiwan | 0.07 | 0.02 |
| Malaysia | 0.17 | -1.22 |
| Singapore | 0.23 | -0.08 |
| Hong Kong | -0.04 | -0.99 |
| Brazil | 1.44 | 0.69 |
| Thailand | 0.54 | -0.13 |
| India | 0.09 | -1.40 |
| Israel | 0.31 | -1.05 |
| Russia | 1.59 | 1.67 |
| Indonesia | 0.35 | -0.53 |
| Philippines | 0.33 | -0.73 |
| Saudi Arabia | 0.00 | n/a |
| Chile | -0.36 | -1.34 |
| Argentina | -0.13 | -1.48 |
| Venezuela | -0.15 | n/a |
| Colombia | 0.24 | n/a |

Notes: The table shows the response of each bilateral exchange rate and each country's NEER to a one-standard-deviation shock to each of the 13 US macroeconomic and monetary policy variables. All of the shocks are included so as to induce a depreciation of the US dollar/appreciation of the foreign currency. The responses are then scaled so as to account together for a 1% depreciation in the US dollar NEER.

## Table 4: Effects of US shocks on NEER of selected countries

| | Canada | UK | Japan | Australia | N.Zealand | Korea | Hong Kong |
|---|---|---|---|---|---|---|---|
| **1. Monetary policy** | | | | | | | |
| Monetary policy | 0.519 | -0.001 | -0.701 | 0.415 | 2.115 | 0.821 | 1.165 |
| | (0.493) | (0.323) | (0.564) | (0.634) | (0.806)*** | (0.543) | (0.359)*** |
| **2. Real activity** | | | | | | | |
| Industrial production | 0.091 | 0.166 | -0.327 | -0.020 | -0.050 | 0.369 | 0.228 |
| | (0.079) | (0.078)** | (0.157)** | (0.122) | (0.123) | (0.189)* | (0.082)*** |
| GDP | 0.009 | 0.175 | -0.096 | 0.210 | -0.176 | 0.707 | 0.001 |
| | (0.108) | (0.081)** | (0.161) | (0.168) | (0.191) | (0.56) | (0.077) |
| NF payroll employment | 0.086 | -0.045 | -0.004 | 0.017 | 0.007 | 0.040 | 0.050 |
| | (0.029)*** | (0.033) | (0.034) | (0.054) | (0.042) | (0.047) | (0.021)** |
| Unemployment | -0.312 | -0.269 | 0.362 | -0.620 | -0.103 | -0.081 | -0.266 |
| | (0.151)** | (0.18) | (0.182)** | (0.249)** | (0.204) | (0.289) | (0.129)** |
| Retail sales | 0.042 | -0.069 | 0.023 | 0.053 | 0.027 | 0.023 | 0.002 |
| | (0.027) | (0.032)** | (0.042) | (0.056) | (0.051) | (0.037) | (0.025) |
| Workweek | -0.147 | -0.528 | 1.075 | 0.277 | 0.072 | -0.118 | -0.124 |
| | (0.382) | (0.246)** | (0.582)* | (0.466) | (0.441) | (0.294) | (0.206) |
| **3. Confidence / forward-looking** | | | | | | | |
| NAPM / ISM | 0.003 | 0.011 | 0.020 | -0.006 | -0.010 | 0.000 | 0.006 |
| | (0.013) | (0.014) | (0.019) | (0.023) | (0.017) | (0.016) | (0.012) |
| Consumer confidence | -0.009 | 0.011 | 0.011 | -0.009 | -0.003 | -0.020 | 0.004 |
| | (0.005)* | (0.004)*** | (0.007) | (0.007) | (0.006) | (0.021) | (0.004) |
| Housing starts | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 | 0.001 | 0.000 |
| | (0) | (0) | (0.000)** | (0.001) | (0.001) | (0) | (0.000)* |
| **4. Prices** | | | | | | | |
| CPI | -0.351 | 0.114 | -0.423 | -0.089 | -0.497 | -0.233 | 0.188 |
| | (0.188)* | (0.186) | (0.261) | (0.296) | (0.250)** | (0.319) | (0.148) |
| PPI | -0.007 | 0.100 | -0.127 | 0.005 | 0.060 | 0.118 | 0.065 |
| | (0.071) | (0.061) | (0.101) | (0.089) | (0.084) | (0.086) | (0.061) |
| **5. Net exports** | | | | | | | |
| Trade balance | 0.002 | -0.007 | -0.007 | -0.015 | -0.018 | -0.004 | 0.026 |
| | (0.013) | (0.015) | (0.019) | (0.019) | (0.021) | (0.023) | (0.010)*** |
| Observations | 5525 | 5525 | 5525 | 5525 | 5525 | 5525 | 5525 |

Notes: Coefficient estimates are based on model (1). ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 5.A: Effects of US shocks for bilateral USD exchange rates - other industrialised countries

| | Australia | Canada | Switzerland | Denmark | UK | Japan | N. Zealand | Sweden |
|---|---|---|---|---|---|---|---|---|
| **1. Monetary policy** | | | | | | | | |
| Monetary policy | -0.217 | -0.859 | -4.179 | -4.345 | -2.039 | -2.716 | 0.251 | -1.301 |
| | (1.011) | (0.374)** | (0.874)*** | (0.856)*** | (0.678)*** | (0.973)*** | (1.136) | (2.485) |
| **2. Real activity** | | | | | | | | |
| Industrial production | -0.237 | -0.044 | -0.256 | -0.263 | -0.092 | -0.117 | -0.228 | 0.077 |
| | (0.132)* | (0.062) | (0.118)** | (0.125)** | (0.095) | (0.121) | (0.172) | (0.498) |
| GDP | -0.110 | -0.145 | -0.506 | -0.613 | -0.347 | -0.415 | -0.315 | -0.685 |
| | (0.189) | (0.089) | (0.140)*** | (0.155)*** | (0.140)** | (0.145)*** | (0.146)** | (0.425) |
| NF payroll employment | -0.123 | -0.040 | -0.299 | -0.308 | -0.291 | -0.170 | -0.097 | 0.011 |
| | (0.067)* | (0.026) | (0.061)*** | (0.057)*** | (0.053)*** | (0.050)*** | (0.065) | (0.156) |
| Unemployment | 0.025 | 0.233 | 1.178 | 0.946 | 0.545 | 0.590 | 0.165 | 0.405 |
| | (0.324) | (0.123)* | (0.277)*** | (0.259)*** | (0.259)** | (0.225)*** | (0.247) | (0.903) |
| Retail sales | -0.091 | -0.011 | -0.065 | -0.017 | -0.071 | -0.008 | -0.059 | 0.122 |
| | (0.061) | (0.02) | (0.066) | (0.067) | (0.06) | (0.048) | (0.056) | (0.122) |
| Workweek | -0.282 | 0.190 | -0.641 | -0.806 | -0.693 | -0.170 | -0.900 | -0.751 |
| | (0.774) | (0.652) | (1.007) | (0.938) | (0.424) | (0.688) | (0.709) | (1.71) |
| **3. Confidence / forward-looking** | | | | | | | | |
| NAPM / ISM | -0.021 | -0.005 | -0.087 | -0.091 | -0.045 | -0.021 | -0.041 | -0.019 |
| | (0.021) | (0.014) | (0.026)*** | (0.024)*** | (0.027)* | (0.021) | (0.021)* | (0.061) |
| Consumer confidence | -0.024 | -0.004 | -0.024 | -0.026 | -0.008 | -0.007 | -0.015 | -0.003 |
| | (0.009)*** | (0.005) | (0.009)*** | (0.008)*** | (0.009) | (0.008) | (0.009) | (0.026) |
| Housing starts | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | -0.001 | 0.001 |
| | (0.001) | (0) | (0) | (0) | (0) | (0.000)* | (0.001) | (0.001) |
| **4. Prices** | | | | | | | | |
| CPI | -0.221 | -0.052 | 0.073 | 0.225 | 0.270 | -0.365 | -0.674 | -0.759 |
| | (0.382) | (0.13) | (0.326) | (0.274) | (0.252) | (0.253) | (0.388)* | (0.872) |
| PPI | 0.090 | 0.039 | 0.031 | 0.037 | -0.001 | -0.088 | 0.052 | -0.104 |
| | (0.097) | (0.06) | (0.115) | (0.108) | (0.091) | (0.112) | (0.099) | (0.315) |
| **5. Net exports** | | | | | | | | |
| Trade balance | -0.028 | -0.010 | -0.141 | -0.124 | -0.070 | -0.071 | -0.041 | 0.101 |
| | (0.023) | (0.015) | (0.026)*** | (0.023)*** | (0.024)*** | (0.029)** | (0.028) | (0.078) |
| Observations | 5485 | 6515 | 6515 | 6515 | 6515 | 6515 | 5166 | 6366 |

Notes: Coefficient estimates are based on model (1). ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 5.B: Effects of US shocks for *flexible* bilateral USD exchange rates – EME Latin America and Asia

| | Argentina | Brazil | Chile | Colombia | Mexico | Indonesia | Korea | Philippines | Singapore | Thailand |
|---|---|---|---|---|---|---|---|---|---|---|
| **1. Monetary policy** | | | | | | | | | | |
| Monetary policy | 3.254 | 3.717 | -0.327 | 0.788 | 0.758 | 1.425 | -1.911 | -1.218 | -0.114 | -1.089 |
| | (2.277) | (1.495)** | (1.754) | (0.769) | (0.843) | (2.503) | (1.359) | (0.713)* | (0.699) | (0.906) |
| **2. Real activity** | | | | | | | | | | |
| Industrial production | -0.058 | -0.211 | 0.044 | -0.050 | -0.015 | -0.629 | -0.045 | -0.411 | -0.051 | -0.202 |
| | (0.339) | (0.301) | (0.142) | (0.178) | (0.185) | (0.334)* | (0.15) | (0.3) | (0.087) | (0.139) |
| GDP | -0.310 | -0.386 | -0.453 | -0.120 | -0.332 | 0.130 | 0.133 | -0.059 | -0.136 | -0.005 |
| | (0.39) | (0.243) | (0.364) | (0.14) | (0.135)** | (0.207) | (0.238) | (0.156) | (0.137) | (0.108) |
| NF payroll employment | -0.121 | -0.228 | 0.005 | 0.013 | -0.087 | 0.009 | -0.039 | 0.037 | -0.079 | -0.032 |
| | (0.092) | (0.119)* | (0.053) | (0.06) | (0.057) | (0.102) | (0.069) | (0.042) | (0.039)** | (0.05) |
| Unemployment | 1.259 | 0.427 | -0.472 | -0.359 | 0.023 | 0.346 | 0.770 | 0.029 | 0.418 | 0.426 |
| | (0.764) | (0.851) | (0.651) | (0.391) | (0.265) | (0.97) | (0.376)** | (0.293) | (0.215)* | (0.265) |
| Retail sales | -0.143 | -0.065 | 0.067 | -0.025 | 0.020 | 0.061 | 0.054 | 0.044 | -0.005 | 0.013 |
| | (0.328) | (0.111) | (0.056) | (0.055) | (0.077) | (0.053) | (0.04) | (0.047) | (0.025) | (0.042) |
| Workweek | 0.367 | 1.382 | -0.855 | 0.013 | 0.420 | -1.378 | 0.171 | -0.210 | -0.176 | -0.491 |
| | (0.392) | (0.869) | (0.470)* | (0.394) | (0.76) | (0.724)* | (0.234) | (0.271) | (0.401) | (0.335) |
| **3. Confidence / forward-looking** | | | | | | | | | | |
| NAPM / ISM | 0.026 | -0.117 | 0.048 | 0.026 | 0.037 | 0.006 | -0.011 | -0.021 | -0.021 | -0.013 |
| | (0.031) | (0.124) | (0.033) | (0.021) | (0.025) | (0.055) | (0.018) | (0.017) | (0.013) | (0.019) |
| Consumer confidence | 0.043 | 0.019 | -0.002 | -0.003 | 0.007 | 0.022 | -0.012 | -0.007 | -0.009 | 0.001 |
| | (0.026)* | (0.019) | (0.008) | (0.008) | (0.01) | (0.017) | (0.007) | (0.01) | (0.006) | (0.011) |
| Housing starts | 0.001 | 0.000 | 0.000 | -0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.001) | (0.001) | (0) | (0) | (0.001) | (0.001) | (0) | (0) | (0) | (0) |
| **4. Prices** | | | | | | | | | | |
| CPI | 1.230 | -0.124 | -0.333 | -0.076 | -0.667 | 0.116 | -0.427 | -0.359 | -0.392 | -0.405 |
| | (0.732)* | (0.748) | (0.279) | (0.371) | (0.346)* | (0.448) | (0.399) | (0.348) | (0.217)* | (0.275) |
| PPI | -0.142 | 0.039 | 0.186 | 0.002 | 0.066 | -0.031 | 0.003 | -0.141 | -0.057 | -0.055 |
| | (0.318) | (0.277) | (0.146) | (0.149) | (0.145) | (0.172) | (0.093) | (0.134) | (0.079) | (0.083) |
| **5. Net exports** | | | | | | | | | | |
| Trade balance | 0.062 | 0.110 | -0.004 | -0.051 | 0.050 | 0.005 | -0.018 | -0.026 | 0.005 | -0.038 |
| | (0.082) | (0.064)* | (0.021) | (0.032) | (0.023)** | (0.04) | (0.029) | (0.023) | (0.015) | (0.03) |
| Observations | 515 | 1385 | 2712 | 1363 | 2277 | 1494 | 1690 | 1842 | 1581 | 1819 |

Notes: Coefficient estimates are based on model (1). ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 5.C: Effects of US shocks for *flexible* bilateral USD exchange rates – EME Europe and other

| | Bulgaria | Cyprus | Czech Rep | Estonia | Hungary | Lithuania | Latvia | Poland | Romania | Russia | Slovenia | Slovak Rep | S. Africa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. Monetary policy** | | | | | | | | | | | | | |
| Monetary policy | 0.174 | -1.405 | -1.448 | 0.193 | -1.668 | 0.442 | -0.659 | -0.477 | -0.964 | -1.278 | 1.133 | -1.153 | -0.017 |
| | (1.556) | (0.626)** | (0.703)** | (0.883) | (0.568)*** | (0.354) | (0.778) | (0.671) | (0.986) | (1.138) | (1.717) | (0.495)** | (0.013) |
| **2. Real activity** | | | | | | | | | | | | | |
| Industrial production | -0.178 | -0.290 | -0.320 | -0.190 | -0.357 | -0.108 | 0.047 | -0.057 | 0.179 | -0.008 | -0.022 | -0.043 | -0.012 |
| | (0.197) | (0.191) | (0.194)* | (0.176) | (0.156)** | (0.132) | (0.116) | (0.16) | (0.2) | (0.057) | (0.222) | (0.152) | (0.01) |
| GDP | -0.387 | -0.373 | -0.594 | -0.367 | -0.456 | -0.262 | 0.194 | -0.237 | -0.202 | -0.043 | -0.278 | -0.389 | 0.004 |
| | (0.237) | (0.156)** | (0.254)** | (0.206)* | (0.209)** | (0.137)* | (0.103)* | (0.189) | (0.104)* | (0.055) | (0.207) | (0.200)* | (0.003) |
| NF payroll employment | -0.418 | -0.181 | -0.221 | -0.297 | -0.270 | -0.166 | 0.171 | -0.043 | -0.094 | -0.034 | -0.203 | -0.231 | 0.000 |
| | (0.120)*** | (0.074)** | (0.083)*** | (0.076)*** | (0.078)*** | (0.064)*** | (0.048)*** | (0.067) | (0.088) | (0.03) | (0.070)*** | (0.075)*** | (0.002) |
| Unemployment | 1.049 | 0.370 | 0.710 | 0.393 | 0.761 | 0.183 | -0.178 | 0.837 | 0.461 | -0.081 | 0.358 | 0.864 | 0.000 |
| | (0.577)* | (0.349) | (0.400)* | (0.358) | (0.322)** | (0.234) | (0.244) | (0.361)** | (0.448) | (0.175) | (0.361) | (0.341)** | (0.005) |
| Retail sales | -0.257 | 0.042 | -0.071 | -0.094 | 0.058 | -0.059 | 0.018 | -0.045 | 0.030 | -0.007 | -0.090 | -0.062 | -0.004 |
| | (0.080)*** | (0.06) | (0.095) | (0.08) | (0.137) | (0.057) | (0.043) | (0.059) | (0.065) | (0.018) | (0.07) | (0.087) | (0.004) |
| Workweek | -0.439 | -0.286 | -0.737 | -0.777 | -1.381 | 0.303 | 0.198 | -1.043 | -0.867 | 0.214 | -0.733 | -0.798 | 0.005 |
| | (0.894) | (0.8) | (0.955) | (0.981) | (0.787)* | (0.827) | (0.528) | (0.7) | (0.475)* | (0.25) | (0.902) | (0.923) | (0.01) |
| **3. Confidence / forward-looking** | | | | | | | | | | | | | |
| NAPM / ISM | 0.508 | -0.037 | -0.097 | -0.099 | -0.106 | -0.032 | 0.028 | -0.028 | -0.032 | 0.001 | -0.091 | -0.107 | 0.001 |
| | (0.6) | (0.026) | (0.027)*** | (0.024)*** | (0.039)*** | (0.02) | (0.017) | (0.034) | (0.025) | (0.019) | (0.024)*** | (0.026)*** | (0.001) |
| Consumer confidence | -0.025 | -0.004 | -0.044 | -0.032 | -0.021 | -0.007 | 0.011 | -0.005 | -0.010 | -0.002 | -0.037 | -0.025 | 0.000 |
| | (0.012)** | (0.011) | (0.022)** | (0.009)*** | (0.009)** | (0.005) | (0.008) | (0.011) | (0.011) | (0.003) | (0.025) | (0.013)* | (0) |
| Housing starts | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | -0.001 | 0.000 | 0.002 | 0.001 | 0.000 |
| | (0.001) | (0) | (0.001) | (0.001) | (0.001) | (0) | (0) | (0.001) | (0.001) | (0) | (0.001)*** | (0.001)* | (0.000)*** |
| **4. Prices** | | | | | | | | | | | | | |
| CPI | -0.305 | -0.243 | -0.309 | -0.143 | 0.228 | -0.136 | 0.381 | -0.253 | -0.411 | -0.161 | -0.206 | -0.018 | -0.008 |
| | (0.397) | (0.323) | (0.461) | (0.435) | (0.582) | (0.263) | (0.275) | (0.483) | (0.344) | (0.127) | (0.4) | (0.381) | (0.006) |
| PPI | 0.101 | -0.001 | 0.106 | 0.202 | 0.124 | 0.046 | -0.030 | 0.012 | 0.088 | 0.068 | 0.079 | 0.040 | 0.001 |
| | (0.146) | (0.111) | (0.147) | (0.107)* | (0.143) | (0.089) | (0.082) | (0.108) | (0.117) | (0.035)** | (0.12) | (0.124) | (0.002) |
| **5. Net exports** | | | | | | | | | | | | | |
| Trade balance | -0.091 | -0.074 | -0.040 | -0.051 | -0.071 | -0.022 | 0.013 | -0.032 | 0.044 | -0.007 | -0.038 | -0.096 | 0.000 |
| | (0.040)** | (0.027)*** | (0.03) | (0.028)* | (0.027)*** | (0.02) | (0.016) | (0.028) | (0.081) | (0.009) | (0.031) | (0.027)*** | (0) |
| Observations | 1819 | 4168 | 3009 | 2664 | 3003 | 2664 | 2664 | 3002 | 1819 | 1297 | 2897 | 2915 | 2534 |

Notes: Coefficient estimates are based on model (1). ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 6: Effects of euro area shocks on US dollar/euro exchange rate

| | Model with US shocks *& without* euro area shocks | | Model with US shocks *& with* euro area shocks | |
|---|---|---|---|---|
| **US SHOCKS** | | | | |
| **1. Monetary policy** | | | | |
| Monetary policy | -4.262 *** | *0.884* | -4.269 *** | *0.877* |
| **2. Real activity** | | | | |
| Industrial production | -0.389 *** | *0.136* | -0.381 *** | *0.139* |
| GDP | -0.605 *** | *0.151* | -0.630 *** | *0.156* |
| NF payroll employment | -0.299 *** | *0.056* | -0.292 *** | *0.056* |
| Unemployment | 0.968 *** | *0.321* | 0.981 *** | *0.323* |
| Retail sales | -0.086 | *0.074* | -0.088 | *0.075* |
| Workweek | -0.778 | *0.931* | -0.622 | *0.907* |
| **3. Confidence / forward-looking** | | | | |
| NAPM / ISM | -0.087 *** | *0.024* | -0.082 *** | *0.023* |
| Consumer confidence | -0.022 *** | *0.008* | -0.022 *** | *0.008* |
| Housing starts | -0.001 * | *0.001* | -0.001 * | *0.000* |
| **4. Prices** | | | | |
| CPI | 0.139 | *0.344* | 0.183 | *0.338* |
| PPI | 0.090 | *0.118* | 0.114 | *0.119* |
| **5. Net exports** | | | | |
| Trade balance | -0.144 *** | *0.025* | -0.142 *** | *0.026* |
| **EURO AREA SHOCKS** | | | | |
| **A. Euro area** | | | | |
| Monetary policy euro area | | | 0.912 ** | *0.421* |
| Business climate euro area | | | 0.145 *** | *0.056* |
| CPI euro area | | | -2.569 *** | *0.775* |
| **B. Germany** | | | | |
| Ifo business confidence Germany | | | 0.101 ** | *0.044* |
| M3 Germany | | | 0.042 * | *0.023* |
| PPI Germany | | | 0.380 * | *0.215* |
| **C. France** | | | | |
| Industrial production France | | | 0.099 ** | *0.045* |
| Unemployment France | | | -0.087 *** | *0.018* |
| **D. Italy** | | | | |
| Industrial orders Italy | | | 0.026 ** | *0.011* |
| Trade balance Italy | | | 0.021 ** | *0.009* |
| Observations | 5537 | | 5537 | |

Notes: The coefficients of the left-hand column are those based on the benchmark model (1) including only US shocks. The coefficients of the right-hand column include in addition to the US shocks also a broad set of 38 euro area shocks (both for the euro area as an aggregate and for its three largest individual economies). Note that for euro area shocks only those 10 shocks are shown in the table that are statistically significant. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 7: Channels – role of monetary policy

| | Interest rate differential | | | |
|---|---|---|---|---|
| | US shock $\beta^1$ | | Interaction US shock with interest rate diff. $\beta^2$ | |
| **1. Monetary policy** | | | | |
| Monetary policy | -0.167 | *0.183* | 0.035 | *0.586* |
| **2. Real activity** | | | | |
| Industrial production | -0.231 *** | *0.083* | 0.061 | *0.111* |
| GDP | -0.385 *** | *0.097* | -0.095 | *0.084* |
| NF payroll employment | -0.200 *** | *0.031* | -0.013 | *0.035* |
| Unemployment | 0.686 *** | *0.176* | -0.188 | *0.171* |
| Retail sales | -0.050 | *0.036* | -0.018 | *0.059* |
| Workweek | -0.381 | *0.285* | 0.284 | *0.264* |
| **3. Confidence / forward-looking** | | | | |
| NAPM / ISM | -0.055 *** | *0.013* | 0.001 | *0.010* |
| Consumer confidence | -0.014 ** | *0.005* | 0.004 | *0.006* |
| Housing starts | 0.000 | *0.000* | 0.000 | *0.000* |
| **4. Prices** | | | | |
| CPI | -0.018 | *0.186* | 0.047 | *0.229* |
| PPI | 0.075 | *0.058* | -0.077 | *0.057* |
| **5. Net exports** | | | | |
| Trade balance | -0.054 *** | *0.013* | 0.025 | *0.015* |
| Observations | 153624 | | | |
| Countries | 43 | | | |

Notes: The parameter estimates are based on model (3), including only countries and time periods with de facto flexible exchange rates. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 8: Determinants of distribution of US dollar shocks – *liquidity, de jure openness and FX regimes*

| | FX regime | | Stock market capit. | | FX volatility | | De jure KA openness | |
|---|---|---|---|---|---|---|---|---|
| | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* |
| **1. Monetary policy** | | | | | | | | |
| Monetary policy | -0.624 | -1.267 | -1.412 | -0.300 | -1.236 | -8.553 | -0.335 | -2.080 |
| | (0.274)** | (0.439)*** | (0.455)*** | (0.378) | (0.631)* | (16.322) | (0.638) | (0.718)*** |
| **2. Real activity** | | | | | | | | |
| Industrial production | -0.067 | -0.087 | -0.216 | 0.063 | -0.831 | 24.709 | 0.026 | -0.225 |
| | (0.044) | (0.083) | (0.078)*** | (0.053) | (0.110)*** | (3.102)*** | (0.106) | (0.120)* |
| GDP | -0.048 | -0.362 | -0.310 | -0.004 | -0.306 | 0.239 | -0.126 | -0.275 |
| | (0.067) | (0.108)*** | (0.096)*** | (0.049) | (0.139)** | (4.006) | (0.131) | (0.155)* |
| NF payroll employment | -0.057 | -0.117 | -0.114 | -0.046 | -0.151 | 0.799 | -0.046 | -0.141 |
| | (0.017)*** | (0.029)*** | (0.029)*** | (0.019)** | (0.043)*** | (1.254) | (0.04) | (0.046)*** |
| Unemployment | 0.194 | 0.527 | 0.493 | 0.066 | 0.374 | 0.942 | 0.265 | 0.257 |
| | (0.092)** | (0.163)*** | (0.160)*** | (0.114) | (0.204)* | (5.541) | (0.216) | (0.242) |
| Retail sales | 0.000 | -0.030 | -0.022 | -0.008 | 0.022 | -0.969 | 0.033 | -0.077 |
| | (0.016) | (0.032) | (0.033) | (0.021) | (0.049) | (1.49) | (0.043) | (0.048) |
| Workweek | 0.085 | -0.610 | -0.330 | -0.066 | -0.738 | 10.269 | -0.087 | -0.524 |
| | (0.341) | (0.509) | (0.324) | (0.097) | (0.435)* | (11.25) | (0.396) | (0.504) |
| **3. Confidence / forward-looking** | | | | | | | | |
| NAPM / ISM | 0.001 | -0.060 | -0.036 | -0.007 | -0.045 | 0.138 | -0.017 | -0.038 |
| | (0.009) | (0.014)*** | (0.013)*** | (0.007) | (0.021)** | (0.692) | (0.018) | (0.021)* |
| Consumer confidence | -0.009 | -0.003 | -0.013 | 0.001 | -0.007 | -0.167 | -0.006 | -0.008 |
| | (0.004)** | (0.006) | (0.005)** | (0.003) | (0.008) | (0.252) | (0.007) | (0.009) |
| Housing starts | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | (0.000)** | 0.000 | (0.01) | 0.000 | 0.000 |
| **4. Prices** | | | | | | | | |
| CPI | 0.024 | -0.123 | -0.083 | -0.020 | -0.191 | 5.688 | 0.005 | -0.071 |
| | (0.088) | (0.177) | (0.164) | (0.119) | (0.253) | (7.723) | (0.219) | (0.244) |
| PPI | 0.055 | -0.011 | -0.005 | 0.052 | 0.043 | -0.926 | -0.025 | 0.079 |
| | (0.041) | (0.069) | (0.064) | (0.033) | (0.098) | (2.885) | (0.086) | (0.1) |
| **5. Net exports** | | | | | | | | |
| Trade balance | -0.013 | -0.042 | -0.055 | 0.014 | -0.019 | -0.458 | -0.002 | -0.052 |
| | (0.008) | (0.014)*** | (0.013)*** | (0.008)* | (0.019) | (0.533) | (0.018) | (0.021)** |
| Observations | 109655 | | 70725 | | 81260 | | 81260 | |
| Countries | 64 | | 44 | | 45 | | 45 | |

Notes: Coefficient estimates are based on (4) and only for flexible exchange rates. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 9: Determinants of distribution of US dollar shocks – financial integration

| | Equity return correl. | | Fin. integ. 1 w ROW | | Fin. integ. 2 w ROW | | Fin. integ. 1 w US | | Fin. integ. 2 w US | |
|---|---|---|---|---|---|---|---|---|---|---|
| | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* |
| **1. Monetary policy** | | | | | | | | | | |
| Monetary policy | -0.454 | -2.487 | 9.811 | -0.710 | -1.289 | -2.356 | 222.242 | -9.036 | -0.508 | -9.223 |
| | (0.503) | (0.866)*** | (6.686) | (0.414)* | (0.481)*** | (1.299)* | (65.689)*** | (2.659)*** | (0.4) | (2.716)*** |
| **2. Real activity** | | | | | | | | | | |
| Industrial production | -0.175 | -0.008 | 0.026 | -0.008 | -0.091 | -0.037 | -3.717 | 0.144 | -0.187 | 3.199 |
| | (0.091)* | (0.157) | (0.919) | (0.056) | (0.082) | (0.171) | (9.019) | (0.365) | (0.068)*** | (4.279) |
| GDP | -0.193 | -0.236 | 0.464 | -0.047 | -0.259 | -0.172 | 16.476 | -0.677 | -0.233 | -6.884 |
| | (0.111)* | (0.19) | (0.923) | (0.056) | (0.106)** | (0.068)** | (9.298)* | (0.377)* | (0.081)*** | (4.105)* |
| NF payroll employment | -0.070 | -0.155 | 1.241 | -0.085 | -0.085 | -0.271 | 18.780 | -0.764 | -0.042 | -9.095 |
| | (0.033)** | (0.055)*** | (0.335)*** | (0.021)*** | (0.031)*** | (0.062)*** | (3.298)*** | (0.134)*** | (0.025)* | (1.578)*** |
| Unemployment | 0.436 | 0.202 | -4.098 | 0.282 | 0.293 | 1.055 | -63.419 | 2.582 | 0.232 | 26.676 |
| | (0.174)** | (0.29) | (1.897)** | (0.117)** | (0.166)* | (0.400)*** | (20.708)*** | (0.838)*** | (0.138)* | (9.290)*** |
| Retail sales | -0.020 | -0.012 | 0.367 | -0.023 | 0.004 | -0.082 | 5.283 | -0.214 | 0.017 | -3.029 |
| | (0.04) | (0.066) | (0.37) | (0.023) | (0.033) | (0.075) | (3.511) | (0.142) | (0.028) | (1.774)* |
| Workweek | -0.202 | -0.409 | -0.059 | -0.023 | -0.397 | -0.083 | 27.235 | -1.114 | -0.316 | -6.257 |
| | (0.367) | (0.605) | (2.472) | (0.145) | (0.375) | (0.44) | (21.455) | (0.87) | (0.267) | (12.454) |
| **3. Confidence / forward-looking** | | | | | | | | | | |
| NAPM / ISM | -0.007 | -0.075 | 0.224 | -0.016 | -0.030 | -0.051 | 4.842 | -0.197 | -0.030 | -1.288 |
| | (0.014) | (0.025)*** | (0.124)* | (0.007)** | (0.014)** | (0.023)** | (1.321)*** | (0.053)*** | (0.011)*** | (0.640)** |
| Consumer confidence | -0.008 | -0.010 | 0.007 | -0.001 | -0.011 | -0.002 | 0.576 | -0.024 | -0.012 | -0.065 |
| | (0.006) | (0.01) | (0.051) | (0.003) | (0.006)* | (0.01) | (0.547) | (0.022) | (0.005)*** | (0.271) |
| Housing starts | -0.001 | 0.001 | -0.007 | -0.001 | 0.000 | -0.001 | -0.043 | 0.002 | 0.000 | 0.014 |
| | (0.000)** | (0.000)** | (0.003)** | (0.000)** | (0.000)* | (0.001)** | (0.026) | (0.001) | 0.000 | (0.013) |
| **4. Prices** | | | | | | | | | | |
| CPI | 0.047 | -0.320 | 1.689 | -0.107 | 0.014 | -0.333 | -4.199 | 0.167 | 0.023 | -2.696 |
| | (0.187) | (0.319) | (2.05) | (0.126) | (0.167) | (0.383) | (19.274) | (0.78) | (0.144) | (9.163) |
| PPI | -0.097 | 0.268 | -0.615 | 0.039 | -0.004 | 0.120 | -8.940 | 0.362 | -0.003 | 3.131 |
| | (0.075) | (0.126)** | (0.625) | (0.038) | (0.068) | (0.115) | (6.012) | (0.243) | (0.053) | (3.083) |
| **5. Net exports** | | | | | | | | | | |
| Trade balance | -0.048 | 0.005 | 0.101 | -0.008 | -0.028 | -0.023 | 3.676 | -0.150 | -0.022 | -1.622 |
| | (0.015)*** | (0.025) | (0.143) | (0.009) | (0.014)** | (0.026) | (1.404)*** | (0.057)*** | (0.011)** | (0.700)** |
| Observations | 72727 | | 81260 | | 81260 | | 71096 | | 69188 | |
| Countries | 45 | | 45 | | 45 | | 42 | | 42 | |

Notes: Coefficient estimates are based on (4) and only for flexible exchange rates. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 10: Determinants of distribution of US dollar shocks – *composition* of financial integration

| | FDI | | Equity securities | | Debt securities | | Loans | |
|---|---|---|---|---|---|---|---|---|
| | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* |
| **1. Monetary policy** | | | | | | | | |
| Monetary policy | -1.402 | -1.333 | -1.803 | -42.240 | -2.133 | -28.738 | -2.124 | -2.650 |
| | (0.299)*** | (0.912) | (0.316)*** | (15.691)*** | (0.340)*** | (12.361)*** | (0.268)*** | (1.411)* |
| **2. Real activity** | | | | | | | | |
| Industrial production | -0.091 | -0.043 | -0.148 | -2.123 | -0.167 | -0.777 | -0.183 | 0.135 |
| | (0.050)* | (0.122) | (0.049)*** | (2.745) | (0.052)*** | (5.804) | (0.044)*** | (0.191) |
| GDP | -0.273 | -0.106 | -0.305 | -7.666 | -0.369 | -5.811 | -0.396 | -0.095 |
| | (0.067)*** | (0.125) | (0.066)*** | (3.083)** | (0.067)*** | (6.166) | (0.059)*** | (0.198) |
| NF payroll employment | -0.102 | -0.154 | -0.142 | -13.923 | -0.175 | -8.067 | -0.149 | -0.382 |
| | (0.019)*** | (0.046)*** | (0.019)*** | (0.990)*** | (0.020)*** | (3.121)*** | (0.017)*** | (0.370) |
| Unemployment | 0.332 | 0.510 | 0.594 | 71.859 | 0.723 | 1.508 | 0.626 | -1.237 |
| | (0.102)*** | (0.475) | (0.102)*** | (35.784)** | (0.110)*** | (0.467)*** | (0.091)*** | (13.043) |
| Retail sales | 0.001 | -0.046 | -0.018 | -6.958 | -0.027 | 0.151 | -0.019 | -0.088 |
| | (0.021) | (0.05) | (0.02) | (3.031)*** | (0.021) | (2.43) | (0.018) | (0.083) |
| Workweek | -0.433 | -0.052 | -0.298 | -12.615 | -0.432 | -7.476 | -0.475 | -0.013 |
| | (0.244)* | (0.352) | (0.22) | (9.746) | (0.216)** | (17.616) | (0.200)** | (0.548) |
| **3. Confidence / forward-looking** | | | | | | | | |
| NAPM / ISM | -0.035 | -0.028 | -0.038 | -3.375 | -0.059 | -0.088 | -0.045 | -0.080 |
| | (0.009)*** | (0.017) | (0.009)*** | (0.409)*** | (0.009)*** | (0.042)** | (0.008)*** | (0.328) |
| Consumer confidence | -0.011 | -0.002 | -0.013 | -0.039 | -0.015 | 0.135 | -0.014 | -0.002 |
| | (0.004)*** | (0.007) | (0.004)*** | (0.172) | (0.004)*** | (0.354) | (0.003)*** | (0.012) |
| Housing starts | 0.000 | 0.001 | 0.000 | 0.022 | 0.000 | 0.035 | 0.000 | 0.002 |
| | (0.000)** | 0.000 | (0.000)*** | (0.009)** | (0.000)** | (0.018)* | (0.000)*** | (0.011) |
| **4. Prices** | | | | | | | | |
| CPI | -0.011 | -0.146 | -0.052 | -3.929 | -0.058 | -5.179 | -0.044 | -0.489 |
| | (0.103) | (0.264) | (0.099) | (1.790)*** | (0.107) | (12.996) | (0.09) | (0.421) |
| PPI | 0.003 | 0.063 | 0.005 | 2.896 | 0.025 | 2.185 | 0.016 | 0.181 |
| | (0.043) | (0.082) | (0.041) | (2.119) | (0.042) | (4.171) | (0.037) | (0.131) |
| **5. Net exports** | | | | | | | | |
| Trade balance | -0.030 | -0.015 | -0.054 | -3.441 | -0.066 | -1.102 | -0.060 | 0.006 |
| | (0.009)*** | (0.019) | (0.009)*** | (1.290)*** | (0.009)*** | (0.94) | (0.008)*** | (0.03) |
| Observations | 69188 | | 69188 | | 69188 | | 69188 | |
| Countries | 42 | | 42 | | 42 | | 42 | |

Notes: Coefficient estimates are based on (4) and only for flexible exchange rates. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 11: Determinants of distribution of US dollar shocks – real integration

| | GDP correl. w US | | Trade integ. 1 w ROW | | Trade integ. 2 w ROW | | Trade integ. 1 w US | | Trade integ. 2 w US | |
|---|---|---|---|---|---|---|---|---|---|---|
| | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* | US shock | *Interaction* |
| **1. Monetary policy** | | | | | | | | | | |
| Monetary policy | -0.333 | -3.289 | -1.614 | 0.237 | -2.054 | 4.638 | -1.776 | 51.972 | -0.871 | -6.484 |
| | (0.645) | (1.189)*** | (0.521)*** | (1.124) | (0.579)*** | (1.947)** | (0.547)*** | (30.153)* | (0.628) | (3.674)* |
| **2. Real activity** | | | | | | | | | | |
| Industrial production | 0.045 | -0.367 | -0.093 | -0.021 | -0.113 | 0.132 | -0.098 | 0.361 | -0.037 | -0.462 |
| | (0.114) | (0.202)* | (0.089) | (0.157) | (0.098) | (0.305) | (0.093) | (5.103) | (0.107) | (0.512) |
| GDP | -0.039 | -0.671 | -0.304 | 0.015 | -0.366 | 0.346 | -0.327 | 3.329 | -0.217 | -0.496 |
| | (0.138) | (0.258)*** | (0.112)*** | (0.15) | (0.125)*** | (0.332) | (0.116)*** | (5.823) | (0.134) | (0.52) |
| NF payroll employment | -0.025 | -0.265 | -0.106 | -0.077 | -0.151 | 0.164 | -0.136 | 0.903 | -0.026 | -0.080 |
| | (0.041) | (0.076)*** | (0.034)*** | (0.057) | (0.037)*** | (0.114) | (0.035)*** | (1.843) | (0.04) | (0.190) |
| Unemployment | -0.025 | 0.998 | 0.335 | 0.303 | 0.512 | -1.017 | 0.425 | -3.445 | 0.033 | 3.547 |
| | (0.228) | (0.408)** | (0.182)* | (0.39) | (0.199)** | (0.588)* | (0.189)** | (10.48) | (0.219) | (1.194)*** |
| Retail sales | 0.011 | -0.056 | 0.004 | -0.036 | -0.007 | 0.005 | -0.003 | -0.722 | 0.028 | -0.279 |
| | (0.047) | (0.083) | (0.036) | (0.064) | (0.04) | (0.111) | (0.038) | (2.077) | (0.044) | (0.22) |
| Workweek | -0.218 | -0.667 | -0.450 | 0.007 | -0.556 | 0.436 | -0.554 | 20.340 | -0.464 | 0.158 |
| | (0.471) | (0.894) | (0.391) | (0.373) | (0.439) | (0.944) | (0.397) | (18.316) | (0.467) | (1.333) |
| **3. Confidence / forward-looking** | | | | | | | | | | |
| NAPM / ISM | 0.002 | -0.105 | -0.039 | -0.008 | -0.052 | 0.062 | -0.050 | 1.715 | -0.019 | -0.144 |
| | (0.018) | (0.034)*** | (0.015)*** | (0.021) | (0.016)*** | (0.044) | (0.015)*** | (0.770)** | (0.018) | (0.072)** |
| Consumer confidence | -0.005 | -0.016 | -0.012 | 0.002 | -0.014 | 0.015 | -0.013 | 0.346 | -0.009 | -0.013 |
| | (0.008) | (0.014) | (0.006)** | (0.009) | (0.007)** | (0.018) | (0.006)** | (0.322) | (0.007) | (0.03) |
| Housing starts | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.009 | -0.001 | 0.003 |
| | 0.000 | (0.001) | (0.000)* | 0.000 | 0.000 | (0.001) | 0.000 | (0.015) | (0.000)** | (0.001)** |
| **4. Prices** | | | | | | | | | | |
| CPI | 0.050 | -0.181 | 0.030 | -0.219 | -0.020 | -0.177 | -0.015 | -7.315 | 0.128 | -1.296 |
| | (0.238) | (0.417) | (0.184) | (0.336) | (0.202) | (0.653) | (0.193) | (10.862) | (0.219) | (1.086) |
| PPI | -0.021 | 0.094 | 0.003 | 0.049 | 0.025 | -0.013 | 0.028 | -1.429 | -0.035 | 0.355 |
| | (0.092) | (0.166) | (0.073) | (0.098) | (0.081) | (0.213) | (0.076) | (3.913) | (0.087) | (0.344) |
| **5. Net exports** | | | | | | | | | | |
| Trade balance | 0.013 | -0.121 | -0.030 | -0.006 | -0.037 | 0.039 | -0.033 | 0.285 | -0.013 | -0.129 |
| | (0.019) | (0.034)*** | (0.015)** | (0.023) | (0.017)** | (0.049) | (0.016)** | (0.835) | (0.018) | (0.077)* |
| Observations | 76761 | | 81260 | | 75429 | | 75429 | | 81260 | |
| Countries | 42 | | 45 | | 43 | | 43 | | 45 | |

Notes: Coefficient estimates are based on (4) and only for flexible exchange rates. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

**European Central Bank Working Paper Series**

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.europa.eu).

790 "Asset prices, exchange rates and the current account" by M. Fratzscher, L. Juvenal and L. Sarno, August 2007.

791 "Inquiries on dynamics of transition economy convergence in a two-country model" by J. Brůha and J. Podpiera, August 2007.

792 "Euro area market reactions to the monetary developments press release" by J. Coffinet and S. Gouteron, August 2007.

793 "Structural econometric approach to bidding in the main refinancing operations of the Eurosystem" by N. Cassola, C. Ewerhart and C. Morana, August 2007.

794 "(Un)naturally low? Sequential Monte Carlo tracking of the US natural interest rate" by M. J. Lombardi and S. Sgherri, August 2007.

795 "Assessing the impact of a change in the composition of public spending: a DSGE approach" by R. Straub and I. Tchakarov, August 2007.

796 "The impact of exchange rate shocks on sectoral activity and prices in the euro area" by E. Hahn, August 2007.

797 "Joint estimation of the natural rate of interest, the natural rate of unemployment, expected inflation, and potential output" by L. Benati and G. Vitale, August 2007.

798 "The transmission of US cyclical developments to the rest of the world" by S. Dées and I. Vansteenkiste, August 2007.

799 "Monetary policy shocks in a two-sector open economy: an empirical study" by R. Llaudes, August 2007.

800 "Is the corporate bond market forward looking?" by J. Hilscher, August 2007.

801 "Uncovered interest parity at distant horizons: evidence on emerging economies & nonlinearities" by A. Mehl and L. Cappiello, August 2007.

802 "Investigating time-variation in the marginal predictive power of the yield spread" by L. Benati and C. Goodhart, August 2007.

803 "Optimal monetary policy in an estimated DSGE for the euro area" by S. Adjemian, M. Darracq Pariès and S. Moyen, August 2007.

804 "Growth accounting for the euro area: a structural approach" by T. Proietti and A. Musso, August 2007.

805 "The pricing of risk in European credit and corporate bond markets" by A. Berndt and I. Obreja, August 2007.

806 "State-dependency and firm-level optimization: a contribution to Calvo price staggering" by P. McAdam and A. Willman, August 2007.

807 "Cross-border lending contagion in multinational banks" by A. Derviz and J. Podpiera, September 2007.

808 "Model misspecification, the equilibrium natural interest rate and the equity premium" by O. Tristani, September 2007.

809 "Is the New Keynesian Phillips curve flat?" by K. Kuester, G. J. Müller und S. Stölting, September 2007.

810 "Inflation persistence: euro area and new EU Member States" by M. Franta, B. Saxa and K. Šmídková, September 2007.

811 "Instability and nonlinearity in the euro area Phillips curve" by A. Musso, L. Stracca and D. van Dijk, September 2007.

812 "The uncovered return parity condition" by L. Cappiello and R. A. De Santis, September 2007.

813 "The role of the exchange rate for adjustment in boom and bust episodes" by R. Martin, L. Schuknecht and I. Vansteenkiste, September 2007.

814 "Choice of currency in bond issuance and the international role of currencies" by N. Siegfried, E. Simeonova and C. Vespro, September 2007.

815 "Do international portfolio investors follow firms' foreign investment decisions?" by R. A. De Santis and P. Ehling, September 2007.

816 "The role of credit aggregates and asset prices in the transmission mechanism: a comparison between the euro area and the US" by S. Kaufmann and M. T. Valderrama, September 2007.

817 "Convergence and anchoring of yield curves in the euro area" by M. Ehrmann, M. Fratzscher, R. S. Gürkaynak and E. T. Swanson, October 2007.

818 "Is time ripe for price level path stability?" by V. Gaspar, F. Smets and D. Vestin, October 2007.

819 "Proximity and linkages among coalition participants: a new voting power measure applied to the International Monetary Fund" by J. Reynaud, C. Thimann and L. Gatarek, October 2007.

820 "What do we really know about fiscal sustainability in the EU? A panel data diagnostic" by A. Afonso and C. Rault, October 2007.

821 "Social value of public information: testing the limits to transparency" by M. Ehrmann and M. Fratzscher, October 2007.

822 "Exchange rate pass-through to trade prices: the role of non-linearities and asymmetries" by M. Bussière, October 2007.

823 "Modelling Ireland's exchange rates: from EMS to EMU" by D. Bond and M. J. Harrison and E. J. O'Brien, October 2007.

824 "Evolving U.S. monetary policy and the decline of inflation predictability" by L. Benati and P. Surico, October 2007.

825 "What can probability forecasts tell us about inflation risks?" by J. A. García and A. Manzanares, October 2007.

826 "Risk sharing, finance and institutions in international portfolios" by M. Fratzscher and J. Imbs, October 2007.

827 "How is real convergence driving nominal convergence in the new EU Member States?" by S. M. Lein-Rupprecht, M. A. León-Ledesma and C. Nerlich, November 2007.

828 "Potential output growth in several industrialised countries: a comparison" by C. Cahn and A. Saint-Guilhem, November 2007.

829 "Modelling inflation in China: a regional perspective" by A Mehrotra, T. Peltonen and A. Santos Rivera, November 2007.

830 "The term structure of euro area break-even inflation rates: the impact of seasonality" by J. Ejsing, J. A. García and T. Werner, November 2007.

831 "Hierarchical Markov normal mixture models with applications to financial asset returns" by J. Geweke and G. Amisano, November 2007.

832 "The yield curve and macroeconomic dynamics" by P. Hördahl, O. Tristani and D. Vestin, November 2007.

833 "Explaining and forecasting euro area exports: which competitiveness indicator performs best?" by M. Ca' Zorzi and B. Schnatz, November 2007.

834 "International frictions and optimal monetary policy cooperation: analytical solutions" by M. Darracq Pariès, November 2007.

835 "US shocks and global exchange rate configurations" by M. Fratzscher, November 2007.

ISSN 1561-0810