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Policy Mix and the US Trade Balance

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Abstract

The strong US policy response to the 2008-09 financial crisis raised concerns about its impact (spillovers) on other countries, with great focus on the monetary stimulus but little attention to fiscal policy, despite their combined deployment. Using a sign-restricted structural VAR approach, we study the trade spillovers of the post-crisis policy mix, by assessing the *joint* impact of monetary and fiscal policy. We find that aggregate trade effects, as reflected in the trade balance, varied across time, reflecting the different timing of fiscal and monetary stimuli, with overall positive spillovers in the immediate aftermath of the crisis. At the same time, reflecting the different transmission mechanisms of monetary policy, we find that the effects differed greatly between trading partners with *fixed* and *flexible* exchange rates. In general, our results highlight (i) the importance of studying fiscal and monetary policy spillovers *jointly* in order to avoid attenuation bias from omitted variables; and (ii) that trading partners' exchange rate regimes are of first order importance in determining the impact of policy spillovers.

JEL Classification Numbers: E52

Keywords: monetary policy, fiscal policy, trade balance, spillovers

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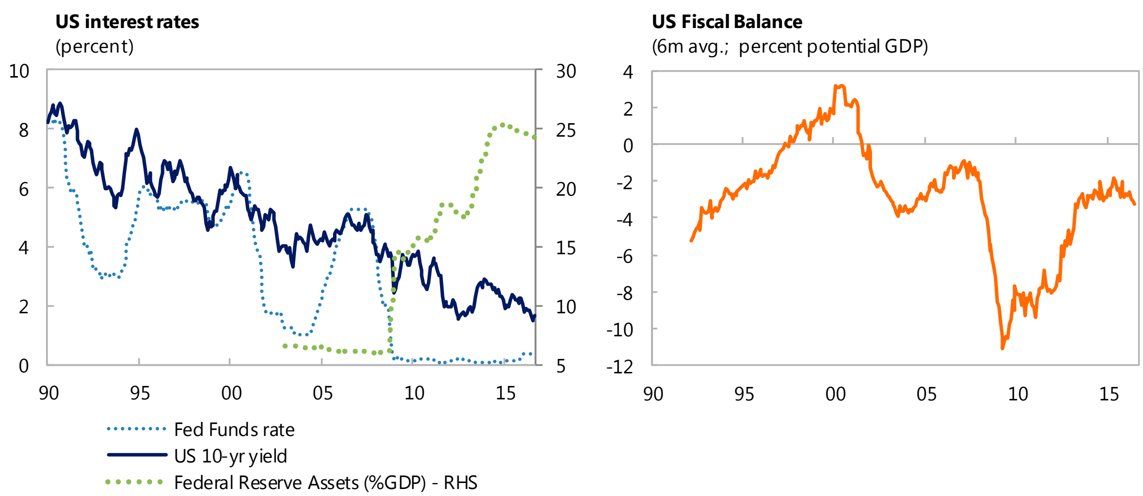
I. INTRODUCTION

Confronted with an impending economic depression, following the 2008-09 financial crisis, policymakers in many advanced economies deployed extraordinary policy measures to stimulate their economies. The US—in the eye of the storm—led the effort with the deployment of sizeable fiscal and monetary policy stimuli. Monetary policy rates were sharply lowered, rapidly reaching the zero lower bound (ZLB), followed by the implementation of quantitative easing (QE) in its different phases (Figure 1, left panel).[1] Extraordinary monetary easing was complemented with the deployment of expansionary fiscal policy, beyond automatic stabilizers, as apparent in the near 8-percentage points of GDP weakening of the fiscal balance between 2007 and 2009 (Figure 1, right panel).

Figure 1. U.S. Interest Rates and Fiscal Balance, 1990-2016



Sources: Haver Analytics; IMF *International Financial Statistics*; and authors calculations.

The implementation of these aggressive policy measures quickly raised questions about its implication for the US external position and its trading partners (i.e., spillovers). Policymakers of emerging market economies, in particular, voiced concerns about the expected effect of aggressive monetary loosening—and the resulting depreciation of the US dollar—on their economies, starting from the premise that such policies entailed large demand-diverting effects in detriment of trading partners.[2] The controversy surrounding the effects of aggressive monetary easing reached its climax with the implementation of quantitative easing (QE), as this was seen to be particularly damaging to trading partners, and led to the perception that there was an ongoing 'currency war'—an expression coined by Brazil's Finance Minister Guido Mantega in a speech delivered in September, 2010.[3] Concerns grew over time, as many believed the US (and other advanced economies) had over-relied on loose monetary policy—partly because of fiscal constraints imposed by high public debt levels—

[1] QE1 (Nov2008-Mar2009): purchases of $600 billion of agency and mortgage-backed securities (MBS); QE1 extended (Mar2009-Mar-2010): purchases of $750 billion of MBS; QE2 (Nov2010-Jun2011): purchases of $600 billion of long-term treasury bonds; Operation twist (Sep2011-Jun2012): purchases of $400 billion of treasury bonds of long maturities (72-360 months) and equivalent sale of short-term maturities (3-36 months); QE3 (Sep 2012-Oct2014): Purchases of $40 billion per month.

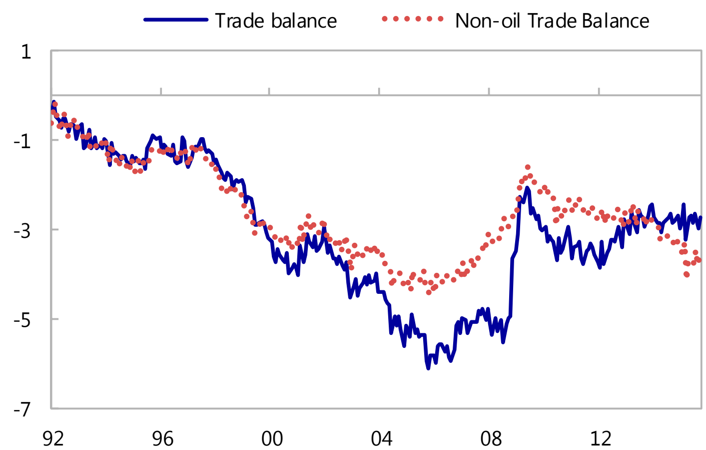
[2] See related analysis in Adler and Osorio-Buitron (2017).

[3] See also IMF (2016) for a discussion on the persistence of high global imbalances.

and had propped up its economy at the expense of its trading partners. The marked improvement in the US trade balance in the initial aftermath of the crisis lent support to such view (Figure 2).

A flurry of academic and policy work followed, focusing almost exclusively on the role of (unconventional) monetary policy and its effects on trading partners. Surprisingly, however, the effects of fiscal policy received very limited attention, even though, these two policy instruments were deployed jointly to mitigate the impact of the financial crisis. As a result, the literature not only provided a partial view of the role of policies during the crisis, but, more importantly, it may have led to inaccurate conclusions about the effects of monetary policy by incurring in omitted-variable bias arising from a focus on individual policies rather than the policy mix.

Figure 2. U.S. Trade Balance, 1992-2016
(percent of trend GDP)



Source: World Economic Outlook.

We revisit this discussion, addressing these key shortcomings by jointly studying the impact of both US fiscal and monetary policy shocks on its trade balance.[4] The methodological approach follows the work by Ehrmann and others (2011), Matheson and Stavrev (2014) and Mountford and Uhlig (2009), who identify policy shocks within a sign-restricted structural VAR model, by exploiting the distinct effect that structural monetary and fiscal policy shocks on key asset prices (bond, stocks and the exchange rate). This methodology provides an alternative to the so-called narrative approach—explored, for example, by Kuttner (2001) and Romer and Romer (2004) for the case of monetary policy shocks; and Romer and Romer (2010), Devries and others (2011), Alesina and others (2016) for the case of fiscal shocks.[5]

[4] Throughout the paper, the trade balance is used as a (summary) indicator of spillovers to other economies. This variable captures the net effect of demand-diverting and demand-creating effects of policy actions. The focus on trade balance departs from the one taken in recent IMF work on policy spillovers (e.g., IMF 2016 and 2016), which paid particular attention to the impact of policy shocks on trading partners' output. The analysis presented in section V, however, indicates that most of our results also hold when focusing on trading partners' output.

[5] Other identification strategies include, for example: focusing on defense spending (Auerbach and Gorodnichenko, 2014); and structural VARs with timing restrictions (Beetsma and others, 2005; Blanchard and Perotti, 2002; Blanchard and others, 2015).

Our results indicate that extraordinary monetary and fiscal policy measures following the 2008-09 financial crisis —i.e., those beyond the normal response to the business cycle—had a sizable impact on the trade balance. Consistent with the perception of policymakers in emerging markets, our results suggest that unprecedented monetary policy stimulus contributed to the strengthening of the US trade balance, arguably in detriment of trading partners. Yet, contrary to this view, we find that the overall policy mix led to a weakening of the US external position in the immediate aftermath of the crisis, helping to stimulate demand in trading partner countries. This result reflects the effect of a sizable fiscal stimulus that more than offset the impact of extraordinarily loose monetary policy. As the policy mix shifted with the gradual withdrawal of fiscal support, so did the effect on the trade balance.

These results suggest that analysis of spillovers following the financial crisis may have been unduly focused on monetary policy, leading to a partial view on the effect of US policies on its trading partners. More broadly, our results show that the effects of policy shocks (both monetary and fiscal) on the trade balance are significantly larger when estimated jointly. This highlights the importance of assessing spillovers from the overall policy mix, rather than focusing on individual policies to avoid attenuation bias from omitting other policy variables.

Beyond these overall results, we find that trade spillovers differed markedly across different groups of countries, depending on their exchange rate regimes and associated monetary policies. Facing muted demand-diverting effects, trading partners with de facto rigid regimes (vis-à-vis the US dollar) benefited significantly from the overall policy stimulus in the aftermath of the financial crisis, with both fiscal and monetary policy stimuli working in their favor. The opposite seems to be true for economies with flexible exchange rates, indicating strong demand-diverting effects.

Finally, the paper provides some insights on the potential effect of changes in the policy mix in the US, currently under discussion. With the economy approaching full employment, prospects of a fiscal loosening coupled with monetary tightening are likely to lead to a significant deterioration of the US external position, and—other things equal—overall positive trade spillovers to the rest of the world.

Our paper relates to two separate strands of literature:

One is the growing work on the effects of US unconventional monetary policy on other countries (Neely, 2010; Fratzscher and others, 2013; Moore and others, 2013; Chen and others, 2012, 2014a, 2014b; Bauer and Neely, 2014; Rogers and others, 2014; Bowman and others, 2015; Georgiadis, 2015).[6] These studies focused primarily on the direct effect of these policy shocks on other economies, rather than on the trade balance. Exceptions are Bernanke (2015 and 2016) and Ammer and others (2016) who argued that US monetary policy in the post-global financial crisis period had muted effects on the trade balance and other countries, as demand augmenting and demand diverting effects offset each other. Our results, as well as those in Adler and Osorio Buitron (2017) suggest otherwise.

A second related branch is the literature on the impact on fiscal shocks on the current account (e.g., Kim and Roubini, 2008; IMF, 2010 and 2011; Bluedorn and Leigh, 2011; Auerbach and Gorodnichenko, 2014). This strand of work has mostly concluded—in line with our findings—that

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

fiscal expansions lead to a current account weakening ('twin deficit' hypothesis), although with contradictory results in some earlier work.[7] Yet, like the literature on monetary policy, this strand of work has focused solely on fiscal policy, thus overlooking the interaction of the two.

The rest of the paper is organized as follows: Section II describes the methodological approach and the data. Section III presents the baseline results on the estimated impact monetary and fiscal policy shocks on the trade balance. Section IV explores several robustness checks. Section V presents some extensions exploring the difference between estimating policy spillovers jointly and individually, the effects through prices and quantities, and the role of trading partners' exchange rate regimes. Section VI concludes with the key takeaways and a discussion on avenues for further research.

II. Empirical Approach

Our interest lies on the impact of U.S. monetary and fiscal policies on its trade balance, reflecting the net results of the demand-diverting and demand-creating effects of these policy actions.[8] This is examined by estimating a structural vector auto-regressive (SVAR) model, in which policy shocks are identified through sign restrictions, following the work by Ehrmann and others (2011), Matheson and Stavrev (2014) and Mountford and Uhlig (2009). The estimation is based on monthly data covering the period 1992m1-2016m9 (for which data are available). The vector of endogenous variables (Y_t) is given by:

$$Y_t^{'} = \left[R_t \quad F_t \quad S_t \quad E_t \quad TB_t \right] \tag{1}$$

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 yields is presented as a robustness check. The focus on long-term yields allows us to catpure any form of monetary policy that affects the yield curve (conventional, QE, forward guidance). Even though the long term nominal yield can be poluted by inflation expectations, as discussed further below, the presence of inflation expectations is innocous given our identification strategy for monetary policy shocks.[9] F_t is the fiscal policy instrument, corresponding to the seasonally-adjusted federal government budget balance, as reported by the U.S. Treasury, and expressed in percent of trend GDP.[10] S_t is the S&P 500

[7] For example, Kim and Roubini (2008) find that fiscal expansions strengthen the current account and depreciate the exchange rate. Meanwhile, Bluedorn and Leigh (2011) find evidence of strong effects, consistent with a 'twin deficits' hypothesis. Consistent with the later, Auerbach and Gorodnichenko (2014) argue that (military) fiscal expansions lead an appreciation of the exchange rate.

[8] The effect of monetary policy through financial channels (i.e., easing of financing conditions for other countries)—often considered a separate effect in the literature—is captured in our setup (as part of the demand-creating effect).

[9] The identification strategy for monetary policy shocks relies on shocks having a positive impact on long-term yields but a negative impact on stock prices. Inflation expectation shocks would not be captured by this, as they would have the opposite effect on nominal stock prices.

[10] Monthly figures of federal government finances obtained from the U.S. Treasury are not seasonally adjusted. To obtain seasonally adjusted budget balance data, we adjust receipts and outlays separately, using the TRAMO/SEATS algorithm, and compute the corresponding balance on the seasonally-adjusted subcomponents.

composite index of stock prices, expressed in logarithm, which serves as a proxy for cyclical conditions. E_t is the nominal effective exchange rate (NEER), that comes from IMF *International Financial Statistics* and is expressed in logarithms, and TB_t is the seasonally-adjusted trade balace (or net exports) as reported by the Census Bureau, and expressed in percent of trend GDP. The monthly GDP series is from Macroeconomic Advisors and its trend is obtained by applying a standard HP filter.

Since the variables are co-integrated, estimating the VAR in levels incorporates any co-integrating relationship without the need to specify a VECM[11]. Furthermore, examination of the impulse response functions reveals that the responses go back to steady-state values.

The reduced-form model is given by: [12]

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

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

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

The empirical strategy for identifying fiscal and monetary shocks through contemporaneous sign restrictions follows the procedure developed by Rubio-Ramirez and others (2005).

The identification of policy shocks entails disentangling endogenous responses of interest rates and the fiscal balance to cyclical conditions, from other changes in these variables. The key identification assumption, relying on sign restrictions, are summarized in Table 2. In particular, it is assumed that a positive cyclical shock increases stock prices, bond yields and the fiscal balance. The intuition is that a positive demand shock increases inflationary pressures, and monetary policy is expected to tighten to prevent inflation from overshooting its target. At the same time, a positive business cycle shock increases the fiscal balance, as higher output raises revenues by boosting tax collection and reducing cyclical spending (e.g., unemployment benefits). This assumption is similar to the identification scheme developed by Mountford and Uhlig (2009). Consistent with empirical evidence, improvements in cyclical conditions are also assumed to lead to an appreciation of the US dollar.

A monetary shock is assumed to increase bond yields and reduce stock prices, as exogenous increases in interest rates (or inflation expectations) have a contractionay effect on demand and, by arbitrage, between stock and bond prices. Consistent with the interest rate parity, a positive monetary policy shock is also assumed to lead to an appreciation of the domestic currency.[13]

The adjustment is done on the components, rather than the balance, as their degree of seasonality is quite different, with receipts displaying significantly more seasonality.

[11] Excepting the fiscal balance, variables have a unit root. See Appendix 3 for unit root and cointegration tests.

[12] Alternative lag structures are explored in the robustness checks.

[13] This assumption is relaxed in the robustness section.

Table 2: Identifying assumptions

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

Discretionary tightening of fiscal policy, meanwhile, is assumed to lead to lower stock prices, reflecting reduced demand. Because our identification entails focusing in actual changes in the fiscal balance that lead to movements in asset prices, the identified fiscal policy shocks should be interpreted as implementation surprises.[14]

Following Mountford and Uhlig (2009), shocks are required to be orthogonal, so we focus only on rrandomly drawn orthonormal matrices Q (in equation 3 above). Specifically, random draws of Q are generated until 1,000 parameterizations satisfying the sign restrictions are obtained. This procedure can only bound the impulse response functions, as the econometric model is only set-identified. In other words, there is a group of models that satisfy the sign restrictions, each solving the structural identification problem. We follow Fry and Pagan (2010) for selecting the model with impulse responses which are closest to the median of the responses generated by the parametrizations that satisfy the sign restrictions. The standard deviation across these responses are used to compute confidence bands.

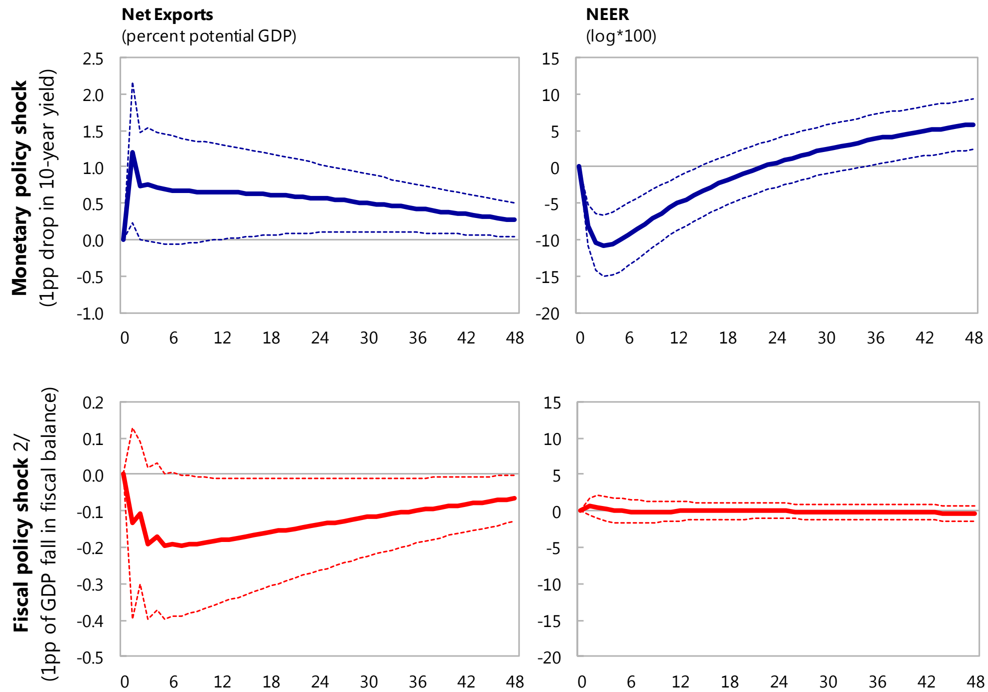
This approach avoids imposing restrictions on the relationship between variables that do not have clear theoretical support—e.g. the effect of fiscal tightening on bond yields and the exchange rate—and lets the "data speak", instead. We explore some of these alternative identifying restrictions as robustness checks, nonetheless, and they deliver very similar results.

III. Baseline results

Figure 3 presents the estimated responses of our main variables of interest (the trade balance and the nominal exchange rate) for the cases of both a monetary and a fiscal impulse.

[14] This is different from the narrative approach undertaken in other studies—which focus on (ex-ante) news.

Figure 3. Baseline Model. Key Impulse Response Functions 1/



Source: authors' estimations.
1/ Impulse responses to a structural shock. Months are reported in the horizontal axis. Confidence bands correspond to one standard deviation.
2/ 6-month moving average is reported.

Consistent with previous findings (see Adler and Osorio Buitron, 2017), a negative monetary policy shock (interest rate drop) entails a depreciation of the nominal exchange rate along with a strengthening of the trade balance. Specifically, a monetary loosening equivalent to a 1 percentage point fall in the 10-year yield leads to a nearly 10 percent depreciation and a 1 percent of GDP strengthening of the trade balance within 4-6 months, with a gradual fading especially of the latter effect.[15] These estimates suggest that, in the short-run, the demand diverting effect (resulting from the depreciation of the US dollar) dominates any short-run demand-augmenting effect (resulting from the effect of a lower interest rate on domestic demand).

Fiscal shocks, meanwhile, do not appear to have meaningful effects on the nominal exchange rate.[16] However, and consistent with previous findings in the 'twin deficits' literature, they entail sizable effects on the trade balance.[17] Specifically, a 1 percent point of GDP drop in the fiscal balance leads to a nearly 0.2 percent of GDP weakening of the trade balance within a year, with the effect dissipating only gradually.

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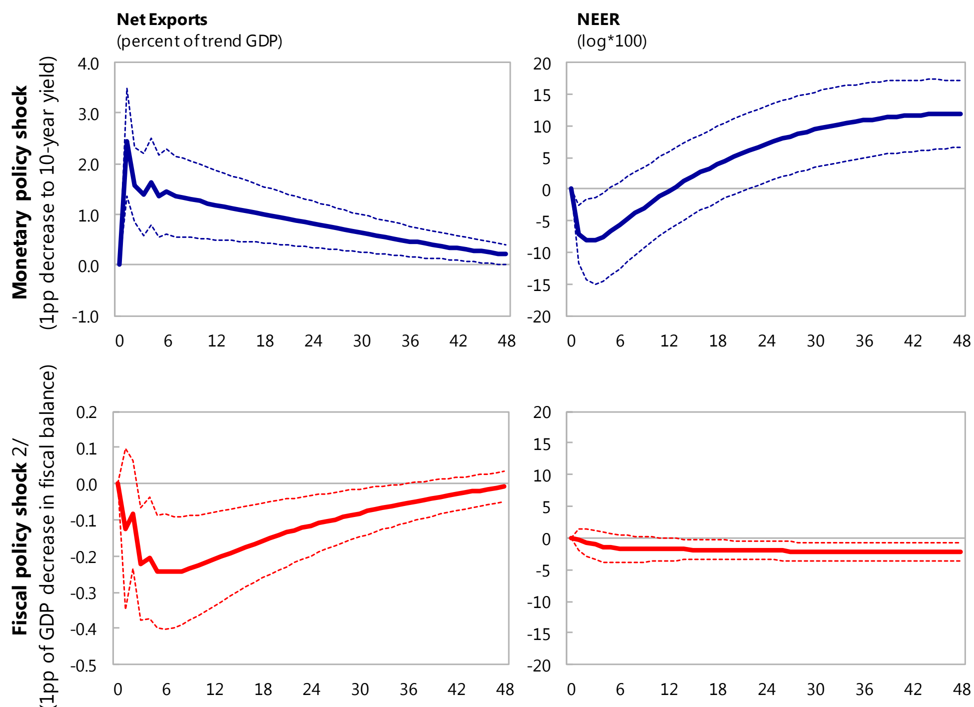
[15] The choice of a 1pp shock to the 10-year yield is convenient for illustrative purposes, although is rather large—equivalent to 4 standard deviations of the monthly changes.

[16] The real exchange rate may still react in response to a fiscal shock, reflecting the impact on domestic prices. Yet, the positive effect on the trade balance indicates that any demand diverting effect resulting from a real appreciation is more than offset by the demand-reducing effect of the fiscal tightening on aggregate demand.

[17] See, for example, Erceg and others (2005) and Abbas and others (2011).

The results presented in Figure 3 have the desirable feature of reflecting the effect of policy shocks on the *overall* trade balance (i.e., vis-a-vis all trading partners). However, they may underestimate the true effect due to uncontrolled for policies in the other economies. Controlling for policy responses in all trading partners is not feasible, given data limitations on interest rates and fiscal accounts for a large set of countries (and the period of analysis). This is a source of concern especially with regards to advanced economy trading partners, as their policies display a high degree of synchronicity with those of the US, notably in the case of monetary policy.[18] A way to partially address this issue is to focus on emerging and developing market economies. Indeed, an alternative specification using the trade balance vis-a-vis the latter group only reveals larger, and statistically more significant effects, as shown in Figure 4.

Figure 4. EMDEs. Key Impulse Response Functions 1/



Source: authors' estimations.
1/ Impulse responses to a structural shock. Months are reported in the horizontal axis. Confidence bands correspond to one standard deviation.
2/ 6-month moving average is reported.

Figure 5 plots the decomposition of the variations of the policy variables into their endogenous (response to the cycle) and exogenous components for the baseline specification.[19] As evident from the left panel, the sharp deterioration of the fiscal balance (of nearly 8 percentage point of GDP) from 2007 to 2012 appears to have been, to a large extent, an endogenous response to the cycle. The estimates, however, also point to an economically meaningful exogenous component, indicating that the fiscal policy response went beyond its normal response to the cycle, especially in the immediate

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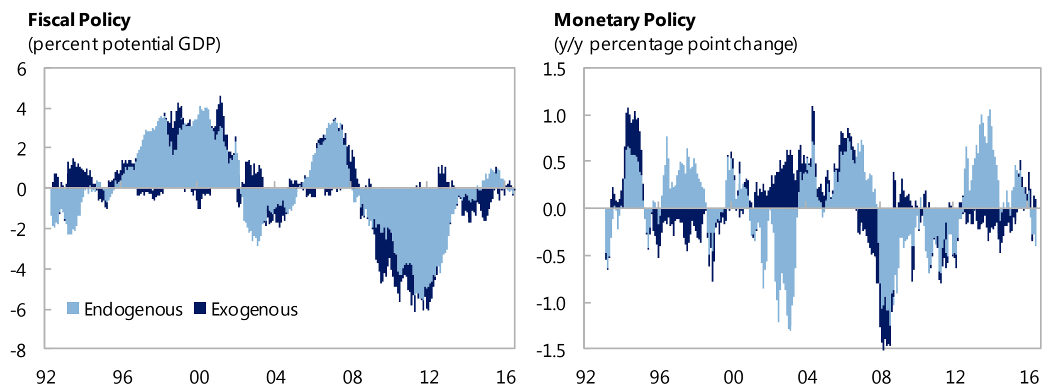
[18] See Adler and Osorio Buitron (2017).

[19] The model for EMDEs only delivers similar policy shocks.

aftermath of the crisis. Similarly, the right panel plots the changes in the 10-year yield, decomposing it into its endogenous and exogenous variations. Like in the case of fiscal policy, much of sizable monetary loosening following the financial crisis was consistent with a normal response to the accompanying cyclical conditions, although there was also a significant extent of extraordinary monetary loosening, both in the months preceding the financial crisis and in the immediate aftermath (right panel).

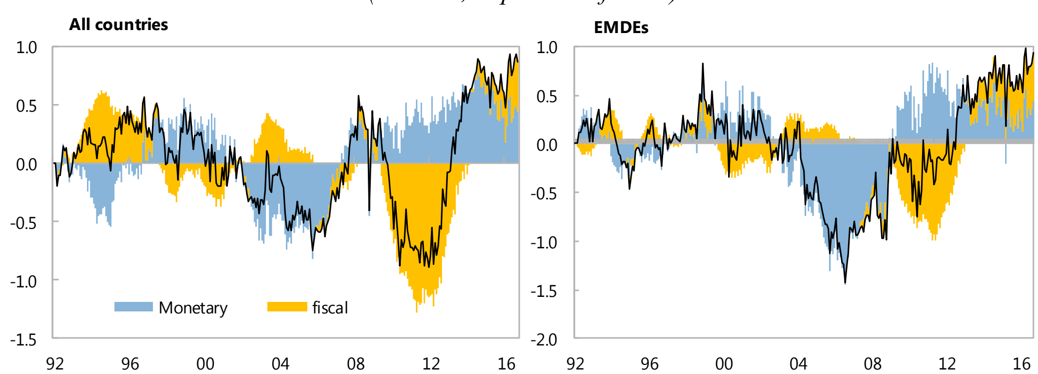
Figure 5. Policy variables. Endogenous and Exogenous Variations, 1992-2016



Source: Authors' estimates.

Figure 6 plots the estimated impact of the structural policy shocks on the trade balance, both for the baseline specification (i.e., all countries) and for the subset of EMDE trading partners. As evident, both monetary and fiscal policy shocks individually entailed large effects on the trade balance in the aftermath of the 2008-09 financial crisis—and in both cases with significantly larger and more sustained effects than in any previous period.

Figure 6. Contribution of Policy Shocks to Trade Balance, 1992-2016
(1992=0, in percent of GDP)



Source: Authors' estimations.
1/ Estimated contributions from monetary and fiscal policy shocks to the trade balance (in percent of potential GDP).

The marked monetary loosing that followed the crisis is shown to have contributed to a strengthening of the trade balance with lasting effects. Meanwhile, the sizable fiscal policy stimulus had a larger offsetting effect, contributing to a weakening of the trade balance in the immediate aftermath of the crisis. As the fiscal stimulus was gradually withdrawn, its effect on the trade balance dissipated and eventually reverted, adding to the positive impact from monetary policy.

Taken together, the overall impact of the policy stimulus appears to have entailed a markedly different effect in the immediate aftermath of the crisis in comparison to the effects in subsequent years (Table 3). Specifically, the policy mix entailed a significant weakening of the US trade balance—of nearly -0.5 percent of GDP—during the period 2009-12—as the effect of the fiscal stimulus (-0.8 percent of GDP) more than offset the impact of the monetary easing (0.3 percent of GDP).

Table 3: Post-GFC Policy Shock Contributions to the Trade Balance

	Monetary Policy				Fiscal Policy				Overall Policy Mix (%GDP) (1+2)
	Policy shock (percentage points)		Contribution to Trade Balance (%GDP)		Policy shock (%GDP)		Contribution to Trade Balance (%GDP)		
	Peak	Avg.	Peak	Avg (1)	Peak	Avg.	Peak	Avg (2)	
Post-Global Financial Crisis (GFC)									
2009-15	-2.21	-0.08	0.78	0.44	3.96	-0.12	-1.27	-0.38	0.06
2009-12	1.82	-0.07	0.57	0.34	-3.26	-0.42	-1.27	-0.79	-0.45
2013-16	1.91	-0.09	0.78	0.44	3.96	0.20	-0.59	0.06	0.50

Source: Authors' estimations.

With the gradual withdrawal of fiscal support—leading to a muted individual effect on the trade balance—the strengthening effect of monetary policy (0.4 percent of GDP) dominated, in the period 2013-16. For the whole post-crisis period, the effect of the policy mix on the trade balance is estimated to have been broadly neutral.

Overall, these results highlight the importance of assessing external implications of policies in a joint fashion, rather than analyzing their effects individually, as much of the literature has done.

IV. Robustness

We conduct a series of robustness checks on the main results presented above. Table 4 summarizes some of these, including:

- Taking a more agnostic view by relaxing the assumption that positive monetary policy shocks (rise in interest rate) lead to an appreciation of the nominal exchange rate (Table 4, column 2).
- Introducing a measure of risk appetite (VIX) in the model, in order to control for the effect that changes in risk aversion may have on bond and equity prices (Table 4, column 3). Specifically, it is assumed that a risk-off shock reduces stock prices and bond yields, as reduced risk-appetite induces market participants to shift their portfolios away from risky assets (stock prices) and towards safe assets (treasury bonds[20]). By the same token, the U.S. dollar is assumed to appreciate, reflecting investors shift towards U.S. investments, which are regarded as safer than non-US ones, notably emerging market securities.

[20] Treasury bonds would see their prices increase and yields decrease.

- Introducing an additional identifying assumption, linking a positive fiscal shock to an appreciation of the real exchange rate (rate). This alternative model specification entails focusing on the REER rather than the NEER, both for identifying the fiscal and monetary policy shocks.[21]
- Finally, we also test an alternative specification that introduces another identifying assumption, linking fiscal policy shocks to a the 10-year rate. The premise is that a fiscal tightening reduces the 10-year rate by improving debt sustainability.

In all cases, with varying degrees of statistical significance, the conclusions of the baseline model are confirmed.[22]

Table 4: Robustness check

	Baseline	NEER unrest.	Risk appetite shocks	REER rest. 3/	10 yr-yield rest. 3/
	(1)	(2)	(3)	(4)	(5)
Trade Balance Response to Policy Shocks					
Monetary shocks 1/					
On Impact	-0.11	-0.11	-0.06	-0.11	-0.11
After 12 months	-0.06	-0.06	-0.03	-0.06	-0.06
Fiscal shocks 2/					
On Impact	0.13	0.13	0.02	0.15	0.13
After 12 months	0.18	0.18	0.06	0.22	0.18
Policy Shocks Contribution to Post-GFC Trade Balance					
Monetary policy					
Full post-GFC period (2009-15)	0.44	0.44	0.49	0.39	0.44
2009-12	0.34	0.34	0.45	0.37	0.34
2013-16	0.54	0.54	0.49	0.37	0.54
Fiscal policy					
Full post-GFC period	-0.46	-0.46	-0.23	-0.42	-0.46
2009-12	-0.79	-0.79	-0.32	-0.82	-0.79
2013-16	0.06	0.06	-0.08	0.21	0.06
Net (policy mix)					
Full post-GFC period	-0.02	-0.02	0.26	-0.03	-0.02
2009-12	-0.45	-0.45	0.14	-0.45	-0.45
2013-16	0.60	0.60	0.42	0.58	0.60

Source: authors' estimations.
1/ One percentage point increase in 10-year yield.
2/ One percentage point of GDP increase in fiscal balance.
3/ Additonal restrictions imposed to identify the fiscal shock.

V. Extensions

A. Policy mix versus single policies

A key aspect worth illustrating is the importance of identifying monetary and policy shocks jointly—as opposed to most of the literature, which focuses on one type of shock at a time. To this end, we compare the impact, from a jointly estimated model, of both policies, with the effect from a model

[21] The change of focus from nominal to real exchange rate comes at a cost. While theory indicates that a positive fiscal (spending) shock may lead to a real appreciation, the impact of a monetary shock is less clear on the latter than on the nominal exchange rate.

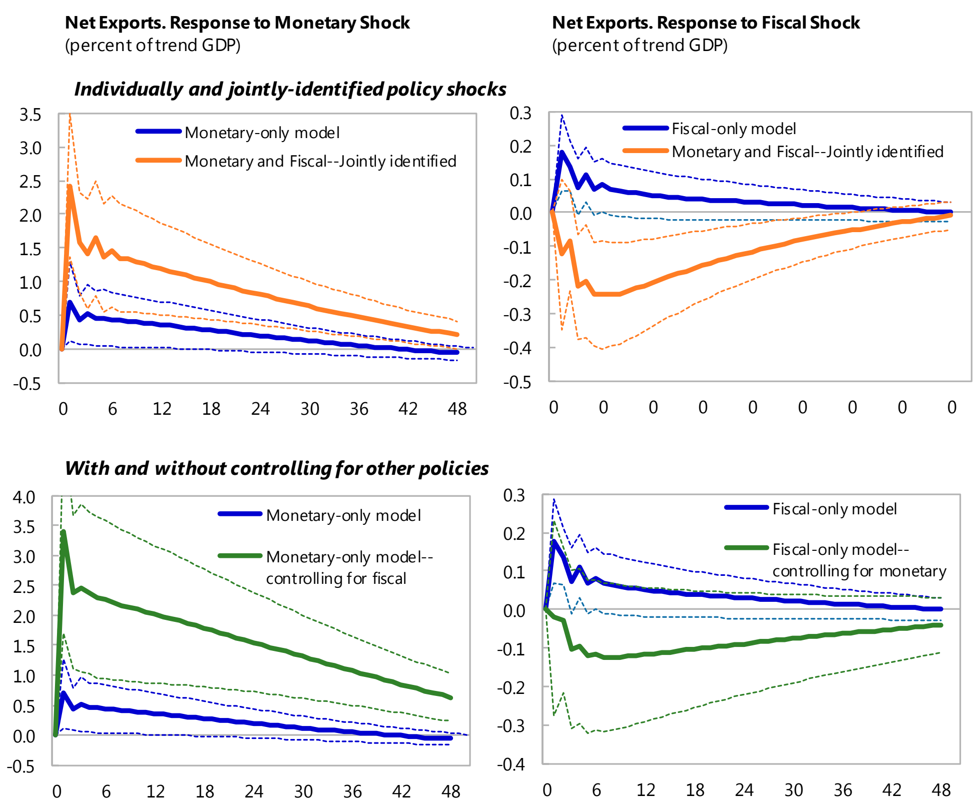
[22] Model results also hold for a 3-lag structure.

estimated with only one type of policy.[23] As shown in the first row of Figure 7, the joint estimation allows to fully unveil the effects of monetary and fiscal policies, which are much larger (with the expected signs) than when estimated individually. In the case of fiscal shocks, the impulse response changes sign when estimating the model jointly with monetary policy, indicating that the effect of monetary policy shocks tends to dominate those of fiscal policy.

Taking a more agnostic view of the identification of the policy shocks, the second row displays a similar comparison between the model with only one policy variable, and the same model but controlling for the other policy variables. As shown, controlling for the other policy tool—even when not fully identifying the structural shock of the latter—is key for fleshing out the full effect of the individual policy shocks.

Overall, these results indicate that, akin to a problem of 'omitted variable bias', monetary and fiscal policy shocks tend to be correlated, and lack of control for one or the other is likely to lead to attenuation bias in the individually estimated effects.

Figure 7. Response of Trade Balance to Policy Shocks—Alternative Specifications 1/



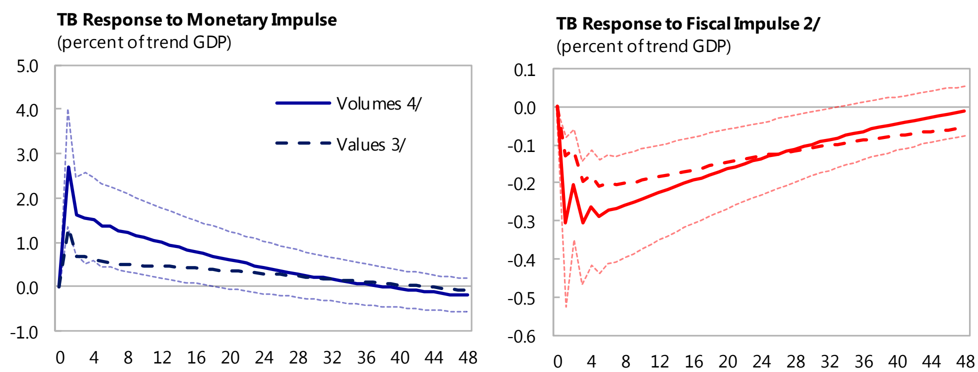
Source: authors' estimations.
1/ Response of trade balance (vis-a-vis EMDEs) to a structural policy shock. Months are reported in the horizontal axis. Confidence bands correspond to one standard deviation.

[23] We focus on the trade balance vis-a-vis EMDEs to minimize problems with lack of control for trading partner policies (as discussed above).

B. Price versus quantity effects

Another aspect relates to the effect of policy shocks on prices versus quantities. To shed some light on this issue, we compare the results from the baseline specification—which is based on trade values, and therefore captures both price and quantity effects—with the results of an alternative model focused on trade volumes.[24] The impact of policies on the trade balance is found to operate primarily through quantities, with some offsetting effects via prices (Figure 8).[25] This price effect appears to be especially important in the case of a (positive) monetary policy shock, indicating that the former arises primarily from the accompanying appreciation of the nominal exchange rate (see further details in Appendix II).

Figure 8. Quantities versus prices 1/



Source: authors' estimations.
1/ Impulse responses to a structural shock. Months are reported in the horizontal axis. Confidence bands correspond to standard deviation. Only trade in goods is reported, due to data limitaion on services volumes..
2/ 6-month moving average.
3/ Model based on trade values (in percent of GDP).
4/ Model based on trade at constant US dollars. The series of trade balance on a real dollar basis (chained 2009 dollars) from the US Census Bureau is used.

C. Spillovers and exchange rate regimes

As discussed in Adler and Osorio Buitron (2017), spillovers on trading partners are likely to depend on their exchange rate regimes vis-a-vis the US, as these determine the extent of demand diverting effects arising from movements in the bilateral exchange rate. To explore this aspect, we divide the sample of countries according to their *de facto* exchange rate regime. Separate models are estimated for these groups, focusing on the partial trade balance with them and the corresponding nominal effective exchange rates (NEER).[26] We rely on the classification by Ilzetzki, Reinhart and Rogoff (2017) to characterize countries exchange rate arrangements. Given the particular importance of the 2008-09 financial crisis period in terms of the deployment of extraordinary monetary policy stimulus,

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[24] The series of trade balance on a real dollar basis (chained 2009 dollars) from the US Census Bureau is used.

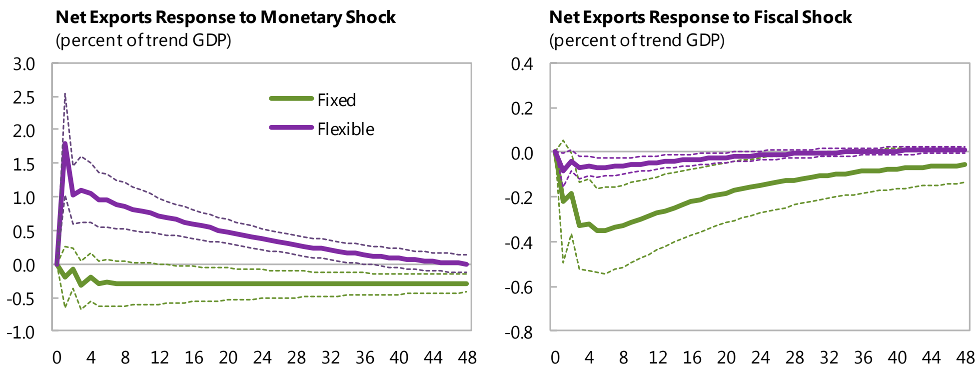
[25] See estimated contributions to the trade balance in Appendix Figure A1.

[26] NEER indexes against subgroups of trading partners is constructed as $NEER_t^J = \sum_{j\in J} S_t^j \left(\frac{X_t^j+M_t^j}{\sum_{j\in J}(X_t^j+M_t^j)}\right)$, 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.

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 is considered a *de facto* flexible (fixed) exchange rate regime.[27]

As shown in Figure 9, and consistent with the results in Adler and Osorio Buitron (2017), the spillovers from monetary policy are starkly different for de facto pegs and flexible exchange rate regimes—reflecting the dominant demand diverting effect in the latter case. Similarly, we find that fiscal spillovers are sizable for trading partners with rigid exchange rate regimes while somewhat muted for those with flexible exchange rates.

Figure 9. Response of Trade Balance to Policy Shocks
Fixed versus Flexible Exchange Rates



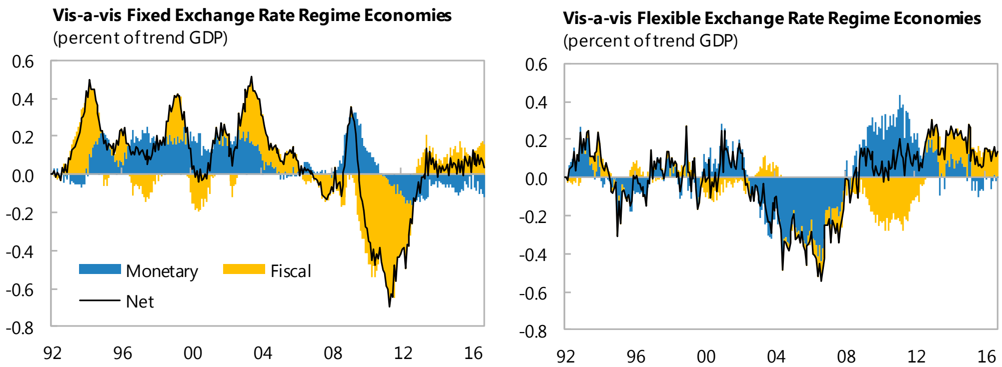
Source: authors' estimations.
1/ Impulse responses to a structural shock. Months are reported in the horizontal axis. Confidence bands correspond to one standard deviation. Model for EMDEs (trade in goods) is reported.

Overall, these results suggest that, when deployed in the same direction (e.g., loosening of both policy instruments) spillovers to economies with de facto pegs are unambiguously positives. Both monetary and fiscal loosening entail increased demand for trading partners (a weakening of the trade balance) without significant demand-diverting effects. The effect on trading partners with flexible exchange rates is, however, ambiguous. It depends on the magnitude of the monetary and fiscal policy shocks, as their effects go in opposite directions, due to the dominant demand-diverting effect of monetary policy shocks.

The estimated contribution of policy shocks to variations in the trade balance (Figure 10) confirm that, for the most part, economies with fixed exchange rates benefited from the overall US policy stimulus in the aftermath of the financial crisis (with especially larger effects from fiscal loosening). Meanwhile, trading partners with flexible rates were adversely impacted by such policies. The adverse net effects of the initial monetary loosening were only partially offset by the initial fiscal loosening; while the effects of the reversal of monetary policy in more recent years was more than offset by the effects of a tighter fiscal policy.

[27] 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 holding flexible regimes.

Figure 10. Contribution of Policy Shocks to Trade Balance. Fixed versus Flexible Exchange Rates



Source: authors' estimations.
1/ Estimated contributions from monetary and fiscal policy shocks to the trade balance (in percent of trend US GDP) vis-a-vis economies with *de facto* fixed and flexible exchange rate regimes respectively.

Overall, these results also shed light on why criticisms about the US policy response to the financial crisis may have come from specific set of countries (EMEs with flexible exchange rate regimes) as opposed to others (EMEs with fixed exchange rate regimes and AEs deploying similar policies in response to the crisis).

D. Spillovers on output

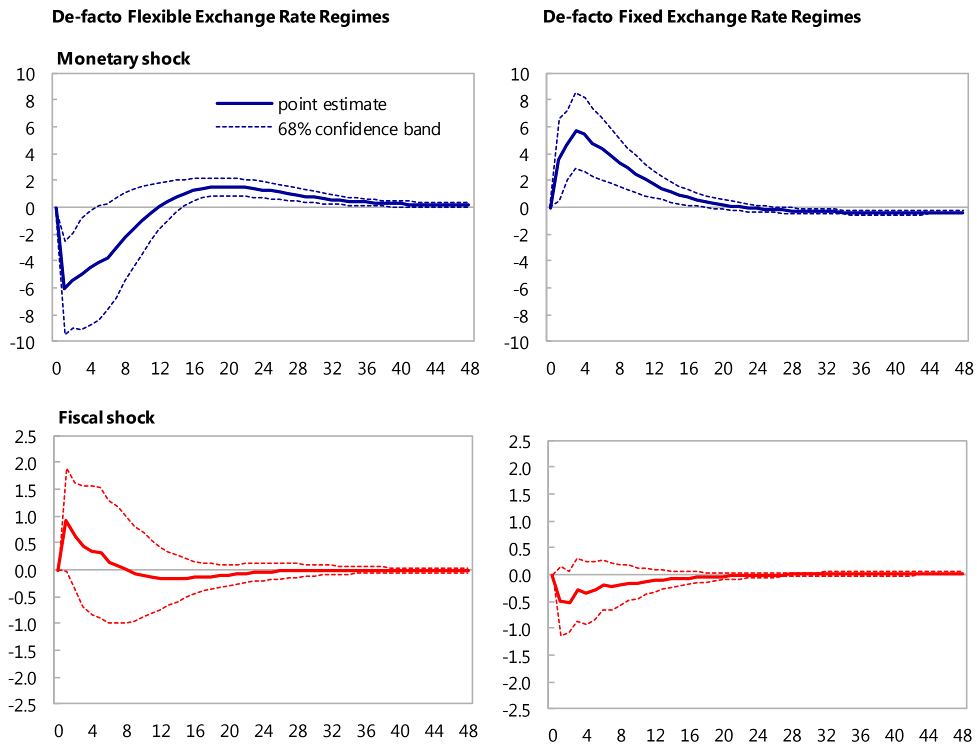
The discussion throughout the paper has focused on the impact of US policies on its trade balance vis-à-vis the rest of the world or different groups of countries. Much of the recent literature on policy spillovers, however, has focused on the impact on trading partner's output.

To shed some light on the spillovers on output, we explore the baseline specification including a de-trended measure of trading partner's industrial production (the only measure of output available on a monthly frequency for a large set of countries). As before, we differentiate trading partners with de facto flexible and fixed exchange rate regimes, given the potentially different effects that US policy shocks could have on each of these country groups.

The estimated impact of monetary shocks on output are found to be strong and consistent with the results on the trade balance (Figure 11, first row). A loosening of monetary policy in the US leads to an output contraction in trading partners with flexible exchange rate regimes. As discussed before, this is consistent with a dominating demand-diverting effect (production in other economies is affected by the reduced competitiveness resulting from the depreciation of the US dollar—i.e., appreciation of their currencies). This contrasts sharply with the effect on output in economies with currencies tied to the US dollar. In the latter case, a loosening of US monetary policy appears to be expansionary, consistent with a dominating demand augmenting effect.

The results on fiscal policy (Figure 11, second row), however, are weaker, with no meaningful statistical difference between the two groups of countries. While further investigation is pending, this result may reflect the fact that, as opposed to monetary shocks—which have broad-based effects (on demand and exchange rates)—fiscal policy shocks may have more narrow impact, affecting only certain sectors of the economy.

Figure 11. Spillovers on output.



Source: authors' estimations.
1/ Response of trade balance to a structural policy shock. Months are reported in the horizontal axis.. Confidence bands correspond to one standard deviation.

VI. Conclusions

We study trade spillovers from policy stimulus in the aftermath of the 2008-09 financial crisis, and find that, extraordinary US monetary and fiscal policy measures had sizable influence on trading partners, as indicated by the effect in the external balance. Consistent with the perception in emerging markets, the unprecedented monetary policy stimulus contributed to the strengthening of the US trade balance, arguably in detriment of trading partners. However, contrary to this view, we find that the overall policy mix led to a weakening of the US external position in the immediate aftermath of the crisis, helping to stimulate demand in trading partner countries, as the effect of a strong fiscal stimulus more than offset the impact of extraordinarily loose monetary policy. As the policy mix shifted with the gradual withdrawal of fiscal support, so did the effect on the trade balance.

Spillovers differed across trading partners. Our findings indicate that, for the most part, economies with fixed exchange rates benefited from the overall US policy stimulus in the aftermath of the financial crisis, while trading partners with flexible rates were adversely impacted by such policies.

Overall, our results suggest that the academic and policy analysis following the financial crisis may have been overly focused on monetary policy, leading to a very partial view on the effect of US policies on its trading partners. Moreover, our results highlight the importance of assessing spillovers from jointly estimated fiscal and monetary policy shocks, rather than focusing on individual policies, in order to avoid attenuation bias from omitted variables and identify more accurately the effects of these policies.

Finally, while our results point to important spillovers of monetary and fiscal policy through trade, the presence of such spillovers should not be interpreted as evidence against the use of these policy instruments. Instead, their use can lead to desirable outcomes both, at the individual economy and global levels, to the extent that spillover-recipient economies can deploy their own policy instruments, to partially offset undesirable spillovers and help stimulate global demand.

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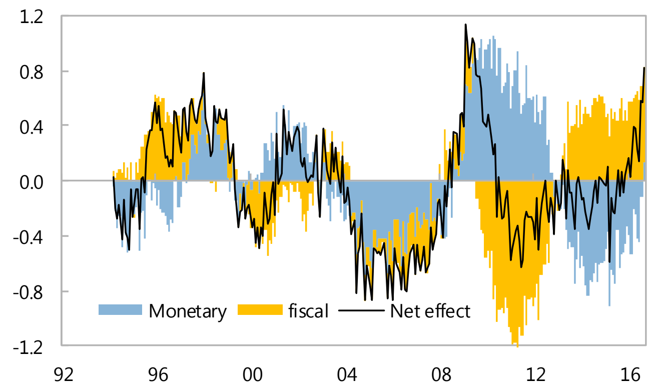
Figure A1. Real Model. Contributions to the trade balance 1/
(percent of trend GDP)



Source: Authors' estimations.
1/ Estimated contributions from monetary and fiscal policy shocks to the trade balance (in percent of potential GDP).

Appendix II. Volume and price effects

Consider the impact of policy shock, *i,* on the trade balance (expressed as share of trend GDP):

$$\underbrace{\frac{d(TB/Y)}{di}}_{\substack{\text{Overall}\\ \text{effect on}\\ \text{TB (value)}}} \cong \underbrace{\left[\frac{dQ^X/Q^X}{di}\left(\frac{X}{Y}\right) - \frac{dQ^M/Q^X}{di}\left(\frac{M}{Y}\right)\right]}_{\text{Volume effect}} + \underbrace{\left[\frac{dP^X/P^X}{di}\left(\frac{X}{Y}\right) - \frac{dP^M/P^M}{di}\left(\frac{M}{Y}\right)\right]}_{\text{Price effect}}$$

where $TB=X\text{-}M$; $X=P^XQ^X$ and $M=P^MQ^M$ *and* Y is *trend* nominal GDP (thus, mostly invariant to current policy shocks). Volume changes (first RHS term) reflects both the effects through demand augmentation and diversion. There is, however, an additional effect coming purely from the impact of the policy shock directly on trade prices (second RHS term).

Consider the case of a monetary tightening. As show in the impulse responses, this entails an overall negative impact on the trade balance $\left(\frac{d(TB/Y)}{di} < 0\right)$; and a similar volume effect but of a larger absolute magnitude. This implies that the price effect goes in the opposite direction $\left(\frac{dP^X/P^X}{di}\left(\frac{X}{Y}\right) - \frac{\frac{dP^M}{P^M}}{di}\left(\frac{M}{Y}\right) > 0\right)$.

Moreover, we can write trade prices as a function of prices in foreign currency and the exchange rate (E=US$/FC) as: $P^X = P^{X,FC}E$ and $P^M = P^{M,FC}E$. It follows that, the price effect can be decomposed as:

$$Price\ effect = \underbrace{\left[\frac{dE/E}{di}\left(\frac{X}{Y} - \frac{M}{Y}\right)\right]}_{\substack{\text{Exchange rate}\\ \text{price effect}}} + \underbrace{\left[\frac{dP^{X,FC}/P^{X,FC}}{di}\left(\frac{X}{Y}\right) - \frac{dP^{M,FC}/P^{M,FC}}{di}\left(\frac{M}{Y}\right)\right]}_{\text{Foreign currency price effect}}$$

where the first RHS term corresponds to the effect of the policy shock on the nominal exchange rate, and the second term is the effect on foreign currency prices.

A monetary tightening unequivocally leads to an appreciation of the US dollar (i.e., $\frac{dE/E}{di} < 0$), as shown in the baseline results. Given the US trade deficit position throughout the sample period, the latter means a positive exchange rate price effect. Since the overall price effect is positive, the latter result indicates that the effect on foreign currency prices is either positive, or negative but small.

Appendix III. Unit root and cointegration tests

Table A.III. 1. Dickey-Fuller test for unit root

Variable	Test statistic	Unit root hypothesis rejected?
bond yield	-1.02	no
stock price index (logs)	-1.367	no
reer (logs)	-1.273	no
net trade (% trend GDP)	-2.043	no
fiscal balance (% trend GDP)	-8.259	yes

1% critical value -3.456

5% critical value -2.878

10% critical value -2.57

Table A.III. 2. Johansen tests for cointegration

Maxmum rank	parms	LL	eigenvalue	trace statistic	5% criticalvalue
0	30	878.73664	.	118.2874	68.52
1	39	917.10836	0.22906	41.5440*	47.21
2	46	929.67174	0.08165	16.4172	29.68
3	51	934.42086	0.03168	6.919	15.41
4	54	937.49019	0.02059	0.7803	3.76
5	55	937.88035	0.00264		

Trend: constant

Number of obs = 29

Sample: 1992m3 - 2016m9

Lags = 2