Trilemma, not Dilemma: Financial Globalisation and Monetary Policy Effectiveness*

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Abstract

We investigate whether the classic Mundell-Flemming "trilemma" has morphed into a "dilemma" due to financial globalisation. According to the dilemma hypothesis, global financial cycles determine domestic financial conditions regardless of an economy's exchange rate regime and monetary policy autonomy is possible only if capital mobility is restricted. We find that global financial cycles indeed reduce monetary policy effectiveness in more financially integrated economies. However, consistent with the predictions from New Keynesian DSGE models we also find that another salient feature of financial globalisation has the opposite effect and amplifies monetary policy effectiveness: Economies increasingly net long in foreign currency experience larger valuation losses on their external balance sheets in response to an exchange rate appreciation triggered by a monetary policy tightening. Overall, we find that the net effect of financial globalisation since the 1990s has been to amplify monetary policy effectiveness in the typical advanced and emerging market economy: The output effect of a tightening in monetary policy has been stronger by 25% due to financial globalisation. Insofar as valuation effects can only play out if an economy's exchange rate is flexible, the choice of the exchange rate regime remains critical for monetary policy autonomy under capital mobility and in the presence of global financial cycles. Thus, our results suggest that the classic trilemma remains valid.

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1 Introduction

Standard macroeconomic theory posits that an economy can have at most two out of an open capital account, a fixed exchange rate and an independent monetary policy. Specifically, if capital is allowed to move freely across borders, domestic interest rates can deviate from interest rates abroad only if the exchange rate is flexible. Alternatively, if policy-makers seek to stabilise the exchange rate under free capital mobility, domestic interest rates have to shadow foreign interest rates. This is the classic Mundell-Flemming "trilemma" or "impossible trinity".

The trilemma describes reasonably well the trade-offs between international capital mobility, the choice of the exchange rate regime and monetary policy autonomy over the last century or so (Obstfeld et al., 2005). However, the rise of financial globalisation since the late 1990s has triggered a lively debate as to whether exchange rate flexibility continues to be a sufficient condition for monetary policy autonomy. In particular, evidence suggests that domestic financial conditions are increasingly affected by developments in the rest of the world. This notwithstanding, until the global financial crisis the consensus was that financial globalisation had not materially reduced monetary control (see Yellen, 2006; Bernanke, 2007; Woodford, 2007; Weber, 2008; Kamin, 2010, and references therein).

The debate has intensified after the global financial crisis, which epitomised the role of global financial cycles in interest rates, asset prices, capital flows and bank leverage (Shin, 2012; Rey, 2013; Agrippino and Rey, 2014; Bruno and Shin, forthcoming). Specifically, it has been argued that financial conditions in the world's foremost financial centre—namely the US—spill over to other economies through global financial cycles regardless of the exchange rate regime and override the efforts of local monetary policy to steer domestic financial conditions. Put differently, due to global financial cycles non-US central banks allegedly lose the ability to control domestic long-term interest rates even in the presence of flexible exchange rates. As a consequence, it is argued, the classic trilemma has morphed into a "dilemma" and the impossible trinity into an "irreconcilable duo": When capital is allowed to flow freely across borders, financial globalisation renders monetary policy in non-US economies ineffective, even if their exchange rates are flexible.[1] While this debate has been particularly heated in emerging market economies, it also concerns advanced economies. For instance, when explaining the ECB's decision to adopt forward guidance President Draghi noted that "a tightening of the policy stance may arise from developments in global bond markets that unduly spill over to the interest rate term structure in the euro area. So far our forward guidance has managed to decouple euro area forward curves somewhat from developments in the US" (Draghi, 2014).

However, there is another aspect of financial globalisation which has been under-appreciated

[1] Interestingly, the evidence also "supports a modified view of the trilemma for the modern [post-Bretton Woods] era. Both the exchange rate regime and capital controls clearly affect autonomy, but the combination of floating with capital controls seems to provide unfettered autonomy, and removing either limits autonomy to some degree" (see Obstfeld et al., 2005, p. 433).

in this debate. In particular, along with the growth in the size of economies' external balance sheets associated with financial globalisation, their net foreign currency exposures have risen as well: Both advanced and emerging market economies have been increasingly net long in foreign currency on their external balance sheet (see Burger et al., 2010; Hausmann and Panizza, 2011; Benetrix et al., forthcoming; Burger et al., 2014; Hale et al., 2014). And as shown in a rich New Keynesian dynamic stochastic general equilibrium (DSGE) model by Meier (2013) in her extension of Woodford (2007)'s classic analysis, an economy that is net long in foreign currency exhibits stronger monetary policy due to exchange rate valuation effects. Specifically, consider for simplicity of illustration an economy whose foreign assets are all denominated in foreign currency and whose foreign liabilities are all denominated in domestic currency. In this case, a tightening of local monetary policy followed by an appreciation of the domestic currency lowers the home-currency value of an economy's foreign assets, but leaves the home-currency value of its foreign liabilities unchanged. As a result, if an economy is net long in foreign currency a tightening of local monetary policy causes a fall in its net foreign asset position, which implies a negative wealth effect that should contract consumption and investment. Thus, while financial globalisation might weaken the interest rate channel of monetary policy through *global financial cycle effects*, it may strengthen the exchange rate channel through *net foreign currency exposure effects*.

Our paper addresses the questions as to (i) whether global financial cycle and net foreign currency exposure effects have been empirically relevant and, if so, (ii) which of these competing forces has had a stronger impact on monetary policy effectiveness since the 1990s. To answer these questions, we first estimate the response of output to a local monetary policy shock for a sample of economies over 1999-2009. We then examine whether heterogeneities in monetary policy effectiveness can be explained by differences in economies' global financial integration patterns. In particular, we consider the role of two salient features of financial globalisation for heterogeneities in monetary policy effectiveness: the *size* of economies' external balance sheets, which reflects their susceptibility to global financial cycle effects; and the *currency exposure* of economies' external balance sheets, which captures their susceptibility to net foreign currency exposure effects.

We focus on euro area economies in our baseline analysis as they are more similar to each other along a number of dimensions than economies in a broader sample. This reduces the list of country characteristics we need to control for in studying the determinants of heterogeneities in monetary policy effectiveness in a cross-section of economies, which is important as we are working with relatively small samples. For example, while Anglo-Saxon economies tend to have market-based financial systems, banks play a more important role in continental European and emerging market economies, which alters the transmission of monetary policy (see Allen, 2004). Inflation volatility is typically higher in emerging markets than in advanced economies, which steepens the Philips curve (see Jarocinski, 2010). Emerging market economies also often manage their currencies, which clogs the exchange rate channel of monetary policy. Moreover, due to

the euro area's single monetary policy, considering solely euro area economies ensures that the monetary policy shock we identify is truly identical across economies. Similarly, focusing on euro area economies ensures that heterogeneities in monetary policy effectiveness are not driven by differences in the endogenous response of monetary policy during the transition back to the steady state. Euro area economies also all have a flexible exchange rate, which is critical for net foreign currency exposure effects. Finally, data on standard determinants of monetary policy effectiveness such as labour market rigidities and industry structure that we need to control for in our analysis are often not available for emerging market economies. However, in order to ensure that our results are not specific to euro area economies, in extensions of our baseline analysis we consider an expanded country sample which includes 36 euro area as well as non-euro area advanced and emerging market economies. In further robustness checks we also consider an advanced economy sample as well as a non-euro area economy sample.

More specifically, our empirical approach consists of two stages. First, we obtain estimates of the impact of a contractionary local monetary policy shock on output from a mixed cross-section global VAR (MCSGVAR) model with sign restrictions. A key advantage of this model relative to the standard GVAR model suggested by Pesaran et al. (2004) is that we can include euro area economies individually and, at the same time, model euro area monetary policy as a function of *aggregate* euro area output growth and inflation. Moreover, the GVAR framework allows us to take into account spillovers from euro area monetary policy to the rest of the world and possible spillbacks, which may play a quantitatively important role for the effects of monetary policy on domestic variables. In a second stage, we regress the trough responses (maximum fall) of output to a local monetary policy shock on the overall size of economies' external balance sheets—to capture the impact of global financial cycle effects on monetary policy effectiveness—and on their currency exposures—to capture the impact of net foreign currency exposure effects. In doing so, we control for standard determinants of monetary policy effectiveness such as labour market rigidities and industry structure.

Our approach differs from that in existing studies on the trilemma (see Philippon et al., 2001; Frankel et al., 2004; Obstfeld et al., 2005; Shambaugh, 2004; Miniane and Rogers, 2007; Bluedorn and Bowdler, 2010; Klein and Shambaugh, 2013; Obstfeld, 2015). Specifically, the extant literature typically seeks to gauge the extent to which domestic interest rates are driven by world/base-country interest rates. To do so, these studies distinguish between floaters and peggers as well as between economies that impose capital controls and those that do not. In general, this literature finds that pass-through from world/base-country to domestic interest rates is stronger in the case of exchange rate pegs and when capital flows are unrestricted. In this paper, we do not assess the extent to which domestic financial conditions are determined by monetary policy abroad and whether differences in domestic interest rate policy autonomy are related to economies' financial integration patterns. Instead, we investigate whether local monetary policy is less effective—in terms of its impact on output—in economies that are more integrated in global financial markets. Moreover, in addition to global financial cycle effects we

account for another channel through which financial globalisation can affect monetary policy effectiveness: net foreign currency exposure effects. Hence, our approach enables us to test directly whether financial globalisation has reduced—or strengthened—monetary policy effectiveness.

We find empirical support both for global financial cycle and net foreign currency exposure effects on monetary policy effectiveness. On the one hand, economies which are more susceptible to global financial cycle effects display a weaker response of output to monetary policy. On the other hand, economies which are more net long in foreign currency exhibit a stronger response of output to a monetary policy shock. Applying these estimates from the cross-section to the evolution of economies' susceptibility to global financial cycle and net foreign currency exposure effects within economies over time, we find that financial globalisation has not markedly changed monetary policy effectiveness in the euro area since the late 1990s. In contrast, financial globalisation has amplified monetary policy effectiveness in the typical non-euro area advanced and emerging market economy. Interestingly, while the results at the group level hide considerable heterogeneity at the country level for euro area and advanced economies, it appears that financial globalisation has strengthened monetary policy effectiveness in most emerging market economies, in line with their progress in redeeming from "original sin" in the 2000s.

Taken together, our results do not support the hypothesis that financial globalisation is *necessarily* associated with a reduction in monetary policy effectiveness in economies with flexible exchange rates. In particular, even if flexible exchange rates do not insulate domestic financial conditions from global financial cycles, flexible exchange rates support monetary policy effectiveness through net foreign currency exposure effects. Hence, flexible exchange rates remain critical for monetary policy autonomy under capital mobility and in the presence of global financial cycles, which implies that the classic trilemma is still valid. Another implication of our results is that even if it does not necessarily reduce its effectiveness, financial globalisation does modify the transmission of monetary policy. In particular, in addition to their impact on import prices and trade competitiveness, exchange rate movements triggered by monetary policy impulses affect domestic agents' wealth under financial globalisation and, thereby, consumption and investment decisions. Financial globalisation may thus imply that the interest rate channel loses and that the exchange rate channel gains importance. These changes may also have implications for optimal monetary policy and the gains from international monetary policy coordination.

The remainder of the paper is organised as follows. Section 2 discusses the mechanisms through which global financial cycles and net foreign currency exposures may affect monetary policy effectiveness. We lay out our empirical modelling strategy in Section 3. Section 4 presents our main results. An array of robustness checks is discussed in Section 5. Finally, Section 6 concludes and draws implications from our findings for policy and future research.

2 How Can Financial Globalisation Affect Monetary Policy Effectiveness?

2.1 Global Financial Cycle Effects

An important transmission channel of monetary policy operates through domestic long-term interest rates that shape firms' credit-financed investment and households' consumption decisions. According to the expectations hypothesis, long-term interest rates are determined by expected future short-term rates, which are set by local monetary policy. However, as long-term interest rates also include risk premia, financial globalisation may weaken monetary control if domestic risk premia are sensitive to their foreign counterparts. This may be the case if domestic and foreign financial assets are considered to be substitutes by investors, and when capital is allowed to move freely and at low cost across borders.

Empirical evidence substantiates the view that risk premia co-move across economies. For example, Hellerstein (2011), Rey (2013) as well as Agrippino and Rey (2014) find that one global factor explains a large fraction of the cross-sectional variance of risky returns around the world. Importantly, Rey (2013) and Agrippino and Rey (2014) argue that a major driver of this global factor is US monetary policy. Similarly, Bekaert et al. (2013) as well as Bruno and Shin (forthcoming) provide evidence that US monetary policy has a large impact on global risk aversion. Moreover, Rey (2013), Agrippino and Rey (2014) as well as Bruno and Shin (forthcoming) find that US monetary policy drives the leverage of global banks, which transmits US financial conditions to the rest of the world.[2] In a related vein, Reinhart and Reinhart (2009), Forbes and Warnock (2012) as well as Ghosh et al. (2014) put forth evidence suggesting that US monetary policy and global risk aversion are key determinants of global capital flow waves that transmit financial conditions in the US across the world. Lo Duca et al. (2014) find that US unconventional monetary policy has been a major determinant of the recent surge in global bond issuance, and the results of McCauley et al. (2014) suggest that US monetary policy has been a crucial driver of the growth in offshore US dollar credit. Obstfeld (2015) finds that even though changes in US short-term interest rates do not have a statistically significant impact on short-term interest rates in economies with flexible exchange rates, the latter do not insulate long-term interest rates from those in the US. Similarly, Ito (2014) finds that the transmission of changes in short-term to long-term interest rates is weaker in economies which are more integrated in global financial markets. Finally, Obstfeld (2015) finds that shifts in global risk aversion have a statistically significant impact on non-US long-term interest rates. The evidence thus points to the existence of a global financial cycle which originates in the US and which undermines

[2] Cetorelli and Goldberg (2012) find that globally active US banks respond to local shocks by shifting liquidity through internal funding markets across domestic and foreign subsidiaries, transmitting US monetary policy to the rest of the world. Domestic (both US and non-US) financial conditions hence become less responsive to local monetary policy and, at the same time, more responsive to foreign monetary policy.

interest rate autonomy and thereby monetary policy effectiveness in non-center economies.[3]

Given that they operate through cross-border capital flows, we would expect the extent to which economies are susceptible to global financial cycles to be related to their degree of integration in global financial markets. The latter is typically measured by the size of economies' external balance sheets. Data on gross foreign asset and liability positions for a large panel of economies' have been assembled by Lane and Milesi-Ferretti (2001, 2007). The top panel of Figure 1 shows the change in euro area economies' gross foreign asset and liability positions relative to GDP, $gfal_{it}$, over 1999-2009 (see also Table 1). The bottom panel shows the levels in 2009.[4] There is considerable variation in gross foreign asset and liability positions over time and across economies. In particular, gross foreign asset and liability positions increased substantially in most euro area economies over 1999-2009. While Austria, Ireland, Greece, Portugal and Slovenia saw strong increases in their gross foreign asset and liability positions, Italy and Finland experienced rather small increases. Concerning the levels, while Belgium, Ireland, and the Netherlands had high gross foreign asset and liability positions in 2009, they were relatively low in Greece, Italy and Slovenia. This heterogeneity also applies to the world as a whole. Specifically, while the euro area and other advanced economies expanded their gross foreign asset and liability positions strongly over 1999-2009, emerging market economies did so to a much lesser extent. And while euro area economies had large gross foreign asset and liability positions in 2009, they were relatively low in emerging market economies.

2.2 Net Foreign Currency Exposure Effects

Differences in the currency composition of an economy's foreign assets and liabilities give rise to valuation effects in response to exchange rate fluctuations. A rigorous analysis of the role of exchange rate valuation effects for monetary policy transmission under financial globalisation is presented in Meier (2013).[5] Extending the New Keynesian DSGE model of Woodford (2007), Meier (2013) shows that a contractionary monetary policy shock is associated with a weaker

[3]He and McCauley (2013) as well as Obstfeld (2015) provide extensive discussions of the channels of transmission from world and US to domestic interest rates and financial conditions more generally.

[4]To minimise the possible influence of extreme values we use $log(1 + gfal_{it})$ throughout the paper, which we refer to as $gfal_{it}$ for ease of notation. As we document in the online appendix to this paper, our results are not sensitive to using the level instead of the logarithm of the gross foreign asset and liability position relative to GDP.

[5]Financial globalisation, valuation effects and monetary policy have been studied from a theoretical perspective elsewhere as well. For example, Devereux and Sutherland (2008) find that pursuing price stability remains welfare maximising under financial globalisation. Engel and Matsumoto (2009) find that exchange rate movements in the presence of foreign currency exposures have major implications for welfare, risk sharing and the international diversification puzzle (see also the discussion in Engel, 2014). Devereux and Sutherland (2010) study the role of valuation effects for the evolution of net foreign asset positions. Devereux and Yetman (2014) show that trade and financial integration reduce the gains from using sterilised interventions to influence exchange rates. In a somewhat different context, Devereux et al. (2013) analyse the extent to which improved performance in terms of the level and predictability of inflation across economies has contributed to the rise of financial globalisation. Finally, Tille (2008) studies the role of exchange rate valuation effects for the international transmission of shocks.

interest rate channel, as financial globalisation allows agents to smooth consumption by borrowing from abroad. At the same time, Meier (2013) shows that the appreciation of the domestic currency in response to a tightening in local monetary policy is associated with exchange rate valuation losses on the economy's external balance sheet that amplify monetary policy effectiveness if the economy is *net long* in foreign currency. In particular, assume for the ease of illustration that all of an economy's foreign assets are denominated in foreign currency, while all its foreign liabilities are denominated in domestic currency. In this case, the home-currency value of an economy's foreign assets falls in response to the appreciation of the domestic currency, but the home-currency value of its foreign liabilities is unchanged. As a result, the economy's net foreign asset position falls, which implies a negative wealth effect that should contract domestic consumption and investment.[6] Overall, Meier (2013) argues that for plausible values of the model parameters the weakening of the interest rate channel of monetary policy under financial globalisation is outweighed by the strengthening of the exchange rate channel.[7] In addition to the wealth effects stemming from changes in the home-currency value of an economy's stock of foreign assets and liabilities, exchange rate valuation effects triggered by local monetary policy impulses may also arise from changes in the home-currency value of foreign investment income flows (see Auer, 2014). Specifically, as dividend payments on foreign equity assets are typically denominated in foreign currency, an appreciation of the domestic currency in response to a tightening of local monetary policy will reduce the home-currency value of foreign investment income receipts.

To measure the exposure of economies' external balance sheets to exchange rate fluctuations, we use the data assembled by Lane and Shambaugh (2010) as well as Benetrix et al. (forthcoming). Denote by $nfal_{it}$ and $gfal_{it}$ economy i's net and gross foreign asset and liability position relative to GDP. Furthermore, let E_{ijt} denote the logarithm of the nominal bilateral exchange rate of economy i's currency vis-à-vis that of economy j in period t, expressed in terms of units of the domestic currency relative to one unit of the foreign currency. Moreover, denote by s_{it}^A and s_{it}^L the shares of foreign assets and liabilities in economy i's gross foreign asset and liability position; and denote by ω_{it}^A and ω_{it}^L the shares of economy i's foreign assets and liabilities which are denominated in foreign currency. Lane and Shambaugh (2010) define economy i's net foreign currency exposure as

$$nfx_{it} \equiv \frac{\partial^N nfal_{it}}{\partial E_{i1t} \cdots \partial E_{1Nt}} = (s_{it}^A \cdot \omega_{it}^A - s_{it}^L \cdot \omega_{it}^L) \cdot gfal_{it}. \tag{1}$$

[6]The exchange rate valuation loss on the economy's external balance sheet in response to an appreciation of the domestic currency does not hinge on the economy's foreign assets being denominated *entirely* in foreign currency and its foreign liabilities in domestic currency. Rather, what matters is the *net* foreign currency exposure, that is the extent to which an economy is net long in foreign currency; see further below for a precise definition.

[7]Our paper differs along several dimensions from that of Meier (2013). First, and most importantly, Meier (2013) does not link her analysis to the global financial cycle and the implications for the dilemma hypothesis. Moreover, she does not test the predictions of her model empirically; rather, she considers plausible calibrations of the model parameters in order to assess the impact of financial globalisation on monetary policy effectiveness.

The net foreign currency exposure reflects the change in economy i's net foreign asset and liability position that results from a uniform depreciation of its currency vis-à-vis all foreign currencies.[8] Specifically, economy i's net foreign asset and liability position improves with ω_{it}^A in response to a depreciation of the domestic currency as the home-currency value of foreign assets rises if these are denominated in foreign currency. Similarly, economy i's net foreign asset and liability position worsens with ω_{it}^L in response to a depreciation of the domestic currency as the home-currency value of foreign liabilities rises if these are denominated in foreign currency. Thus, a positive value of nfx_{it} implies that economy i will experience an improvement in its net foreign asset and liability position in response to a depreciation of its currency vis-à-vis all foreign currencies; analogously, a positive value of nfx_{it} implies that economy i will experience a worsening in its net foreign asset position in response to an appreciation of its currency vis-à-vis all foreign currencies. Of course, the magnitude of these exchange rate valuation effects also depends on the (relative) magnitude of economy i's foreign asset and liability positions, and thereby on s_{it}^A, s_{it}^L and $gfal_{it}$.

The top panel of Figure 1 shows the change of euro area economies' net foreign currency exposures over 1999-2009 (see also Table 1).[9] The bottom panel shows the corresponding levels in 2009. The data again display substantial variation. Net foreign currency exposures rose markedly in Ireland, Austria and Belgium, but only little in France, Spain and Germany. Ireland and the Netherlands stand out as economies with particularly high net foreign currency exposures in 2009, while Italy exhibited a rather low value. As all euro area economies' net foreign currency exposures were positive in 2009, their net foreign asset positions worsen in response to an appreciation of the euro, albeit to different degrees. The data suggest that valuation effects in response to exchange rate fluctuations can be economically significant. For example, a 10% appreciation of the euro vis-à-vis all other currencies implies a 27 percentage points (0.1×2.69) drop in the net foreign asset position relative to GDP for Ireland; in the average euro area economy, a 10% appreciation of the euro implies a 2.8 percentage points drop in the net foreign asset position relative to GDP. Net foreign currency exposures and their evolution over time also differ markedly across the euro area, other advanced economies and emerging market economies. Specifically, euro area economies experienced a smaller increase in their net foreign currency exposures over 1999-2009 than non-euro area economies. This reflects that a considerable portion of euro area economies' foreign assets and liabilities is denominated in euro, consistent with the progress in financial market integration during the first decade of monetary union. Concerning the levels, non-euro area advanced economies had rather high net foreign currency exposures in 2009, much higher than the average euro area and emerging market economy.

It is important at this point to compare the role of foreign currency exposure in our analysis to that in the work of Bruno and Shin (forthcoming). In particular, Bruno and Shin (forthcoming) put forth a "double-decker" model of banking in which regional banks borrow in US dollars

[8] See Appendix B for a formal derivation.

[9] The data of Lane and Shambaugh (2010) as well as Benetrix et al. (forthcoming) do not include Luxembourg.

from global banks to lend to local corporate borrowers. Global banks finance cross-border lending to regional banks by tapping US dollar money market funds in the US. A key feature of their model is the link between an appreciation of the local currency vis-à-vis the US dollar and the loosening of local financial conditions through increases in banking sector leverage. In particular, when the local currency appreciates local borrowers' balance sheets appear stronger as the home-currency value of their US dollar-denominated liabilities falls, resulting in lower credit risk and hence expanded (local and global) bank lending capacity. As a result, a US dollar depreciation is akin to a loosening of global financial conditions and to a loosening of local financial conditions, and thereby to a loosening of local monetary policy. The analysis of Bruno and Shin (forthcoming) is not inconsistent with ours. First, in their analysis they focus on the role of net foreign currency exposures for the transmission of *US monetary policy to the rest of the world*; in contrast, in this paper we study the role of net foreign currency exposures for the transmission of *local monetary policy to the domestic economy.* Moreover, the effects spelled out in Bruno and Shin (forthcoming) depend on local firms being *net short* in foreign currency. The net foreign currency exposure effects we put forth in this paper and which are based on the model of Meier (2013) are analogous to the mechanisms in Bruno and Shin (forthcoming). That said, based on the data of Lane and Shambaugh (2010) and Benetrix et al. (forthcoming) most economies are, in fact, net *long* rather than net short in foreign currency. Of course, there may be heterogeneities across sectors within an economy.[10] However, if an economy is net long in foreign currency on aggregate, then there must be some sectors which are net long in foreign currency and which outweigh the sectors which are net short. For the former sectors the effect of local monetary policy will be amplified through net foreign currency exposure effects. And if the economy is net long in foreign currency on aggregate, we would expect the effects of local monetary policy to be amplified on aggregate as well. Most importantly, however, our analysis does *not assume* this to be the case. Instead, whether this is the case or not is the central hypothesis we test empirically in this paper.

3 Empirical Modelling Strategy

3.1 The MCSGVAR Model

We use a GVAR model for our analysis in order to account for international trade and financial integration in the global economy. Shocks in many economies may have spillovers to the rest of the world followed by spillbacks, which should be taken into account in order to estimate consistently the transmission of domestic shocks. In particular, we consider the MCSGVAR model of Georgiadis (2015) to estimate the impact of a local monetary policy shock on domestic output. A key advantage of this model relative to the standard GVAR model suggested by

[10] This may be the case in particular in emerging market economies in which the private sector is net short in foreign currency and the public sector is net long due to foreign exchange reserve holdings.

Pesaran et al. (2004) is that we can consider euro area economies individually and, at the same time, model euro area monetary policy as a function of aggregate output growth and inflation dynamics. For the euro area, the shock we identify is therefore truly identical across economies, and it is ensured that monetary policy behaves identically for all euro area economies during the reversion to the steady state. These are important model features for the purpose of this paper, as they reduce the possible sources of heterogeneities in monetary policy effectiveness, which helps to identify the role of global financial cycle and net foreign currency exposure effects given the relatively small samples we are working with.

As in the standard GVAR model, the MCSGVAR model of Georgiadis (2015) builds on country-specific VARX models

$$\boldsymbol{x}_{it} = \boldsymbol{a}_i + \sum_{j=1}^{p_i} \boldsymbol{\Phi}_{ij} \cdot \boldsymbol{x}_{i,t-j} + \sum_{j=0}^{p_i^*} \boldsymbol{\Gamma}_{ij} \cdot \boldsymbol{x}_{i,t-j}^* + \boldsymbol{u}_{it}, \quad i = 1, 2, \ldots, N, \tag{2}$$

where $\boldsymbol{x}_{it}$ is a $k_i \times 1$ vector of endogenous variables and $\boldsymbol{x}_{it}^*$ is a $k_i^* \times 1$ vector of averages of the other economies' endogenous variables. In a standard GVAR model, one would let the subscript i refer to individual economies. Moreover, in each individual economy monetary policy would typically be modelled by entering short-term interest rates in the vector of endogenous variables $\boldsymbol{x}_{it}$. Of course, this does not apply to euro area economies, which share a single monetary policy.

In contrast to the standard GVAR model, in the MCSGVAR model of Georgiadis (2015) the subscript i may refer to a generic cross-sectional unit rather than only to economies. This allows us to consider the ECB as a separate unit in the MCSGVAR model along with euro area (and non-euro area) economies. In particular, in the ECB's model the "foreign" variables $\boldsymbol{x}_{it}^*$ are given by GDP-weighted averages of individual euro area economies' output and inflation dynamics (and, possibly, trade-weighted non-euro area output growth, inflation and financial market dynamics). As a result, consistent with the institutional framework of EMU we model euro area monetary policy as a function of euro area aggregate output growth and inflation dynamics, and at the same time include euro area economies individually in the MCSGVAR model. Non-euro area economies and their monetary policies can be represented in single VARX models.

More specifically, for the euro area economies the vector of endogenous variables $\boldsymbol{x}_{it}$ comprises output and prices.[11] The corresponding vector of "foreign" variables $\boldsymbol{x}_{it}^*$ includes trade-weighted foreign output, prices and non-euro area short-term interest rates, oil prices, and euro area short-term interest rates as the ECB is modelled as a distinct unit. As in Pesaran et al. (2004), bilateral exchange rates are not included in each country VARX model symmetrically. In particular, as

[11] The sample of euro area economies includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Slovenia, Slovakia and Estonia are not treated as euro area economies in the estimation of the MCSGVAR model since they joined the euro area only at a later stage so that their inflation and output growth dynamics were not relevant for the ECB's monetary policy during much of our sample period.

all euro area members have the same nominal bilateral exchange rate we cannot include it as an endogenous variable in each euro area economy model. Instead, we choose the euro as the numéraire and enter the trade-weighted nominal bilateral euro exchange rate in the vector of foreign variables.[12] For the euro area economies we thus have:

$$\boldsymbol{x}_{it} = \begin{bmatrix} \text{output} \\ \text{prices} \end{bmatrix}, \quad \boldsymbol{x}_{it}^{*} = \begin{bmatrix} \text{foreign output} \\ \text{foreign prices} \\ \text{euro area short-term interest rates} \\ \text{foreign short-term interest rates} \\ \text{oil prices} \\ \text{exchange rate} \end{bmatrix}. \tag{3}$$

As discussed above, in order to model euro area monetary policy as a function of euro area aggregate output growth and inflation dynamics while at the same time including euro area economies individually we introduce the ECB as a separate cross-sectional unit. The short-term interest rate is the only endogenous variable in the ECB's model and the vector of "foreign" variables comprises GDP-weighted euro area output and prices. Moreover, the ECB's model also includes GDP-weighted non-euro area short-term interest rates, the euro area trade-weighted nominal exchange rate and oil prices. Specifically:

$$\boldsymbol{x}_{it} = \begin{bmatrix} \text{euro area short-term interest rates} \end{bmatrix}, \quad \boldsymbol{x}_{it}^{*} = \begin{bmatrix} \text{euro area output} \\ \text{euro area prices} \\ \text{foreign short-term interest rates} \\ \text{oil prices} \\ \text{exchange rate} \end{bmatrix}. \tag{4}$$

For non-euro area economies, the vector of endogenous variables comprises output, prices, the nominal bilateral exchange rate vis-à-vis the euro, and short-term interest rates. The corresponding vector of foreign variables includes trade-weighted foreign output, prices, short-term interest rates and oil prices. Hence, we have:

$$\boldsymbol{x}_{it} = \begin{bmatrix} \text{output} \\ \text{prices} \\ \text{short-term interest rates} \\ \text{exchange rate} \end{bmatrix}, \quad \boldsymbol{x}_{it}^{*} = \begin{bmatrix} \text{foreign output} \\ \text{foreign prices} \\ \text{foreign short-term interest rates} \\ \text{oil prices} \end{bmatrix}. \tag{5}$$

Finally, as in Georgiadis (2015) we introduce an oil block as an additional cross-sectional unit in order to model the evolution of commodity prices endogenously as a function of global output

[12] The weights for each euro area economy are given by the relevant bilateral trade shares with non-euro area economies.

growth, inflation and interest rate developments. Specifically, we have:

$$\boldsymbol{x}_{it} = \begin{bmatrix} \text{oil prices} \end{bmatrix}, \quad \boldsymbol{x}^*_{it} = \begin{bmatrix} \text{foreign short-term interest rates} \\ \text{foreign output} \\ \text{foreign prices} \end{bmatrix}. \tag{6}$$

The derivation of the global solution of the model is standard and can be found in Appendix A.

3.2 Model Specification

We enter output, prices, the nominal bilateral exchange rate and oil prices in first-differences of their logarithms.[13] As in Pesaran et al. (2004), in order to mitigate the impact of extreme interest rate spikes we consider $r_{it} = log(1 + R_{it})$, where R_{it} is the annual nominal short-term interest rate; we also enter r_{it} in first-differences. Also as in Pesaran et al. (2004), due to the relatively small time-series dimension of our sample we allow the lag orders of the endogenous and the foreign variables in each VARX model to be at most one. Finally, we treat the US as a dominant unit in the sense of Chudik and Pesaran (2013) to account for its extraordinary role in the global economy. In terms of model specification, this requires to add the domestic endogenous variables of the US in all other units' vectors of foreign variables in Equations (3) to (6). Georgiadis (2015) documents that estimates of the effect of a euro area monetary policy shock are robust to a number of alternative model specifications, such as the inclusion of equity prices as endogenous and foreign variables in the MCSGVAR model, the treatment of the ECB as a dominant unit along with the US, and extending the sample to 2012 rather than stopping in 2009 (see below). Moreover, in Section 5 we document the robustness of our findings to the inclusion of the VIX index and long-term interest rates as additional endogenous and foreign variables in the MCSGVAR model as well as to allowing for higher lag orders.

3.3 Estimation Sample

Our sample comprises quarterly observations over 1999:Q1-2009:Q4 for 61 economies (Table 2). We subsume the economies of Estonia, Latvia and Lithuania into a Baltic (BAL) block, and the economies of Venezuela, Ecuador and Saudi Arabia into an oil exporting countries (OPC) block (the latter should not be confused with the oil block discussed above, which models the evolution of oil prices). We drop the more recent quarters in order to preclude possible structural breaks stemming from the European sovereign debt crisis. All data we use are taken from Haver Analytics (see Table 3).

[13] See Georgiadis (2015) for a discussion of estimating the GVAR in first differences.

3.4 Identification of Monetary Policy Shocks

As in Georgiadis (2015) we identify a euro area monetary policy shock by imposing sign restrictions on the responses of euro area short-term interest rates, inflation and the nominal effective exchange rate of the euro. In particular, we require that short-term interest rates rise on impact, that the euro appreciates on impact, and that inflation turns negative after four quarters reflecting the stickiness of aggregate prices. We impose these restrictions on euro area short-term interest rates in the ECB's model, GDP-weighted aggregate euro area inflation, and the trade-weighted nominal effective exchange rate. In Georgiadis (2015) and in the online appendix to this paper we document that our results are very similar if we identify the monetary policy shock by imposing additional sign restrictions on the responses of output, money growth, and oil price inflation; identify the monetary policy shock based on sign restrictions with a different timing; identify monetary policy shocks independently of the MCSGVAR model based on the difference between lagged financial market expectations and actual policy rates; and use as an exogenous variable a monetary policy shock time series obtained from estimated DSGE models such as the New Area-Wide Model of Christoffel et al. (2008) or the model of Smets and Wouters (2003).

4 Results

4.1 Euro Area Sample

Figure 2 shows the trough responses (maximum fall) of the level of real GDP to a 100 basis points surprise increase in euro area short-term interest rates as estimated by the MCSGVAR model with sign restrictions. Belgium, France and Portugal experience a relatively small decline in output; in contrast, output declines strongly in Finland, Ireland, and Slovenia.[14]

To what extent can heterogeneities in the output responses to a monetary policy shock be accounted for by differences in euro area economies' susceptibility to global financial cycle (as proxied by $gfal_i$) and net foreign currency exposure effects (as proxied by nfx_i)? Figure 3 presents scatter plots of $gfal_i$ and nfx_i on the one hand and the trough responses of real GDP on the other hand. The scatterplots suggest that the trough responses of real GDP appear to be positively related to $gfal_i$ and negatively to nfx_i. However, the relationships are not statistically significant, and/or some economies could be outliers. Of course, these are only unconditional correlations, and the outliers may disappear after additional controls are taken into account.

In particular, we estimate a cross-section regression for the determinants of heterogeneities in monetary policy effectiveness in the spirit of Carlino and DeFina (1998) as well as Dedola and

[14]The full profile of the responses of real GDP and the other variables can be found in the online appendix of this paper.

Lippi (2005)

$$s_i = \alpha + \boldsymbol{\gamma} \cdot \boldsymbol{w}_i + \beta^{gfal} \cdot gfal_i + \beta^{nfx} \cdot nfx_i + u_i, \tag{7}$$

where s_i is the trough response of real GDP shown in Figure 2 and $\boldsymbol{w}_i$ includes standard determinants of monetary policy effectiveness, such as industry structure and labour market rigidities (see Georgiadis, 2015).[15,16] The data for the explanatory variables are time averages over 1999-2009. Table 4 reports descriptive statistics for the dependent and the explanatory variables. Note that the trough responses s_i have a negative sign as output falls in response to a contractionary monetary policy shock. Thus, based on the discussion in Section 2 we expect $\widehat{\beta}^{gfal} > 0$ if global financial cycle effects reduce monetary policy effectiveness, and $\widehat{\beta}^{nfx} < 0$ if net foreign currency exposure effects strengthen monetary policy effectiveness.

As in Georgiadis (2015) the results in Table 5 suggest that labour market rigidities and industry structure have a statistically significant impact on monetary policy effectiveness. Moreover, when entered simultaneously in the regression both $gfal_i$ and nfx_i have a statistically significant impact on monetary policy effectiveness. In particular, in line with the discussion in Section 2 the results suggest that global financial cycle effects weaken monetary policy effectiveness ($\widehat{\beta}^{gfal} > 0$). Also in line with the discussion in Section 2, the results suggest that net foreign currency exposure effects amplify monetary policy effectiveness ($\widehat{\beta}^{nfx} < 0$). The results in Table 5 imply that the global financial cycle and net foreign currency exposure effects are also economically significant. Specifically, a one-standard deviation increase in nfx_i is associated with an additional fall in output by 9 basis points in response to a monetary policy tightening ($.43 \times -.22$); this is sizeable, as the mean trough response of output across euro area economies is 24 basis points (see Table 4). Similarly, a one-standard deviation increase in $gfal_i$ is associated with a fall in output in response to a tightening of monetary policy that is dampened by 9 basis points ($.57 \times .15$).

4.2 The Role of Financial Globalisation for Monetary Policy Effectiveness Across Demand Components within Economies

We augment euro area economies' VARX models by private consumption, gross fixed capital formation and credit one at a time and obtain the responses of these variables to a contractionary euro area monetary policy shock.[17,18] Figures 4 to 6 document that private consumption, gross fixed capital formation and credit fall in all euro area economies in response to a monetary

[15] The dependent variable in Equation (7) is generated in a first stage. The consequence of estimation uncertainty in the dependent variable is to magnify the variance of the regression error u_i, and thereby the variance of the estimates $\widehat{\beta}^{gfal}$ and $\widehat{\beta}^{nfx}$.

[16] See Appendix C for a description of the construction of the indicators of labor market rigidities and industry structure.

[17] The data for credit are taken from Bank for International Settlements (2013).

[18] The impulse responses are very similar if we we add private consumption, gross fixed capital formation and credit simultaneously as endogenous variables in the MCSGVAR model.

policy tightening. Moreover, the results for the cross-section regression in Equation (7) reported in Table 6 suggest that heterogeneities in the trough responses of private consumption, gross fixed capital formation and credit are generally related to differences in economies' susceptibility to net foreign currency exposure and global financial cycle effects. Specifically, private consumption and gross fixed capital formation decline more strongly in response to a monetary policy tightening in euro area economies which have higher net foreign currency exposures. At the same time, stronger susceptibility to global financial cycle effects is associated with a dampened impact of monetary policy on gross fixed capital formation, but not on private consumption. These results are consistent with the hypothesis that net foreign currency exposure effects occur on the balance sheets of households and non-financial firms, and are associated with contractions in consumption and investment spending. Moreover, the evidence is consistent with the hypothesis that the effects of monetary policy on investment are dampened for firms that are able to tap foreign financial markets in more financially integrated economies. In contrast, the results for the responses of credit to a monetary policy tightening do not suggest that financial intermediaries restrict lending due to negative exchange rate valuation effects on their balance sheets: The fall in credit appears to *follow* that in consumption and gross fixed capital formation (see Figures 4 to 6), and heterogeneities in the trough responses of credit are not linked statistically significantly to differences in economies' net foreign currency exposure and susceptibility to global financial cycle effects (see Table 6).

4.3 Expanded Country Sample

Considering only euro area economies has the advantages (i) that we need to control for fewer country characteristics in the cross-section regression in Equation (7) as euro area economies are more similar to each other along a number of dimensions—such as financial market structure or trade openness—than a randomly picked country pair from a broader sample; (ii) that we can identify exactly the same monetary policy shock and impose exactly the same monetary policy behaviour during the reversion back to the steady state for all euro area economies; (iii) that all euro area economies have a flexible exchange rate, which is critical for net foreign currency exposure effects; (iv) that the data for the traditional determinants of monetary policy effectiveness in $\boldsymbol{w}_i$ in Equation (7) is readily available for euro area economies but often not for emerging market economies (see Appendix C). At the same time, the euro area sample is rather small implying few degrees of freedom, which, some might argue, could call into question our inference. Moreover, we would like to know whether our results from the euro area sample also apply to non-euro area economies. Therefore, in addition to the euro area sample we consider an expanded country sample which includes non-euro area advanced and emerging market economies as well. In particular, in the expanded country sample we consider all economies for which we were able to identify monetary policy shocks based on analogous sign restrictions in the MCSGVAR model as for the euro area, and for which we were able to collect data on the

controls in the cross-section regression in Equation (7). The resulting expanded country sample includes 36 euro area and non-euro area economies.

The trough responses of real GDP to a local monetary policy shock for all economies in the expanded country sample are shown in Figure 7 and the descriptive statistics are reported in Tables 7 and 8. The results for the cross-section regression in Equation (7) for the expanded country sample are reported in Table 9. If we do not control for additional country characteristics in the expanded country sample in column (2) the results from the euro area sample reproduced in column (1) are not recovered. However, this is consistent with the hypothesis that we need to control for additional country characteristics when we add a wide range of rather disparate advanced and emerging market economies to the euro area economies in the sample. Notice, for example, that the expanded country sample includes economies as diverse as, for example, Indonesia and Canada. It is unlikely that differences in labor market rigidities, industry structure and financial integration patterns can explain the bulk of heterogeneities in monetary policy effectiveness in this diverse set of economies. Once domestic financial market development, trade openness, euro area contiguity and euro area membership are controlled for, our results from the euro area sample in column (1) are recovered in the expanded country sample in column (3).[19]

It is important to examine more closely the role of exchange rate flexibility in the expanded country sample. In particular, while theory suggests that exchange rate flexibility is critical for net foreign currency exposure effects (see Section 2), the extent of exchange rate flexibility differs across economies in the expanded country sample. Moreover, how flexible an economy's exchange rate needs to be in order for net foreign currency exposure effects to materialise and be quantitatively significant is unclear. At a minimum, ceteris paribus, net foreign currency exposure effects should be larger the more flexible an economy's exchange rate is. We test for the relevance of the degree of exchange rate flexibility for net foreign currency exposure effects by estimating the cross-section regression in Equation (7) for the expanded country sample with an interaction term between net foreign currency exposures and exchange rate flexibility. The relevant coefficient estimates reported in Table 9 in the column labelled "NFX x ERF" are not statistically significant individually. However, for economies with a sufficiently flexible exchange rate regime the overall marginal effect of net foreign currency exposure is negative and statistically significant (see Figure 8).[20]

[19] The euro area dummy may capture a bias arising from the fact that the data for gross foreign asset and liability positions for euro area economies from Lane and Milesi-Ferretti (2001, 2007) include intra-euro area holdings and that euro area economies maintain a stable nominal exchange rate vis-à-vis their main trading partners. The euro area contiguity dummy may capture the strong trade and financial ties of these economies with the euro area, and possibly the effects of a regional financial cycle with the euro area at its center.

[20] For the robustness checks for the expanded country sample that we carry out in Section 5 we will consider the results from the cross-section regression in Equation (7) for the expanded country sample including only economies with sufficiently flexible exchange rate regimes.

4.4 Cumulated Impact of Financial Globalisation on Monetary Policy Effectiveness

Whether financial globalisation amplifies or weakens monetary policy effectiveness depends on the relative magnitude of global financial cycle and net foreign currency exposure effects. To shed light on which of these competing forces has had a larger impact on monetary policy effectiveness since the 1990s, we calculate the actual cumulated partial effects of $gfal_i$ and nfx_i within economies over time implied by the estimation results for Equation (7). Specifically, consider the panel version of the cross-section regression in Equation (7)

$$s_{it} = \alpha + \boldsymbol{\gamma} \cdot \boldsymbol{w}_{it} + \beta^{gfal} \cdot gfal_{it} + \beta^{nfx} \cdot nfx_{it} + u_{it}, \tag{8}$$

and take the first difference

$$\Delta s_{it} = \boldsymbol{\gamma} \cdot \Delta \boldsymbol{w}_{it} + \beta^{gfal} \cdot \Delta gfal_{it} + \beta^{nfx} \cdot \Delta nfx_{it} + \Delta u_{it}. \tag{9}$$

Assuming that the variation within economies over time is governed by the same forces as the variation in the cross-section—a fundamental assumption in panel data econometrics—we can determine by how much changes in $gfal_i$ and nfx_i have altered the effect of monetary policy on output over the sample period based on Equation (9) according to

$$\widehat{\Delta s}_{it}^{gfal} \equiv \sum_{j=1}^{t} \widehat{\beta}^{gfal} \cdot \Delta gfal_{ij}, \tag{10}$$

$$\widehat{\Delta s}_{it}^{nfx} \equiv \sum_{j=1}^{t} \widehat{\beta}^{nfx} \cdot \Delta nfx_{ij}. \tag{11}$$

Given the negative sign of the trough responses of output to a contractionary monetary policy shock s_i, the positive sign of the coefficient estimate $\widehat{\beta}^{gfal}$ and the definition of $gfal_i$, a positive value for $\widehat{\Delta s}_{it}^{gfal}$ implies that monetary policy effectiveness has weakened due to global financial cycle effects. Analogously, a negative value for $\widehat{\Delta s}_{it}^{nfx}$ implies a strengthening of monetary policy effectiveness due to net foreign currency exposure effects. To facilitate the comparison of the magnitudes of global financial cycle and net foreign currency exposure effects, in the following we *reverse* the sign of $\widehat{\Delta s}_{it}^{nfx}$: positive values for $\widehat{\Delta s}_{it}^{nfx}$ reflect a strengthening of monetary policy effectiveness. For the calculation of $\widehat{\Delta s}_{it}^{nfx}$ and $\widehat{\Delta s}_{it}^{gfal}$ for the euro area economies we take the coefficient estimates from the euro area sample in Table 5, and for the non-euro area economies we take the coefficient estimates from the cross-section regression of Equation (7) for the expanded country sample including only economies with an exchange rate flexibility assessment that is associated with a negative and statistically significant coefficient estimate for net foreign currency exposure (see Figure 8). For those economies which had a lower exchange rate flexibility over 1999-2012 the results would be interpreted as the extent to which financial

globalisation would have changed monetary policy effectiveness if they had had a more flexible exchange rate regime.

The upper left-hand side panel of Figure 9 shows the GDP-weighted averages of the cumulation of Equations (10) and (11) across euro area economies over 1999-2012. The lower left-hand side panel depicts the sum of the cumulated global financial cycle and net foreign currency exposure effects from Equations (10) and (11). The results suggest that financial globalisation has weakened monetary policy effectiveness in the euro area, as global financial cycle effects have outweighed net foreign currency exposure effects. In particular, the results suggest that for the typical euro area economy financial globalisation has reduced the trough response of output to a contractionary monetary policy shock by around 1 basis point in absolute terms, which is little relative to the mean trough response across euro area economies of about 24 basis points (see Table 4). Therefore, while our results for the euro area are qualitatively consistent with the dilemma hypothesis, quantitatively they are far from suggesting that financial globalisation has annihilated monetary policy effectiveness.

The middle and right-hand side panels in Figure 9 display the change in monetary policy effectiveness due to global financial cycle and net foreign currency exposure effects for a broad set of non-euro area advanced and emerging market economies (excluding the US).[21] The results suggest that for the typical advanced and emerging market economy changes in monetary policy effectiveness due to net foreign currency exposure effects have dominated those due to global financial cycle effects. The change in monetary policy effectiveness due to financial globalisation is also economically significant: Given the average trough response of around 12 basis points an additional fall in output by 3 basis points represents a strengthening of monetary policy effectiveness by about 25% (see Tables 7 and 8). Financial globalisation has thus strengthened monetary policy effectiveness appreciably for the typical non-euro area advanced and emerging market economy, which is inconsistent with the dilemma hypothesis.

As the data on gross foreign asset and liability positions are available prior to 1999, we can calculate the cumulated partial effects of the global financial cycle and net foreign currency exposure effects on changes in monetary policy effectiveness according to Equations (10) and (11) already from the early 1990s.[22] The results displayed in Figure 10 are consistent with our findings for 1999-2012, but provide additional insights. In particular, the strengthening of monetary policy effectiveness due to financial globalisation in non-euro area advanced economies did not start only in 1999. In contrast, financial globalisation has amplified monetary policy effectiveness in emerging market economies only from the early 2000s onwards. This is consistent

[21] We carry out the calculations for all non-euro area economies which had an exchange rate regime assessment above four on average over 1999-2009 according to Ilzetzki et al. (2010). We thus do not consider economies with a "pre-announced peg" or "currency board arrangement", a "pre-announced horizontal band that is narrower than or equal to +/-2%" and with a "de facto peg". Denmark, the Baltics and Bulgaria are thereby not considered in this exercise.

[22] We do not consider euro area economies in this exercise due to the structural break stemming from the introduction of the euro in 1999.

with the rise in net foreign currency exposures after the Asian financial crisis, when emerging market economies increasingly issued foreign debt in domestic currency, thereby redeeming from "original sin", (see also Burger et al., 2010; Hausmann and Panizza, 2011; Benetrix et al., forthcoming; Burger et al., 2014; Hale et al., 2014). Thus, considering the impact of financial globalisation on monetary policy effectiveness over a longer time period provides even more evidence which is inconsistent with the dilemma hypothesis.

4.5 Heterogeneity within Country Groups

It is noteworthy that the findings for the euro area as a whole do not apply homogenously across individual economies. In particular, the top left-hand side panel in Figure 11 plots the change in $gfal_i$ against that in nfx_i over 1999-2012 for each euro area economy. Figure 11 also plots the change in monetary policy effectiveness due to global financial cycle effects against that due to net foreign currency exposure effects in the top right-hand side panel. In the left-hand side panel, the shaded areas indicate the combinations of changes in $gfal_i$ and nfx_i for which the cumulated global financial cycle and net foreign currency exposure effects cancel each other out, given the estimates $\widehat{\beta}^{gfal}$ and $\widehat{\beta}^{nfx}$ in Equation (7). Similarly, in the right-hand side panel the shaded areas are separated by the 45-degree line, which indicates economies for which global financial cycle effects outweigh net foreign currency exposure effects and vice versa. In about half of the euro area economies, changes in monetary policy effectiveness due to global financial cycle effects have dominated those due to net foreign currency exposure effects and vice versa. Interestingly, while the results at the group level hide substantial heterogeneity at the country level for the non-euro area advanced economies (middle row), the impact of financial globalisation on monetary policy effectiveness has been more homogenous across emerging market economies (bottom row). In particular, financial globalisation has strengthened monetary policy effectiveness only in about half of the non-euro area advanced economies. In contrast, net foreign currency exposure effects have dominated global financial cycle effects in most emerging market economies.

5 Sensitivity Analysis

We consider several robustness checks. First, we examine the sensitivity of our results to the small size of our baseline euro area sample. Second, we explore the sensitivity of our results to the inclusion of additional control variables in Equation (7) in the euro area sample. Third, we introduce additional endogenous variables in the MCSGVAR model. Fourth, we investigate alternative measures of economies' susceptibility to global financial cycle and net foreign currency exposure effects. Finally, we examine modifications of the expanded country sample.

5.1 Sample Size and Outliers in the Euro Area Sample

5.1.1 Robust and Median Regressions

We first obtain robust-to-outlier and median regression estimates (`rreg` and `qreg` in Stata). The results reported in Table 10 suggest that even if the robust estimator identifies Ireland as an outlier and drops it from the regression the results are unchanged. Similarly, the results are also unchanged when we carry out median regressions.[23]

5.1.2 Outliers and Additional Euro Area Economies

Table 10 suggests that our results are also robust to (i) dropping Ireland from the sample (which has a rather high net foreign currency exposure); (ii) dropping Ireland and the Netherlands (which has a rather high net foreign currency exposure as well); (iii) dropping Ireland and Belgium (which has a rather high gross foreign asset and liability position); (iv) dropping Slovenia (as it joined the euro area only in the middle of the sample period); (v) adding Slovakia (as it also maintained a de facto peg to the euro during the sample period); (vi) adding Slovakia and Denmark (which also maintained a de facto peg to the euro during the sample period);[24] (vii) reducing the number of explanatory variables in order to increase the degrees of freedom in the regression by using the first principal component of the standard determinants of monetary policy effectiveness.

5.2 Additional Controls in the Cross-section Regression

5.2.1 Trade Integration

It could be argued that our estimation results for $gfal_i$ pick up the effect of trade integration on monetary policy effectiveness. Indeed, Cwik et al. (2011) show in a New Keynesian DSGE model that trade integration may amplify monetary policy effectiveness. Moreover, trade integration is correlated with financial integration in the data. However, it is unlikely that our findings are biased because trade integration is omitted as an explanatory variable. In line with the prediction of Cwik et al. (2011), the results for the euro area sample reported in Table 11 document that the coefficient estimate for trade integration is negative and not far from conventional significance levels.[25] At the same time, the coefficient estimates for $gfal_i$ and nfx_i are very similar to those from our baseline results.

[23] Added-variable plots provided in the online appendix to this paper and which show the conditional correlations also suggest that our results are not driven by individual observations.

[24] Additional candidates for this exercise are Bulgaria and the Baltics as they also maintained a de facto peg to the euro. However, there are no data for labor market rigidities and/or industry structure for these economies.

[25] We measure trade openness by the logarithm of one plus the sum of exports and imports scaled by an economy's GDP. The data are taken from the World Bank's World Development Indicators.

5.2.2 Domestic Financial Market Development

One could also argue that $gfal_i$ and nfx_i pick up the effect of financial market development on monetary policy effectiveness. On the one hand, it might be that economies with more efficient financial markets display a weaker impact of monetary policy on output as there exist better technologies to alleviate information asymmetries, which are key to credit channel effects. The positive coefficient estimate for $gfal_i$ in the regression of Equation (7) could be driven by this relationship and the positive correlation between financial market development and gross foreign asset and liability positions in the data. On the other hand, economies with more developed financial markets are typically more leveraged, which could be associated with stronger credit channel effects. More developed financial markets may also invest more in foreign assets denominated in foreign currency due to better risk management abilities. As a consequence, the impact of more advanced financial market development on monetary policy effectiveness could also show up as a negative coefficient estimate for nfx_i in Equation (7). However, none of these hypotheses are borne out by the data. The estimation results reported in Table 11 document that including financial market development does not change our baseline results.[26]

5.2.3 Financial Sector Size

Large gross foreign asset and liability positions are typically a feature of economies with large financial sectors (in terms of their contribution to aggregate GDP) which are heavily engaged in cross-border financial intermediation. Monetary policy could be less effective in economies with such financial sectors as international demand for financial intermediation services is not sensitive to domestic interest rates. As a consequence, the positive coefficient estimate for $gfal_i$ could stem from the positive correlation between the size of economies' external balance sheets and the size of their financial sectors, as well as the latter's dampening impact on monetary policy effectiveness. However, the results reported in Table 11 document that when we add the share of total value added accounted for by the financial sector as an explanatory variable the results do not support this hypothesis.[27]

5.2.4 Variable-rate Housing Loans Share

Euro area economies exhibit differences in the share of variable-rate housing loans. Specifically, while only a small fraction of housing loans in France, Belgium and the Netherlands is subject to variable rates, almost all such loans are subject to variable rates in Finland, Slovenia and Ireland; and, as shown in Figure 2 this variation in the importance of variable-rate housing loans

[26] We measure domestic financial market development by the logarithm of one plus private credit relative to GDP. The data are taken from the World Bank's World Development Indicators.

[27] The data are taken from the EU KLEMS database.

aligns broadly with differences in the impact of monetary policy on output across euro area economies. However, the results in Table 11 document that our baseline results are unaffected by the inclusion of the share of variable-rate housing loans as an additional control in Equation (7).[28]

5.2.5 Property Price Bubbles, Stressed Country and Small Country Dummy

Certain developments after the introduction of the euro might have had a bearing on heterogeneities in monetary policy effectiveness in the euro area. In particular, Table 11 reports results from regressions in which we enter the average residential property price increase, as an additional control variable in the cross-section regression in Equation (7); we alternatively add the maximum property price increase as most economies in which house prices had risen strongly in the early 2000s also experienced a collapse before 2009. The results are very similar to those from the baseline.[29] The finding that the coefficient estimates for property price growth in the euro area are positive and statistically significant is consistent with the hypothesis that the effects of a monetary policy tightening on output were weaker in countries in which households experienced and expected future rises in their wealth due to continuous property price increases, which weakened the effectiveness of monetary policy. More generally, our baseline results for the euro area are also recovered if we add a "stressed" country dummy which equals one for Greece, Spain, Italy, Portugal and Ireland, or a "small" country dummy which equals one for Austria, Belgium, Greece, Ireland, Netherlands, Portugal and Slovenia.

5.3 Alternative Specifications of the the MCSGVAR Model

A reduced transmission of short to long-term interest rates is key for the global financial cycle effects hypothesised by Rey (2013). In order to ensure that our results do not hinge on the omission of long-term interest rates we add them as endogenous variables in euro area economies' VARX models, re-estimate the MCSGVAR model, obtain impulse responses to a euro area monetary policy shock, and re-estimate the cross-section regression in Equation (7). Table 12 reports the results (columns labelled "LT rates"). The results are consistent with those from our baseline.

Another variable that plays a key role in the alleged collapse of the trilemma into a dilemma is global investors' risk appetite. Similarly to the omission of long-term interest rates, it is therefore important to ensure that our results do not hinge on the exclusion of a variable reflecting investors' risk appetite from the MCSGVAR model. Table 12 reports the results for estimations of the MCSGVAR model in which we add the VIX as an endogenous variable (columns labelled

[28]The data are obtained from national sources.
[29]The data for property prices are obtained from the ECB and national sources.

"VIX").[30] The results for this alternative specification are again consistent with those from our baseline.

Our results are also unchanged if we allow the lag orders to be at most two rather than only one. Specifically, Table 12 reports the results for the cross-section regression in Equation (7) when we consider as dependent variable the trough response of real GDP obtained from estimations of the MCSGVAR model in which the lag orders can be up to two depending on lag length selection criteria (column labelled "Lag 2"). The results suggest that restricting the lag orders to be at most one in our baseline specification is not critical for our results.[31]

5.4 Alternative Samples

Our results are also obtained in various modifications of the expanded country sample. In particular, Table 13 reports results for (i) a sample including only advanced economies (column labelled "AEs"); (ii) a sample in which we collapse euro area economies into a euro area aggregate using GDP-weights (column labelled "EA aggr."); and (iii) a sample without euro area economies (column labelled "No EA"). The results—in particular for net foreign currency exposures—are very similar to those from our baseline.

5.5 Alternative Measures of Economies' Susceptibility to Global Financial Cycle and Net Foreign Currency Exposure Effects

5.5.1 Exchange-rate Response-weighted Net Foreign Currency Exposure

Figure 12 shows that the exchange rate responses to a contractionary euro area monetary policy shock differ across currencies. This finding suggests that our baseline measure of net foreign currency exposure might not be fully appropriate, as it reflects the change in an economy's net foreign asset and liability position that occurs in response to a *uniform* depreciation of the domestic currency vis-à-vis all foreign currencies. For example, suppose that Portugal's foreign assets were all denominated in sterling and that its foreign liabilities were all denominated in euro; also assume that the euro's exchange rate vis-à-vis sterling did not respond to a euro area

[30] We enter the VIX as an endogenous variable in the oil block, which can then be interpreted as modelling the evolution of global variables more generally rather than only oil prices. The VIX is determined as a function of global (GDP-weighted) output growth, consumer-price inflation, and interest rates, as well as oil-price inflation. Analogously to oil-price inflation, The VIX enters economies' VARX models as a "foreign" variable.

[31] In the online appendix to this paper we show that the cumulated impact of global financial cycle and net foreign currency exposure effects on monetary policy effectiveness are very similar to those from our baseline—or even suggest a slight strenthening of monetary policy effectiveness—for all the robustness checks considered for the euro area economies considered up to this point. For most of the robustness checks considered below the cumulated impact of global financial cycle and net foreign currency exposure effects on monetary policy effectiveness cannot be determined, as the data for the alternative measures of economies' susceptibility to global financial cycle effects are not available as time series.

monetary policy shock, while the exchange rates vis-à-vis other currencies did. In this case, although Portugal's net foreign currency exposure as defined in Equation (1) would clearly not be nil, exchange rate movements in response to a euro area monetary policy shock would not elicit exchange rate valuation effects on its external balance sheet.

In order to address this issue we construct a measure of net foreign currency exposure which takes into account our finding that some currencies depreciate more strongly against the euro in response to a euro area monetary policy tightening than others, thereby eliciting larger exchange rate valuation effects. In particular, recall the definition of the net foreign currency exposure in Equation (1)

$$nfx_{it} = (s_{it}^A \cdot \omega_{it}^A - s_{it}^L \cdot \omega_{it}^L) \cdot gfal_{it} \tag{12}$$

$$= \left[s_{it}^A \cdot \sum_{j=1, j \neq i}^{N} \omega_{ijt}^A - s_{it}^L \cdot \sum_{j=1, j \neq i}^{N} \omega_{ijt}^L \right] \cdot gfal_{it}, \tag{13}$$

where j represents currencies other than the euro. Building on this, we define

$$\widetilde{nfx}_{it} = \frac{1}{\sum_{j=1, j \neq i}^{N} irf_j^{fx}} \left[s_{it}^A \cdot \sum_{j=1, j \neq i}^{N} \omega_{ijt}^A \cdot irf_j^{fx} - s_{it}^L \cdot \sum_{j=1, j \neq i}^{N} \omega_{ijt}^L \cdot irf_j^{fx} \right] \cdot gfal_{it}, \tag{14}$$

where irf_j^{fx} represents the maximum appreciation of the euro vis-à-vis currency j in response to a euro area monetary policy shock displayed in Figure 12. According to this measure of net foreign currency exposure, currencies against which the euro exhibits a stronger appreciation in response to a monetary policy tightening enter with a larger weight. The results from using this measure of net foreign currency exposure in the regression of Equation (7) are reported in Table 14 for the euro area sample and in Table 15 for the expanded country sample.[32] The results are very similar to those from the baseline.[33]

5.5.2 IMF CPIS Bilateral Portfolio Holdings Data

One could argue that for the gross foreign asset and liability positions we should use the IMF's CPIS data rather than those from Lane and Milesi-Ferretti (2007), as the latter do not net out intra-euro area holdings and might thereby mis-measure economies' susceptibility to global financial cycle effects, in particular for euro area economies. However, the results reported in Tables 14 and 15 document that our baseline findings are recovered both in the euro area and

[32] Recall from Section 4.3 that for the robustness checks in the expanded country sample we only consider economies with an exchange rate flexibility assessment of at least eleven according to the classification of Ilzetzki et al. (2010). However, the results for the robustness checks regarding alternative measures of economies' susceptibility to global financial cycle and net foreign currency exposure effects are hardly different if we consider the full expanded country sample without a minimum exchange rate flexibility requirement.

[33] We do not calculate this alternative measure of net foreign currency exposure for Slovenia as it maintained a flexible exchange rate vis-à-vis the euro for half of the sample period.

in the expanded country sample if we use gross foreign asset and liability positions that exclude intra-euro area holdings.

5.5.3 BIS Data on Cross-border Banking Claims

Instead of the gross foreign asset and liability positions from Lane and Milesi-Ferretti (2001, 2007) we next consider the sum of an economy's international banking assets and liabilities. Analogous to the IMF CPIS data, the BIS banking statistics data allow us to construct gross cross-border banking claims that exclude intra-euro area exposures. Tables 14 and 15 report the results from the estimation of Equation (7) using this alternative measure of economies' susceptibility to global financial cycle effects. As in the baseline results, the coefficient estimate for the net foreign currency exposure has a negative sign and is statistically significant. Even though the coefficient estimate for gross banking assets and liabilities has a positive sign, it is not statistically significant at conventional significance levels. The evidence based on extra-euro area gross cross-border banking assets and liabilities is therefore also inconsistent with the dilemma hypothesis.

5.5.4 Gross Foreign Asset and Liability Positions Relative to Domestic Credit

Whether global financial cycles can affect domestic financial conditions might also hinge on the size of an economy's external balance sheet relative to that of its domestic financial markets. In particular, if an economy's external balance sheet is small relative to domestic credit—even if the former is large in absolute terms compared to other economies—swings in capital flows are unlikely to have an impact on domestic financial conditions. We therefore consider the ratio of the gross foreign asset and liability position to domestic credit provided by the banking sector.[34] As in the baseline results, the coefficient estimate for the net foreign currency exposure reported in Tables 14 and 15 has a negative sign and is statistically significant. The coefficient estimate for gross foreign assets and liabilities relative to domestic credit has a positive sign and is statistically significant, at least in the expanded country sample. Thus, the results are in line with those from the baseline.

5.5.5 Gross Foreign Asset and Liability Buckets

The distribution of gross foreign asset and liability positions is skewed, as some economies exhibit very high values. One way to ensure that our results are not driven by extreme observations is to allocate economies into buckets that reflect groups of economies with different, discrete degrees of susceptibility to global financial cycle effects. Specifically, we allocate economies into

[34] The data for credit are again taken from the World Bank's World Development Indicators.

four buckets defined by the 25%, 50% and 75% percentiles of the cross-country distribution of gross foreign asset and liability positions. As reported in Tables 14 and 15, the results are again in line with those from the baseline.

5.5.6 Price-based Measure of Global Financial Integration

Tables 14 and 15 report the results obtained from replacing the gross foreign asset and liability position by the correlation between an individual economy's and US equity returns as an alternative measure for financial market integration and susceptibility to global financial cycle effects (see Quinn and Voth, 2008). The coefficient estimate for net foreign currency exposures is again negative and statistically significant, in line with our baseline results. In contrast, while the coefficient estimate for equity return correlations is positive, it is at best only marginally statistically significant. The results from this robustness check are therefore in line with our baseline results and inconsistent with the dilemma hypothesis.

5.5.7 Share of US/UK-Owned Banks and of Credit Extended

We also consider the share of US/UK-owned banks as well as the share of credit that is extended by US/UK banks as alternative measures of economies' susceptibility to global financial cycle effects.[35,36] For example, Goldberg (2013) finds that domestic interest rates co-move more strongly with those in the base economy even in the presence of flexible exchange rates if a larger share of domestic credit is provided by global banks. The results for the net foreign currency exposures reported in Tables 14 and 15 are again very similar to those from our baseline. The coefficient estimates for the share of US/UK-owned banks in the domestic economy and the share of credit in the economy that is extended by US/UK banks are not statistically significant in most cases, which is not consistent with the dilemma hypothesis.

[35] For the share of US/UK-owned banks we draw on the data provided by Claessens and Horen (2014). For the share of credit that is extended by US/UK banks we consider the ratio of the sum of cross-border banking claims of US and UK banks obtained from the BIS banking statistics relative to total credit to the private sector taken from the World Development Indicators.

[36] A superior measure of economies' susceptibility to global financial cycle effects based on the activity of globally active banks would be the share of credit in an economy extended by *domestic and foreign* globally active banks. Unfortunately, the data needed to construct this measure are not available to us. Specifically, we would need data on credit broken down by *residence of borrower*. Such data—typically at the bank level—are available only to supervisors (see, for example, Cetorelli and Goldberg, 2012). While databases such as Bankscope do provide bank-level loan data, they do not provide information on the residence of the borrower. Alternatively, one could use household and firm-level credit data broken down by *residence and entity of lender*, which are, however, even harder to obtain.

5.5.8 *De jure* Measures of Economies' Susceptibility to Global Financial Cycle Effects

Another alternative measure for economies' susceptibility to global financial cycle effects are *de jure* indicators of financial openness. These measures are typically constructed based on readings of the IMF's assessment of economies' legal regulations concerning capital account transactions in its Annual Report on Exchange Arrangements and Exchange Restrictions. In general, we think that *de jure* measures are unlikely to reflect adequately economies' susceptibility to global financial cycle effects. In particular, while economies' susceptibility to global financial cycle effects is likely to depend on their actual integration with the rest of the world, *de jure* measures reflect economies' financial openness/lack of capital account restrictions from a legal point of view. Nevertheless, we re-estimate the cross-section regression in Equation (7) for the expanded country sample considering the *de jure* measure of capital account openness constructed by Chinn and Ito (2003).[37]

In particular, we first replace the gross foreign asset and liability positions by the Chinn and Ito (2003) index as an alternative measure for economies' susceptibility to global financial cycle effects in the expanded country sample. The results reported in Table 16 suggest that our baseline results—in particular for net foreign currency exposures—generally do not hinge on the use of gross foreign asset and liability positions as a measure for economies' susceptibility to global financial cycle effects (columns (2) and (3)). Second, we consider a sample in which we collapse individual euro area economies into a euro area aggregate using GDP weights (column (5)). The results are again consistent—in particular for net foreign currency exposures—with those from our baseline. Third, we consider a sample without euro area economies (column (7)). Again, the results—in particular for net foreign currency exposures—are very similar to those from our baseline.

It is noteworthy that the coefficient estimates for the Chinn and Ito (2003) index are not statistically significant in any of the samples we consider. We interpret this result as indicating that *de jure* measures for capital account openness are poor proxies for economies' susceptibility to global financial cycle effects, as explained above. At a minimum, the results for this *de jure* measure of economies' susceptibility to global financial cycle effects are not consistent with the dilemma hypothesis.

6 Conclusion

This paper investigates whether the classic Mundell-Flemming trilemma has morphed into a dilemma due to financial globalisation since the 1990s. We estimate the output response to

[37] As we show in the online appendix to this paper the results are very similar if we use the capital account openness measures of Quinn and Toyoda (2008) or Fernández et al. (2015).

a contractionary local monetary policy shock for a sample of advanced and emerging market economies using an MCSGVAR model, and examine whether heterogeneities in monetary policy effectiveness can be explained by cross-country differences in global financial integration patterns. The results suggest that the impact of financial globalisation on monetary policy effectiveness depends on the relative importance of two salient features of financial globalisation: the size of economies' external balance sheets, which determines the extent to which global financial cycles influence domestic financial conditions and thereby reduce monetary policy effectiveness; and the currency exposure of economies' external balance sheets, which may give rise to exchange rate valuation effects that strengthen monetary policy effectiveness. As the latter can only play out if an economy's exchange rates is flexible, the choice of the exchange rate regime remains critical for monetary policy autonomy under free capital mobility and in the presence of global financial cycles. Hence, our results suggest that the trilemma remains valid.

Our results have implications for policy and academia. From a policy perspective, insofar as valuation effects on economies' external balance sheets arising from exchange rate movements grow in importance, central banks might need to re-assess the way their monetary policy transmits to the economy. In particular, while the traditional interest rate channel might lose significance due to the increasing influence of global financial markets on domestic financial conditions, the exchange rate channel may gain importance due to rising net foreign currency exposures of economies' external balance sheets. As a result, the exchange rate channel matters not only because of its role for import and export prices, but also because of wealth effects. From an academic perspective, our finding that exchange rate valuation effects on economies' external balance sheets have implications for the transmission of monetary policy suggests that these should become a standard element in DSGE models. Specifically, the rotation in the transmission channels of monetary policy may play an economically significant role in the design of optimal monetary policy and the gains from international monetary policy coordination. Finally, future research should investigate possible heterogeneities in the importance of net foreign currency exposure effects across the public, household, corporate and financial sectors.

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A Global Solution of the MCSGVAR Model

Denoting by $\boldsymbol{z}_{it} = (\boldsymbol{x}'_{it}, \boldsymbol{x}^{*\prime}_{it})'$, $\boldsymbol{A}_{i0} = (\boldsymbol{I}_{k_i}, -\boldsymbol{\Gamma}_{i0})$, $\boldsymbol{A}_{ij} = (\boldsymbol{\Phi}_{ij}, \boldsymbol{\Gamma}_{ij})$, and $q_i = max(p_i, p^*_i)$, Equation (2) can be written as

$$\boldsymbol{A}_{i0} \cdot \boldsymbol{z}_{it} = \boldsymbol{a}_i + \sum_{j=1}^{q_i} \boldsymbol{A}_{ij} \cdot \boldsymbol{z}_{i,t-j} + \boldsymbol{u}_{it}. \tag{A.1}$$

The vector of endogenous and "foreign" variables of unit i can then be linked to the vector which stacks the endogenous variables of all units by $\boldsymbol{z}_{it} = \boldsymbol{L}_i \boldsymbol{x}_t$, where $\boldsymbol{L}_i$ is a link matrix containing the weights that are used to aggregate all other units' endogenous variables into unit i's "foreign" variable $\boldsymbol{x}^*_{it}$. Equation (A.1) can then be written as

$$\boldsymbol{A}_{i0} \cdot \boldsymbol{L}_i \cdot \boldsymbol{x}_t = \boldsymbol{a}_i + \sum_{j=1}^{q_i} \boldsymbol{A}_{ij} \cdot \boldsymbol{L}_i \cdot \boldsymbol{x}_{t-j} + \boldsymbol{u}_{it}. \tag{A.2}$$

With $q = max(q_1, q_2, \ldots, q_N)$ the unit-specific models in Equation (A.2) can now be stacked to deliver

$$\boldsymbol{G}_0 \cdot \boldsymbol{x}_t = \boldsymbol{a} + \sum_{j=1}^{q} \boldsymbol{G}_j \cdot \boldsymbol{x}_{t-j} + \boldsymbol{u}_t, \tag{A.3}$$

where

$$\boldsymbol{G}_0 = \begin{bmatrix} \boldsymbol{A}_{10}\boldsymbol{L}_1 \\ \boldsymbol{A}_{20}\boldsymbol{L}_2 \\ \vdots \\ \boldsymbol{A}_{N0}\boldsymbol{L}_N \end{bmatrix}, \quad \boldsymbol{a} = \begin{bmatrix} \boldsymbol{a}_1 \\ \boldsymbol{a}_2 \\ \vdots \\ \boldsymbol{a}_N \end{bmatrix}, \quad \boldsymbol{G}_j = \begin{bmatrix} \boldsymbol{A}_{1j}\boldsymbol{L}_1 \\ \boldsymbol{A}_{2j}\boldsymbol{L}_2 \\ \vdots \\ \boldsymbol{A}_{Nj}\boldsymbol{L}_N \end{bmatrix}, \quad \boldsymbol{u}_t = \begin{bmatrix} \boldsymbol{u}_{1t} \\ \boldsymbol{u}_{2t} \\ \vdots \\ \boldsymbol{u}_{Nt} \end{bmatrix}. \tag{A.4}$$

The global solution of the MCSGVAR model is then given by

$$\boldsymbol{x}_t = \boldsymbol{b} + \sum_{j=1}^{q} \boldsymbol{F}_j \cdot \boldsymbol{x}_{t-j} + \boldsymbol{\epsilon}_t, \tag{A.5}$$

where $\boldsymbol{b} = \boldsymbol{G}_0^{-1}\boldsymbol{a}$, $\boldsymbol{F}_j = \boldsymbol{G}_0^{-1}\boldsymbol{G}_j$, and $\boldsymbol{\epsilon}_t = \boldsymbol{G}_0^{-1}\boldsymbol{u}_t$. Estimation of the MCSGVAR model amounts to (i) estimating each unit's VARX model in Equation (2) by ordinary least squares, (ii) using the link matrices $\boldsymbol{L}_i$ in stacking the relevant estimated matrices as in Equation (A.4), and (iii) obtaining the global solution in Equation (A.5).

B Interpretation of Net Foreign Currency Exposure

Consider an economy's net foreign asset and liability position relative to GDP, $nfal_{it}$, denoting by Y_{it} nominal GDP, by A_{it} and L_{it} foreign assets and liabilities, and by w^A_{it} (w^L_{it}) the share of

foreign assets (liabilities) which is denominated in foreign currency

$$nfal_{it} = \frac{A_{it} - L_{it}}{Y_{it}} = \frac{w_{it}^A A_{it} + (1 - w_{it}^A)A_{it} - w_{it}^L L_{it} - (1 - w_{it}^L)L_{it}}{Y_{it}}. \tag{B.1}$$

After a uniform percentage change in the price of economy i's currency relative to all foreign currencies by Δfx, the value of the net foreign asset and liability position relative to GDP is given by

$$nfal'_{it} = \frac{(1 + \Delta fx)w_{it}^A A_{it} + (1 - w_{it}^A)A_{it} - (1 + \Delta fx)w_{it}^L L_{it} - (1 - w_{it}^L)L_{it}}{Y_{it}}. \tag{B.2}$$

The difference to the initial net foreign asset and liability position relative to GDP is given by

$$\begin{aligned} \Delta nfa_{it} &= nfal'_{it} - nfal_{it} \\ &= \frac{\Delta fx(w_{it}^A A_{it} - w_{it}^L L_{it})}{Y_{it}} \\ &= \Delta fx \cdot \frac{(w_{it}^A A_{it} - w_{it}^L L_{it})}{Y_{it}} \frac{A_{it} + L_{it}}{A_{it} + L_{it}} \\ &= \Delta fx \cdot (w_{it}^A s_{it}^A - w_{it}^L s_{it}^L) \cdot gfal_{it} \\ &= \Delta fx \cdot nfx_{it}. \end{aligned} \tag{B.3}$$

C Construction of Indicators for Industry Structure and Labor Market Rigidities

The construction of the industry structure and labour market rigidities indicators is the same as in Georgiadis (2015). The metric for industry structure is calculated as the sum of standardised data for the share of aggregate output accounted for by (durables) manufacturing, construction and services; the sign for services is reversed, as a higher share of services is associated with demand being less interest rate-sensitive. We take the data from the OECD STAN Database and the World Bank's World Development Indicators.

The labour market rigidities metric consists of two components: real wage and unemployment rigidities. For real wage rigidities, we consider union density taken from the OECD as well as the Social Security Index from Botero et al. (2004) which summarises information on old age, disability, death, sickness, health and unemployment benefits. For unemployment rigidities, we also consider two measures. First, we consider the OECD's Strictness of Employment Protection Index, which is based on 21 items covering three aspects of employment protection: individual dismissal of workers with regular contracts, additional provisions for collective dismissals and the regulation of temporary contracts. Second, we consider the Regulation of Labour Index from Botero et al. (2004) which summarises information on alternative employment contracts, the

cost of increasing hours worked and firing workers, dismissal procedures, labour union power and collective disputes. The individual labour market rigidities series are standardised and summed, with a negative sign for the variables for unemployment rigidities, as they dampen the response of output to a shock.

D Imputation of Missing Data for the Explanatory Variables in Equation (7) in the Expanded Country Sample

We use the share of manufacturing to impute missing data for the durable goods manufacturing share for Brazil, Chile, Indonesia, Malaysia, Russia, Thailand and South Africa. We use the Regulation of Labour Index and Social Security Index to impute missing data for union density for Brazil, Indonesia, Israel, Malaysia, Russia, Thailand and South Africa. We use the Social Security Index to impute missing data for the Strictness of Employment Protection Indicator for Malaysia and Thailand. For the share of construction for Brazil, Chile, Indonesia, Thailand, Russia and South Africa we resort to data from the World-Input-Output Database and national sources.

E Tables

Table 1: Gross Foreign Asset and Liability Positions and Net Foreign Currency Exposures

	Change 1999-2009		2009 level	
	GFA/GDP (log)	Net FX exp.	GFA/GDP (log)	Net FX exp.
AUT	0.72	0.58	1.91	0.25
BEL	0.54	0.59	2.39	0.60
DEU	0.45	0.16	1.64	0.22
ESP	0.47	0.11	1.49	0.16
FIN	0.25	0.25	1.71	0.20
FRA	0.43	0.01	1.78	0.20
GRC	0.64	0.27	1.43	0.25
IRL	0.92	1.54	3.43	2.69
ITA	0.18	0.22	1.25	0.09
NLD	0.42	0.49	2.22	0.95
PRT	0.61	0.21	1.77	0.18
SVN	0.63	0.36	1.21	0.40
EA	0.42	0.21	1.68	0.28
AEs	0.32	0.39	1.45	0.94
EMEs	0.13	0.32	0.81	0.28

Note: The table reports the changes in economies' gross foreign asset and liability positions relative to GDP as well as net foreign currency exposures over 1999-2009; the table also reports their levels in 2009. For the gross foreign asset and liability position we report the logarithm of one plus the original value. The advanced economies exclude the euro area and the US.

Table 2: Country Groups

Region	*Countries*
Indiv. countries/units	ALB, AUS, AUT, BAL, BEL, BGR, BOL, BRA, CAN, CHE, CHL, CHN, COL, CRI, CZE, DEU, DNK, ECB, EGY, ESP, FIN, FRA, GBR, GRC, HKG, HRV, HUN, IDN, IND, IRL, ISR, ITA, JOR, JPN, KOR, LUX, MAR, MEX, MYS, NLD, NOR, NZL, OIL, OPC, PER, PHL, POL, PRT, PRY, ROU, RUS, SGP, SVK, SVN, SWE, THA, TUR, USA, ZAF
Baltics (BAL)	EST, LVA, LTU
Oil exporting countries (OPC)	VEN, ECU, SAU

Note: The table reports the countries included and details the composition of the country groups.

Table 3: Data Sources

Unit	Real GDP	Prices	Short-term interest rates	Oil prices
ALB	A914GDPC@IMFWEO	H914PC@EMERGE	C914IC@IFS	
AUS	S193NGCD@G10	H193PC@G10	N193RI3@G10	
AUT	J122GDPT@EUDATA	H122PC@G10		
BEL	S124NGCD@G10	H124PC@G10		
BGR	J918GDPT@EUDATA	H918PC@EMERGE	C918IM@IFS	
BOL	H218NGCD@EMERGE	H218PC@EMERGE	C218IM@IFS	
BRA	H223NGCD@EMERGE	H223PC@EMERGE	C223IM@IFS	
CAN	S156NGCD@G10	H156PC@G10	C156IM@IFS	
CHE	S146NGCD@G10	H146PC@G10	N146RI3@G10	
CHL	H228NGCD@EMERGE	H228PC@EMERGE	N228RTAR@EMERGE	
CHN	H924NGCD@EMERGE	H924PC@EMERGE	N924RTAR@EMERGE	
COL	S233NGPC@EMERGELA	H233PC@EMERGE	C233IM@IFS	
CRI	H238NGCD@EMERGE	H238PC@EMERGE	C238IC@IFS	
CZE	J935GDPT@EUDATA	H935PC@EMERGE	N935RI3@EMERGE	
DEU	S134NGCD@G10	C134PC@IFS		
DNK	S128NGCD@G10	H128PC@G10	N128RTAR@G10	
ECB			C023IM@IFS	
ECU	C248GDPI@IFS	H248PC@EMERGE	C248IC@IFS	
EGY	A469GDPC@IMFWEO	H469PC@EMERGE	N469RTAR@EMERGE	
ESP	S184NGCD@G10	H184PC@G10		
EST	J939GDPT@EUDATA	H939PC@EMERGE	C939IM@IFS	
FIN	S172NGCD@G10	H172PC@G10		
FRA	S132NGCD@G10	H132PC@G10		
GBR	S112NGCD@G10	H112PC@G10	N112RI3@G10	
GRC	C174GDPI@IFS	H174PC@G10	C174IC@IFS	
HKG	H532NGCD@EMERGE	H532PC@EMERGE	N532RI3@EMERGE	
HRV	C960GDPI@IFS	H960PC@EMERGE	C960IM@IFS	
HUN	H944NGCD@EMERGE	H944PC@EMERGE	N944RTAR@EMERGE	
IDN	H536NGCD@EMERGE	H536PC@EMERGE	C536IM@IFS	
IND	H534NGCD@EMERGE	C534PC@IFS	C534IC@IFS	
IRL	S178NGCD@G10	H178PC@G10		
ISR	S436NGPC@EMERGEMA	H436PC@EMERGE	N436RI3@EMERGE	
ITA	S136NGCD@G10	H136PC@G10		
JOR	H439NGCD@EMERGE	H439PC@EMERGE	C439IC@IFS	
JPN	S158NGCD@G10	H158PC@G10	C158IM@IFS	
KOR	S542NGPC@EMERGEPR	H542PC@EMERGE	C542IM@IFS	
LTU	H946NGCD@EMERGE	H946PC@EMERGE	C946IM@IFS	
LUX	S137NGCD@G10	H137PC@G10		
LVN	H941NGCD@EMERGE	H941PC@EMERGE	C941IM@IFS	
MAR	C686GDPI@IFS	C686PC@IFS	C686IM@IFS	
MEX	S273NGPC@EMERGE	H273PC@EMERGE	C273IM@IFS	
MYS	H548NGCD@EMERGE	H548PC@EMERGE	C548IM@IFS	
NLD	S138NGCD@G10	H138PC@G10		
NOR	S142NGCD@G10	H142PC@G10	N142RI3@G10	
NZL	S196NGCD@G10	H196PC@G10	C196IM@IFS	
PER	H293NGCD@EMERGE	H293PC@EMERGE	C293IM@IFS	
PHL	H566NGCD@EMERGE	C566PC@IFS	C566IM@IFS	
POL	H964NGCD@EMERGE	H964PC@EMERGE	C964IM@IFS	
PRT	S182NGCD@G10	H182PC@G10		
PRY	H288NGCD@EMERGE	H288PC@EMERGE	C288IM@IFS	
OIL				N112POIL@G10
ROU	A968GDPC@IMFWEO	H968PC@EMERGE	C968IM@IFS	
RUS	H922NGCD@EMERGE	H922PC@EMERGE	C922IM@IFS	
SAU	A456GDPC@IMFWEO	H456PC@EMERGE	N456RD3M@EMERGEMA	
SGP	H576NGCD@EMERGE	S576PC@EMERGEPR	N576RI3@EMERGE	
SVK	H936NGCD@EMERGE	H936PC@EMERGE	C936IC@IFS	
SVN	H961NGCD@EMERGE	H961PC@EMERGE	C961IM@IFS	
SWE	S144NGCD@G10	H144PC@G10	N144RI3@G10	
THA	S578NGPC@EMERGEPR	H578PC@EMERGE	C578IM@IFS	
TUR	H186NGCD@EMERGE	H186PC@EMERGE	C186IM@IFS	
USA	S111NGCD@G10	C111PC@IFS	N111RI3@G10	
VEN	S299GPC@EMERGELA	H299PC@EMERGE	C299IM@IFS	
ZAF	S199NGPC@EMERGEMA	H199PC@EMERGE	C199IM@IFS	

Note: The table provides the Haver series codes of the variables used. Data available only at annual frequency are interpolated to quarterly frequency.

Table 4: Descriptive Statistics

	mean	min	max	sd
Trough response of GDP	-0.24	-0.37	-0.16	0.08
Industry mix	-0.31	-3.87	3.42	2.72
Labor market rigidities	-0.55	-5.04	3.25	2.55
Net FX exposure	0.28	-0.12	1.51	0.43
GFA/GDP (log)	1.64	0.94	3.01	0.57

Table 5: Determinants of Heterogeneities in Monetary Effectiveness in the Euro Area

	(1)	(2)	(3)	(4)
Labor market rigidities	-0.01	-0.01	-0.01	-0.01**
	(0.20)	(0.23)	(0.35)	(0.03)
Industry mix	-0.01*	-0.01^{+}	-0.01^{+}	-0.01*
	(0.09)	(0.10)	(0.15)	(0.06)
Net FX exposure			-0.05^{+}	-0.22***
			(0.19)	(0.00)
GFA/GDP (log)		0.00		0.15***
		(0.88)		(0.00)
Adj. R-squared	0.45	0.39	0.48	0.83
Observations	12	12	12	12

p-values in parentheses
Robust standard errors.
$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Results for Alternative Dependent Variables in the Cross-section Regression

	(1) Baseline	(2) Cons.	(3) Inv.	(4) Credit
Labor market rigidities	-0.01**	-0.00	-0.02^{+}	-0.02
	(0.03)	(0.97)	(0.16)	(0.36)
Industry mix	-0.01*	-0.01	-0.02^{+}	0.02
	(0.06)	(0.38)	(0.16)	(0.58)
Net FX exposure	-0.22***	-0.20**	-0.60**	-0.11
	(0.00)	(0.01)	(0.03)	(0.56)
GFA/GDP (log)	0.15***	0.04	0.39*	0.04
	(0.00)	(0.45)	(0.07)	(0.81)
Adj. R-squared	0.83	0.57	0.59	-0.38
Observations	12	12	12	12

p-values in parentheses
Robust standard errors.
$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Descriptive Statistics for Non-Euro Area Advanced Economies

	mean	min	max	sd
Trough response of GDP	-0.10	-0.16	-0.04	0.04
Industry mix	-2.06	-3.04	0.16	1.32
Labor market rigidities	2.26	0.96	3.40	1.01
Net FX exposure	0.54	-0.18	1.02	0.47
GFA/GDP (log)	1.38	0.89	2.12	0.44

Table 8: Descriptive Statistics for Non-Euro Area Emerging Market Economies

	mean	min	max	sd
Trough response of GDP	-0.13	-0.26	-0.02	0.09
Industry mix	1.60	-2.68	6.71	3.60
Labor market rigidities	-2.15	-7.65	-0.67	2.28
Net FX exposure	-0.00	-0.33	0.42	0.25
GFA/GDP (log)	0.72	0.61	0.91	0.11

Table 9: Determinants of Heterogeneities in Monetary Effectiveness in Expanded Country Sample

	(1)	(2)	(3)	(4)
Labor market rigidities	-0.02**	-0.01	-0.01***	-0.01***
	(0.03)	(0.22)	(0.00)	(0.00)
Industry mix	-0.01*	-0.01**	-0.01**	-0.01*
	(0.07)	(0.04)	(0.04)	(0.08)
Net FX exposure	-0.22***	0.06**	-0.08***	-0.05
	(0.00)	(0.01)	(0.00)	(0.84)
GFA/GDP (log)	0.16***	-0.09***	0.05*	0.06+
	(0.00)	(0.00)	(0.06)	(0.12)
EA country dummy			-0.17***	-0.16***
			(0.00)	(0.00)
EA contiguity dummy			0.12***	0.13***
			(0.00)	(0.00)
Domestic credit/GDP (log)			0.11*	0.12**
			(0.08)	(0.03)
Trade/GDP (log)			-0.10**	-0.15**
			(0.04)	(0.04)
Net FX exposure x ER flexibility				-0.00
				(0.90)
ER flexibility				-0.01
				(0.59)
Observations	12	36	36	36
Adjusted R^2	0.84	0.16	0.72	0.72

p-values in parentheses

Robust standard errors.

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Robustness for Euro Area Sample—Sample and Outliers

	(1) Baseline	(2) rreg	(3) qreg	(4) W/o IRL	(5) W/o BEL,IRL	(6) W/o NLD,IRL	(7) W/o SVN	(8) +SVK	(9) +SVK,DNK	(10) PC	(11) PC+SVK,DNK
Labor market rigidities	-0.01**	-0.01**	-0.01*	-0.01**	-0.01*	-0.01**	-0.01**	-0.01**	-0.01		
	(0.03)	(0.04)	(0.10)	(0.04)	(0.06)	(0.04)	(0.05)	(0.02)	(0.24)		
Industry mix	-0.01*	-0.01*	-0.01+	-0.01*	-0.01*	-0.01*	-0.01+	-0.01**	-0.02***		
	(0.06)	(0.09)	(0.12)	(0.07)	(0.10)	(0.09)	(0.14)	(0.03)	(0.01)		
Net FX exposure	-0.22***	-0.27***	-0.24***	-0.27***	-0.27***	-0.33***	-0.21***	-0.20***	-0.17***	-0.21***	-0.16**
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)
GFA/GDP (log)	0.15***	0.15***	0.17***	0.14***	0.14***	0.14***	0.14***	0.15***	0.12***	0.14***	0.12**
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)
PC of traditional determinants										-0.04***	-0.04***
										(0.00)	(0.00)
Adj. R-squared	0.83	0.78		0.81	0.77	0.81	0.78	0.77	0.72	0.85	0.67
Observations	12	11	12	11	10	10	11	13	14	12	14

p-values in parentheses

Robust standard errors.

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Robustness for Euro Area Sample—Additional Controls in Cross-section Regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Labor market rigidities	-0.01**	-0.01*	-0.00	-0.01*	-0.01*	-0.02**	-0.02***	-0.01*	-0.01**
	(0.03)	(0.07)	(0.40)	(0.05)	(0.05)	(0.01)	(0.01)	(0.06)	(0.04)
Industry mix	-0.01*	-0.01*	-0.01**	-0.01+	-0.01*	-0.00	-0.00*	-0.01*	-0.01**
	(0.06)	(0.07)	(0.04)	(0.13)	(0.07)	(0.36)	(0.10)	(0.09)	(0.04)
Net FX exposure	-0.22***	-0.21***	-0.20***	-0.24***	-0.22***	-0.26***	-0.27***	-0.24***	-0.22***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
GFA/GDP (log)	0.15***	0.16***	0.10**	0.13***	0.15***	0.18***	0.17***	0.16***	0.15***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade/GDP (log)		-0.12+							
		(0.18)							
Domestic credit/GDP (log)			0.19*						
			(0.07)						
Financial sector value added share				1.65					
				(0.24)					
Variable-rate share in housing loans					0.01				
					(0.73)				
Average property price increase						0.01*			
						(0.06)			
Maximum property price increase							0.08***		
							(0.00)		
Stressed dummy								0.03+	
								(0.16)	
Small country dummy									-0.02
									(0.24)
Adj. R-squared	0.83	0.83	0.89	0.85	0.81	0.87	0.90	0.86	0.84
Observations	12	12	12	12	12	12	12	12	12

p-values in parentheses

Robust standard errors.

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Robustness for Euro Area Sample—Results with Additional Endogenous Variables and Alternative Specifications in the MCSGVAR Model

	(1) Baseline	(2) LT rates	(3) VIX	(4) Lag 2
Labor market rigidities	-0.01**	-0.01***	-0.01***	-0.01*
	(0.03)	(0.00)	(0.01)	(0.06)
Industry mix	-0.01*	-0.01**	-0.01**	-0.01*
	(0.06)	(0.04)	(0.02)	(0.05)
Net FX exposure	-0.22***	-0.21***	-0.19***	-0.20***
	(0.00)	(0.00)	(0.00)	(0.00)
GFA/GDP (log)	0.15***	0.13***	0.13***	0.08*
	(0.00)	(0.00)	(0.00)	(0.07)
Adj. R-squared	0.83	0.91	0.87	0.85
Observations	12	12	12	12

p-values in parentheses

Robust standard errors.

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Robustness to Modifications of the Expanded Country Samples

	(1) Baseline EA	(2) All	(3) ERF>11	(4) AEs	(5) EA aggr.	(6) No EA
Labor market rigidities	-0.02**	-0.01***	-0.01***	-0.01	-0.02^{+}	-0.02^{+}
	(0.03)	(0.00)	(0.01)	(0.22)	(0.13)	(0.12)
Industry mix	-0.01*	-0.01**	-0.01*	-0.01***	-0.01	-0.01
	(0.07)	(0.04)	(0.05)	(0.00)	(0.39)	(0.38)
Net FX exposure	-0.22***	-0.08***	-0.15***	-0.08**	-0.14**	-0.14**
	(0.00)	(0.00)	(0.00)	(0.03)	(0.03)	(0.03)
GFA/GDP (log)	0.16***	0.05*	0.09***	0.05^{+}	0.10^{+}	0.10^{+}
	(0.00)	(0.06)	(0.01)	(0.10)	(0.14)	(0.13)
EA contiguity dummy		0.12***	0.14***	0.15**	0.15**	0.15**
		(0.00)	(0.00)	(0.02)	(0.01)	(0.01)
EA country dummy		-0.17***	-0.17***	-0.12***	-0.16***	
		(0.00)	(0.00)	(0.00)	(0.00)	
Domestic credit/GDP (log)		0.11*	0.19***	0.14**	0.21*	0.21*
		(0.08)	(0.00)	(0.01)	(0.08)	(0.08)
Trade/GDP (log)		-0.10**	-0.06	-0.09^{+}	-0.10	-0.10
		(0.04)	(0.30)	(0.15)	(0.51)	(0.49)
Observations	12	36	28	22	15	14
Adjusted R^2	0.84	0.72	0.79	0.86	0.30	0.08

p-values in parentheses

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Robustness for Euro Area Sample—Alternative Measures for Economies' Susceptibility to Net Foreign Currency Exposure and Global Financial Cycle Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Labor market rigidities	-0.01**	-0.01*	-0.01+	-0.01	-0.02**	-0.01+	-0.01	-0.01+	-0.01+
	(0.03)	(0.05)	(0.11)	(0.34)	(0.02)	(0.16)	(0.53)	(0.18)	(0.17)
Industry mix	-0.01*	-0.01+	-0.01+	-0.01+	-0.01+	-0.01*	-0.01	-0.01*	-0.01+
	(0.06)	(0.19)	(0.15)	(0.16)	(0.14)	(0.06)	(0.21)	(0.10)	(0.18)
Net FX exposure	-0.22***		-0.24***	-0.12*	-0.13*	-0.12***	-0.07+	-0.21*	-0.07
	(0.00)		(0.01)	(0.09)	(0.10)	(0.00)	(0.10)	(0.06)	(0.27)
GFA/GDP (log)	0.15***	0.11**							
	(0.00)	(0.02)							
Net FX exp. with FX response weights		-0.17***							
		(0.00)							
GFA/GDP (CPIS, log)			0.15**						
			(0.01)						
BIS banking assets and liab./GDP (log)				0.16+					
				(0.16)					
GFA to dom. credit (log)					0.10+				
					(0.18)				
GFA/GDP (log) bucket						0.04***			
						(0.00)			
Equity return correlation with US							0.17		
							(0.26)		
Share of US/UK owned banks								0.01*	
								(0.08)	
Share of credit provided by US/UK banks (WDI)									0.00
									(0.61)
Adj. R-squared	0.83	0.75	0.64	0.55	0.53	0.77	0.49	0.60	0.42
Observations	12	11	12	12	12	12	12	12	12

p-values in parentheses

Robust standard errors.

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Robustness for Expanded Country Sample—Alternative Measures for Economies' Susceptibility to Net Foreign Currency Exposure and Global Financial Cycle Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Labor market rigidities	-0.02**	-0.01***	-0.01**	-0.01***	-0.00	-0.01***	-0.01***	-0.01**	-0.01**	-0.01**
	(0.03)	(0.01)	(0.02)	(0.01)	(0.50)	(0.01)	(0.01)	(0.03)	(0.02)	(0.03)
Industry mix	-0.01*	-0.01*	-0.01+	-0.01*	-0.01*	-0.01**	-0.01+	-0.01**	-0.01*	-0.01*
	(0.07)	(0.05)	(0.13)	(0.10)	(0.06)	(0.04)	(0.14)	(0.03)	(0.06)	(0.06)
Net FX exposure	-0.22***	-0.15***		-0.14***	-0.10**	-0.15***	-0.11***	-0.09***	-0.08***	-0.08***
	(0.00)	(0.00)		(0.00)	(0.04)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)
Net FX exp. with FX response weights			-0.00+							
			(0.10)							
GFA/GDP (log)	0.16***	0.09***	0.01							
	(0.00)	(0.01)	(0.85)							
GFA/GDP (CPIS, log)				0.07*						
				(0.10)						
BIS banking assets and liab./GDP (log)					0.01					
					(0.85)					
GFA to dom. credit (log)						0.09**				
						(0.03)				
GFA/GDP (log) bucket							0.03**			
							(0.03)			
Equity return correlation with US								0.11+		
								(0.10)		
Share of US/UK owned banks									0.00	
									(0.36)	
Share of credit provided by US/UK banks (WDI)										0.00
										(0.21)
EA country dummy		-0.17***	-0.13***	-0.12***	-0.10***	-0.17***	-0.16***	-0.14***	-0.11***	-0.13***
		(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
EA contiguity dummy		0.14***	0.09**	0.14***	0.14***	0.13***	0.12***	0.11***	0.15***	0.14***
		(0.00)	(0.03)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Domestic credit/GDP (log)		0.19***	0.12*	0.19***	0.19**	0.29***	0.18***	0.14**	0.21**	0.22**
		(0.00)	(0.09)	(0.00)	(0.02)	(0.00)	(0.00)	(0.03)	(0.01)	(0.02)
Trade/GDP (log)		-0.06	-0.08	-0.09	0.02	-0.06	-0.05	-0.03	-0.05	-0.05
		(0.30)	(0.31)	(0.37)	(0.92)	(0.39)	(0.49)	(0.67)	(0.57)	(0.55)
Observations	12	28	28	28	21	28	28	27	28	28
Adjusted R^2	0.84	0.79	0.66	0.75	0.62	0.78	0.77	0.82	0.72	0.73

p-values in parentheses

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 16: Robustness—*De jure* Measures of Financial Openness in Expanded Country Sample

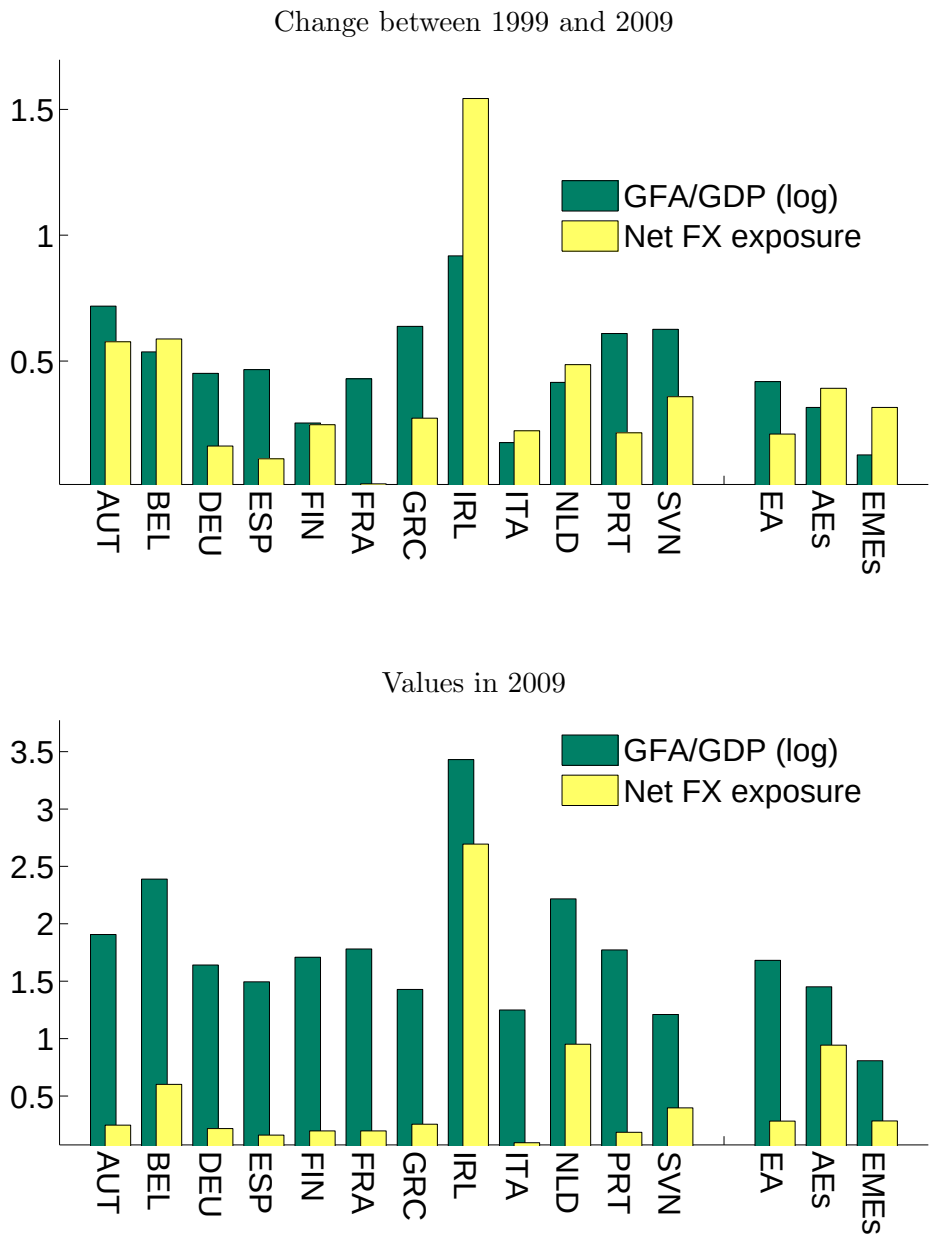
	(1) Baseline EA	(2) Baseline Exp.	(3) kaopen	(4) EA aggr.	(5) kaopen	(6) No EA	(7) kaopen
Labor market rigidities	-0.02**	-0.01***	-0.01**	-0.02+	-0.02	-0.02+	-0.02
	(0.03)	(0.01)	(0.02)	(0.13)	(0.28)	(0.12)	(0.26)
Industry mix	-0.01*	-0.01*	-0.01**	-0.01	-0.01	-0.01	-0.01
	(0.07)	(0.05)	(0.04)	(0.39)	(0.32)	(0.38)	(0.31)
Net FX exposure	-0.22***	-0.15***	-0.08***	-0.14**	-0.08*	-0.14**	-0.08**
	(0.00)	(0.00)	(0.01)	(0.03)	(0.05)	(0.03)	(0.05)
GFA/GDP (log)	0.16***	0.09***		0.10+		0.10+	
	(0.00)	(0.01)		(0.14)		(0.13)	
Chinn and Ito (2003): kaopen index			0.01		0.01		0.01
			(0.38)		(0.57)		(0.56)
EA contiguity dummy		0.14***	0.12***	0.15**	0.13**	0.15**	0.13**
		(0.00)	(0.00)	(0.01)	(0.03)	(0.01)	(0.03)
Domestic credit/GDP (log)		0.19***	0.17**	0.21*	0.18	0.21*	0.18
		(0.00)	(0.02)	(0.08)	(0.23)	(0.08)	(0.22)
Trade/GDP (log)		-0.06	0.00	-0.10	-0.03	-0.10	-0.03
		(0.30)	(0.97)	(0.51)	(0.90)	(0.49)	(0.89)
EA dummy		-0.17***	-0.14***	-0.16***	-0.14***		
		(0.00)	(0.00)	(0.00)	(0.00)		
Observations	12	28	28	15	15	14	14
Adjusted R^2	0.84	0.79	0.73	0.30	0.20	0.08	-0.05

p-values in parentheses

$^{+}$ $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

F Figures

Figure 1: GFA/GDP and Net Foreign Currency Exposure

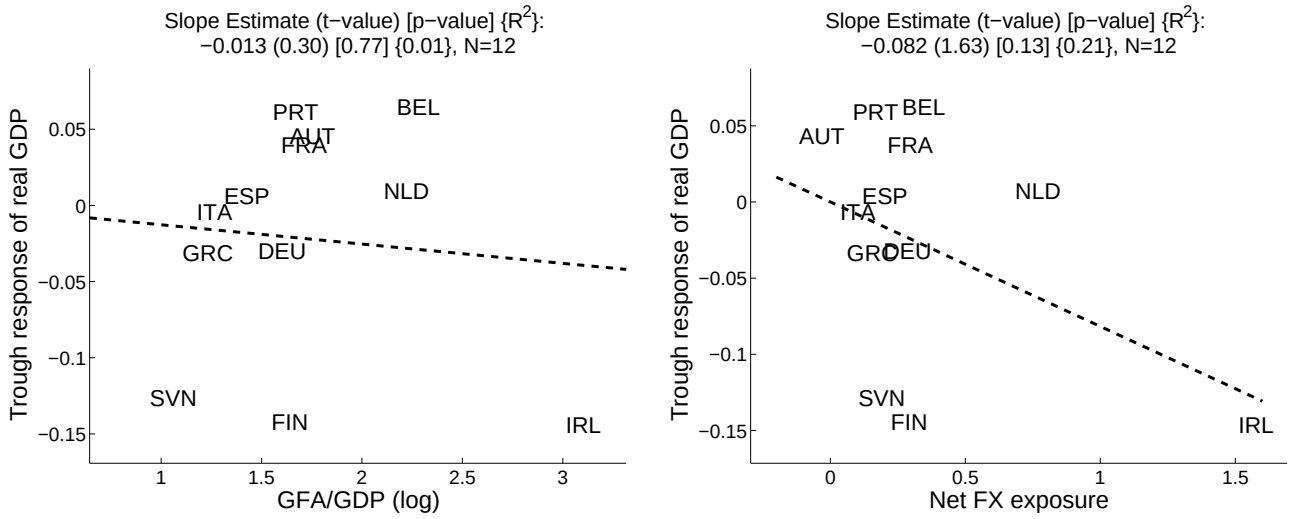


Note: The top panel shows the change in the gross foreign asset and liability position relative to GDP as well as the net foreign currency exposure over 1999-2009. The bottom panel shows the corresponding averages. The advanced economies exclude the euro area and the US. The country aggregates are based on GDP-weights.

Figure 2: Trough Response of Real GDP to a Contractionary Euro Area Monetary Policy Shock

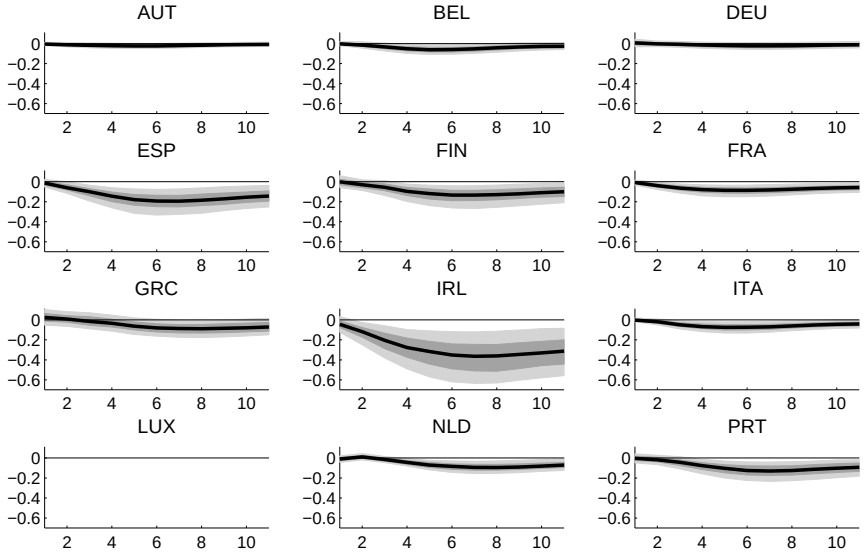
Note: The figure displays the trough responses of real GDP to a 100 basis points contractionary euro area monetary policy shock obtained from the MCSGVAR model with sign restrictions. The vertical axis depicts deviations from baseline in percent.

Figure 3: Scatter Plots for Gross Foreign Asset and Liability Positions, Net Foreign Currency Exposures and the Trough Responses of Real GDP



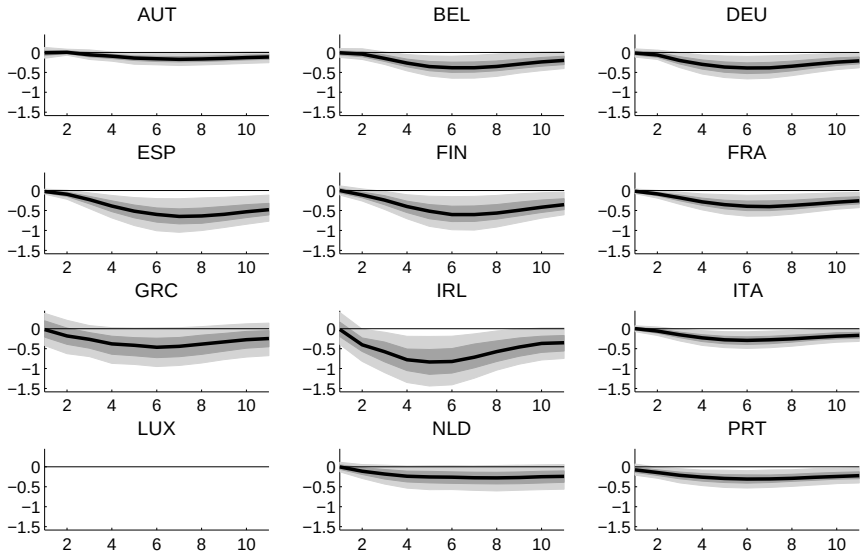
Note: The figure displays scatter plots between gross foreign asset and liability positions, net foreign currency exposures and the trough responses of real GDP to a contractionary euro area monetary policy shock. The trough responses are demeaned.

Figure 4: Responses of Private Consumption to a Contractionary Euro Area Monetary Policy Shock



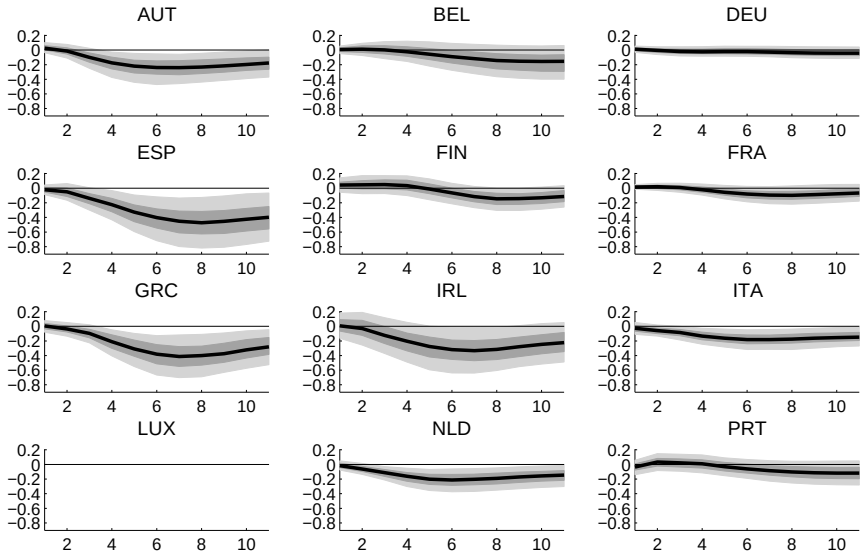
Note: The figure shows the responses of private consumption to a contractionary euro area monetary policy shock. The responses are obtained from a version of the MCSGVAR model in which private consumption is added as endogenous variable in euro area economies' VARX models.

Figure 5: Responses of Gross Capital Formation to a Contractionary Euro Area Monetary Policy Shock



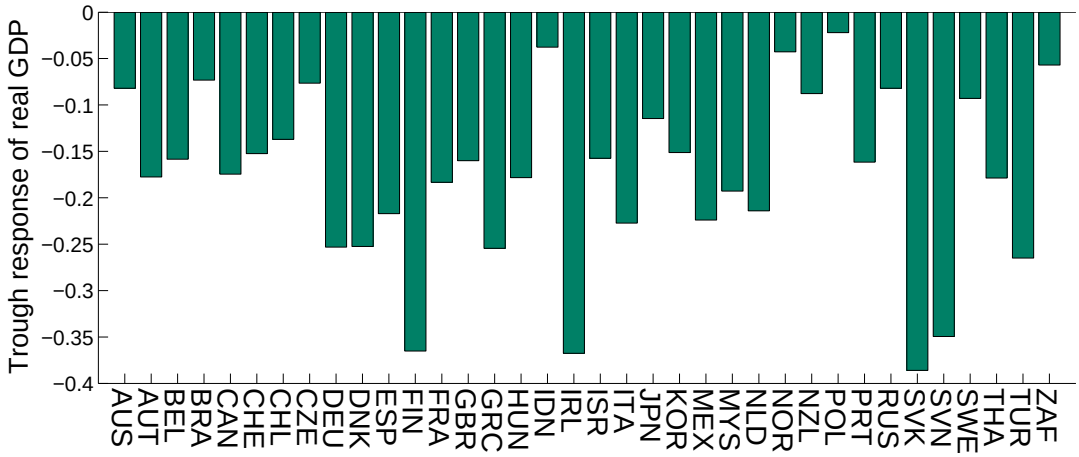
Note: See the note to Figure 4.

Figure 6: Responses of Credit to a Contractionary Euro Area Monetary Policy Shock



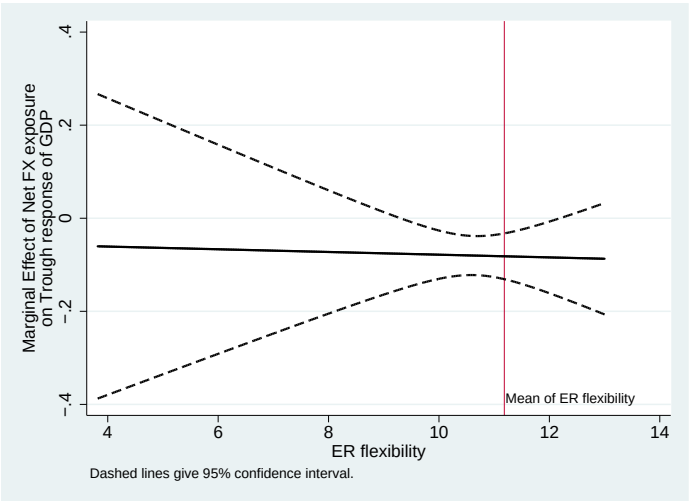
Note: See the note to Figure 4.

Figure 7: Trough Responses of Real GDP to Country-specific Contractionary Monetary Policy Shocks



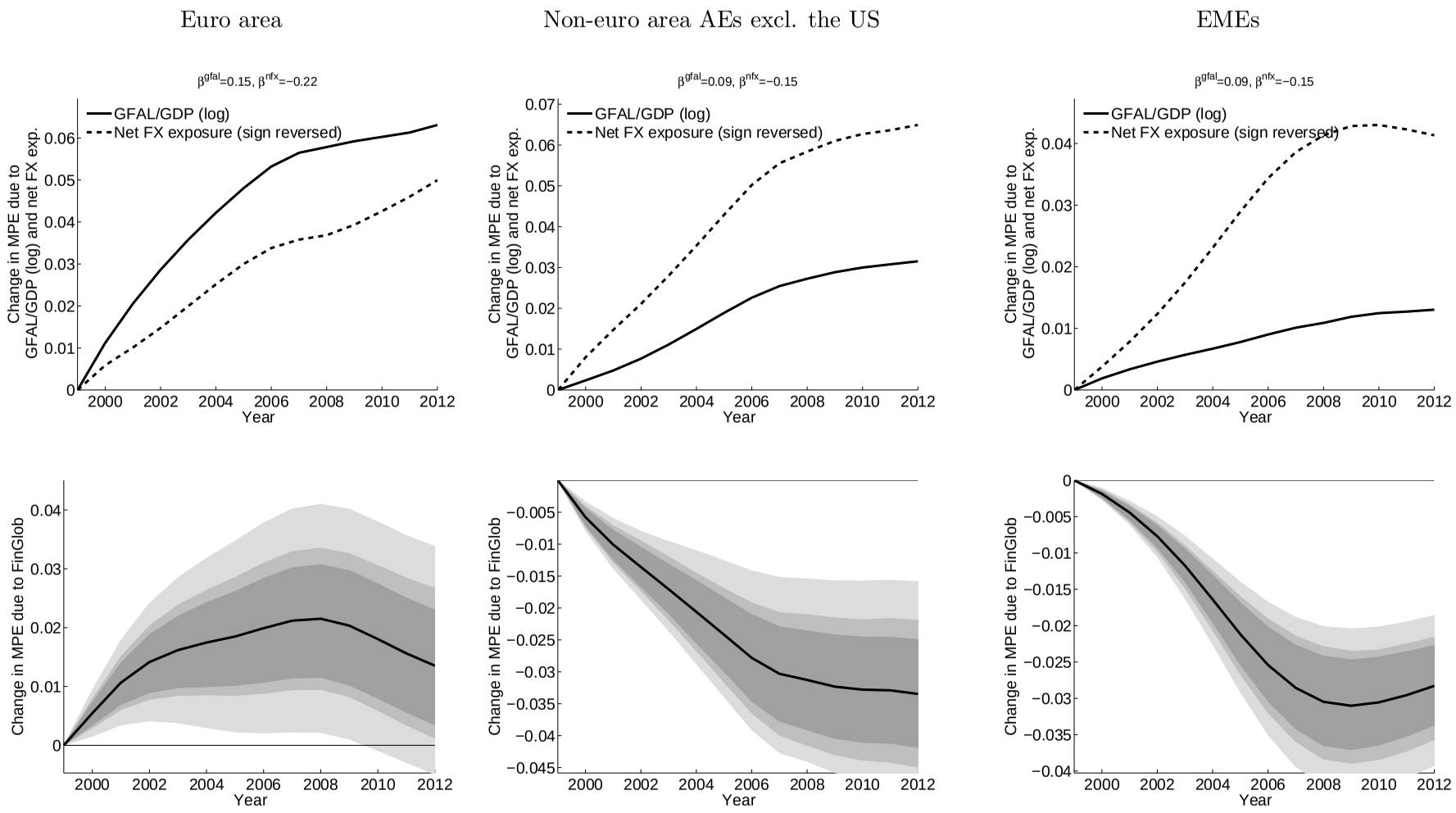
Note: The figure presents the trough responses of the level of real GDP to a contractionary domestic monetary policy shock for all economies in the expanded country sample. For Slovakia and Denmark the trough responses refer to a euro area monetary policy shock.

Figure 8: Marginal Effect of Net Foreign Currency Exposure on Monetary Policy Effectiveness Across Different Degrees of Exchange Rate Flexibility



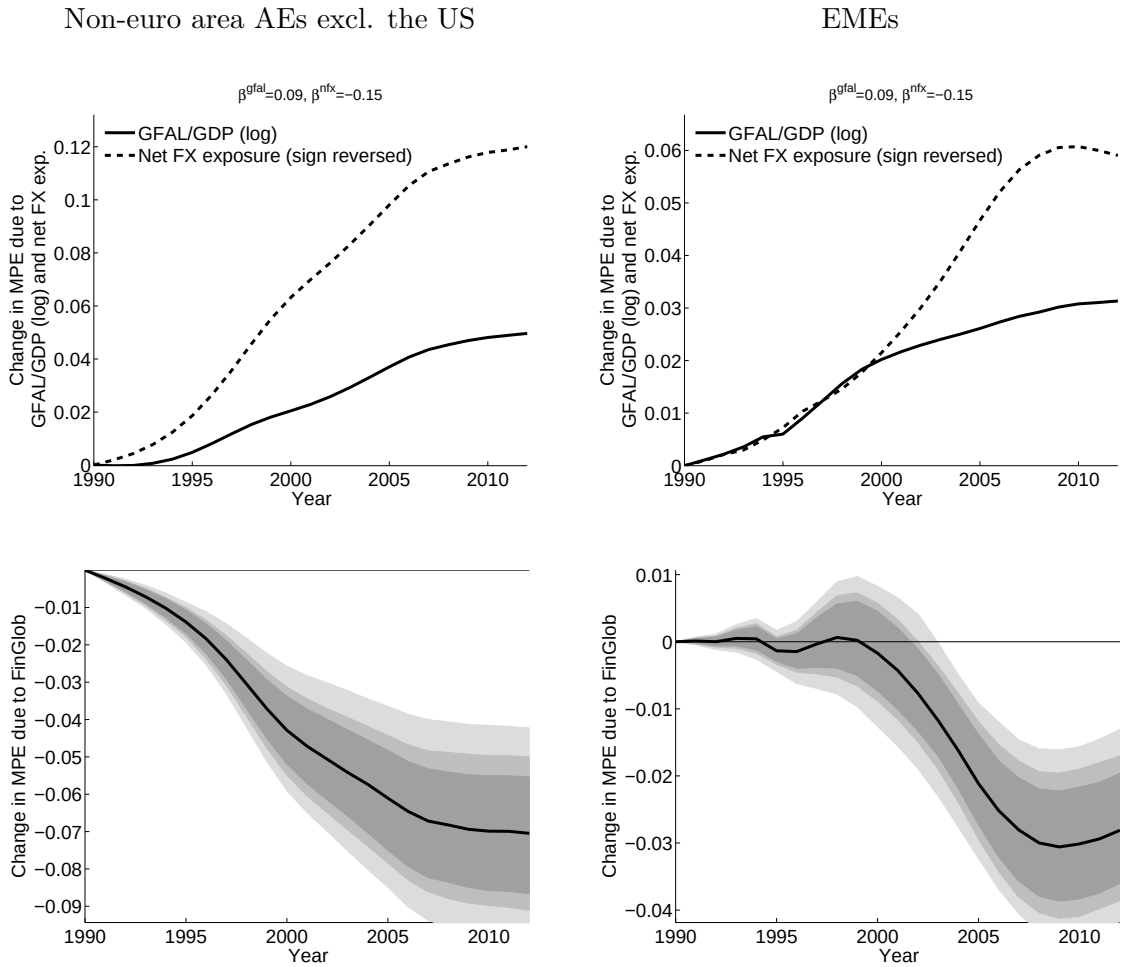
Note: The figure displays the marginal effect of net foreign currency exposure on the trough response of output to a contractionary domestic monetary policy shock across different degrees of exchange rate flexibility based on the cross-section regression in Equation (7) for the expanded country sample with an interaction between the net foreign currency exposure and the exchange rate regime added. A higher value of the exchange rate flexibility variable reflects a more flexible exchange rate regime. The corresponding regression results are reported in Table 9. The figure has been produced using the "grinter" routine in Stata.

Figure 9: Cumulated Global Financial Cycle and Net Foreign Currency Exposure on Monetary Policy Effectiveness



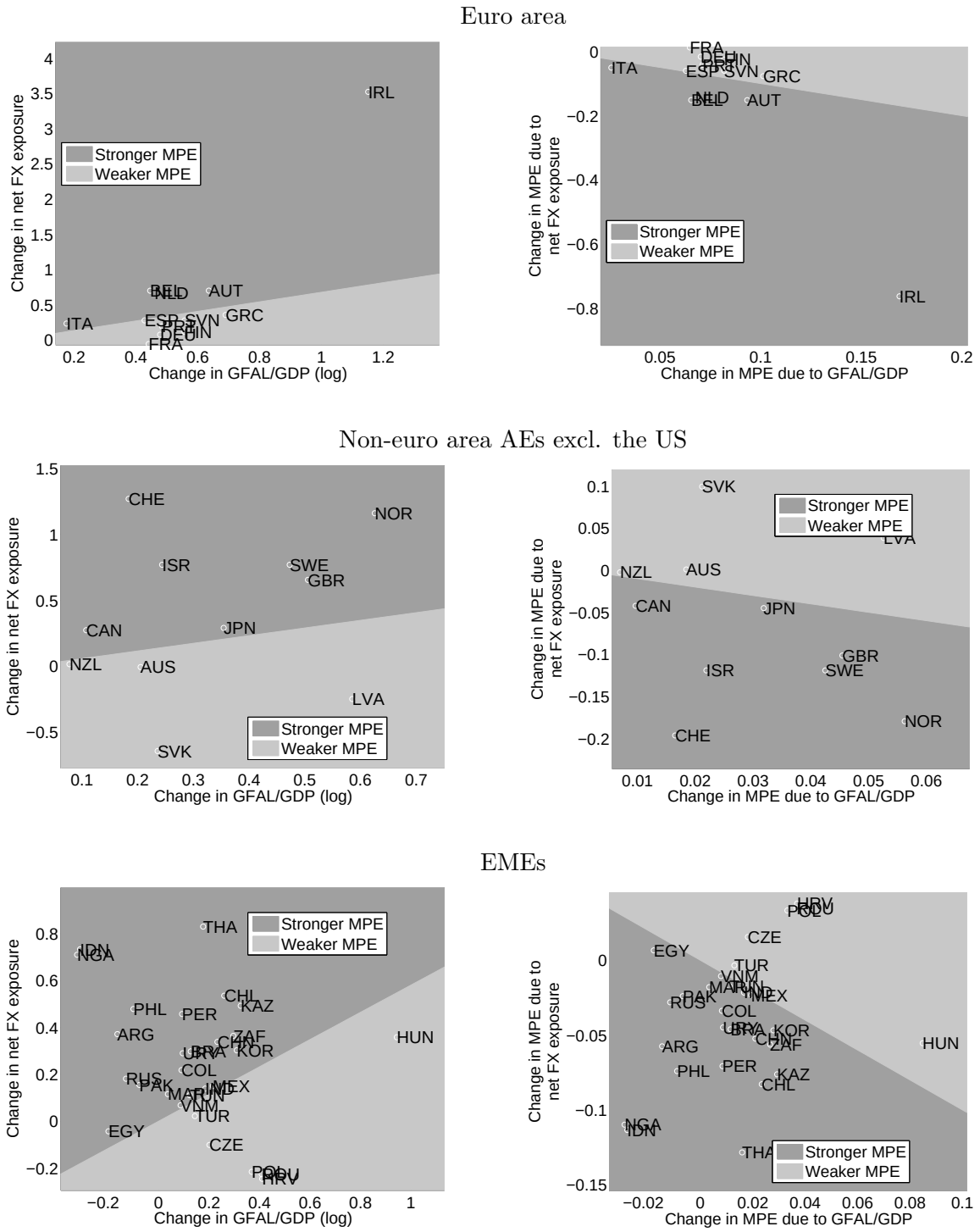
Note: The upper panels display the cross-country GDP-weighted average of the evolution of the cumulated global financial cycle (solid lines) and net foreign currency exposure (dashed lines) effects on monetary policy effectiveness as defined in Equations (10) and (11). Monetary policy effectiveness is measured as the trough response of output to a tightening in monetary policy. In particular, a positive value for the cumulated effect reflects a weakening of monetary policy effectiveness due to global financial cycle effects (the opposite for the net foreign currency exposure effects as we reverse its sign): The trough response of output to a monetary policy tightening has approached zero from below. The lower panels display the cumulated net effect of financial globalisation on monetary policy effectiveness: A positive value reflects an overall weakening of monetary policy effectiveness due to financial globalisation. The shaded areas represent 90%, 95% and 99% confidence bands obtained from Monte Carlo simulations. The time series for $gfal_{it}$ and nfx_{it} used in the calculations of each economy are smoothed with a Hodrick-Prescott filter before they are sued in the calculations.

Figure 10: Cumulated Global Financial Cycle and Net Foreign Currency Exposure Effects on Monetary Policy Effectiveness over 1990-2012



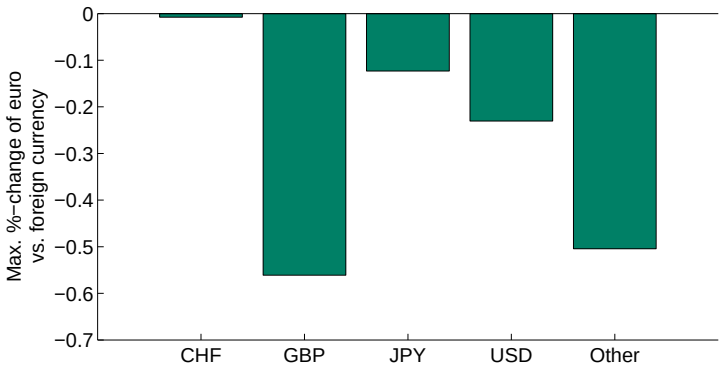
Note: See the note to Figure 9.

Figure 11: Change in Monetary Policy Effectiveness due to the Global Financial Cycle and Net Foreign Currency Exposure Effects



Note: The left-hand side panels show the relationship between changes in $gfal_i$ and nfx_i over 1999-2012, respectively. The shaded areas indicate the combinations of changes in $gfal_i$ and nfx_i which give rise to a stronger/weaker effect of monetary policy on output given the estimates $\widehat{\beta}^{gfal}$ and $\widehat{\beta}^{nfx}$ in Equation (7). The right-hand side panels display the change in the impact of monetary policy on output over 1999-2012 that is due to the global financial cycle and net foreign currency exposure effects, respectively. The shaded areas indicate whether the former effect outweighs the latter and vice versa.

Figure 12: Maximum Appreciation of the Euro Exchange Rate in Response to a Contractionary Euro Area Monetary Policy Shock



Note: The figure displays the maximum appreciation of the euro vis-à-vis major currencies in response to a 100 basis points contractionary euro area monetary policy shock. The exchange rate is expressed in terms of units of domestic currency relative to one unit of foreign currency.