US shocks and exchange rates

SUMMARY

Many academics and observers emphasize that a sharp US dollar depreciation is inevitable for returning the burgeoning US current account deficit to more sustainable levels. How may such a US dollar adjustment occur, and what may it imply for global exchange rate configurations? The paper focuses on the role of US-specific economic shocks in the adjustment process, and finds that such US shocks have historically exerted a remarkably heterogeneous effect across currencies. It shows that this heterogeneity is not only due to policy choices of inflexible exchange rate regimes or to monetary policy, but to an important extent is explained by market forces, in particular the degree of financial integration – foremost in portfolio investment – though not by trade. This helps explain why it has been in particular the euro, and its predecessor currencies, as well as other European currencies that have contributed the bulk to the adjustment of the US dollar effective exchange rate over the past 25 years, while other flexible currencies have been much less responsive to US shocks.

The results suggest that currency flexibility is a necessary but not a sufficient condition for achieving a more balanced contribution across currencies 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 make this transmission work, which requires in particular that countries have well-developed financial markets and are financially integrated. These findings have implications for an unwinding of global imbalances, and for monetary policy choices and financial market policies in emerging market economies.

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US shocks and global exchange rate configurations

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1. INTRODUCTION

Global current account and financial imbalances continue to have a tight grip on the global policy debate as well as on the academic work in 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 is 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 *et al*., 2005) and one that may be rather abrupt and severe (Krugman, 2007).

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How may such a US dollar adjustment occur? 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 so far have shown few signs 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, the key question is what global exchange rate configurations will be in a world in which global current account imbalances are adjusting. This issue seems particularly pertinent at the current juncture amid financial market turmoil and a US dollar weakening.

To address this question, the paper analyses how US macroeconomic and monetary policy shocks have affected global exchange rate configurations historically over the past 25 years; and what channels account for the heterogeneity in the response pattern to such US shocks. The objective is not to explain the movement of individual bilateral exchange rates, but rather to understand why and how a given shock may exert an asymmetric effect across different currencies. Taking such a cross-sectional perspective is important because it shows how shocks can have 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 analysing 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]

The empirical analysis of the paper shows 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. Importantly, this result is not primarily explained by differences in exchange rate regimes, but holds also when analysing 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-à-vis the US dollar.

By contrast, the euro and the Swiss franc are among the currencies most affected by US developments. 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

[1] By analysing the underlying factors of the responsiveness of exchange rates to fundamentals, the present paper draws on the important conceptual work by Hau and Rey (2006), Lane and Milesi-Ferretti (2003, 2005), and Tille (2003).

effective terms induces, on average, an effective appreciation of the euro by 1.2%. Again, this striking sensitivity of the effective exchange rate of the euro and the Swiss franc is explained in part by the fact that many important trading partners have inflexible currency regimes against the US dollar, but also in part due to the result that other flexible currencies are less sensitive to US shocks. Thus the analysis sheds light on the reaction of cross-rates to US economic developments, and more generally how individual effective exchange rates react in contrast to bilateral rates.

Moreover, the paper shows that movements of European currencies have accounted historically for more than 50% of the adjustment of the US dollar effective exchange rate, which is two to three times more than their weights in the trade-weighted basket of the US dollar, 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 focus of the paper focuses on the determinants of this heterogeneity and the channels through which US shocks are transmitted to exchange rates. The paper investigates whether the strength of the exchange rate response to US shocks is related to the real and financial integration and interdependence of countries with the United States or globally. With regard to financial integration, researchers have tried to explain capital flows and exchange rate movements in response to various shocks using portfolio balance models, and recent studies have indeed found evidence that such portfolio rebalancing takes place among advanced economies (Hau and Rey, 2006; Tille and van Wincoop, 2007). These models imply that shocks to the US economy will cause portfolio shifts and affect exchange rates, and these exchange rate effects are higher the larger the financial exposure and integration of investors. A related argument applies to trade integration. Higher bilateral trade with the United States may imply that, for example, a negative demand shock in the United States 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 first point is that the heterogeneity in the transmission process appears unrelated to monetary policy as there is no systematic relationship between how a country's currency reacts and how its short-term interest rates respond to US developments. The empirical findings of the paper indicate that it is in particular a country's financial integration, both globally and bilaterally with the United States, 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 foreign direct investment (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 of countries.

There are no studies to date that systematically analyse 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) analyse 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. Another related paper is by Lane and Milesi-Ferretti (2007), who analyse the effect on Europe from an adjustment of global current account imbalances, though their focus is not on the role of the exchange rate *per se*. 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 *et al.*, 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 *et al.*, 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, analysing 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 analyse the cross-sectional effect

[2] Some features of exchange rate behaviour, 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, Goldberg and Klein (2006) and Gürkaynak *et al.* (2005) emphasize the role of the precise objective function and the degree of credibility of central banks, while Fratzscher *et al.* (2007) emphasize the link of exchange rates to asset price responses.

of specific shocks – that is, shocks that are specific to the United States and that can be identified cleanly through the empirical approach. 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 because understanding how US shocks have affected exchange rates in the past should help us gauge how they may do so in the future. The results stress that while exchange rate flexibility is one important element for helping achieve a more balanced contribution to a US dollar adjustment across currencies, such currency flexibility alone is not sufficient. It is also financial integration that is a key prerequisite for a smoother and more balanced adjustment of global exchange rate configurations over time. Thus the empirical results of the paper have implications for the choice of exchange rate regimes and for the conduct of monetary policy, in particular for EMEs that lack flexibility, and underline the importance of financial globalization and integration for those economies 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. 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 policy implications follow in Section 6.

2. DATA AND STYLIZED FACTS

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 *et al.* (2005) and are the changes of the Fed funds futures in the 30-minute window around

Table 1. Summary statistics of macroeconomic surprises and announcements

Variable	Definition/unit		Surprise/shock		Announcement		Announcement change	
		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	59.400	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 US$ billion	274	1.367	0.985	–18.11	–61.310	2.823	6.600

Source: MMS International, S&P and Bloomberg for macroeconomics variables; Gürkaynak *et al.* (2005) for the monetary policy variable.

Federal Open Markets Committee (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.

An important point to emphasize is that the empirical analysis is conducted using a daily data frequency. As shown and discussed in detail by Andersen *et al.* (2003) and Ehrmann and Fratzscher (2005b), using a high data frequency is crucial for identification and ensuring that what is measured as a particular shock to, for example, US employment is not diluted by other factors. Therefore the lower the data frequency, the more noisy is the data and the less precise can the shocks be identified. While Andersen *et al.* (2003) show that much of a data release is priced into FX markets within the first 10 minutes after the release – which in the US mostly take place at 8.30 EST – the findings of Ehrmann and Fratzscher (2005b) indicate that some further price adjustment takes place during the remainder of the business day. Also due to data availability, the choice here is therefore to conduct the empirical analysis at the daily frequency.

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 United States reaching back to 1973; NEERs for other currencies stem from the Bank for International Settlements (BIS).[3]

[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.

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 2001–4, 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 United States and partner countries is used. The UNCTAD data has annual data in US dollars for around 90 reporting countries 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, that is, daily or intra-daily data, follows the standard approach in the literature:

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

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.[4]

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 percentage point 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 US$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, for example due to tighter monetary policy, the exchange rate may depreciate. In fact, 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 the Taylor-rule type of fundamentals and implies that the positive inflationary shocks should indeed appreciate the domestic currency. Moreover, Clarida and

[4] It is important to account for the heteroscedasticity in the data. Many papers studying the impact of macroeconomics news or other events on asset prices use the 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 least 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.

Table 2. Effects of US shocks on US dollar and euro

	Bilateral USD/EUR	NEER USD	NEER USD excl. EUR	NEER 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)*	(0.000)	(0.000)
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.

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.

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

	Bilateral exchange rates	NEER
Industrialized 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.

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,[5] 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 countries 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 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.[6] 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 5a. 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

[5] 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.

[6] It should be stressed that all the currencies shown in Tables 5a–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. The results have been cross-checked using the alternative classification by Klein and Shambaugh (2006), which yields very similar empirical results. 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 facto* regimes.

Table 4. Effects of US shocks on NEER of selected countries

	Canada	UK	Japan	Australia	New 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
	(0.000)	(0.000)	(0.000)**	(0.001)	(0.001)	(0.000)	(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 5a. Effects of US shocks for bilateral USD exchange rates – other industrialized countries

	Australia	Canada	Switzerland	Denmark	UK	Japan	New 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)	(0.000)	(0.000)	(0.000)	(0.000)	(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 5b. 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)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
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 5c. 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)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(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.

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 5b. The Mexican peso hardly reacts to US shocks, and in fact depreciates in response to a positive US shock 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 5c). 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.

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 1a (for all 64 currencies) and Figure 1b (only for flexible exchange rates) plot the distribution of the effect of the US shocks, with the horizontal axis showing the coefficient β_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 a 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 analysing only currencies that are flexible vis-à-vis the US dollar.

3.3. Robustness and extensions

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

First, many factors, originating not only in the United States 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

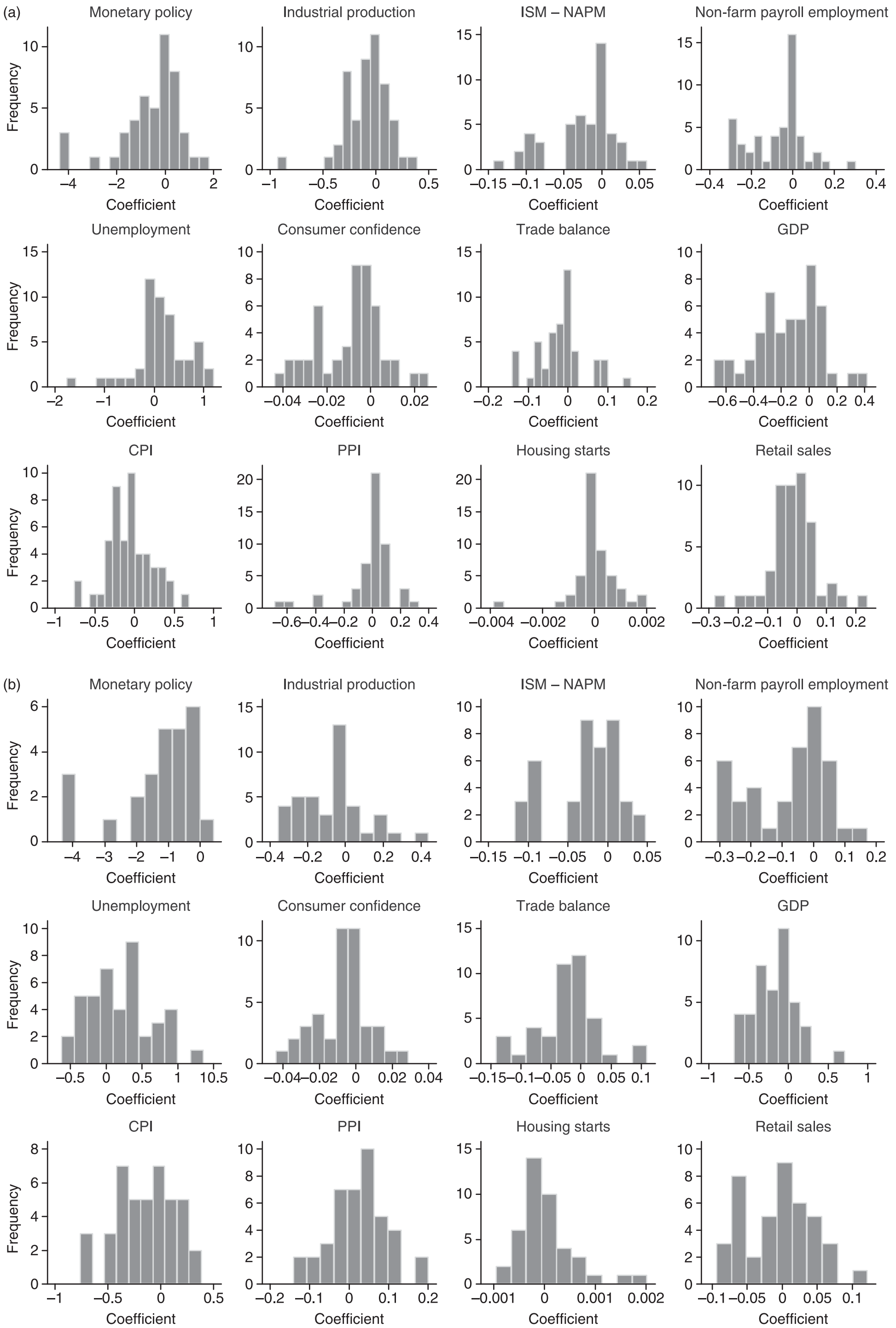

Figure 1. Distribution of US shocks on bilateral US dollar exchange rates. (a) All exchange rates. (b) Only *flexible* exchange rates

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.

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

	Model with US shocks			
	& *without*		& *with*	
	euro area shocks		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, 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 that are statistically significant are shown in the table. Numbers in italics are robust standard errors. ***, **, * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

macroeconomic and monetary policy shocks, i.e. for the three largest economies (Germany, France and Italy) and for the euro area as an aggregate.[7] Table 6 shows

[7] 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.

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 shock leads to an appreciation of the euro.[8] The second finding is that the estimates for the effects of US shocks are hardly changed when controlling for other shocks, such as euro area news. This confirms the hypothesis that the analysed 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 affects order flow in some cases for several days. However, for almost all of the 64 currencies analysed, 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 is 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, for example, 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.[9]

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.

[8] Note, however, that for the 38 euro area shocks included only those 10 shocks that are statistically significant are shown in the table. The other 28 shocks, which are not shown for brevity reasons, are not found to exert a statistically significant effect on the euro–dollar exchange rate.

[9] Results are available upon request. A more detailed discussion and results are available in an earlier version of the paper (Fratzscher, 2007).

4. 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:

$$\frac{\left| w_{i,t}\hat{e}_{i,t} \right|}{\sum_i \left| w_{i,t}\hat{e}_{i,t} \right|} \tag{2a}$$

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 $e_{i,t}$:

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

There is one important difference between the conditional measure (2a) and the unconditional measure (2b). 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 United States or it could come from the partner country or even stem from third countries.

Figure 2 shows the *evolution over time* in the conditional contribution (dark line), the unconditional contribution (light line) and the trade weight (dashed line) for 16 of the 26 main currencies in the US NEER over the period 1980–2006, using time-varying weights and recursive parameter 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 2). 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.

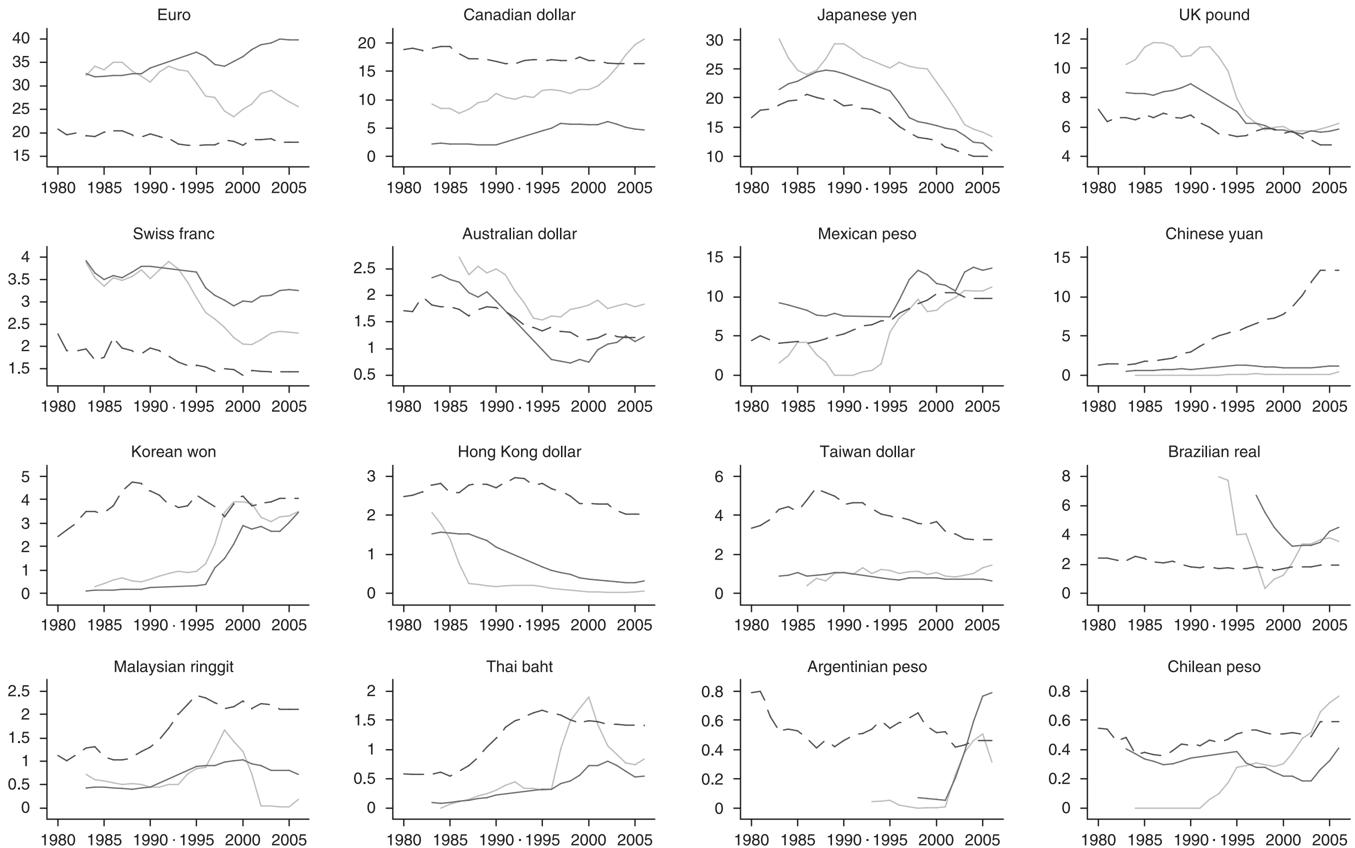

Figure 2. Contributions to US dollar NEER adjustment

Notes: The figure shows the conditional contribution (dark line), the unconditional contribution (light line), as well as the trade weight (dashed 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.

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 3 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 2. 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.[10]

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.[11]

As a sensitivity check, note that all results shown here are robust to using alternative time frequencies for the construction of the contribution measures (2a) and (2b). 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 (2b), 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.

[10] 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.

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

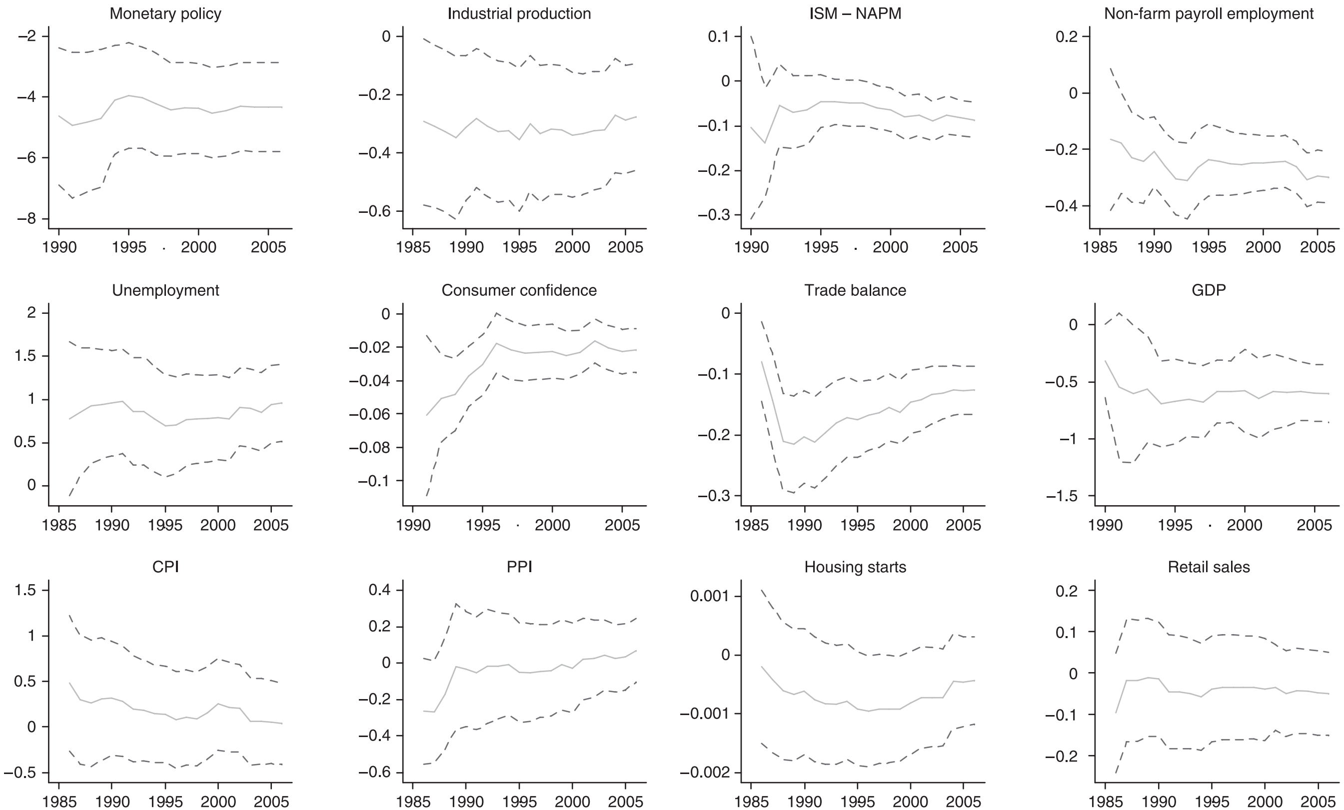

Figure 3. Time-varying parameters estimates – USD/EUR exchange rate

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.

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 analysing 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-à-vis the US dollar respond less compared to those where short-term interest rates are less sensitive.

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 (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:

$$e_{i,t} = \alpha_i + \sum_k \left[\beta_k^1 s_{k,t} + \beta_k^2 s_{k,t}\left(r_{i,t} - r_t^*\right)\right] + \delta(r_{i,t} - r_t^*) + \varepsilon_{i,t} \tag{3}$$

with r_t and r_t^* as domestic interest rates and US interest rates, respectively.[12] 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 α_i, although 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 β^1 and β^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 β^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 4 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 4

[12] 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.

Table 7. Channels – role of monetary policy

	Interest rate differential			
	US shock β^1		Interaction β^2 US shock with interest rate diff.	
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	15 3624			
Countries	43			

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

distinguishes between currencies of countries that have a high degree of financial integration (light dots in Figure 4; 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 (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 analyse 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.

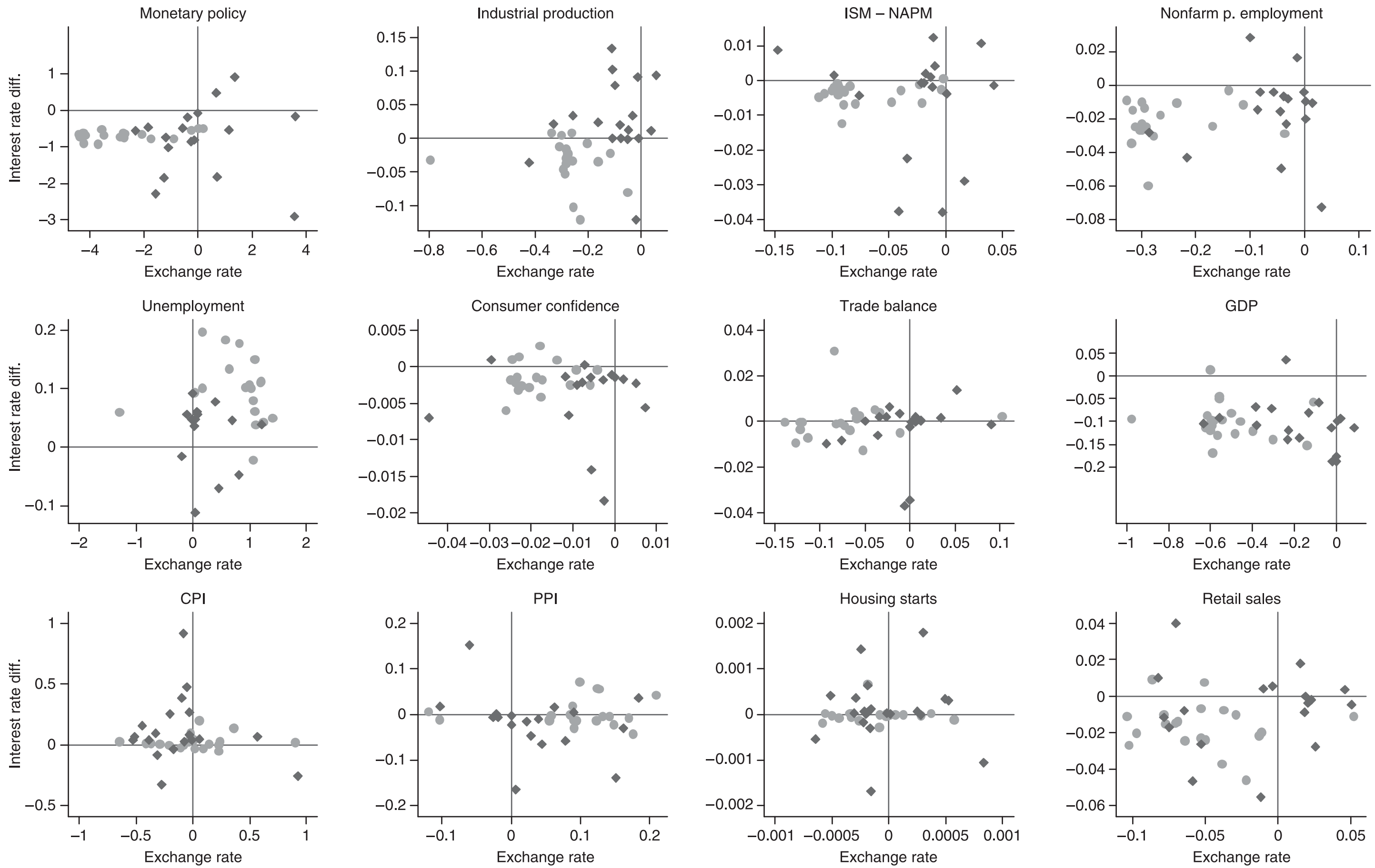

Figure 4. Response to US shocks of *interest rate differentials* versus exchange rates

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

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. Why would one expect such a relationship? On the finance side, researchers have tried to explain capital flows and exchange rate movements in response to various shocks using portfolio balance models (e.g. Kouri, 1982; Branson and Henderson, 1985). The key feature of these portfolio balance models is the imperfect substitutability between domestic assets and foreign assets due to, for example, exchange rate risk or other types of risk. Hence a shock to one economy induces a shift in financial portfolios, and a capital flow and adjustment in asset prices and the exchange rate. While earlier work struggled to find compelling empirical evidence for these models, more recent studies indeed find evidence that such portfolio rebalancing takes place among advanced economies (Hau and Rey, 2006; Tille and van Wincoop, 2007). The insight of this work is that shifts in risks and exposure induces international portfolio rebalancing. Applied to the present paper, what these models imply is that shocks to the US economy will cause portfolio shifts and thus affect the exchange rate of the US dollar vis-à-vis its partner countries. Moreover, portfolio balance models entail that the larger the exposure of investors, the higher will also be the cross-border shift in portfolios. Thus, this insight implies that a higher degree of financial exposure to the United States should induce a larger exchange rate response to US shocks, which is a central hypothesis analysed in this section.

A similar argument applies to real/trade integration. As to trade, higher bilateral trade with the United States may mean that a negative demand shock in the United States affects close trading partners in a more similar way, in particular if a large share of the trade is in complements, 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.

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 5 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

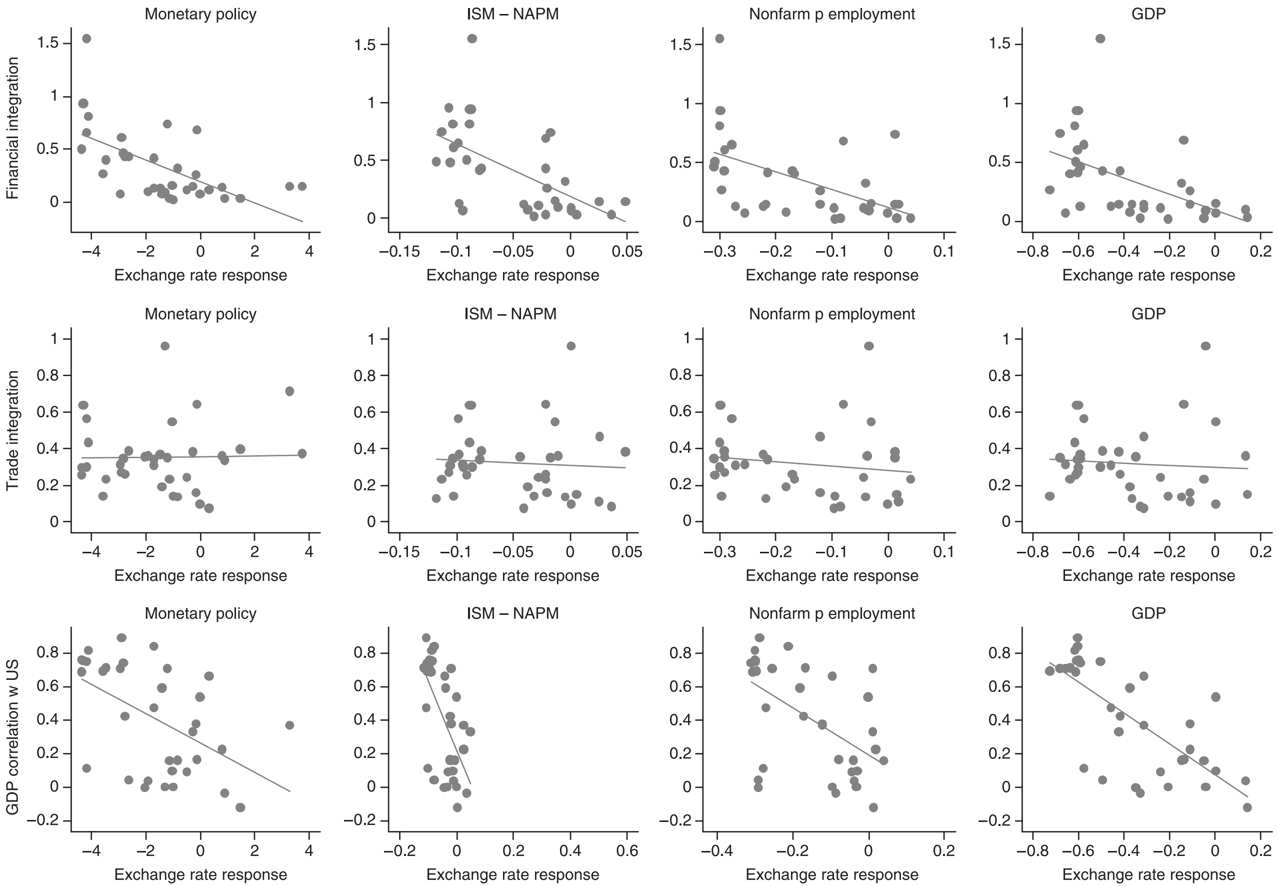

Figure 5. Financial vs. real integration and exchange rate response to US shocks

Notes: The figure shows the coefficients for four selected US shocks on bilateral US dollar exchange rates (horizontal axis) against: 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).

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 the 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 α_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 δ drops out from the model as country-specific, time-invariant variables are captured by the country fixed effects α_i.

Table 8 starts by analysing 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 β^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.

A distinct possibility is that what determines a country's exchange rate response to US shocks depends not only on this country's exchange rate regime, financial integration or real integration, but also on all the other countries' exchange rate regimes, financial integration and real integration. To investigate the role of the exchange rate regime of the rest of the world, Table 8 includes an analysis (labelled 'FX regime ROW') which tests whether a country's exchange rate response to US shocks is larger when more of the other countries (weighted by their trade weights) have *de facto* flexible exchange rate regimes. The table shows that this does not seem to be the case; however, as Figure 6 suggests, the reason for this result is likely to reflect the fact that

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

	FX regime		FX regime ROW		Stock market capit.		FX volatility		*De jure* KA openness	
	US shock	*Interaction*	US shock	*Interaction*	US shock	*Interaction*	US shock	*Interaction*	US shock	*Interaction*
1. Monetary policy										
Monetary policy	−0.624	−1.267	−1.210	−7.768	−1.412	−0.300	−1.236	−8.553	−0.335	−2.080
	(0.274)**	(0.439)***	(0.391)***	(8.244)	(0.455)***	(0.378)	(0.631)*	(16.322)	(0.638)	(0.718)***
2. Real activity										
Industrial production	−0.067	−0.087	−0.068	0.316	−0.216	0.063	−0.831	24.709	0.026	−0.225
	(0.044)	(0.083)	(0.066)	(1.272)	(0.078)***	(0.053)	(0.110)***	(3.102)***	(0.106)	(0.120)*
GDP	−0.048	−0.362	−0.252	−0.061	−0.310	−0.004	−0.306	0.239	−0.126	−0.275
	(0.067)	(0.108)***	(0.082)***	(1.292)	(0.096)***	(0.049)	(0.139)**	(4.006)	(0.131)	(0.155)*
NF payroll employment	−0.057	−0.117	−0.106	−0.653	−0.114	−0.046	−0.151	0.799	−0.046	−0.141
	(0.017)***	(0.029)***	(0.025)***	(0.477)	(0.029)***	(0.019)**	(0.043)***	(1.254)	(0.04)	(0.046)***
Unemployment	0.194	0.527	0.383	1.955	0.493	0.066	0.374	0.942	0.265	0.257
	(0.092)**	(0.163)***	(0.137)***	(2.369)	(0.160)***	(0.114)	(0.204)*	(5.541)	(0.216)	(0.242)
Retail sales	0.000	−0.030	−0.004	−0.407	−0.022	−0.008	0.022	−0.969	0.033	−0.077
	(0.016)	(0.032)	(0.028)	(0.556)	(0.033)	(0.021)	(0.049)	(1.49)	(0.043)	(0.048)
Workweek	0.085	−0.610	−0.779	7.100	−0.330	−0.066	−0.738	10.269	−0.087	−0.524
	(0.341)	(0.509)	(1.026)	(19.40)	(0.324)	(0.097)	(0.435)*	(11.25)	(0.396)	(0.504)
3. Confidence/forward-looking										
NAPM/ISM	0.001	−0.060	−0.041	−0.035	−0.036	−0.007	−0.045	0.138	−0.017	−0.038
	(0.009)	(0.014)***	(0.010)***	(0.160)	(0.013)***	(0.007)	(0.021)**	(0.692)	(0.018)	(0.021)*
Consumer confidence	−0.009	−0.003	−0.009	−0.095	−0.013	0.001	−0.007	−0.167	−0.006	−0.008
	(0.004)**	(0.006)	(0.004)*	(0.066)	(0.005)**	(0.003)	(0.008)	(0.252)	(0.007)	(0.009)
Housing starts	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.007	0.000	0.000
	0.000	0.000	(0.000)	(0.004)*	0.000	(0.000)**	0.000	(0.01)	0.000	0.000
4. Prices										
CPI	0.024	−0.123	−0.009	1.310	−0.083	−0.020	−0.191	5.688	0.005	−0.071
	(0.088)	(0.177)	(0.137)	(2.626)	(0.164)	(0.119)	(0.253)	(7.723)	(0.219)	(0.244)
PPI	0.055	−0.011	−0.005	1.143	−0.005	0.052	0.043	−0.926	−0.025	0.079
	(0.041)	(0.069)	(0.057)	(1.107)	(0.064)	(0.033)	(0.098)	(2.885)	(0.086)	(0.1)
5. Net exports										
Trade balance	−0.013	−0.042	−0.028	−0.010	−0.055	0.014	−0.019	−0.458	−0.002	−0.052
	(0.008)	(0.014)***	(0.011)**	(0.199)	(0.013)***	(0.008)*	(0.019)	(0.533)	(0.018)	(0.021)**
Observations	109655		69618		70725		81260		81260	
Countries	64		44		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.

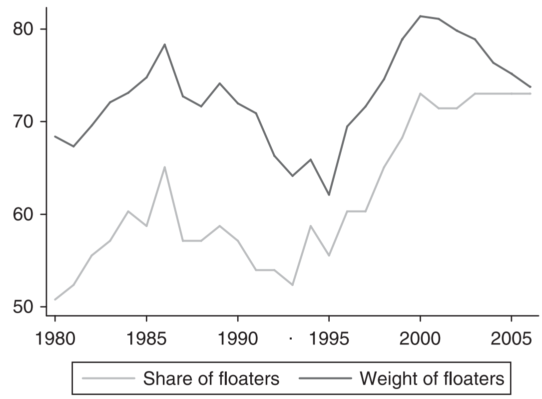

Figure 6. Share and weight of floating currencies in US dollar NEER (in %)

Notes: The light 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 line shows the combined weight of all de facto floating currencies in the US dollar NEER basket.

there has not been an overall large increase in the weight of *de facto* floating currencies for the US dollar effective exchange rate over the period 1980–2005.[13]

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 β^2 is in almost no case statistically significant. A similar 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 the role of financial integration, Table 9 shows the findings for flexible exchange rates when using various proxies for financial integration – measured as the sum of asset plus liabilities vis-à-vis the rest of the world over domestic GDP (second set of columns) or bilaterally vis-à-vis the United States (third set of columns). The first columns show 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 United States. Moreover, the last set of columns tests whether financial integration with the United States matters in the transmission process when controlling for financial

[13] An interesting point to note is the significant drop in the weight of floaters since 2000, which primarily reflects the rising weight of China.

Table 9. Determinants of distribution of US dollar shocks – financial integration

	Equity return correl.		Fin. integ. with ROW		Fin. integ. with US		Fin. integ. US vs ROW	
	US shock	*Interaction*	US shock	*Interaction*	US shock	*Interaction*	US shock	*Interaction*
1. Monetary policy								
Monetary policy	−0.454	−2.487	−2.488	−0.559	−2.495	−0.986	−0.968	−0.557
	(0.503)	(0.866)***	(0.580)***	(0.633)	(0.596)***	(0.148)***	(0.494)**	(0.161)***
2. Real activity								
Industrial production	−0.175	−0.008	−0.228	0.039	−0.234	0.096	−0.056	−0.036
	(0.091)*	(0.157)	(0.090)**	(0.084)	(0.092)**	(0.182)	(0.085)	(0.022)*
GDP	−0.193	−0.236	−0.421	−0.045	−0.426	−0.066	−0.231	−0.066
	(0.111)*	(0.19)	(0.117)***	(0.077)	(0.120)***	(0.168)	(0.108)**	(0.04)
NF payroll employment	−0.070	−0.155	−0.160	−0.126	−0.152	−0.265	−0.089	−0.036
	(0.033)**	(0.055)***	(0.035)***	(0.030)***	(0.036)***	(0.067)***	(0.032)***	(0.010)***
Unemployment	0.436	0.202	0.612	0.566	0.592	1.194	0.295	0.091
	(0.174)**	(0.29)	(0.191)***	(0.211)***	(0.195)***	(0.466)**	(0.171)*	(0.045)**
Retail sales	−0.020	−0.012	−0.019	−0.033	−0.017	−0.075	0.010	−0.012
	(0.04)	(0.066)	(0.037)	(0.037)	(0.037)	(0.083)	(0.035)	(0.009)
Workweek	−0.202	−0.409	−0.698	0.134	−0.696	0.243	−0.320	−0.129
	(0.367)	(0.605)	(0.345)**	(0.154)	(0.345)**	(0.356)	(0.38)	(0.162)
3. Confidence/forward-looking								
NAPM/ISM	−0.007	−0.075	−0.050	−0.024	−0.050	−0.043	−0.033	−0.009
	(0.014)	(0.025)***	(0.016)***	(0.011)**	(0.016)***	(0.024)*	(0.014)**	(0.005)*
Consumer confidence	−0.008	−0.010	−0.016	0.000	−0.017	0.003	−0.009	−0.002
	(0.006)	(0.01)	(0.007)**	(0.005)	(0.007)**	(0.01)	(0.006)	(0.002)
Housing starts	−0.001	0.001	0.000	−0.001	0.000	−0.001	0.000	0.000
	(0.000)**	(0.000)**	0.000	(0.000)*	0.000	(0.001)*	0.000	0.000
4. Prices								
CPI	0.047	−0.320	0.025	−0.189	0.038	−0.419	−0.057	0.022
	(0.187)	(0.319)	(0.187)	(0.189)	(0.19)	(0.406)	(0.175)	(0.044)
PPI	−0.097	0.268	0.011	0.063	0.009	0.123	0.027	−0.006
	(0.075)	(0.126)**	(0.074)	(0.053)	(0.076)	(0.115)	(0.07)	(0.021)
5. Net exports								
Trade balance	−0.048	0.005	−0.071	0.004	−0.073	0.016	−0.012	−0.018
	(0.015)***	(0.025)	(0.016)***	(0.013)	(0.016)***	(0.027)	(0.014)	(0.004)***
Observations	72727		81260		81260		81260	
Countries	45		45		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.

integration of the rest of the world with the United States. This relative measure is the ratio of each country's bilateral financial integration with the United States divided by the average measure of financial integration of all other countries with the United States.

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 several 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 third set of columns of Table 9. The size of the β^2 coefficient is in most cases much larger for this bilateral financial integration measure than for the other proxies. Similarly, this result is robust to when controlling for financial integration of other countries, shown in the last set of columns. 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 less so 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 proxies of trade integration which are analogous to the financial integration measures discussed for Table 9 (measuring exports plus imports over GDP vis-à-vis the rest of the world and the United States in columns 2 and 3, and the ratio of bilateral trade with the United States over the average trade intensity of other countries in the last set 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 United States, 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 β^2 is not statistically significant. However, a note of caution is in 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 (2007), 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 analysed 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 large number of shocks and interaction variables included already in model (4), there are however

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	0.413	7.011	−1.043	−9.036	0.965	−5.024	−2.059	−2.793
	(2.318)	(10.335)	(0.375)***	(2.659)***	(2.371)	(14.003)	(0.642)***	(4.782)
2. Real activity								
Industrial production	0.005	−0.510	−0.170	0.144	0.029	−1.303	−0.180	0.749
	(0.165)	(0.698)	(0.062)***	(0.365)	(0.167)	(1.671)	(0.093)*	(0.564)
GDP	−0.310	−0.215	−0.264	−0.677	−0.303	−1.125	−0.295	−0.144
	(0.152)**	(0.655)	(0.080)***	(0.377)*	(0.154)**	(1.442)	(0.102)***	(0.509)
NF payroll employment	−0.356	−0.907	−0.096	−0.764	−0.361	−0.925	−0.129	−0.910
	(0.066)***	(0.282)***	(0.024)***	(0.134)***	(0.067)***	(0.635)	(0.033)***	(0.206)***
Unemployment	1.507	2.486	0.389	2.582	1.502	13.812	0.527	2.008
	(0.403)***	(1.66)	(0.126)***	(0.838)***	(0.410)***	(7.555)*	(0.202)***	(1.35)
Retail sales	−0.162	−0.004	0.000	−0.214	−0.166	0.430	−0.013	−0.285
	(0.092)*	(0.398)	(0.025)	(0.142)	(0.093)*	(0.862)	(0.043)	(0.214)
Workweek	−0.257	1.143	−0.296	−1.114	−0.432	5.807	−0.416	0.299
	(0.396)	(1.733)	(0.271)	(0.87)	(0.404)	(3.172)*	(0.293)	(1.285)
3. Confidence/forward-looking								
NAPM/ISM	−0.054	−0.150	−0.032	−0.197	−0.055	−0.122	−0.038	−0.177
	(0.022)**	(0.092)	(0.011)***	(0.053)***	(0.022)**	(0.218)	(0.013)***	(0.081)**
Consumer confidence	−0.007	−0.029	−0.011	−0.024	−0.010	0.063	−0.011	−0.019
	(0.01)	(0.042)	(0.004)**	(0.022)	(0.01)	(0.096)	(0.005)**	(0.033)
Housing starts	0.000	0.002	0.000	0.002	0.000	−0.003	0.000	0.002
	0.000	(0.002)	0.000	(0.001)	0.000	(0.004)	0.000	(0.002)
4. Prices								
CPI	−0.314	−2.713	−0.066	0.167	−0.292	−6.595	−0.143	−0.483
	(0.362)	(1.539)*	(0.127)	(0.78)	(0.367)	(3.485)*	(0.22)	(1.192)
PPI	0.148	0.049	0.012	0.362	0.160	−0.305	0.038	0.446
	(0.103)	(0.448)	(0.051)	(0.243)	(0.105)	(0.942)	(0.071)	(0.343)
5. Net exports								
Trade balance	−0.027	−0.257	−0.029	−0.150	−0.034	−0.050	−0.027	−0.142
	(0.023)	(0.101)**	(0.011)***	(0.057)***	(0.024)	(0.227)	(0.015)*	(0.086)
Observations	71906		71906		71906		71906	
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. with ROW		Trade integ. with US		Trade integ. US vs ROW	
	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	−1.776	51.972	−1.785	0.179
	(0.645)	(1.189)***	(0.521)***	(1.124)	(0.547)***	(30.153)*	(0.550)***	(0.100)*
2. Real activity								
Industrial production	0.045	−0.367	−0.093	−0.021	−0.098	0.361	−0.096	0.000
	(0.114)	(0.202)*	(0.089)	(0.157)	(0.093)	(5.103)	(0.094)	(0.017)
GDP	−0.039	−0.671	−0.304	0.015	−0.327	3.329	−0.330	0.015
	(0.138)	(0.258)***	(0.112)***	(0.15)	(0.116)***	(5.823)	(0.116)***	(0.021)
NF payroll employment	−0.025	−0.265	−0.106	−0.077	−0.136	0.903	−0.138	0.005
	(0.041)	(0.076)***	(0.034)***	(0.057)	(0.035)***	(1.843)	(0.035)***	(0.006)
Unemployment	−0.025	0.998	0.335	0.303	0.425	−3.445	0.429	−0.014
	(0.228)	(0.408)**	(0.182)*	(0.39)	(0.189)**	(10.48)	(0.190)**	(0.034)
Retail sales	0.011	−0.056	0.004	−0.036	−0.003	−0.722	−0.004	−0.002
	(0.047)	(0.083)	(0.036)	(0.064)	(0.038)	(2.077)	(0.039)	(0.007)
Workweek	−0.218	−0.667	−0.450	0.007	−0.554	20.340	−0.556	0.084
	(0.471)	(0.894)	(0.391)	(0.373)	(0.397)	(18.316)	(0.397)	(0.074)
3. Confidence/forward-looking								
NAPM/ISM	0.002	−0.105	−0.039	−0.008	−0.050	1.715	−0.051	0.007
	(0.018)	(0.034)***	(0.015)***	(0.021)	(0.015)***	(0.770)**	(0.015)***	(0.003)**
Consumer confidence	−0.005	−0.016	−0.012	0.002	−0.013	0.346	−0.013	0.001
	(0.008)	(0.014)	(0.006)**	(0.009)	(0.006)**	(0.322)	(0.006)**	(0.001)
Housing starts	0.000	0.000	0.000	0.001	0.000	0.009	0.000	0.000
	0.000	(0.001)	(0.000)*	0.000	0.000	(0.015)	0.000	0.000
4. Prices								
CPI	0.050	−0.181	0.030	−0.219	−0.015	−7.315	−0.024	−0.015
	(0.238)	(0.417)	(0.184)	(0.336)	(0.193)	(10.862)	(0.194)	(0.035)
PPI	−0.021	0.094	0.003	0.049	0.028	−1.429	0.036	−0.012
	(0.092)	(0.166)	(0.073)	(0.098)	(0.076)	(3.913)	(0.077)	(0.014)
5. Net exports								
Trade balance	0.013	−0.121	−0.030	−0.006	−0.033	0.285	−0.032	0.000
	(0.019)	(0.034)***	(0.015)**	(0.023)	(0.016)**	(0.835)	(0.016)**	(0.003)
Observations	76761		81260		75429		75429	
Countries	42		45		43		43	

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

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

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 *et al.*, 2005; Krugman, 2007; 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 alone may be insufficient for solving 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.

Discussion

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This paper puts numbers where we only had impressions. Everybody seems to know that the euro has borne the brunt of the recent dollar fluctuations, and that very little has happened elsewhere. Marcel Fratzscher quantifies these effects precisely and the exercise is useful. A US shock that corresponds to a 1% change of the effective dollar exchange rate actually affects the euro more than one-for-one. At the same time, the same shock barely budges the Canadian dollar or Mexican peso. That there should be a cross-section of responses is interesting in its own right. Understanding the determinants of this cross-section is even more interesting, but probably harder. In what follows, I discuss why.

A word of caution

Drawing causal inferences from cross-sectional correlations is always hazardous, and the present exercise is no exception. Here the data suggest that the currencies whose exchange rates respond to US shocks are those of countries where (1) trade in financial assets is intense with the United States, (2) business cycles are synchronized with the United States, but (3) goods trade with the United States is not observably different. It is important to interpret these findings as descriptive, rather than causal. In particular, it is important not to infer that further financial integration between, say, China and the United States would foster exchange rate adjustments there. Financial flows and exchange rate movements are endogenous. So are trade flows and indeed business cycles synchronization.

The response of a non-US currency's exchange rate to US specific exogenous shocks can be understood as an (inverse) index of shock diffusion between the two economies. If shocks diffuse perfectly – or indeed if policy responds identically everywhere – then there should be no exchange rate response. But then, if a given shock has identical effects in two economies, economic theory tells us there is little incentive to hold securities in both, at least conditional on the realization of the considered US shock. Since these are the shocks the paper builds on, a simple diversification motive would imply that one should observe little investment between countries that respond identically to a series of US shocks, which is precisely where the nominal exchange rate is largely left unchanged. *A contrario*, when shocks diffuse less than perfectly, diversification gains are present, capital flows respond and so do exchange rates. The exact same is true of portfolio rebalancing. If a US shock has identical consequences in the US and abroad, it should not motivate any rebalancing of investment portfolios, and nor should it affect the exchange rate.

In short, it is possible that, if China integrates financially with the United States, it will reflect a changing shock structure between the two economies, which the exchange rate will also capture. But nothing in the exercise here tells us that financial integration 'stimulates' exchange rate responses.

The same line of reasoning may explain, at least in part, some of the other findings in the paper. Consider goods trade. As Marcel Fratzscher emphasizes, whether more goods are sold internationally depends on the nature of the shock. A US demand shock that diffuses internationally – either because monetary policies are perfectly synchronized, or because it has a strong international component – will have little impact on the exchange rate, but will increase trade linkages. Especially trade in complements. In the cross-section considered here, bilateral trade is high when the exchange rate is unresponsive. On the other hand, a US supply shock that does *not* diffuse internationally – one based on the use of information technologies? – may increase trade in substitutes, as competitiveness in the US changes and the world takes advantage of it. But it will also affect the exchange rate. In the cross-section here, bilateral trade is high when the exchange rate responds.

An adequate combination of shocks may therefore account for the empirical irrelevance of goods trade. But it also suggests a relevant differentiation between vertical and horizontal trade, perhaps a more direct test of the conjecture developed here. What is for certain is that an observable increase in goods trade – triggered perhaps by lower tariffs – may or may not be accompanied by exchange rate movements. Nothing in the exercise presented here tells us that goods trade integration will not 'stimulate' exchange rate adjustments. It all depends whether goods trade occurs because shocks are asymmetric.

Finally, the data imply exchange rate responses to US shocks are largest in countries whose cycles tend to be synchronized with the United States. This is intriguing and deserves further study. The argument I have been developing should imply large exchange rate movements in economies where US shocks do *not* diffuse. That is, economies whose business cycles are uncorrelated with the United States – *conditional* on the realization of the considered US shock. Of course, the overall business cycle synchronization used here is effectively unconditional, and so may well be orthogonal to the international diffusion of the US shocks considered.

These comments are meant to be more than just a sobering reminder of the celebrated Lucas critique. Hopefully they also help making sense of the world, and in particular of the disproportionate, anecdotally well-known response of the euro to US shocks. Marcel Fratzscher tells us this happens because the Eurozone and the United States are financially integrated, and have synchronized business cycles. Is that plausible? For instance, are Canada or Mexico not puzzling counter-examples? Surely the international correlations between US, Canadian and Mexican business cycles are among the highest observable? And presumably financial linkages within NAFTA cannot be so much below those observed between the United States and the Eurozone. Still, the Canadian dollar and the Mexican peso hardly respond to US shocks. Why is that? The alternative approach just developed proposes simply that US shocks diffuse almost perfectly within NAFTA – but not between the United States and the Eurozone. The reason for *that* is an open research question.

Identification issues

It is crucial to account properly for multilateral – or indeed third party – effects when seeking to identify bilateral linkages. For instance, the Hong Kong dollar is pegged to the US dollar, and yet it does respond sizeably to US monetary shocks. How can that be? Goods trade between Hong Kong and Mainland China dwarfs any other bilateral trade linkages of the Province. Since it has to be mimicked by Hong Kong monetary authorities to maintain a peg, a US monetary shock will therefore affect the competitiveness of Hong Kong on its world markets, and especially in China. That in turn is likely to affect the Hong Kong economy and possibly exchange rate expectations. In short, it may be because Hong Kong trades with Mainland China – rather than with the US – that a US monetary shock affects the Hong Kong dollar.

The paper does put some effort in controlling for 'rest of the world' weighted averages in all its estimations. That is commendable, but could be given more prominence in the text. How are these averages computed? Are they augmenting the previous regressions, or rather the object of separate estimations? Are both coefficients, on bilateral and multilateral variables, always constrained to be the same? In other words, are they simply included as ratios?

A perennial concern in the literature concerned with shock diffusion is whether a high correlation in observed macroeconomic variables effectively reflects an exogenous international transmission of unexpected developments, or simply correlated policy responses. This is particularly thorny when it comes to monetary policy. Is it really that financial integration is associated with exchange rate responses to US shocks? Or rather that monetary policies tends to be highly synchronized internationally when countries hold large stocks of each other's financial assets?

To address this question, Fratzscher augments his cross-sectional regressions with (daily?) interest rate differentials, and runs a horse-race between exchange rate response and interest differentials, in the form of an interaction term between the two. The residual effect of US shocks on the currency, above and beyond changes in interest differentials, is purged from policy decisions. The approach, although intuitive, is not fully transparent. Suppose monetary policies are perfectly synchronized in both economies. Interest differentials are then continuously zero, and so will be any interaction term involving them. In other words the residual effect is exactly identical to the initial estimate if policy responses are perfectly synchronized. I thought the purpose was exactly the opposite.

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This paper is motivated by the threat of a collapse of the US dollar in the wake of the burgeoning US current account deficit. A sharp decline in the dollar does not require a uniform appreciation of other currencies and the author asks what the pattern of different dollar exchange rate changes might be. While the empirical investigation is potentially useful, I discuss why this question is perhaps less pressing than is suggested and why it is poorly posed and inherently difficult, if not impossible, to answer. I argue that the econometric exercise has little to do with global imbalances. I explore some of the data and econometric issues, propose a different motivation and pose some additional questions.

The US current account deficit has not actually burgeoned for some time, but it is large. This has sparked fears that the situation is unsustainable and that a further significant drop in the dollar may be imminent. However, favourable valuation changes and high returns on US claims on foreigners relative to the returns on foreign claims on the United States have probably partially offset the negative effect of sizeable US trade deficits on US net foreign indebtedness.

In addition, measured US net foreign indebtedness as a share of GDP is not all that extraordinarily large. But, even if a dramatic shift in global imbalances were to occur suddenly it is not clear what this would imply for dollar exchange rates. This is for two reasons.

First, the current account is endogenous. It is not possible to specify the co-movements of the current account and other endogenous variables without first specifying the underlying fundamental shocks. That is, it does not make sense to think of exchange rates responding to the current account balance independently of why the current account deficit is so large and why it suddenly declines. Second, in the long run, a fundamental shock to savings demand or investment requires a change in real interest rates or real exchange rates to restore equilibrium. Imagine a shock to home output in a one-good two-country model. Equilibrium may be restored with a change in the path of real interest rates. The home price level and the nominal exchange rate, depending solely on monetary policy, need not be affected. In the real world such a shock does affect nominal exchange rates, but their paths depend in a complicated way on what the nominal rigidities are, the nature of the non-linear adjustment process and the extent to which market participants coordinate in response to information associated with the shock.

Perhaps, then, it is fortunate that the rather interesting econometric tests have little to do with the motivation. Instead of looking at the long-term response of exchange rates to unannounced changes in the state of the world that are hard to observe, describe and interpret, this paper looks at the sensitivity of high-frequency (daily) movements in nominal bilateral and effective dollar exchange rates to regularly scheduled, perfectly observable and simple bits of news.

Specifically, the author looks at how the market responds to the headline number in US data releases such as industrial production, housing starts and retail sales. To see how this works, suppose that it is early January 2008. All the currency traders know that at 8:30 am ET on 15 January, a report on retail sales will be released. For any relevant data, they will all know the consensus view; they get it from Bloomberg or MMS. When the report is released, the traders, already poised, check the deviation of the headline number from the consensus view and most of their reaction will take place within seconds. Only later will economists evaluate the entire report and use it to update their beliefs about current and future fundamental variables and the likely market response.

This may lead to a further exchange rate reaction, but perhaps after the day is over.

There are a number of problems with interpreting the daily exchange rate change in response to the data considered as an indicator of the long-run response of exchange rates to economic fundamentals. First, perhaps the frequency of the data is too high. It is not clear that slicing time up into ever finer intervals tells us more about a long-run response. Second, the data releases considered are not generally reports of fundamental shocks and they contain more information than is captured in the headline number. The market response depends upon the context. For example, depending on the contents of the report and on the current economic situation, the same deviation between actual retail sales and the consensus view might be interpreted as either the beginning of an economic recovery or as a signal that inflation is out of control.

There are also some econometric issues. First, there are some timing problems: is an apparent reaction to retail sales just a delayed reaction to the previously released trade data? Is the response to the CPI figure muted because it is released right after the (presumably) highly correlated PPI figure? Second, a 25-year data set is long and perhaps it mixes up too many regimes to convey much information about the present. As an example, the author notes that the Canadian dollar reacts less to US news than the euro does. Perhaps in part this is because, in the past, the Canadian monetary authorities put a lot of weight on the US dollar exchange rate. If so, what does this tell us about the response of the Canadian dollar in a world where the Canadians are inflation targeters?

I think that with a different interpretation this type of study might have been more interesting. There appears to be a strong element of a beauty contest in the traders' reactions to the type of news considered. The traders clearly care more about what the rest of the market is doing and their position relative to the rest of the market than they do to correctly updating their beliefs about the state of the economy. Maybe such an exercise could have something useful to say about coordination games. Under what circumstances do traders coordinate? Are traders, for example, systematically coordinating more on variables that convey more information about fundamentals? Maybe, however, even daily data is not fine enough for this; perhaps it would be better to use intra-day data, even if (or perhaps especially if) it means looking at a shorter time period and fewer currencies.

There are also some additional questions that the authors could have looked at. Is the effect of scheduled news substantially different than that of unscheduled news? Does news affect exchange rate volatility as well as levels? Not all the data comes out at the same time of day and global markets are more active at some times of the day than at others. Does this matter? Is the consensus survey more stale for some variables than others. Does this matter?

Panel discussion

Allan Drazen suggested giving more weight in the analysis to the possibility of cross-country heterogeneity of expectations. Not only may the diffusion of a shock differ across countries but also the extent to which a shock is unanticipated. In the case of Canada, for instance, the small response may be due to more precise expectations.

Several panel members criticized the choice of using a bilateral approach. In the same vein, the difference in reaction of exchange rates to US shocks may be due more to multilateral trade openness than to bilateral trade openness. Also, Richard Portes suggested that the fact that countries such as China fix their exchange rates against the dollar implies that the burden of adjustment is shifted to the euro, and pointed out that this is not necessarily the case if the same countries also prefer to invest their trade surplus in dollar denominated assets.

A number of panellists commented on the degree of substitutability between the US dollar and the euro. Richard Portes noticed that the degree of substitutability between the two currencies may indeed matter. The variable of financial market integration used in the paper does not account for this degree of substitutability and, in addition, may be endogenous.

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