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Tipping the Scale? The Workings of Monetary Policy through Trade

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Abstract

Monetary policy entails demand augmenting and demand diverting effects, with its impact on the trade balance—and spillovers to other countries—depending on the relative magnitude of these opposing effects. Using US data, and a sign-restricted structural VAR identification strategy, we investigate how monetary policy shocks affects the trade balance, shedding light on the importance of the two effects. Overall, the results indicate that monetary policy has a meaningful impact on the trade balance. A monetary loosening (tightening) leads to a strengthening (weakening) of the overall trade balance, indicating that, on average, demand diversion dominates. This effect of monetary policy on trade is revealed in full when distinguisging between trading partners with fixed exchange rates—for which only demand augmenting operates—and flexible exchange rates—for which both effects operate. We also explore spillover differences between conventional and unconventional monetary policy, as well as changes in spillovers in the post-crisis period (due to an impaired monetary transmission mechanism). While our results suggest that monetary policy comes with spillovers through trade, they should not be interpreted as evidence against the use of this policy instrument as such. From a global perspective, optimal monetary policy should be assessed in conjunction with deployment of other policy measures, inclluding the ability of recipient countries to deploy their own policy measures to offset undesirable spillovers.

JEL Classification Numbers:

Keywords: monetary policy, current account, trade balance, spillovers

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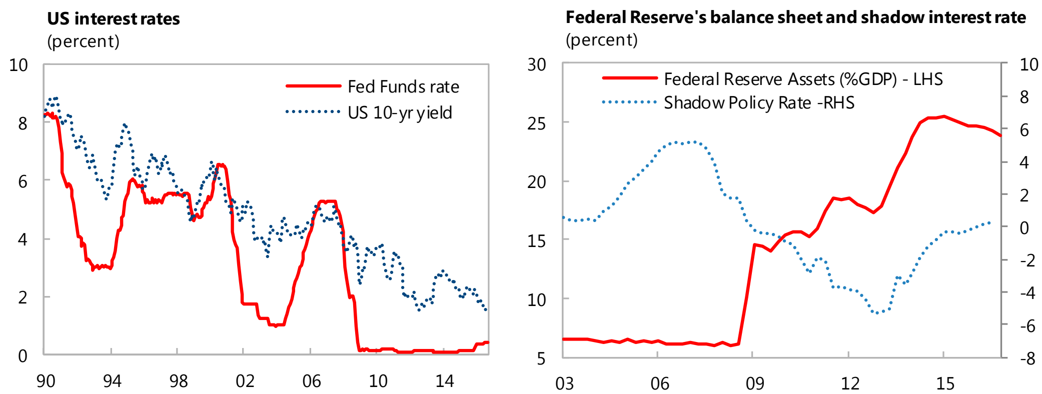
I. Introduction

The 2008-09 financial crisis, and the prolonged period of subdued growth in advanced economies that followed, led to an aggressive use of monetary policy as a countercyclical tool in many of these economies. First came the sharp loosening of monetary policy—whereby short-term policy rates were lowered to zero (Figure 1, Panel A)[1]—, rapidly followed by the implementation of unconventional measures in the form of asset purchase programs and forward guidance (Figure 1, Panel B). Along with the wave of unconventional monetary policy (UMP) measures—first by the US and later by the Euro Area, UK and other key systemic economies—came the discussion of whether extraordinarily loose monetary policy entailed negative spillovers to the rest of the world (and particularly adverse effects associated with negative interest rates). [2]

Figure 1. U.S. Monetary Policy Tools and Interest Rates, 1990-2016



Sources: Haver Analytics, FRED, Krippner (2016), IMF staff calculations.

Despite the flurry of research that followed, a consensus on the effects of UMP and, especially the difference (or lack thereof) between the effects of UMP and conventional monetary policy (CMP), has yet to emerge. A number of studies have focused on the effects of the Federal Reserve's UMP on global asset prices, capital flows and exchange rates, indicating that these policies had a large impact through both the signaling and portfolio re-balancing channels (Neely, 2010; Fratzscher and others, 2013; Moore and others, 2013; Bauer and Neely, 2014; Rogers and others, 2014; Bowman and others, 2015).[3] Yet, most of these studies have explored only partial aspects of the effects of UMP—focusing mainly on the impact on asset prices—and have said little about both the effects through trade. Similarly, Gagnon and others (2017) study the impact of QE (and other policies) on the current account, while also focusing on unconventional tools.

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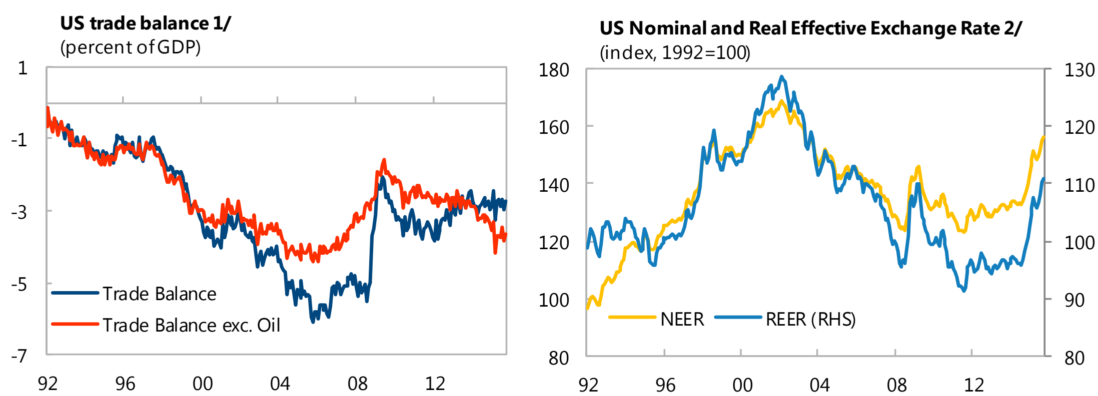
[1] See Appendix Figure A1 for a comparison a monetary policy interest rates between large advanced economies and other systemic economies.

[2] For example, Brazil's Finance Minister Guido Mantega argued in a speech delivered in September, 2010, arguing that "We're in the midst of an international currency war…This threatens us because it takes away our competitiveness". India's Central Bank Governor Raghuram Rajan pointed to the adverse spillovers of advanced economies' monetary easing on emerging markets economies (Rajan 2014).

[3] A few studies have investigated spillovers from UMP in Europe. See, for example, Fratzscher and others (2014), and Georgiadis and Grab (2015).

Another strand of work has focused on the effects of UMP on global real variables, although the evidence has been more scarce and inconclusive, in part reflecting cross-country heterogeneity of such effects. For example, Chen and others (2012, 2014a, 2014b), find that QE in the US had heterogeneous cross-border effects across advanced and emerging market economies. Along this line, Georgiadis (2015) finds significant effects from U.S. monetary policy, with the magnitude depending on key country characteristics, like financial integration, trade openness, the exchange rate regime, etc. These studies have primarily focused on the overall effect of UMP on other countries' output, in general without disentangling the different effects of monetary policy—demand diverting effects arising from the depreciation of the US dollar, and demand augmenting effects arising from the demand stimulus—nor the differences between UMP and CMP. More recently, former Federal Reserve's Chairman, Ben Bernanke (2015), pointing to the limited movements in the value of the US dollar and the US trade balance (Figure 2), argued that UMP did not entail significant spillovers to the rest of the world, as demand diverting and augmenting effects largely offset each other. Yet, a simple observation of the dynamics of the exchange rate and the trade balance does not necessarily speak to the consequences of monetary policy, as the effect of other, contemporaneous, cyclical forces may offset the impact of policies.

Figure 2. U.S. Trade Balance and Exchange Rate, 1992-2016



Sources: Haver Analytics and authors' calculations.
1/ In percent of potential (trend) GDP.
2/ An increase denotes US dollar appreciation.

In this paper, we take a fresh look at this issue. Using US data, given the greater availability of relevant series, we test whether monetary policy shocks have positive or negative spillovers to other economies, based on their impact on the trade balance. Moreover, by studying the impact on the trade balance vis-a-vis trading partners with different exchange rate regimes (fixed and flexible vis-à-vis the US dollar) our work sheds light on the role of demand augmenting and demand diverting effects of monetary policy. We also explore potential differences between the effects of conventional and unconventional monetary policies, as well as possible changes in spillovers in the post-crisis period due to an impaired monetary transmission mechanism.

The methodological approach builds on the work by Ehrmann, Fratzcher and Rigobon (2011) and Matheson and Stavrev (2014), who identify monetary policy shocks in a VAR, by exploiting information in asset prices. Specifically, the approach builds on the assumption that bond and equity prices tend to decrease with unanticipated increases of the policy rate—or upward revisions about expected future monetary policy—while equity and bond prices move in opposite directions (increasing and decreasing, respectively) in response to positive cyclical shocks. The setting is also extended to differentiate the effect of UMP and CMP by exploring the impact of structural monetary shocks in the long- and short-end of the yield curve, respectively.

Our results indicate that monetary policy significantly affects the trade balance. For the US, a monetary loosening (tightening) leads to a strengthening (weakening) of the overall trade balance, indicating that *on average* demand-diverting tends to dominate demand-augmenting effects. This average net effect, however, is biased by the 'demand-augmenting-only' impact vis-a-vis countries with fixed exchange rates (against the US dollar). The net effect of monetary policy is revealed in full when focusing on trading partners with flexible exchange rates—for which both demand augmenting and diverting channels are relevant—confirming that the latter effect dominates.

Meanwhile, a simple exploration of possible differences between conventional and unconventional monetary policy point to similar working of both instruments, with demand augmenting effects for pegs, and dominant demand diversion effect for flexible regimes.

Finally, the paper finds suggestive evidence that spillovers effects were larger in the post-crisis period, due to a dampened demand-augmenting effect, which supports the hypothesis of an impaired transmission mechanism of monetary policy during the crisis.

Overall, while our results speak about the workings of monetary policy through trade, the presence of monetary policy spillovers should not be interpreted as evidence against the use of this policy instrument. Monetary policy can be desirable from both an individual economy and global perspectives, provided that other economies are able to use their own interest/exchange rate policy instruments to partially offset these spillovers.[4]

The rest of the paper is structured as follows: Section II describes the methodological approach and the data. Section III presents the baseline results and documents the estimated impact of monetary policy on the trade balance. Section IV goes through a number of robustness checks of the baseline results. Section V discusses two related aspects with the goal of shedding some light on potential differences between conventional and unconventional monetary policy, as well as potential differences in spillovers effects during the post-crisis period. Section V concludes with the key takeaways.

II. METHODOLOGY AND DATA

The effects of U.S. monetary policy shocks on the trade balance are examined by estimating a structural vector auto-regressive (SVAR) model, where monetary policy shocks are identified through sign restrictions following the approach by Ehrmann and others (2011) and Matheson and Stavrev (2014). Specifically, our baseline estimation focuses on a reduced-form model given by:

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[4] For example, simultaneous monetary easing in the US and trading partners would help mitigate demand-diverting effects, while preserving demand-augmenting effects in both economies.

$$Y_t = A + \sum_{k=1}^{2} B_k Y_{t-k} + \varepsilon_t \tag{2}$$

where the reduced form residuals, ε_t , are a linear combination of the structural perturbations, μ_t , with the relation between them expressed as:

$$\varepsilon_t \ = Q\mu_t \tag{3}$$

The vector of endogenous variables (Y_t) is given by:

$$Y_t^{'} = \begin{bmatrix} R_t & S_t & E_t & TB_t \end{bmatrix} \tag{1}$$

where R_t, is the long-term interest rate (10 year U.S. treasury bond yield) and its fluctuations are understood as reflecting (contemporaneous and prospective) monetary policy changes. The baseline specification focuses on nominal yields, and an alternative specification with real yield is presented as a robustness check. The focus on long-term yields in the baseline specification allows us to catpure any form of monetary policy that affects the yield curve (conventional, QE, forward guidance).[5] Long-term nominal yields also reflect inflation expectations. However, as discussed further below, our identification strategy for monetary policy shocks is not affected by inflation expectations, as the latter would have the opposite effects on *nominal* stock prices.[6] S_t is the index of the S&P 500 composite of stock prices (expressed in logarithm), which serves as a proxy for cyclical conditions. E_t denotes the nominal effective exchange rate (NEER) vis-a-vis trading partners (expressed in logarithms)[7]; and TB_t is the trade balance, measured as percent of trend GDP, from the Census Bureau (on a balance of payment basis). The focus on trade values (as opposed to volumes) allows us to capture effects on both quantities and prices.[8] The U.S. monthly GDP series is from Macroeconomic Advisors and its trend is obtained with a standard Hodrick-Prescott filter to smooth out short-run GDP fluctuations.

The estimation is based on monthly data covering the period 1992m1-2016m9 (for which data are available). The model is estimated in levels, incorporating any co-integrating relationship between unit root variables without the need to specify a VECM.[9]

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[5] Differences between movements in the short- and long-end of the curve are explored a later section of the paper.

[6] Moreover, an alternative specification focused on the *real* 10-year yield delivers similar results, indicating that identified monetary shocks do not reflect inflation expectations for the most part.

[7] While the TB depends on the real rather than the nominal exchange rate, the model focuses on the latter as the identification strategy entails assuming a directional effect of monetary policy shocks on the exchange rate (e.g., monetary tightening leading to an appreciation) and theory provides greater guidance of such relationship for the nominal than for the real exchange rate. Yet, a robustness check with variables expressed in real terms (see section IV) deliver the same results.

[8] Later in the paper we explore a model with variables in real terms to shed light, by comparison with the baseline model, on price effects.

[9] Examination of the impulse response functions reveals that the responses go back to the steady-state values. Thus, estimating the model without first-differencing is acceptable.

Monetary shocks are identified through contemporaneous sign restrictions using the procedure developed by Rubio-Ramirez and others (2005). Our key identifying assumptions aim at disentangling interest rate movements that reflect endogenous responses to cyclical conditions from other changes in interest rates. Following Ehrmann, Fratzcher and Rigobon (2011) and Matheson and Stavrev (2014), a positive cyclical shock is assumed to increase both stock prices and bond yields: a positive demand shock increases inflationary pressures, and monetary policy is expected to tighten to prevent inflation from overshooting its target. Meanwhile, a positive money shock is assumed to increase bond yields and reduce stock prices, the latter reflecing the effect of arbitrage between bonds and equities. Finally, both improvements in cyclical conditons and tighter monetary conditions are assumed to lead to an appreciation of the currency on account of the interest rate parity and the appreciation that normally comes from a stronger economy.[10] These assumptions are summarized in the table below.

Table 1: Identifying assumptions

	10yr bond yield	Stock prices	NEER
Monetary policy tightening	+	-	+
Cyclical conditions improvement	+	+	+

The approach entails generating random draws of orthonormal matrices Q in equation (3) above until 1,000 parameterizations satisfying the sign restrictions are obtained. This procedure can only bound the impulse response functions, as the econometric model is just set-identified—that is, there is a group of models that satisfy the sign restrictions, each solving the structural identification problem. In order to identify a unique model, we follow Fry and Pagan (2010), selecting the estimated model whose impulse responses are closest to the median of the responses on impact. The standard deviation across these responses are used to compute confidence bands.

III. BASELINE RESULTS

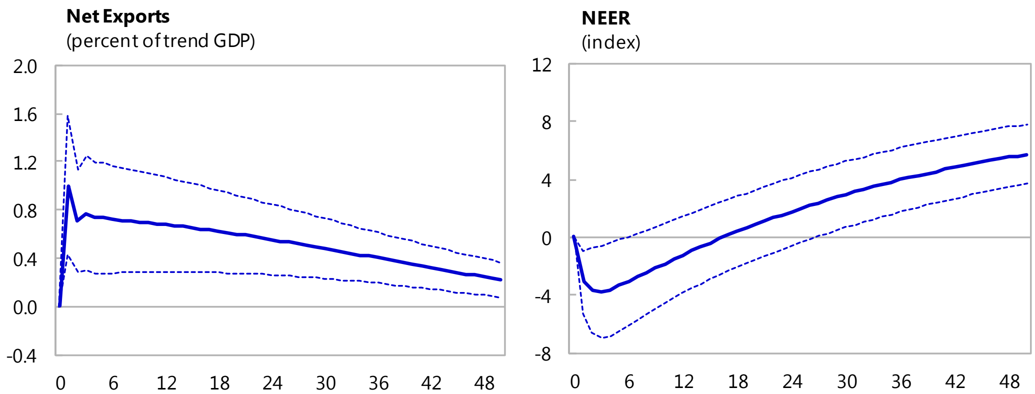
Figure 3 presents the estimated responses to a monetary loosening shock—equivalent to a 1 percentage point decrease in the 10-year yield—of the main variables of interest: the trade balance and the nominal exchange rate.[11] The results indicate that a monetary tightening leads, on impact, both to an depreciation of the nominal effective exchange rate (of about 4 percent) and a significant improvement of the trade balance (of near 1 percentage points of GDP). The statistically significant impact on the exchange rate appears to be relatively short-lived—after 12 months, the exchange rate starts to appreciate, possibly due to the positive effect of the monetary shock on the real economy—

[10] The sign restriction on the exchange rate builds on the notion that interest rate parity held for most of the estimation period. Recent evidence of deviation from interest parity (see, for example, Arai and other, 2016; Barclays, 2015; Borio and others, 2016; Du and others, 2016, Iida and others, 2016; JPMorgan, 2015; Shin, 2016) does not affect our analysis, as our focus is on a longer time period.

[11] While the choice of a 1 percentage point shock to the 10-year yield is convenient for interpretation, a shock of that magnitude is quite large, as the standard deviation for changes to the 10-year rate is about 0.25 percentage points. The standard deviation of the short-term rate—discussed later—tend to be significantly larger.

while the impact on the trade balance is somewhat persistent, averaging 0.7 percent of GDP over the first 24 months[12].

Figure 3. Response to Monetary Shocks
(1 percentage point negative shock to 10-year yield)

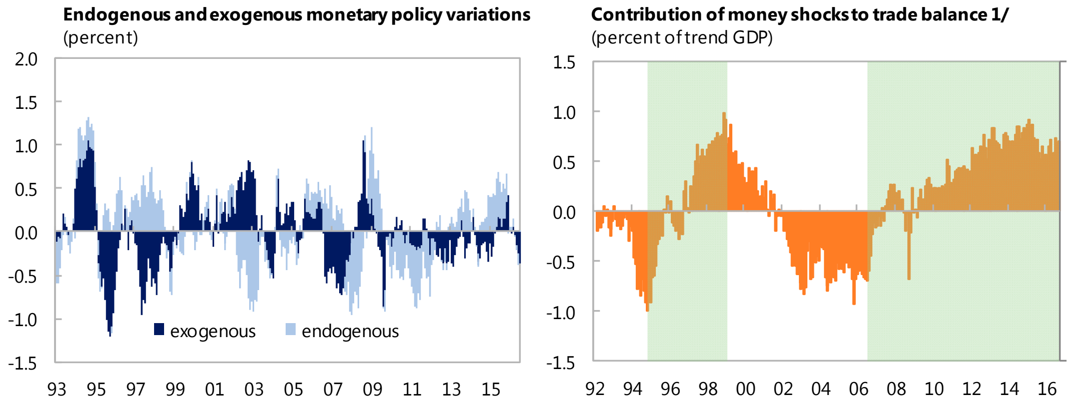


Source: authors' estimates.
1/ Confidence bands correspond to one standard deviation.

Identified structural monetary policy shocks—i.e., changes in interest rates that do not correspond to the endogenous response of monetary policy to the cycle—have contributed significantly to the fluctuations in the trade balance. Figure 4-left panel plots the decomposition of monetary shocks into its endogenous component (response to the cycle) and the exogenous component, which mainly reflects monetary policy surprises. The latter appear to have been greater in absolute magnitude during the 1990s and early 2000s than during the global financial crisis. This indicates that most of the substantial monetary loosening that followed the crisis actually reflected the normal policy response to economic conditions. The early monetary loosening of 2007 appears to have been an exception—possibly reflecting the Federal Reserve's anticipation of the tightening of financial conditions that followed, not yet reflected in economic conditions at the moment. Another noteworthy pattern relates to the sign of the structural shocks, with evidence of both positive and negative surprises in the pre-crisis period, but mostly negative shocks in the post-crisis years, pointing to the continuous efforts to stimulate the economy in the aftermath of the crisis.

[12] In the longer run, all impulse responses go back to zero.

Figure 4. Monetary Policy Shocks and Contribution to Trade Balance



Source: authors' estimates.
1/ Shaded areas denote monetary easing episdes, defined as a decreasing contribution of money shocks to yields.

As shown in Figure 4-right panel, the identified exogenous monetary policy variations had a sizeable impact on the trade balance (see also Table 2). Moreover, the monetary cycle, beyond the response to the business cycle, shows two clear periods of significant monetary easing over the last 25 years (1994-99 and 2007-16) that entailed significant strengthening of the trade balance, in the range of [0.2, 0.4] percent of GDP on average, but also with peak effects of nearly 1 percentage point of GDP in both cases. Similarly, tightening cycles (during 1992-94 and 1999-2006) entailed a sizable weakening of the external position, in the range of [-0.3, -0.2] percent of GDP on average and close to -1 percent of GDP at the peak.

Table 2. Monetary Cycle and Trade Balance

	Change in yield due to money shock		Money shock contribution to net exports	
	Peak (absolute value)	Average	Peak (absolute value)	Average
Tightening events				
1992m3-1994m11	0.138	0.036	-0.994	-0.303
1999m2-2006m7	0.069	0.017	-0.925	-0.240
Easing events				
1994m12-1999m1	-0.100	-0.031	0.984	0.181
2006m8-2016m10 (exc. GFC) 1	-0.072	-0.013	0.912	0.426

1/ Excludes 2008 as the period of the global financial crisis.

Overall, these results indicate that, on average, monetary policy entails sizable spillovers on trading partners—thus pointing to greater demand diverting than demand augmenting effects.

Trading partners' exchange rate regime

A useful extension of our baseline specification is studying the effect of monetary policy vis-a-vis countries with *de facto* flexible and fixed exchange rate regimes against the US dollar, separately, in order to shed further light on the role of demand-augmenting and diverting effects. Conceptually, both effects should be mostly muted with respect to trading partners with hard fixed exchange rate regimes, as a stable exchange rate against the US dollar would imply no demand-diverting effect in the face of a U.S. monetary policy shock, while synchronized interest rate movements—necessary to maintain a hard pegs—would imply symmetric demand augmenting effects.[13] In contrast, demand augmenting and diverting effects should materialize fully in the US trade balance vis-a-vis trading partners with flexible exchange rate regimes. In practice, with many countries actually implementing some form of managed floating regime, these differences are more blurred. US trade balances vis-a-vis economies with more heavily managed regimes, however, are expected to display smaller demand diverting effects.

In order to explore these potential differences, we construct trade balance as well as the NEER series for the US vis-a-vis the two different exchange rate regime groups, focusing on the 50 economies with whom the US trades most (representing 95 percent of total US trade).[14] We rely on the *de facto* exchange rate classification of Ilzetzki, Reinhart and Rogoff (2017). Given the particular importance of the 2008-09 financial crisis period in terms of the deployment of extraordinary monetary policy stimulus, we group countries according to their regime classification during 2007-10. Trading partner countries classified with a category at or above 10 (below 10)—which corresponds to *de facto* crawling peg with a band narrower than ±5 percent—for more than half of the period are considered to operate under a *de facto* flexible (fixed) exchange rate regime. Countries that maintain de facto pegs vis-a-vis currencies other than the US dollar (e.g., members of the Euro area) are classified as flexible regimes.[15]

Additionally, we distinguish between advanced economies and emerging and developing economies (EMDEs), primarily because many US trading partners in the former group conducted aggressive monetary loosening in the aftermath of the financial crisis, contemporaneously US, in stark contrast to the latter group (see Appendix Figure A1). Figure 5 plots the corresponding trade balances by income group and exchange rate regime.[16] As shown, barring differences in levels reflecting the extent of trade with the different groups, there is a noticeable difference in trade balance dynamics between exchange rate regimes, especially during the post-crisis policy stimulus period. A rapidly improving trade balance vis-a-vis economies with flexible exchange rate contrasts with a much more gradual, or muted, improvement vis-a-vis countries with de facto fixed exchange rate regimes. This pattern holds for both EMDEs (with and without China) and AEs, although in the latter case the group of countries with fixed ER regimes is quite small.

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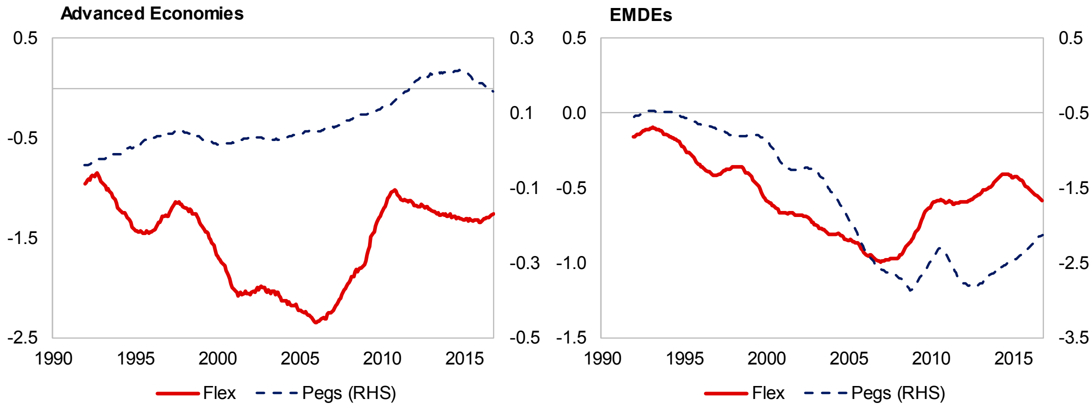
[13] Conceptually, demand augmenting effects may be different between two countries with pegged currencies even if interest rates move symmetrically due, for example, to different strengths of their monetary policy channels. As shown below, however, results for the US do not point to significant asymmetries at least on aggregate. Capital controls can also play a role, allowing countries to maintain their currencies pegged to the US dollar while not moving their domestic interest rates one-to-one with the US monetary policy rate. See Gagnon and others (2017) for a related discussion.

[14] NEER indexes against subgroups of trading partners is constructed as $NEER_t^J = \sum_{j\in J} S_t^j \left(\frac{X_t^j + M_t^j}{\sum_{j\in J}\left(X_t^j + M_t^j\right)}\right)$, where S_t^j denotes the indexed exchange rate vis-a-vis country *j*; and X_t^j (M_t^j) denote exports (imports) vis-a-vis the same country.

[15] The model is also estimated using the IMF's classification of de facto exchange rate regimes. Results, presented in Appendix Figure A.2, are qualitatively and quantitatively similar.

[16] Due to data limitations, the break-down by exchange rate regime is conducted using data on bilateral trade in goods only. Consequently, estimated effects measures in percent of GDP are smaller than for total trade.

Figure 5. Trade Balance by Exchange Rate Regime, 1990-2016
(24-month moving average, in percent of GDP)

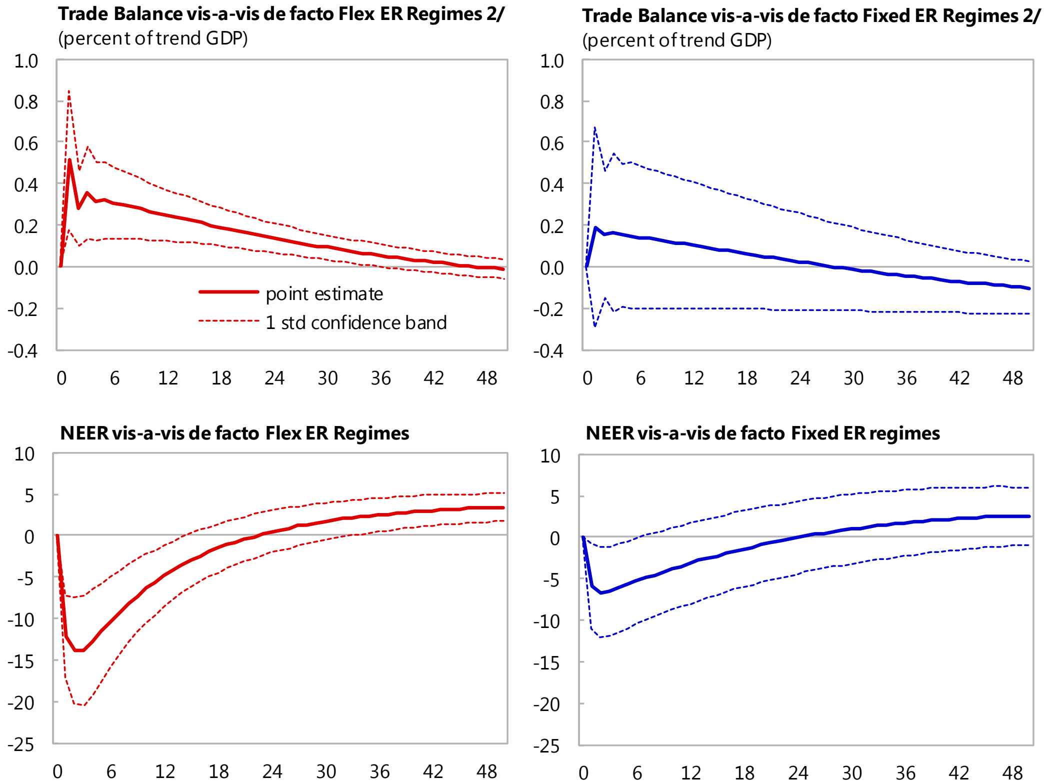


Sources: Direction of Trade Statistics, World Economic Outlook, and authors' calculations.
1/ Trade balance in goods, relative to the 50 largest trading partners (which represents about 95 percent of total trade). Exchange rate regime is based on Ilzetzki and others (2017).

Figure 6 presents the impulses responses from the estimation of the baseline model for EMDEs—for which there is richer exchange rate regime variation—with de facto flexible and fixed exchange rate regimes separately.[17] As apparent, and in line with our priors, the trade balance with countries with flexible exchange rates react markedly to monetary policy shocks, while the balance vis-a-vis countries with more rigid regimes displays a muted response (both in terms of point estimates and statistical significance). A sizable nominal depreciation vis-a-vis the former group plays a key role in the adjusting mechanism, as shown also in Figure 6 (lower row).

[17] Results for the full sample are similar, although somewhat weaker, likely reflecting the fact that key advanced economy-trading partners also conducted aggressive monetary policy (not controlled for in our baseline specification) during the period of analysis.

Figure 6. Effect of Monetary Policy on Trade Balance, by Exchange Rate Regime 1/



Source: authors' estimations.
1/ De facto exchange rate regime classification based on Ilzetzki and others (2010). Country sample includes EMDEs only.
2/ Impulse responses are comparable, as the degree of trade (exports+imports) vis-a-vis each exchange rate group is broadly similar.

Overall, these results point to the importance of the exchange rate and the associated demand diverting effect, which appears to more than offset any demand augmenting effect in the case of trading partners with flexible exchange rates.

The presence of monetary policy spillovers, however, should not be interpreted as evidence against the use of monetary policy. In fact, the use of monetary policy instruments can be desirable both from an individual economy as well as a global perspective, provided that other economies can use their own interest/exchange rate policy instruments to partially offset these spillovers. For example, simultaneous monetary easing in the US and trading partners would help mitigate demand-diverting effects, while preserving demand-augmenting effects in both economies.[18]

[18] This is in line with the results of Obstfeld and Rogoff (2002), who find that, in a multi-country model, coordinated and uncoordinated monetary policy deliver very similar global outcomes. When countries are at the zero lower bound (ZLB), however, coordination becomes more important. See also, Blanchard (2016) for related discussion on the use of foreign exchange intervention and capital controls as tools to offset the spillovers of monetary policy.

IV. ROBUSTNESS

We conduct a series of alternative estimations to test the robustness of the baseline results. These results are presented in Table 3 and include the following variations to the baseline specification:[19]

- Relaxing the sign restriction on the effect of monetary policy shocks on the nominal exchange rate (column 2). Relaxing this assumption has no material impact on the estimates, indicating, as expected, that the assumption is consistent with the empirical evidence.
- Using a measure of the shadow interest rate (see Krippner, 2013 and 2014), instead of the 10-year yield, in order to measure monetary conditions at the zero lower bound (column 3). In this case, while qualitatively results holds, the magnitude of the estimated effects varies somewhat relative to baseline. This is expected, as a 1pp shock to the 10-year rate is not necessarily comparable to a 1pp shock in the shadow rate (which is meant to capture a short-term rate).
- Adding risk appetite shocks to refine the identification of the real shocks[20] (column 4), reduces somewhat the point estimates, but less so the overall contributions.
- Removing the nominal exchange rate from the model (column 5) delivers very similar results to the baseline.
- Specifying the model in terms of real variables for trade (i.e., volumes) and the real effective exchange rate (column 6). This exercise provides further insights into the workings of monetary policy through volumes and prices. As shown, estimated impulse responses and contributions to the trade balance are somewhat small, indicating that monetary policy shocks in the US partly work through affecting terms of trade. This is consistent, for example, with the literature that finds a relationship between US dollar movements and commodity prices.
- Defining all variables in real terms—i.e., trade volumes, real effective exchange rate, real stock price index (CPI deflated), real 10-year yield (column 7). In this case, again, qualitative results hold but the magnitudes of the impulse responses and contributions to the trade balance are different to the baseline, reflecting the fact that real (in this exercise) and nominal shocks (in the baseline) are not directly comparable.

[19] An additional robustness exercise entails excluding the bilateral trade balance vis-a-vis countries that undertook UMP following the financial crisis—as the demand diverting and augmenting effects of the later may have offset those of the US. See appendix Figure A3.

[20] Risk-on shocks are assumed to increase stock prices and bond yields, and depreciate the U.S. dollar. Consistent with empirical evidence, this builds on the notion that increased risk-appetite induces investors to adjust their portfolios away from safe assets (bonds) and toward risky assets (stocks and foreign assets). See Osorio-Buitron and Vesperoni (2015) and IMF (2014) for a discussion.

Table 3. Robustness checks

	Baseline	Unrest. NEER	Shadow rate	Risk appetite shock	Exc. NEER	Trade volumes + REER	Real model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Response of Trade Balance to Monetary Shock (IRF) (in percent of GDP)							
On impact	-1.00	-1.01	-0.31	-0.57	-0.73	-0.71	-0.92
After 12 months	-0.68	-0.79	-0.26	-0.48	-0.62	-0.43	-0.51
12 month average	-0.74	-0.84	-0.28	-0.47	-0.64	-0.51	-0.61
Contribution to trade balance through money cycle (in percent of GDP)							
Tightening periods	-0.26	-0.41	-0.04	-0.28	-0.50	-0.18	-0.26
Easing periods (exc. GFC) 1/	0.35	0.42	0.23	0.40	0.35	0.26	0.78

Source: authors' estimations.
1/ Exlcudes 2008.

In all cases, the estimations are based on the full sample of countries (in terms of income groups and exchange rate regimes). As shown, with different degrees of statistical significance, the alternative specifications deliver very similar results to the baseline.

V. Discussion

A. Conventional versus unconventional

Another key unresolved issue in the policy debate is whether the effects of conventional and unconventional monetary policy are alike, or whether UMP had particularly strong or pervasive spillover effects on trading partners. We explore potential differences between these two instruments in a simple experiment relying on the interpretation that CMP operates primarily on the short-end of the yield curve, while UMP operates throughout the curve. Thus we differentiate the effects of these two instruments by disentangling movements of the short- and long-end of the yield curve arising from structural monetary shocks. Specifically, we estimate two models:

i. *Short-end*. We estimate a specification similar to the baseline but focusing on the 2-year yield (i.e., short-end of the curve), while controlling for the 10-year yield (long-end). We interpret the resulting structural shocks as CMP.

ii. *Long-end*. This specification—along the lines of the baseline model presented before—focuses on monetary shocks that move the long-end (10-year) of the yield curve. These may arise from movement in the long-end alone—for example in the case of quantitative easing—or from the transmission of movements in the short-end to the long-end (monetary shocks that are perceived as largely persistent).[21]

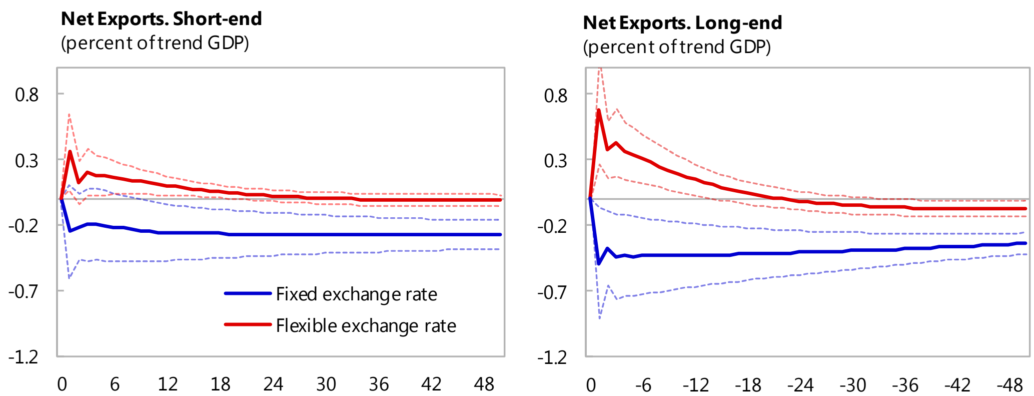
The estimation for both specifications is based on the period 1992-2007 for comparability, as well as to exclude the crisis period (when the monetary transmission channel may not have operated normally, as discussed in detail below). [22]

[21] See related work by Ehrmann and others (2011).

[22] While ideally the long-end model should constraint the short-term rate to be at the effective lower bound, insufficient post-crisis observations preclude this refinement. Moreover, as discussed above, estimations based

As before, the sample of countries is divided into those with de facto fixed exchange rates and those with de facto flexible rates in order to isolate the demand augmenting and full effects of monetary policy shocks. Figure 7 presents the corresponding impulse responses to monetary shocks at the short- and long-end of the yield curve. As shown, results are qualitatively identical for both types of shocks—with demand augmenting effects operating for de facto pegs, and demand diversion dominating in the case of flexible regimes. Effects for the two country groups differ only in their magnitudes, with larger effects from shocks to long-term rates. This is expected, as given movements in the long-end of the curve imply greater monetary shocks than movements of equal magnitude in the short-end.[23]

Figure 7. Trade balance response by policy tool and exchange rate regime



Source: Authors' estimations.
1/ Short- and Long-end curves depict the trade balance responses to a 1pp negative shock to the 2-year yield and 10-year yield, respectively. Estimations are based on pre-crisis period only. One standard deviation confidence bands are reported.

B. Strength of monetary transmission mechanism

Some have argued that the post-crisis period was characterized by a weak monetary transmission mechanism due to greatly impaired financial institutions, and that this feature implied different, and larger, spillovers of monetary policy to other economies as demand-augmenting effects were more muted than normally.[24] We attempt to shed some light on this issue by estimating our baseline specification separately for the pre-crisis and full sample periods. A comparison of the corresponding impulse-responses provides some suggestive evidence on the extent to which the spillover effects in the pre-crisis and post-crisis periods differ.[25] As plotted in Figure 8 (left panel), this exercise shows a somewhat larger effect of monetary shocks on the trade balance when the post-crisis period is included. Moreover, the trade spillovers vis-a-vis countries with de facto fixed exchange rate

only on the post-crisis environment may be polluted by a different working of the monetary transmission mechanism. For these reasons, the analysis in this section focuses on the pre-crisis period.

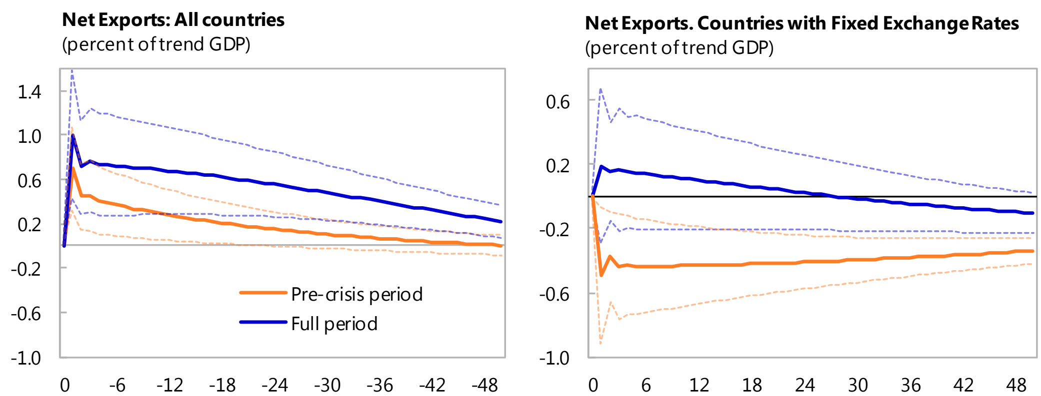
[23] A 1 percent change in the (short-term) monetary policy rate normally leads to a significantly smaller movement in the long-term rate.

[24] See, for example, Bouis and others (2013), Gambacorta and others (2014) Jannsen and others (2016).

[25] Estimating the model only for the post-crisis period (2009-16) delivers imprecise estimates, reflecting the limited number of observations.

regimes—for which demand augmenting is the primary effect—are starkly different for the two sample periods, with strong spillovers in the pre-crisis period, but muted effects (statistically zero) for the full sample (Figure 8, right panel). In line with the discussion above, these results could be an indication that indeed the transmission of monetary policy functioned differently on the pre- and post-crisis periods.

Figure 8. Pre-crisis and full sample period



Source: Authors' estimations.
1/ IRFs correspond to a 1pp negative shock to the 10-year yield, estimated for the pre-crisis and full sample periods. Left panel plots the IRFs for the overal trade balance, while the right panel plost the IRFs for the trade balance balance vis-a-vis economies with de facto fixed exchange rate regimes.

VI. Conclusions

The paper explores the spillover effects and trade balance impact of monetary policy. We find that monetary policy significantly affects the trade balance—thus entailing trade spillovers to the rest of the world. In the specific case of the US, positive (negative) monetary shocks lead to a weakening (strengthening) the overall trade balance. These average effects mostly reflect the impact on trade vis-a-vis trading partners with de facto flexible exchange rate regimes, indicating that demand diverting tends to dominate demand augmenting effects.

A first, simple, exploration of possible differences between conventional and unconventional monetary policy point to similar working of both instruments, with demand augmenting effects for pegs, and dominant demand diversion effect for flexible regimes. At the same time, the paper finds suggestive evidence that spillovers effects may have been larger in the post-crisis period, reflecting dampened demand-augmenting effects. While only suggestive, this evidence is consistent with the notion of a weak monetary transmission mechanism on account of an impaired financial system in the aftermath of the financial crisis.

Finally, while our results speak about the workings of monetary policy through trade for the US, they should not be interpreted as universal. The relative of importance of demand augmenting and diverting effects may vary across economies, as these effects are likely to depend on a number of country-specific factors, like the type of goods traded (determining trade elasticities), the degree of trade openness, the strength of the monetary transmission mechanism, the degree of exchange rate pass-through, etc. Moreover, the presence of monetary policy spillovers should not be interpreted as evidence against the use of this policy instrument. Instead, the use of monetary policy can lead to desirable outcomes both, at the individual economy and global levels, to the extent that spillover-recipient economies can use their own interest/exchange rate policy instruments, to partially offset these spillovers and help stimulate global demand.

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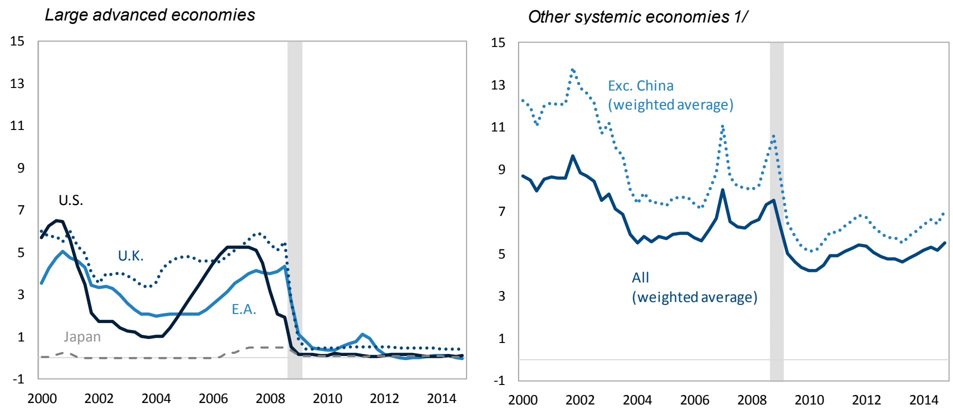
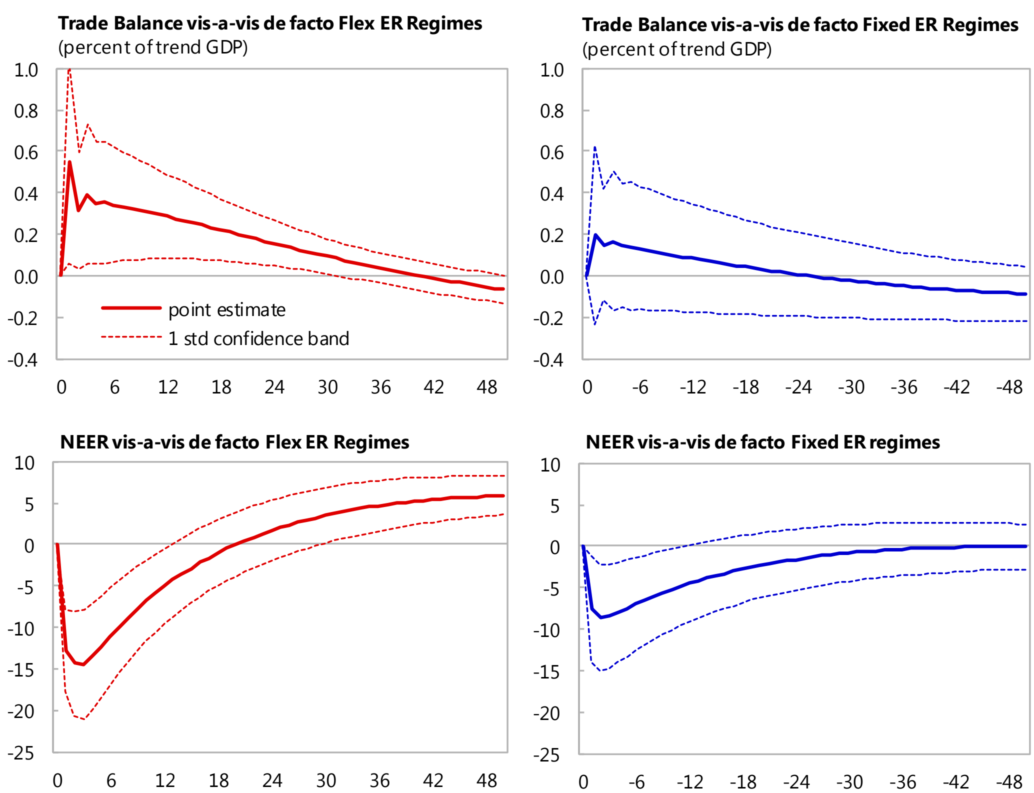
Appendix

Figure A1. Monetary Policy Rates in Systemic Economies, 2000-15



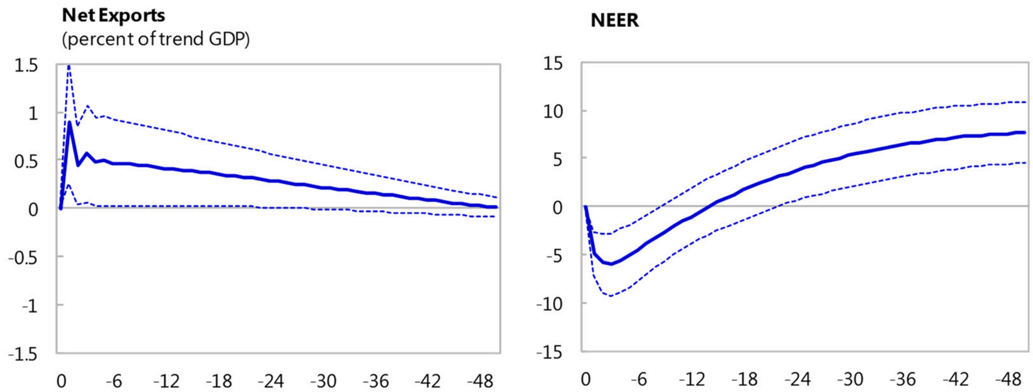
Sources: IMF International Financial Statistics; and authors' calculations.
1/ Includes Argentina, Brazil, Chile, Colombia, China, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, New Zealand, Norway, Peru, Philippines, Russia, Sweden, South Africa, Thailand, Turkey.

Figure A2. Alternative Classification of Exchange Rate Regimes
(response to a 1pp negative monetary shock)



Source: authors' estimations.
1/ De facto exchange rate regime classification based on IMF's AREAER. Country sample includes EMDEs only.

Figure A3. Estimated Response to (1pp) UMP Monetary Shock, excluding major countries implementing UMP



Source: authors' estimates.
1/ Confidence bands correspond to one standard deviation.