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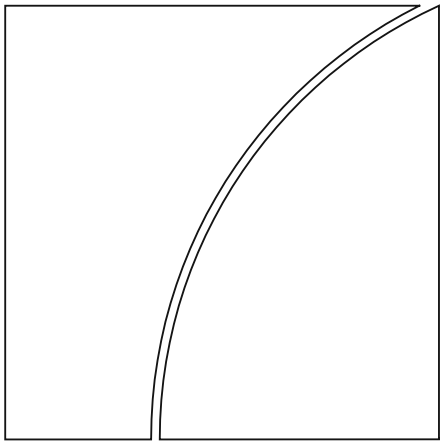

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The cross-border credit channel and lending standards surveys

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THE CROSS-BORDER CREDIT CHANNEL AND LENDING STANDARDS SURVEYS:

IMPLICATIONS FOR THE INTERNATIONAL TRANSMISSION OF MONETARY POLICIES

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ABSTRACT

This paper argues that a measure of lending conditions – Senior Loan Officer (SLO) surveys – offers important insights into the monetary transmission mechanism. Using a Global VAR (GVAR) and SLO survey data from 16 countries, we document bank lending standards' significant role in explaining the dynamics of domestic credit conditions. Changes in lending attitudes lead to spillovers of financial conditions to other advanced and emerging market economies. We also examine the interaction of unconventional monetary policies (UMPs) and lending attitudes by using an external high frequency instrument. Looking through this lens of UMPs, we see that expansionary monetary policy led to a lowering of domestic credit standards which amplified the impact of the initial monetary stimulus. However, we also find evidence that the need to resort to UMPs also brought about a decline in lending demand, raising questions about whether the signaling channel of monetary policy unintentionally worked at cross purposes by sapping the full effectiveness of these policies. The varied experiences in the United States and euro area draw attention to the relative importance of bank intermediation in determining the strength of the bank lending channel of monetary policy.

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1. Introduction

A decade after the start of the Global Financial Crisis (GFC), monetary policy around the globe continues to struggle to normalize. Indeed, several central banks in advanced economies have kept their policy rates near historic lows, in some cases maintaining policy rates in negative territory (e.g., the ECB, the Bank of Japan, the Swiss National Bank, and the Riksbank). And many central banks have yet to unwind unconventional monetary policies (UMPs). The unusual delay in the success of these policy actions to generate a robust recovery has raised questions about the effectiveness of these monetary policies' strategies. And policy makers have grown increasingly concerned that prolonging these measures may prove counterproductive. The experience of the past decade has left many wondering about the monetary policy lessons that we should learn about the monetary transmission mechanism.

Pre-crisis, there was a consensus about the monetary transmission mechanism. In a nutshell, the policy rate altered incentives to consume, invest and work which, in turn, determined real economic activity and inflation. This consensus led to the construction of policy models that, all things considered, worked fairly well in stabilizing short-run output and inflation.

Post-crisis, however, the limited room for maneuver near the effective lower bound for policy rates led central banks to shift away from reliance on policy rates towards commitments to expand central bank balance sheets through large-scale asset programs (i.e., quantitative easing (QE)). At the same time, academics and central banks began to view to developments in private sector balance sheets through the lens of the so-called financial cycle (e.g., Borio (2012)). One particular challenge from the greater financial cycle prominence is a finer understanding about how risk perceptions of various actors in the financial system, especially those of banks and asset managers, affect the monetary transmission mechanism. These perspectives, among other things, have led some to consider reform of monetary policy frameworks (BIS (2016)).

In the post-crisis period, another increasingly prominent concern has been the shortcomings of the international monetary system, not least being the cross-border monetary policy spillovers. To be sure, the adoption of UMPs has been limited primarily to the major advanced central banks (viz., the Fed, the Bank of England (BoE), the Bank of Japan (BoJ), and the European

Central Bank (ECB)). Nevertheless, their impacts were felt widely and were not universally welcomed (Chen et. al. (2016)). The nature of and dealing with cross-border spillovers continues to preoccupy smaller economies, especially in emerging markets. And, in some cases, the recipients of the spillovers have taken actions which have generated so-called spillbacks (Rajan (2014)). Micro-banking data confirm the important roles that banks have played in the international transmission of monetary policy (Buch et. al. (2018)). Of note, attitudes toward risk by banks, and other financial market participants, is seen as a major factor driving not only domestic conditions but also cross-border spillovers and spillbacks (Hale and Obstfeld (2016)).

These post-crisis developments–i.e., UMPs and spillovers–point to the possibility of fundamental change in the key channels through which monetary policy influences the economy: e.g., the portfolio rebalancing channel and the signaling channel of monetary policy. The portfolio rebalancing channel stresses the impact of the size and composition of central bank balance sheets on longer-term interest rates by influencing the portfolio incentives of the private sector. The signaling channel works on expectations of the future short-term interest rate path and perceptions of the health of the economy. This channel also helps to shape the risk-taking attitudes of banks and borrowers, thereby determining the sensitivity of credit expansion to interest rates both domestically and internationally. Both of these channels have the potential to strengthen the asset side of banks' balance sheets. By lowering sovereign yields through lower expected short rates and compressed risk premia, banks benefit from net worth and collateral valuation effects. As well, stimulative monetary policy improves the prospects of future loan repayments.

There is still no clear consensus about which channel dominates empirically. Pre-crisis research had begun to document evidence of a portfolio rebalancing channel. In the context of globally active banks, the impact of portfolio rebalancing appeared to be working. Den Haan et. al. (2007, 2009), for example, found that tighter policy incentivizes banks to substitute away from riskier loans to less risky assets. The experimentation with UMPs appears to have tilted the balance further in favor of the portfolio rebalancing channel for some (e.g., see Bernanke (2012)).

The signaling channel also has grown in importance over time. Pre-crisis, central banks had already put greater emphasis on transparency and forward-lookingness in monetary policy communications. Experience gained with UMPs, especially enhanced forward guidance, has reinforced the centrality of the signaling channel in monetary policy (e.g., Bauer and Rudebusch (2014), Bauer and Neely (2014), Woodford (2012), Filardo and Nakajima (2018)). The effectiveness of the signaling channel however can be complicated. On the one hand, signaling a commitment to an expansionary monetary policy can bolster confidence. On the other hand, signaling the *need* for considerably more monetary stimulus can sap the overall effectiveness if interpreted as downgrade in the economic outlook.

In this paper, we focus on the signaling channel and what we can learn about the role of banks in the monetary transmission mechanism by examining bank lending behavior, namely the lending attitudes of senior loan officers. The literature on the role of banks has typically relied upon observed measures of (bank) loans and varieties of interest rate spreads, to give two examples, as potential supply-side indicators of lenders' attitudes toward extending credit. These indicators were seen as capturing the legacy of impaired balance sheets after financial turmoil and being correlated with lending attitudes. Financial institutions, understandably concerned about the potential risks of lending in such an environment, would restrict loan supply. At the same time, household and business deleveraging would cast a pall on the demand for loans. When these supply and demand factors mutually reinforced each other, an economy would find itself mired in a malaise which would hold back a meaningful recovery. In such an environment, monetary policy is generally thought to have a key role. An aggressive easing of policy is expected to bolster confidence at the same time it offsets the tendency of lending spreads to widen. In this way, it has the ability to boost both the demand and supply of loans. While theoretically sound, questions remain about the empirical support.

This paper asks whether data on loan officer attitudes toward lending provide a better lens through which to understand the dynamics of credit conditions and hence the transmission mechanism of monetary policy. We tap an underused source of information on attitudes about lending conditions, obtained from surveys conducted with Senior Loan Officers (SLO). From an

empirical research point of view, the increasing availability of these surveys is a real plus. Early on, few countries collected such data (i.e., the United States, Canada, and Japan). And the focus of the questions was fairly narrow; they only asked about the big picture and were typically backward-looking. Now, the focus has broadened both in terms of number of countries and the scope of the questions. Many of these survey questions are forward-looking, cover expected supply and demand conditions, and ask about perceived credit conditions in different lending sub-markets (e.g., mortgage versus household and commercial loans).

We build our panel (cross-country) dataset with SLO surveys from 17 economies, 10 of which belong to the Euro area (which makes up one economy). The sample covers the 2002-2014 period, which gives us enough data to equally divide the sample between the pre- and post-GFC period. With this dataset, we use the Global VARs (GVAR) methodology (Pesaran et. al. (2004)) relying on a smaller set of critical advanced economies for largely practical reasons owing to a combination of data and space limitations. This methodology is well suited to address the domestic impact of changing attitudes as well as the international (real and financial) spillovers through cross-border inter-linkages.

Our results lead us to conclude that lending attitudes help to explain credit dynamics and the monetary transmission channels above and beyond the information contained in the levels and spreads of interest rates. First, we show that cross-country lending standards help to explain why some economies felt the pre-crisis credit boom more keenly than others did. And, given that Europe is more bank-dependent than the United States, it is not surprising that the effect was more significant in the Euro area than in the United States. Second, the UMP impact on domestic financial conditions was reinforced by changes in lending standards; this also contributed to stronger cross-border spillovers. Third, we find that the overall effectiveness of UMPs was compromised by the signaling channel of monetary policy. For example, when central banks announced an urgency to expand the use of UMPs, our evidence suggests that this led to downward revisions in loan demand, owing to the information being interpreted as a pessimistic revision to expectations about the economic and financial health of the economy.

Overall, our study underscores the important role lending attitudes play – for both borrowers and lenders–in explaining the dynamics of credit conditions and hence in the monetary transmission mechanism. It also suggests that improving the scientific foundations of lending surveys and using this information more systematically may forge a better understanding of the post-crisis period as well as the challenges ahead. With respect to monetary policy, the lesson we draw is that there may be opportunities for strengthening UMP strategies. In the future, central banks may improve effectiveness by focusing on how best to boost the power of positive signals and reduce that of the negative signals. One communication option worth considering when ramping up QE programs is to emphasize the desire to overshoot macroeconomic targets, rather than announce less favorable economic conditions, as the motivation. Of course, a full cost-benefit analysis of such an option would have to address other relevant (i.e., intended and unintended) consequences that might arise.

The rest of the paper is structured as follows. The following section is a brief review of the literature on the role of banks in transmitting monetary policy stimulus to the economy. Then, we briefly outline the empirical methodology in section 3. The data, their construction, sources, and some stylized facts are described in section 4. Section 5 reports our empirical results which are followed, in section 6, by some conclusions and policy implications.

2. Financial Intermediation and the Transmission of Monetary Policy: A Brief Review

Until the GFC, credit supply conditions were arguably thought to be reflected in a small number of financial indicators, namely various prices of credit (typically proxied by credit spreads). [1] For example, researchers would often focus on the differential between long-term and short-term government bond yields. This approach neatly fit the pre-crisis consensus of assuming that the

[1] Indeed, Jordà et. al. (2016) marshal empirical evidence based on the data since 1870 and show that financial stability risks are more likely to originate from credit booms followed by busts than from excessive expansion of government debt. Lopez-Salido et. al. (2016) also associate economic downturns with credit conditions, with links to credit spreads. Also, Haldane (2015) argues that the procyclical nature of lending behavior, the so-called doom loop, reflects perverse incentives in current regulatory regimes.

stance of monetary policy could be evaluated by looking at the central bank policy rate, and this state of affairs became the conventional wisdom by at least the late 1990s.

However, an earlier literature that dates at least to the 1950s, and given proper theoretical foundations by the 1980s, hypothesized the supply of credit being determined by both price and non-price financial factors.[2] Asymmetric information, transaction costs, and other institutional constraints on the supply of credit implied that various forms of non-price rationing resulted in a mismatch between borrowers needs and lenders ability to supply credit. As a result, observed interest rates need not always reflect market clearing conditions and macroeconomic fundamentals.

More recently, UMPs in the major advanced industrial economies (i.e., United States, United Kingdom, Japan and the Euro area) succeeded in compressing the term spread between long- and short-term sovereign bonds. Indeed, UMPs have been partly responsible for distorting the conventional benchmarks of the monetary policy transmission mechanism. As argued in the BIS's 2014 Annual Report, it is not surprising that global financial markets have come "under the spell" of monetary policy. An additional complication has been the reduction of policy rates by several central banks in advanced economies to the zero lower bound (ZLB) and beyond. Some argue that this impaired bank profitability and, over time, encouraged excessive risk taking.[3] Theory would have us believe that while the conventional use of interest rates becomes less effective at this point, UMPs may well give central banks extra room for manoeuver to stimulate the economy (e.g., see Altavilla et. al. (2016)).

A common theme in this literature is the central role financial factors play in influencing the real economic consequences of monetary policy (e.g., Claessens et. al. 2011, Borio 2012). The earlier literature largely assumed that finance was "a veil" which simplified macroeconomic modeling and empirical analyzes. However, experiences over the past decades have drawn

[2] Siklos and Lavender (2015) provide a brief survey for the United States and Canada.

[3] Some evidence suggests that negative rates might impair bank profitability and hence constrain lending supply (e.g., Brunnermeier and Koby (2017), Borio and Gambacorta (2017), and Borio and Hofmann (2017)). So far, the size of the state-dependent impact is difficult to calibrate, but economies which have experienced negative rates in recent years have seen good bank profitability and an expansion of lending (e.g., Madaschi and Pablos Nuevo (2017) and Zurbrügg (2016)).

attention to the problems with this assumption. Macro-financial linkages are now seen as critical features of monetary policy. Moreover, as Adrian and Liang (2014) remind us, it is also useful to distinguish between financial conditions (e.g., whether markets are stressed or not) and financial vulnerabilities. The latter concept stems from the implications of, say, easy monetary policies on the behavior of borrowers who, for example, have the incentive to become over-leveraged, take on too many risks in chasing returns, or both. Whereas financial conditions provide information about the current environment, financial vulnerabilities represent the dangers that lurk within the financial system and can set the stage for future financial tantrums and crises (e.g., Feroli et. al. 2014, Caruana et. al. 2014, Aikman et. al. 2017).

And it is the real economy consequences of booms and busts that have become all too well known. Siklos and Lavender (2015) and Siklos (2015) provide brief surveys of the extant literature on links between the business cycle and the financial cycle. An extensive empirical analysis is presented in Hubrich et. al. (2013) which examines the experiences in the Euro area, European Union (EU), and OECD economies over three decades beginning in 1980. Their study confirms that macro-financial linkages have always played a role, even before the GFC (also see Schularick and Taylor (2012)). There is a growing literature on this topic that, owing to space limitations, cannot be surveyed here (e.g., see Jermann and Quadrini (2012) for the United States).

Conventional macroeconomic models have yet to incorporate mechanisms behind the financial cycle or links to monetary policy in a satisfying way. Among the various questions left open, empirical modelers have had difficulty explaining why monetary policy was so ineffective in sparking a robust recovery. Why do periods of financial booms and busts stand out in the historical record as the key financial factors associated with serious impairment of the monetary transmission mechanism? Especially in busts, disconnects appear to arise between signals from interest rates, credit conditions and the stance of monetary policy. Low interest rates may signal weak economic conditions rather than very expansionary conditions.[4] This can arise because the

[4] Disconnects may arise from many different mechanism. A partial list includes: a credit or asset price channel; a bank lending channel; a risk channel; a balance sheet or portfolio balance channel; an exchange rate channel; a signaling channel and, finally, a risk-taking channel. Of course, it needs to be underscored that some or all of the channels can operate simultaneously. Peek and Rosengren (2013), and Boivin et. al. (2010) provide recent reviews of the relevant literature. Perhaps unsurprisingly, the evidence is mixed. While Bech et. al. (2014) find that monetary

short-term natural rate of interest becomes depressed by the prospect for persistent economic malaise.

Central to our understanding of the macro-financial linkages also is the relative importance of banks, versus non-bank financial institutions, in financial intermediation. It is also well known, e.g., that Europe is far more bank-dependent than the United States (e.g., see Hempell and Kok Sorenson (2010), Cappiello et. al. (2010), Siklos (2015) and references therein). More generally, the degree of bank-dependency varies across countries is quite wide. Among advanced economies, the United States is lowest, at approximately 20%, while the figure for New Zealand is almost 80%. In emerging markets, bank credit as a share of total credit has been declining, a reflection no doubt of the growing maturity of financial systems in those countries (Beck and Demigüç-Kunt (2009), Gambacorta et. al. (2014)).[5] A similarly large range describes the data for emerging markets.

Research has also emphasized the growing importance of cross-border flows as key features of the macro-financial linkages influencing economies. Cetorelli and Goldberg (2011, 2012) conclude that cross-border lending supply shocks played an important role in the GFC. Emerging markets are especially vulnerable because of the outsized role played by foreign banks in these economies. Rey (2013) argues that cross-border flows exacerbate the volatility of gross flows, rendering booms and busts more volatile. Bruno and Shin (2015) also highlight the importance of the movement of global liquidity across borders but underscore the vital role played by the banking sector in the transmission of financial shocks. In part for these reasons, concerns have been expressed, particularly among policy makers in emerging markets, about the implications of spillovers from unconventional monetary policies adopted by the major central banks in advanced economies.[6]

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policy becomes less effective in crisis conditions, Dreschler et. al. (2017) and Dahlhaus (2014) are just two examples of studies that conclude otherwise. The effective lower bound can also distort the effective stance of monetary policy as recently shown in the shadow rate literature (see, e.g. Lombardi and Zhu (2018) and Wu and Xia (2016)).

[5] Both studies rely on data collected by the World Bank, namely the Financial Development and Structure database and the Global Financial Development database. Both are available from http://data.worldbank.org/.

[6] A consequence of these developments has been to bring the issue of capital controls back into favor, often labelled a version of macroprudential measures nowadays (inter alia, Ostry et. al. (2010), Brunnermeier and Sannikov (2015)).

For a deeper understanding of the role of banks in shaping these macro-financial linkages, it is helpful to distinguish between the demand and supply side factors driving the changes in bank credit conditions (e.g., Bernanke and Gertler 1995, Gertler and Karadi 2015). This has long been a concern of empirical banking studies, especially for those with detailed bank-level balance sheet data such as is found in credit registries.[7] The potential value of adding survey information to enrich the analysis has received attention, such as in the work at the country level by Bassett et. al. (2014), Blaes (2011), Ciccarelli, et. al. (2015), de Bondt et. al. (2010), Del Giovane et. al. (2011), Demiroglu, et. al. (2012), Ferrari et. al. (2013), IMF (2013), Jara et. al. (2017), Kwan (2010), Neuenkirch and Nöckel (2018), van der Veer and Hoebricht (2016) and Wośko (2015).[8] While the overall conclusions of studies do not necessarily conflict with the ones using balance sheet data, one important insight from this literature is that the incentives loan officers face do not show up in the balance sheet but do influence credit dynamics (e.g., Agarwal and Ben-David (2017)).

Likewise, our understanding of credit dynamics has been enriched by the attention paid over the past decade to the growing importance of cross-border banking flows. Financial globalization has re-shaped international bank lending, especially during the QE period (for a review of recent papers, see Cerutti et. al. (2014, 2015), Georgiadis and Jancokova (2017), Correa et. al. (2017)).[9] This has been abetted by the growth of non-bank cross-border financial flows. Together, these flows have altered the monetary policy environment in open economies, which has had implications for exchange rates and domestic monetary policy control. However, SLO surveys do not generally cover questions about cross-border lending attitudes, which limits the ability to

There is also growing interest in the potential benefits of exchange rate interventions to counter the exchange rate impact of cross-border flows.

[7] See, e.g., Jiménez et. al. (2014, 2017) and references therein. Note also that the level of detail can complicate cross-border comparisons, not least owing to different accounting rules.

[8] For earlier research on the practical uses of SLO surveys, see Lown et. al. (2000), Lown and Morgan (2006).

[9] As the GFC struck the major advanced economies and domestic economic prospects deteriorated, QE helped strengthen bank balance sheets. This, all else the same, would raise the attractiveness of foreign lending, even if foreign lending was generally more risky than domestic lending. It is not surprising that QE had implications for cross-border lending. Chen et. al. (2016), for example, find evidence that cross-border QE spillovers from the major advanced economies working through (term and credit) spreads and cross-border financial flows. They also find that the impacts of QE shocks are often much larger externally rather than domestically. More recently, Hofmann and Peersman (2017) document the growing strength of monetary policy on GDP by working through credit and housing prices; Anundsen et. al. (2016) also highlight the impact of credit and housing price shocks on the global economy. Lombardi, Siklos, and St. Amand (2018) provide evidence suggesting that monetary policy spillovers are enhanced by what central banks say and not solely by the actions they take on the policy rate and UMP fronts.

directly test the influence of foreign lending attitudes. Our paper is one of the first to use the domestic SLO survey data to draw inferences about these attitude spillovers. We achieve this with the GVAR methodology. Our research also suggests that these surveys could be improved by asking questions that distinguish SLO attitudes about domestic and foreign lending.

3. An Outline of the GVAR Methodology

The GVAR model, proposed by Pesaran et. al. (2004), is a global modelling framework that links $N + 1$ country-specific (or some other entity) VAR models (VARX*) to empirically identify global links. The principal advantage of the GVAR is that it represents a practical and coherent solution to the 'curse of dimensionality' that stems from global modelling that resort to standard VARs. In addition to providing an alternative method that addresses endogeneity and model specification issues, the GVAR methodology is particularly attractive in the present context. First, GVARs are well suited to estimate parsimoniously cross-border spillovers from UMPs. In particular, we can model a large cross-section of economies without running out of degrees of freedom. Second, the GVAR assumption that country-specific foreign variables serve as proxies for a small set of common unobserved factors is consistent with the key role that US and European banks play in international banking. Hence, the panel approach is well designed to capture the transmission of unconventional monetary policies associated with the activities and lending attitudes of global banks. Third, the GVAR's generalized impulse responses allow us to skirt some of the unresolved identification issues in the SLOS VAR literature.[10]

We briefly outline the GVAR methodology with which to assess the cross-country spillovers.[11] In a nutshell, the first step is estimation of individual country VARX models. Each country model includes domestic and foreign variables, as well as global variables capturing international factors (e.g., oil price, volatility in financial markets based on the VIX). Then the resulting country VARX estimates are combined to construct our GVAR model, using bilateral trade as a basis of the

[10] See, e.g., Bassett et. al. (2014). In addition, the GIRFs have the added benefit of letting us take an agnostic stand on the structural relationships in question since we do not observe the explicit link between SLOS and actual lending.
[11] Pesaran and Chudik (2016) provides a comprehensive literature review, while di Mauro and Pesaran (2013) updates Dées et. al. (2007) and highlights many empirical applications in different fields of economics.

linking matrices. The accuracy of the GVAR depends on weak exogeneity of the foreign and global variables in country VARX models, for which we test.

Technically, the econometric framework of the GVAR is as follows. First, the individual country VARX* (p, p^*) for country $i = 0,1, \dots, N$ is given by

$$x_{it} = a_{i0} + a_{i1}t + \sum_{j=1}^{p} \psi_{ij} x_{i,t-j} + \sum_{j^*=0}^{p^*} \Lambda_{ij^*} x^*_{i,t-j^*} + \vartheta_{i0} d_t + \vartheta_{i1} d_{t-1} + \varepsilon_{it} \quad (1)$$

where x_{it} is a $k_i \times 1$ matrix of endogenous domestic variables in country i at time t; a_{i0} and a_{i1} denote the constant and coefficient on the time trend respectively; d_t is a $(k^{ex} \times 1)$ vector of global exogenous variables; and the white noise process is denoted by $\varepsilon_{it} \sim \mathcal{N}(0, \sum_i)$. In the actual estimation stage, the intercepts are unrestricted.

Finally, the weakly exogenous foreign variables, denoted with a '*', are defined as

$$x^*_{i,t} = \sum_{r \neq i}^{N} \omega_{i,r} x_{r,t} \quad (2)$$

where $x^*_{i,t}$ is a $k^*_i \times 1$ vector and $\omega_{i,r}$ denotes bilateral weights between countries i and r, such that $w_{ii} = 0$ and $\sum_{j=0}^{N} w_{i,j} = 1$. These weights reflect the economic links between country j's economy to country i's economy and, as noted previously, are based on bilateral trade flows.

To illustrate the basic structure of the GVAR, assume that a VARX (1, 1) model is specified and set $\vartheta_{i0} = \vartheta_{i1} = 0$. To solve the model, we specify the vector $z_{i,t} = (x_{i,t}, x^*_{i,t})'$ with dimension $(k_i + k^*_i) \times 1$. Collecting all contemporaneous terms on the left-hand side, together with other simplifications of the notation, yields

$$A_i z_{it} = a_{i0} + a_{i1}t + B_i z_{i,t-1} + \varepsilon_{it} \quad (3)$$

where $A_i = (I_{ki}, -\Lambda_{i,0})$ and $B_i = (\psi_{i,1}, \Lambda_{i,1})$. Defining z_{it} in terms of the global vector $x_t = (x'_{0t}, x'_{1t}, \dots, x'_{Nt})$ alongside the weight matrix W_i such that $z_{it} = W_i x_t$, we can re-write (3) as

$$A_i W_i x_t = a_{i0} + a_{i1}t + B_i W_i x_{t-1} + \varepsilon_{it} \quad (4)$$

Stacking all country models yields

$$Gx_t = a_0 + a_1 t + Hx_{t-1} + u_t \tag{5}$$

where

$$a_0 = \begin{pmatrix} a_{00} \\ a_{10} \\ \vdots \\ a_{N0} \end{pmatrix}, a_1 = \begin{pmatrix} a_{01} \\ a_{11} \\ \vdots \\ a_{N1} \end{pmatrix}, u_t = \begin{pmatrix} \varepsilon_{0t} \\ \varepsilon_{1t} \\ \vdots \\ \varepsilon_{Nt} \end{pmatrix}, G = \begin{pmatrix} A_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_N W_N \end{pmatrix}, H = \begin{pmatrix} B_0 W_0 \\ B_1 W_1 \\ \vdots \\ B_N W_N \end{pmatrix}.$$

Pre-multiplying (5) by G^{-1}, the GVAR model obtained from the estimated individual country models takes the following form:

$$x_t = G^{-1}a_0 + G^{-1}a_1 t + G^{-1}Hx_{t-1} + G^{-1}u_t = b_0 + b_1 t + Fx_{t-1} + e_t \tag{6}$$

Note that (6) resembles a VAR (1) model with a deterministic time trend, and therefore can be used to generate forecasts, impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). These features allow us to investigate the model's dynamic properties as well as the time-varying effects of variable-specific shocks across economies (e.g., US interest rate hike, global credit shock). In particular, the IRFs trace out the responsiveness over time of the model variables to shocks, while the FEVDs highlight the proportion of the forecast error variance of variables due to the range of shocks being experienced.

For completeness, we highlight a number of additional details. Using the Schwartz Bayesian criterion (SBC) the number of lags for domestic variables is set to 1 for all country models. The maximum number of lags for foreign variables is also set to 1. All of the series are in levels or in log levels before unit root tests are applied (not shown). Unit roots are found in the (log) levels of real GDP, equity prices, cross-border claims, the real exchange rate, the level of short-term interest rates, and the inflation rate, but not SLO indicators. These conclusions seem consistent with previous GVAR applications (e.g., Dées et. al. 2007, Feldkircher and Huber 2015, Eickmeier and Ng 2015) other than SLO data which were not previously used.

All non-US country VARX models contain as endogenous (domestic) variables real GDP, inflation, real equity prices, the short-term interest rate, real bilateral exchange rate against the US dollar, cross-border claims from BIS reporting countries and total credit to the non-financial

sector, and SLO indicators.[12] These models also include similarly defined foreign variables (except the foreign real bilateral exchange rate) as well as the oil price as a global variable, all of which enter as being weakly exogenous. Following Dées et al. (2007), the US model is treated differently given its dominant role in the global economy. In particular, the US model does not contain the domestic real bilateral exchange rate, foreign real equity prices or the foreign short-term interest rate. However, oil prices and the US VIX are included as endogenous variables. The US shocks are identified by imposing a specific ordering.

4. Data and Stylized Facts

Data

We collected data for 16 countries plus the Euro area: United States, Japan, United Kingdom, Canada, Australia, the Euro area, Denmark, Norway, Poland, Czech Republic, Romania, Hungary, Turkey, Philippines, Thailand, New Zealand, and Sweden.[13] The survey data are typically sampled at the quarterly frequency.

Data for the United States begin in 1990, 1999 for Canada, 2000 for Australia and Japan, 2002, and 2007 for the United Kingdom.[14] For Euro area economies the relevant survey data begin in 2002 although data for several Euro area members, particularly countries that joined the European Union (EU) after 2004, only starts in 2009. For the remaining countries in our dataset the start date for lending standards data ranges from 2003 (e.g., Poland) to 2012 (e.g., Czech Republic). In terms of sample sizes, this implies that anywhere from 10 to 99 observations per economy are available. Since the data are occasionally quantified slightly differently across economies, all observations were converted such that a positive value for the standards data implies a tightening of credit conditions while a negative value means a loosening of standards.

[12] For reasons that will become apparent in the following section we use available forward-looking SLO indicators of credit supply conditions (viz., survey of lending conditions usually expected over the next three months). This reduces the length of the potential sample but the resulting credit conditions proxy is more likely to satisfy weak exogeneity conditions not to mention being more germane with the signalling phenomenon that is the focus of the paper.

[13] The ECB does not release data for all members of the single currency area.

[14] Actually, US data go back as far as the 1970s but with an interruption in the 1980s. See, for example, Siklos and Lavender (2015), and references therein, for more details. Partly because the earlier US data may not, strictly speaking, be comparable with data beginning in the late 1980s, we do not examine data prior to 1990.

The same interpretation applies to estimates of loan demand side conditions based on survey data. It is worth noting, however, that there are fewer surveys of senior loan officers' views concerning past or anticipated loan demand. Survey data are also available since 2009 for several regional groupings (e.g., Asia, Emerging markets, Latin America, Middle East). The surveys are carried out by the Institute of International Finance (https://www.iif.com/). The remaining surveys are usually carried out by the central bank although there are some exceptions (e.g., Australia, New Zealand).

One difficulty in drawing precise inferences with our dataset is the difference in survey methodologies across countries, and across time for a particular country. Even though space constraints prevent a complete listing of the survey SLO questions,[15] all of the surveys do ask similar types of questions which allows us to have confidence in our cross-country findings. But the precise wording of the questions differs across surveys. Another difficulty we faced is an identification problem. The surveys, especially those from long ago, can fail to distinguish between supply and demand conditions. The principal aim of the questions was whether lending conditions have been, or are likely to be, tighter or looser than in the past or in the near future. While a growing number of the surveys over time have addressed credit supply and demand conditions separately, these more precise responses that would simplify the identification strategy reduce our sample size. Finally, the open-ended nature of the relevant questions also leaves open, for example, the extent to which changes in lending conditions, or borrowing when data availability permits, are due to changes in the stance of monetary policy or in response to other economic conditions.[16]

Countries with the longest span of lending survey data (viz., United States, Japan, and Canada) originally did not distinguish between types of loans. In recent years, the survey questions began to discriminate between residential, commercial and loans to households. The ECB was a pioneer,

[15] Details are, however, available on request.

[16] As Bassett et. al. (2014) highlight, precise measures of credit supply and demand factors are difficult to assess from surveys because many of the same factors that influence the supply of loans also affect the demand for credit. Even though we address this concern in the setup of our GVAR model, it suggests caution in drawing strong inferences about the point estimates in the model. There is also the difficulty that assessments of lending conditions do not make a distinction according to whether any tightening or loosening stem from purely domestic forces or whether international factors are at play. We return to this point in the conclusions.

and many central banks have begun following its lead. Nevertheless, differences between types of loans seem neither large nor persistent, an indication perhaps that common standards for loans predominate.[17] Accordingly, all estimates below use aggregate indicators of lending standards.

We include a set of macroeconomic and financial variables of interest. For the aggregate activity and inflation, we use real GDP growth, headline inflation (core inflation was also examined but the results were robust), and the price of oil. Turning to financial variables, other than the lending standards data, we include the term spread, that is, the long-short government bond yield differential, total bank credit (e.g., as a share of the private non-financial sector), and the VIX. All data are from the BIS, individual central banks, and the International Monetary Fund.

A Few Stylized Facts

One of the contributions of this paper is studying the relevance of attitudes towards loan demand and supply on the monetary transmission mechanism. Accordingly, we report here only stylized facts as they pertain to the attitude toward credit conditions. Figures 1A and 1B aggregate some of the available data according to the size or type of monetary policy regime in place. The large economies include the G4 (i.e., United States, United Kingdom, Euro area and Japan). Emerging markets in our sample are grouped separately as are the advanced inflation targeting (IT) economies, which tend to be small and open (e.g., Australia, Canada, and Sweden). In one case we have disaggregated the Euro area economies according to whether they are members of the core (viz., France, Germany, and Italy) or part of the periphery, relying on two definitions (see Figure 1A). We also consider EU member states not in the Euro area (Hungary, Poland, Romania, and the Czech Republic).

Figure 1A illustrates that credit supply conditions over time quite are heterogeneous around the globe. Nevertheless, as shown by the dashed vertical lines, which capture the timing of QE policies introduced by the G4, QE measures generally loosen credit conditions, although the impact of these policies appears to diminish over time. When data permit we can also illustrate

[17] Of course, this result may also reflect a flaw in the survey itself. We do not pursue this question further.

the diversity of global credit supply conditions by asking how SLO expectations of lending standards evolve over six-month horizons. The results are shown in Figure 1B which further highlights the diversity of loan supply conditions across different economies. It is especially notable that conditions in the EMEs reveal the large impact of the GFC as well as spillovers from various attempts at QE by the G4.[18]

Figures 2A and 2B focus on the experience of the Euro area economies. Whereas the behavior of loan demand is similar among Euro area members (Figure 2A) in both the core and in the periphery, there is considerable variation in perceptions of the degree of ease or tightening in the supply of credit across various Euro area members (for which data are available).[19] In addition, it is worthwhile pointing out that credit conditions tightened considerably precisely at the time loan demand rose sharply, and not necessarily in the periphery economies. Rather, the impact was most acute in the less widely publicized periphery economies in the wake of the sovereign debt crisis in that region of the world (e.g., Estonia, Malta, Slovakia, and Slovenia).

The potential role of spillover effects is again illustrated in Figure 3. While the extant literature has focused its attention on cross-border spillovers of QE into asset prices the impact is also visible in the evolution of credit supply standards. It is also apparent that the impact of various QE measures is, at best, temporary. In every single case shown, a tightening (i.e., a rise in the index) is followed by a loosening of standards in the next quarter. In a couple of cases, an initial loosening of standards is offset by a subsequent tightening. Overall, this behavior supports the notion that QE has been having mixed effects on the macroeconomy, at least with regard to credit supply conditions.

Focusing on the EMEs in our sample, Figure 4A suggests that loan demand conditions, at least as measured by the surveys, appear to mirror conditions in the economy more generally. By

[18] Indeed, this graph might suggest that authorities could have lessened the impact of the financial crisis by responding more aggressively. By the time UMPs were deployed, the rapid tightening of credit standards appears to have spread globally. It is also interesting to note that an increasing number of central banks have begun collecting this kind of data.

[19] It is unclear how significant the omission of data from certain Euro area members (e.g., Greece) is. A comparison of Euro area-wide data and the mean of individual Euro area member countries for which data are available suggest that the unavailable data have only a modest overall effect (plot not shown).

contrast, as shown in Figure 4B, credit standards in various parts of the globe seem relatively volatile and, at least visually, there are no obvious links with global economic performance. We turn next to the econometric evidence.

5. GVAR Results

When estimating the GVARs, the following economies are included: Australia, Canada, the Euro area, Japan, Sweden, the United Kingdom and the United States. The countries in the Euro area grouped together in one region are as follows: Austria, Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. There were too few observations available for the other economies to include them in the econometric estimation.

Figures 5 through 8 display the impulse responses for two sets of shocks. They are a positive shock to lending standards in the United States or the Euro area (Figures 5 and 6) and a negative shock to the demand for loans (Figures 7 and 8), again originating either from the United States or the Euro area.

We first examine the positive shocks to lending standards which imply that senior loan officers tighten credit. Hence, one also expects a tightening of loan supply. As Figure 5A demonstrates for the United States, a tightening of lending standards is highly persistent. Moreover, a tightening of US lending standards (first two rows of Figure 5A) is seen as reverberating across the advanced economies with the exception of Japan.[20] Not surprisingly, the largest response tends to be in the United States, closely followed by a similarly large response in Canada; Canada is the United States' largest trading partner whose financial links are equally important. Notice also that the responses parallel each other across the economies considered, at least for the first four quarters. Hence, one may think of a lending standard shock as having the flavor of a common global financial shock. Whether this is a reflection of financial globalization, the role of global banks or a manifestation of the global financial cycle we cannot

[20] It has been suggested to us that the Financing Facilitation Act may be partly responsible for the results for Japan. The legislation, influenced by the impact of earthquakes including the large one is 2011, is aimed at easing lending conditions to small and medium sized enterprises. See, for example, IMF (2012),

say. Nevertheless, this shock is one that has generally been overlooked in macroeconomic models.

The omission is even more noticeable when we turn to the impact of a tightening of lending standards on real GDP growth (bottom two rows of Figure 5A). As expected, a tightening of lending standards tends to be contractionary, again on a global scale, though the impact appears to diminish after two to three years, except in Japan where there appears to be a permanent effect on a scale similar to that seen in the United States.

We now turn to the responses of the term spread and total credit growth (top two and bottom two rows, respectively, of Figure 5B). Although the impact of a tightening of standards is to raise the term spread,[21] the global effect is reversed everywhere after about three years. There are, however, some notable exceptions. In the United States and the United Kingdom, there are signs that the effect is long lasting.[22] As well, tighter standards do lead to an economically small but persistent decline in total credit. However, perhaps consistent with the rebalancing channel, investors tend to shy away from those tightening standards and look more favorably on others. This positive effect is most noticeable for the Euro area and Sweden. Once again, we observe the importance of making the connection between lending standards and credit. Ignoring the former omits a potentially important link that exists between the financial and real sectors of the economy even though the economic significance of this relationship may not be measured precisely.

Figure 6 presents the results from a similar exercise but now the positive shock to lending standards originates from the Euro area. Moreover, the global spillovers appear to be somewhat more modest than in the case of the US shock. This could reflect less synchronization of the Euro area's business cycle with in the rest of world and the more dominant role of the US dollar as an international currency (e.g., see Constâncio (2015)). Paralleling the US results, a Euro area lending standards shock is globally contractionary for GDP, albeit with a somewhat smaller influence on

[21] Of course, this can be a lowering of the short-term interest rate, a rise in the long-term rate, or a combination of the two.

[22] After 40 quarters the change in the term spread does fall back to zero in both cases (not shown).

Japan. The impact is for GDP is clearly negative for the Euro area and Sweden. The Euro area is Sweden's largest trading partner. It is worth noting that the size of the lending standards impulse responses from a Euro area shock is generally somewhat smaller than that found for the same-sized US shock.

The impulse responses for the term spread and total credit growth (Figure 6B) are broadly comparable to the ones found for the United States although, as is true for the other variables shown, the size of the responses is smaller than the ones shown in Figure 5B. This is especially true of the response of total credit. However, unlike our finding for the United States, a tightening of lending standards in the Euro area produces a significantly positive response in Canada, at least for a few quarters.

Figures 7 and 8 consider the other side of the loan markets by investigating the impact of a negative loan demand shock that originates from either the United States or Euro area. When the shock originates from the United States (Figures 7A and 7B), we see a significant loosening of standards. Clearly, a possible response to a decline in loan demand is to lower standards. The same response is even clearer when the negative demand shock comes from the Euro area (first two rows of Figure 8A). The fact that lower lending standards can partly offset the impact of a negative demand shock represents a challenge to theoretical and empirical modeling that ignores a role for credit standards.

Interestingly, a negative US loan demand shock is contractionary almost everywhere. The bank lending channel effect appears muted because of the reduction of credit standards (Figure 7A). For the Euro area (Figure 8A), a negative loan demand shock is clearly negative at home and abroad. The larger decline in the Euro area, as noted earlier, may reflect the fact that the transmission mechanism in the Euro area is far more dependent on bank intermediation than in the United States. There is little doubt that this difference is part of the explanation for the differential responses. The impulse responses for the term spread (top two rows of Figures 7B and 8B) suggest that a negative loan demand shock persistently lowers the spread in the United States and elsewhere.

The greater bank-dependent financial intermediation in the Euro area is also evident in the credit impulse responses (bottom two rows in Figures 7B and 8B). A negative loan demand shock in the Euro area unambiguously contracts credit growth in the Euro area and the spillovers to the other European economies are noticeably larger than in the case of the US shock to loan demand. These are consistent with the 'spare tire' hypothesis of a financially diversified financial system like that of the United States. If bank loan demand contracts, overall lending may be held up by those who regularly borrow in capital markets. This also means that there would be fewer spillovers to the rest of the world from a loan demand shock in the United States.

Next, we briefly examine forecast error variance decompositions (FEVD) for the cases shown in Figures 9 and 10.[23] Own shocks to loan standards explain the largest portion of the variation in loan standards in both the United States and the Euro area, though the relative importance of this variable, of course, declines as lags increase. Real GDP growth also explains much. The term spread and credit growth explain only a small proportion of the N-step ahead forecast error variance. Again, the United States and Euro area results parallel each other.

Turning to the explanatory power of the same variables in response to a negative loan demand shock, we find that there are modest differences for the United States versus the Euro area case. While lending standards explain more of the variation in loan demand than any other variable considered, for both the United States and the Euro area, credit plays a relatively more important role in the Euro area. Changes in real GDP growth explain only a small proportion of the total variation.

Finally, Figure 11 shows confidence intervals for the impulse responses to a QE shock that originates in the United States. The shocks are daily surprises in two-year US Treasury yields at the time of significant announcements about QE, aggregated up to a quarterly frequency. [24] The QE proxy has the flavor of an external instrument that is increasingly viewed as an improvement

[23] As noted above, results not shown here are available in an Appendix from the authors.

[24] QE was only implemented in the United States, the Euro area, Japan, and the United Kingdom during our sample. To conserve space, we only display the responses of credit standards and loan demand to a QE shock. We also considered a global indicator of QE shocks, namely the sum of QE shocks in the four economies involved, with the conclusions unchanged. Results using QE shocks proxied by surprise changes in 10-year government yields are also similar.

in correctly identifying the shock of interest (e.g., also see Stock and Watson 2018). In all four economies, a QE shock results in a lowering of credit standards though the effect, after 20 quarters, is generally not permanent. However, the effect is longer lasting in the United States and the Euro area than in the other two economies. Unfortunately, QE also seems to dampen loan demand and the effect is very persistent everywhere except in the United States. We interpret this as an unintended signaling effect of QE, i.e. the QE action was seen as a signal that economic and financial conditions have deteriorated. This QE signal of poorer near-term economic prospects has the effect of dampening loan demand.[25]

6. Conclusions and Policy Implications

It is sometimes claimed that the GFC impaired the normal monetary policy transmission mechanism. The implementation of quantitative easing policies in major advanced economies (United States, United Kingdom, Euro area, and Japan) was intended to offset the financial strains. Much as there is an ongoing debate about the impact of QE on financial markets around the world, it has proved difficult to determine empirically the extent to which QE policies have been able to assist in the healing of the monetary policy transmission.

Stressed bank balance sheets, for the most part, have stood in the way of a rapid normalization of monetary conditions. Policy makers continue to grapple with the macroeconomic consequences and the associated sharp reduction in lending and investment activity. Surprisingly, the extant empirical literature has shied away from using data based on surveys of Senior Loan Officers even if central bankers themselves regularly publish and discuss the surveys. As shown by the empirical evidence in this paper, inclusion of cross-country SLO survey data enriches the analysis. We have shown that the behavior of bankers' lending standards have significant macroeconomic effects.

[25] The sizes of the impulse responses are small owing to the fact that the variable is the log of a ratio. Admittedly, loan demand is a noisy signal and could partly borrowers' inability to borrow as opposed to purely a signal of poorer economic conditions that are thought to lie ahead. Nevertheless, since a tightening of borrowing constraints also likely reflects a worsening economic outlook the signaling element of QE remains the one at play.

An objective of this paper is to seek to empirically determine the extent to which data from lending surveys can help us understand not only whether the monetary policy transmission mechanism has been impaired but also the implications for monetary policy spillovers.

Employing data from up to 17 economies, 10 of which belong to the Euro area, for a sample covering the 2002-2014 period, we estimate a GVAR model. This methodology seems well-suited to accounting for domestic and international real and financial sources of shocks to the aggregate economy. We focus on two sets of shocks to the United States and the Euro area and examine their potential spillovers to the rest of the world: a positive shock to lending standards (i.e., an effective tightening of policy) and a negative shock to loan demand. QE is intended, at least in principle, to offset these two types of shocks. We find that cross-border effects of QE significantly interact with domestic lending conditions. More precisely, unless these shocks are offset they have significant negative effects on economic growth and interest rate spreads, to give two examples. Moreover, the effects can be quantitatively larger for the Euro area than the United States, owing in large part to bank lending being much more important in the former economy than in the latter. Finally, cross-border spillovers are evident. Data limitations prevent us from providing answers that are more definitive.

Our approach also provides insights into why the credit boom that preceded the GFC was felt more keenly in some economies than in others. Our study also leads to some policy implications. For example, it is important that policy makers survey lending attitudes beyond those about domestic credit conditions. Cross-border influences on domestic credit conditions need to be separately identified if surveys are to provide further insights into the evolving monetary policy transmission mechanism. Finally, more data will allow a more definitive evaluation of the role of QE and lending standards on emerging market economies.

Equally important is the finding that QE shocks lead to a loosening of credit standards. In principle this ought to be considered an additional benefit of unconventional policies. Unfortunately, we did not find a concomitant positive reaction in the form of higher loan demand. Instead, the evidence is more consistent with the hypothesis that potential borrowers see QE actions as a harbinger of poorer near-term economic and financial prospects. In other

words, QE appeared to have had positive impacts on the supply of credit, reflecting in at least part an improvement in the asset side of bank balance sheets, but a negative QE signaling effect on demand. This raises the possibility that if QE policies are required in the future, central banks may find it useful to reflect, with 20-20 hindsight, on the lending experience of the past 10 years in order to draw lessons about how to refine their strategies (i.e., the timing and communication) so as to boost the overall effectiveness of QE policies.

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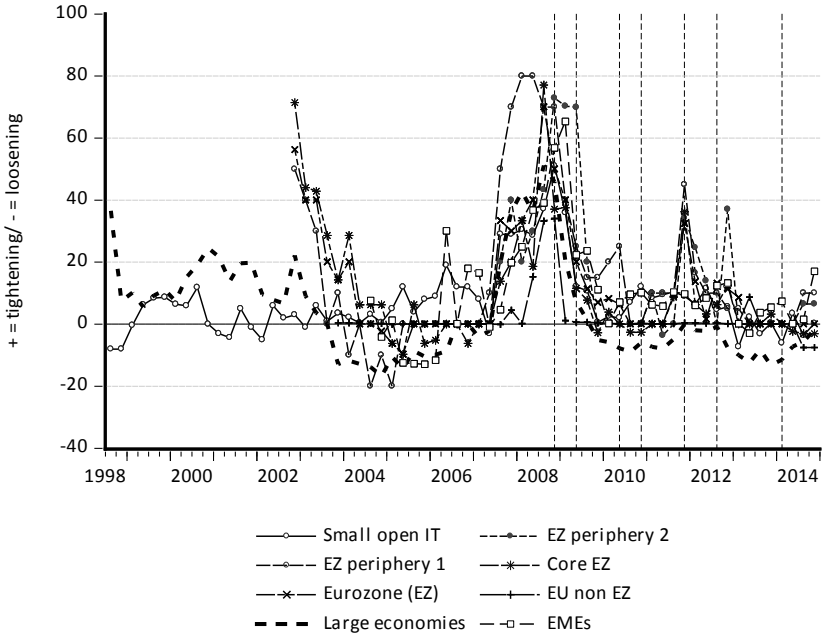
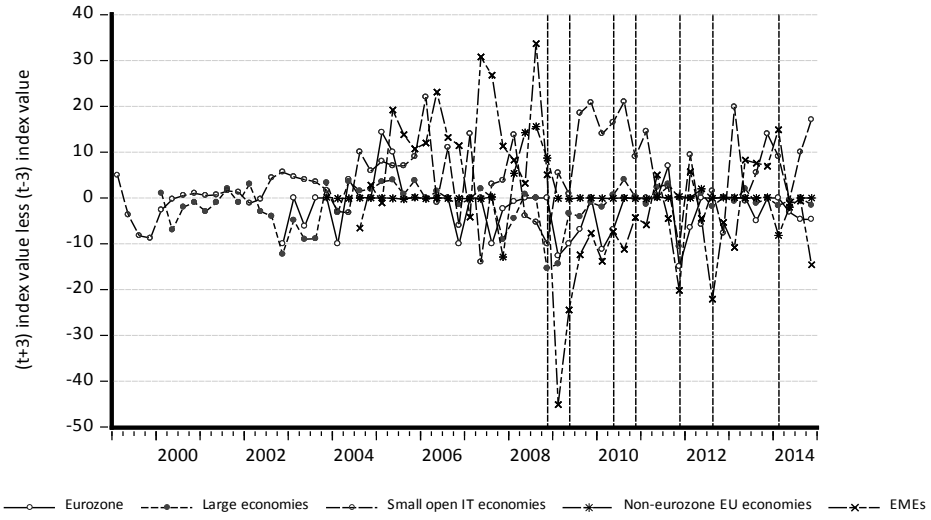
Figure 1A - Survey of Lending Standards in a Selection of Economies



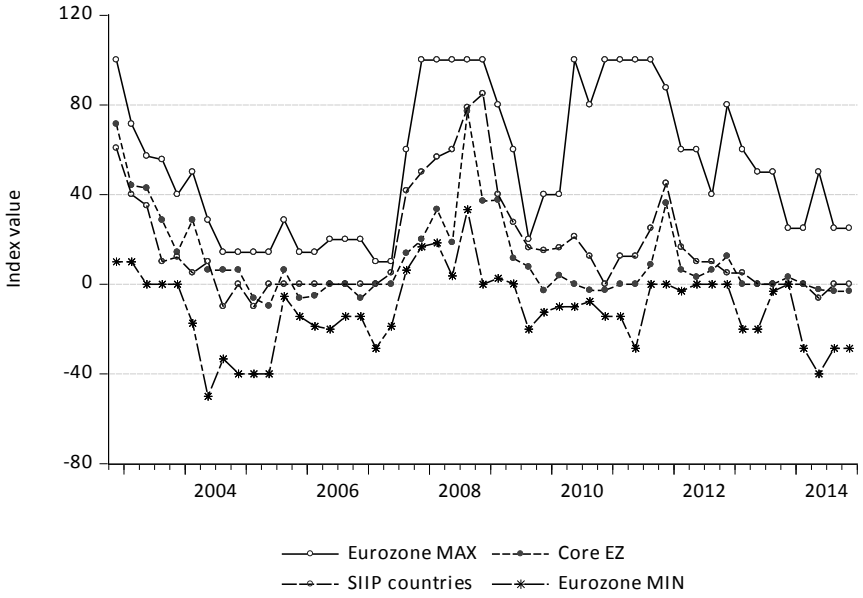
Notes: Vertical dashed lines refer to the UMP actions taken by the central banks in the four large economies. See Figure 3 for the precise dates used. Data refer to senior loan officers' views about conditions over the previous three months.

Figure 1B - Expected Movements in Lending Standards – Global



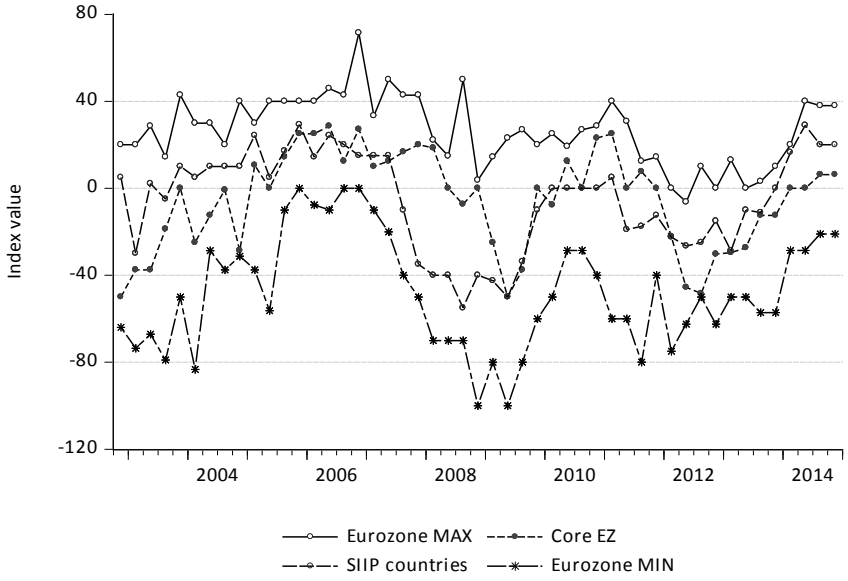
Note: Euro area defined previously. Large economies consist of the United States, Euro area, Japan, and the United Kingdom. Small open IT economies include: Canada, New Zealand, Sweden, Australia, and Norway. Expected movements refer to senior loan officers' views about conditions three months ahead.

Figure 2A - Lending Standards: Euro area and SIIP Countries



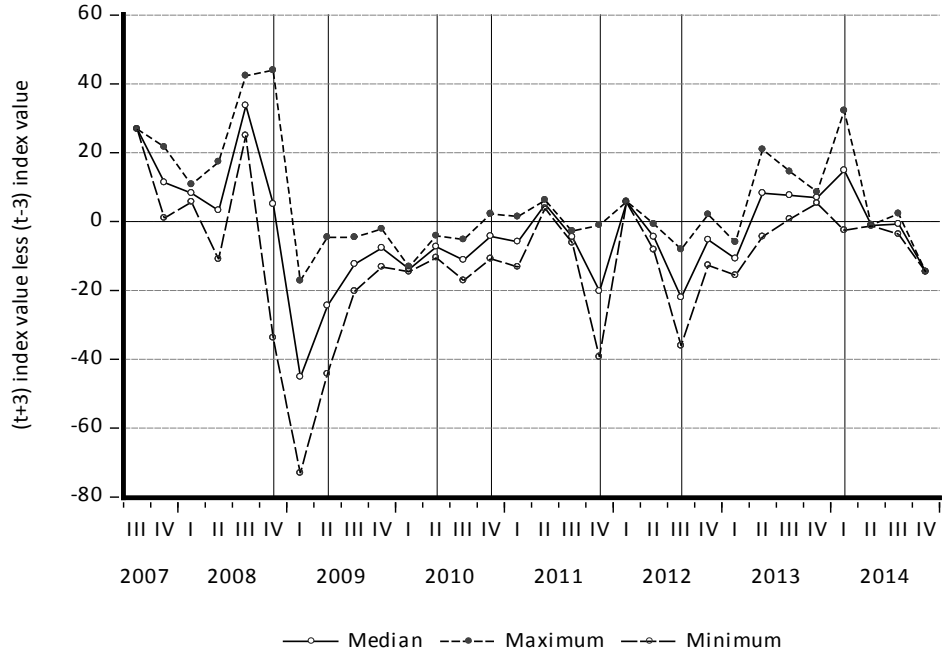
Notes: SIIP Countries are: Spain, Italy, Ireland, and Portugal. Core EZ countries defined above. MAX, MIN refer to the maximum and minimum values obtained from the Survey for the entire Euro area.

Figure 2B - Loan Demand: Euro area and SIIP Countries



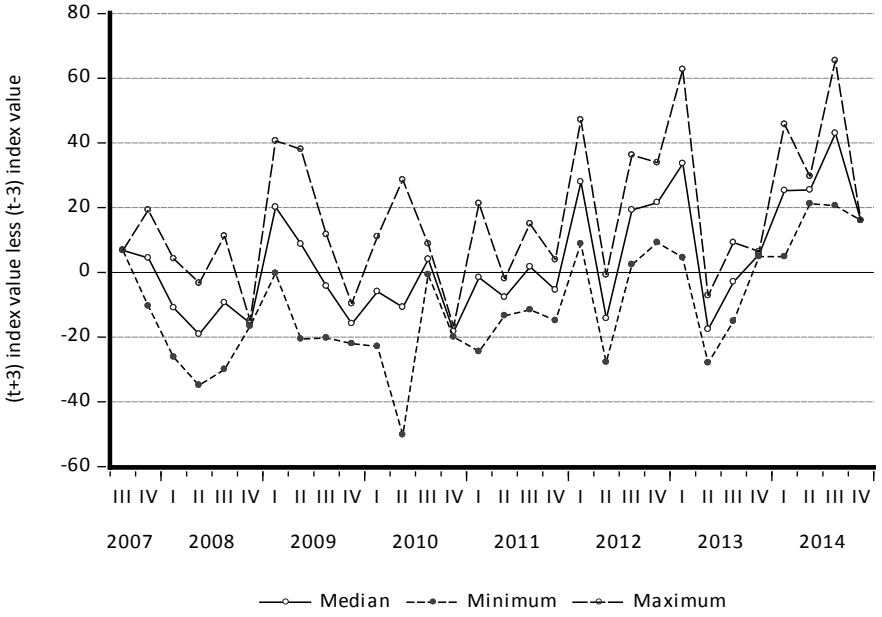
Note: See note to Figure 2A.

Figure 3 - Expected Movements in Lending Standards – Emerging Market Economies



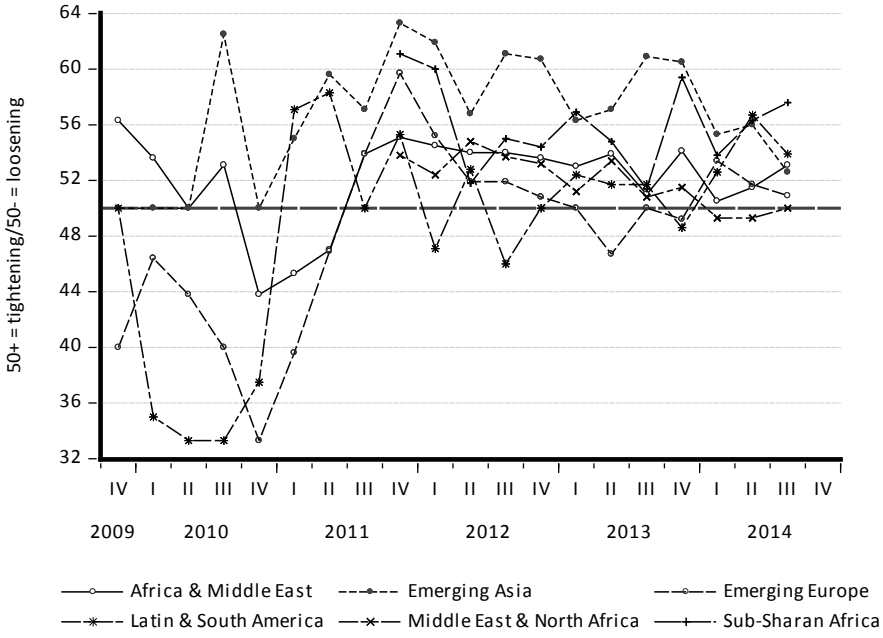
Notes: EMEs are Turkey, Thailand, and Philippines. Vertical lines indicate UMP (CE, QE) policies by the major central banks. 2008Q4 (Fed), 2009Q2 (ECB/BoE), 2010Q2 (ECB), 2010Q4 (Fed), 2011Q4 (BoE), 2012Q3 (BoE), 2012Q3 (Fed/ECB), 2014Q1 (BoJ).

Figure 4A - Expected Movements in Loan Demand in Emerging Market Economies



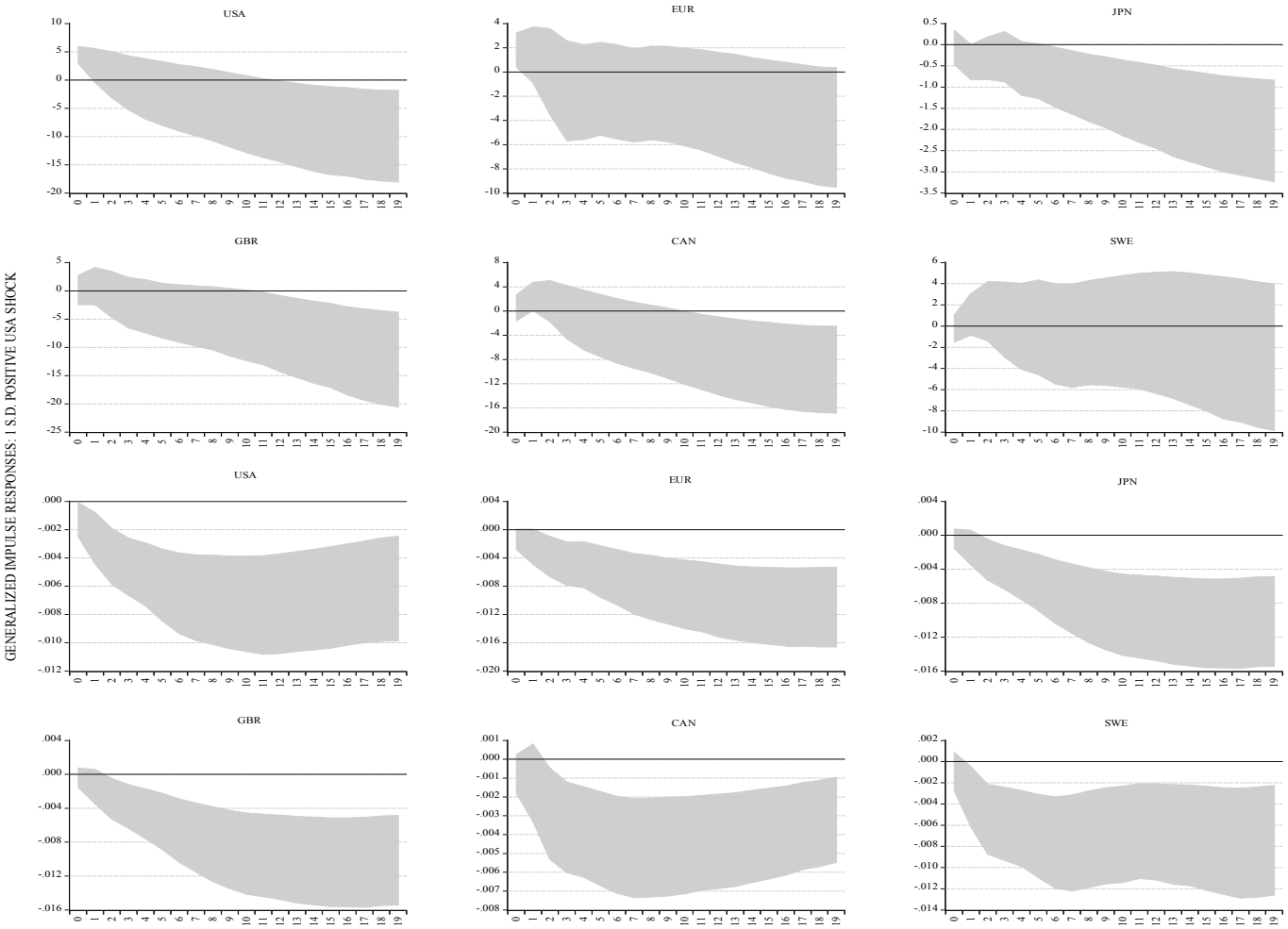
Note: See note to Figure 2A.

Figure 4B - Institute of International Finance Lending Standards Survey – Regional Groupings



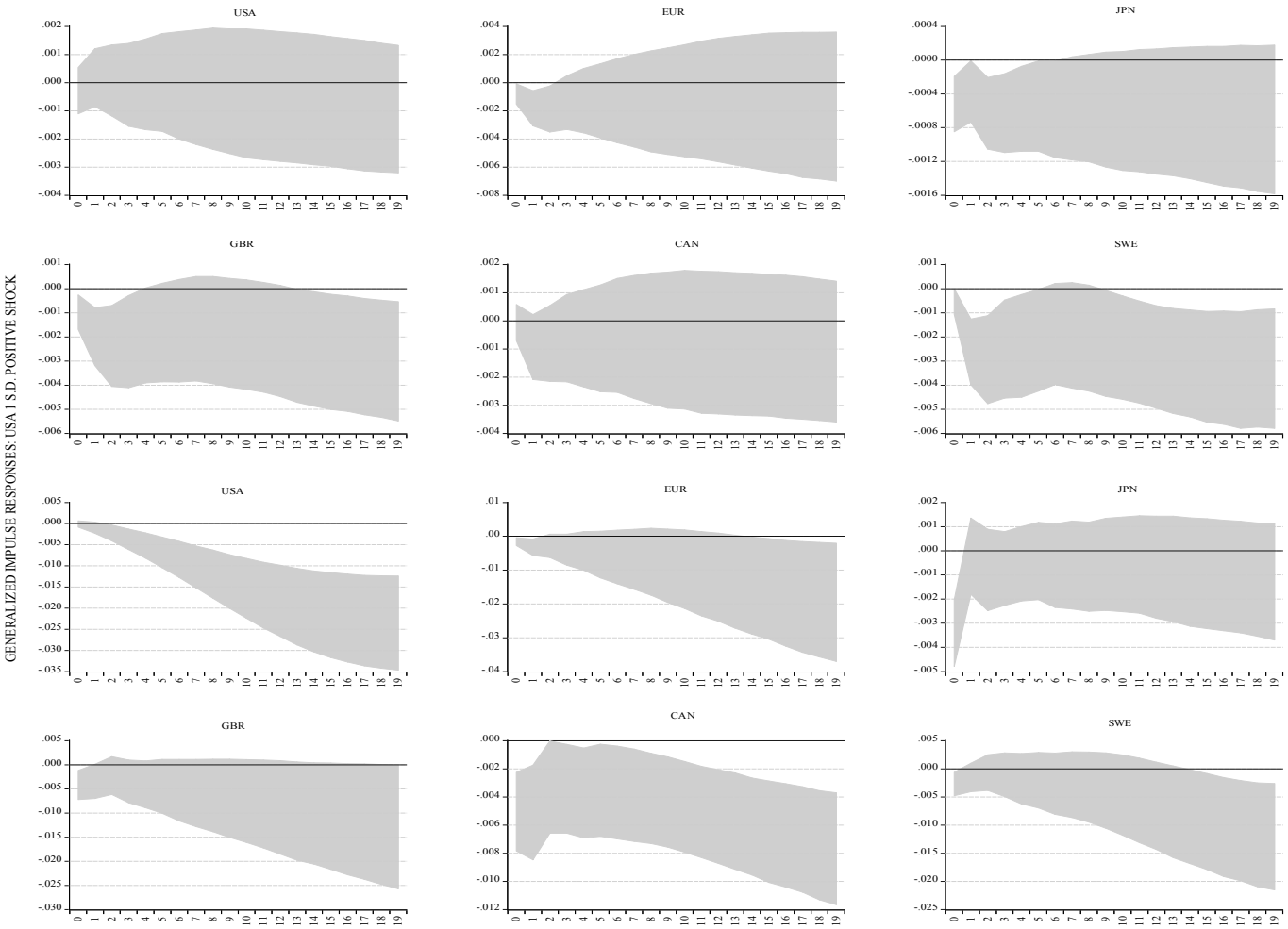
Note: Regional definitions follow those of the International Monetary Fund.

Figure 5A Impulse Responses to a Tightening Lending Standards Shock from the UNITED STATES



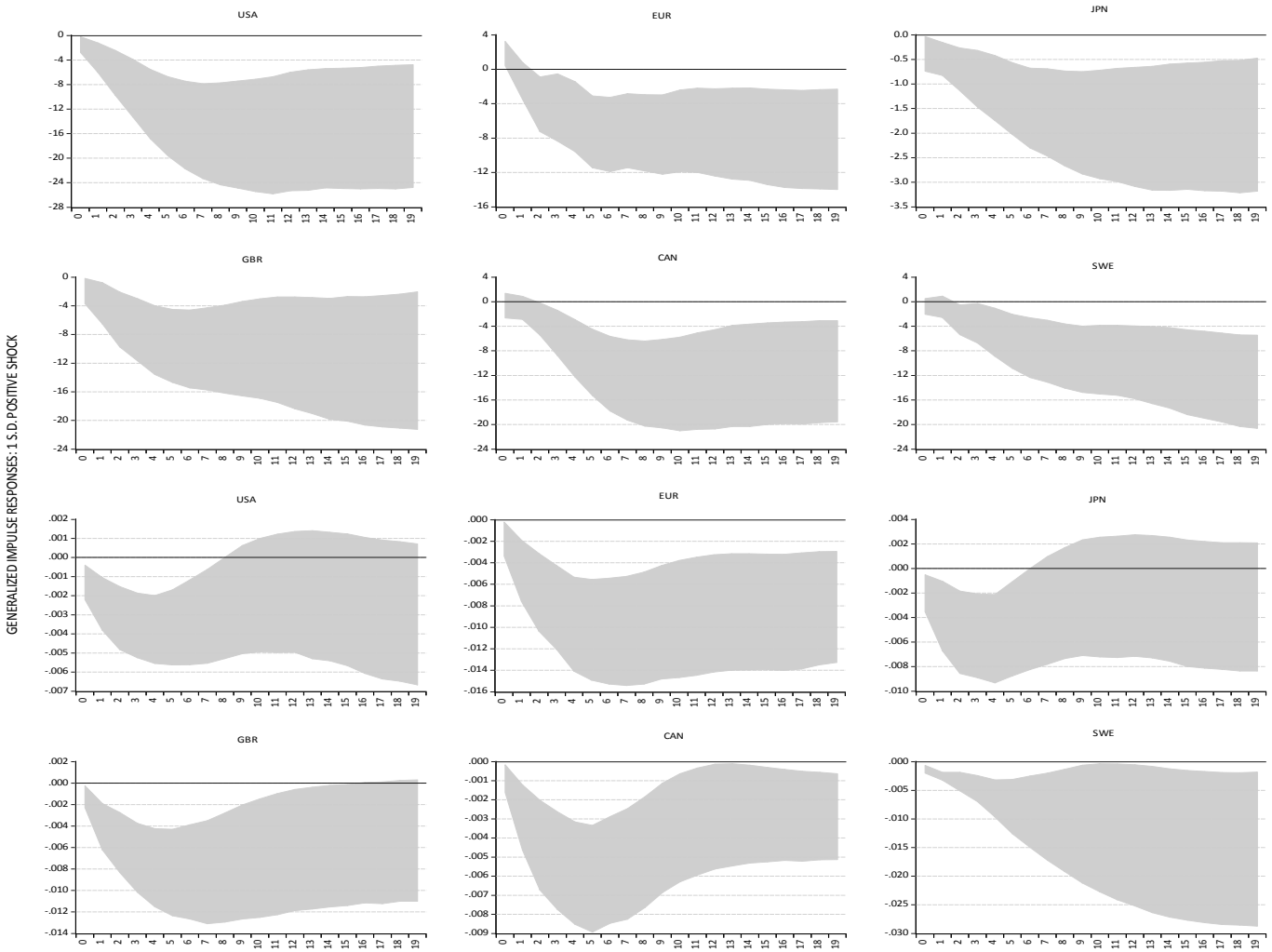
Notes: the first two rows show the response to lending standards; the last two rows the real GDP growth response. Impulse responses are based on bootstrapping (5000 replications) around median estimates of the generalized impulse response functions (GIRFs). The shaded area represents the upper and lower bounds of the bootstrapped 95% confidence intervals. Raw lending standards are in index form, transformed so that they are comparable across countries. A rise in the index represents a tightening of loan standards. GDP is in log form before differencing. Note that the GVAR is estimated in VECM form.

Figure 5B Impulse Responses to a Tightening Lending Standards Shock from the UNITED STATES



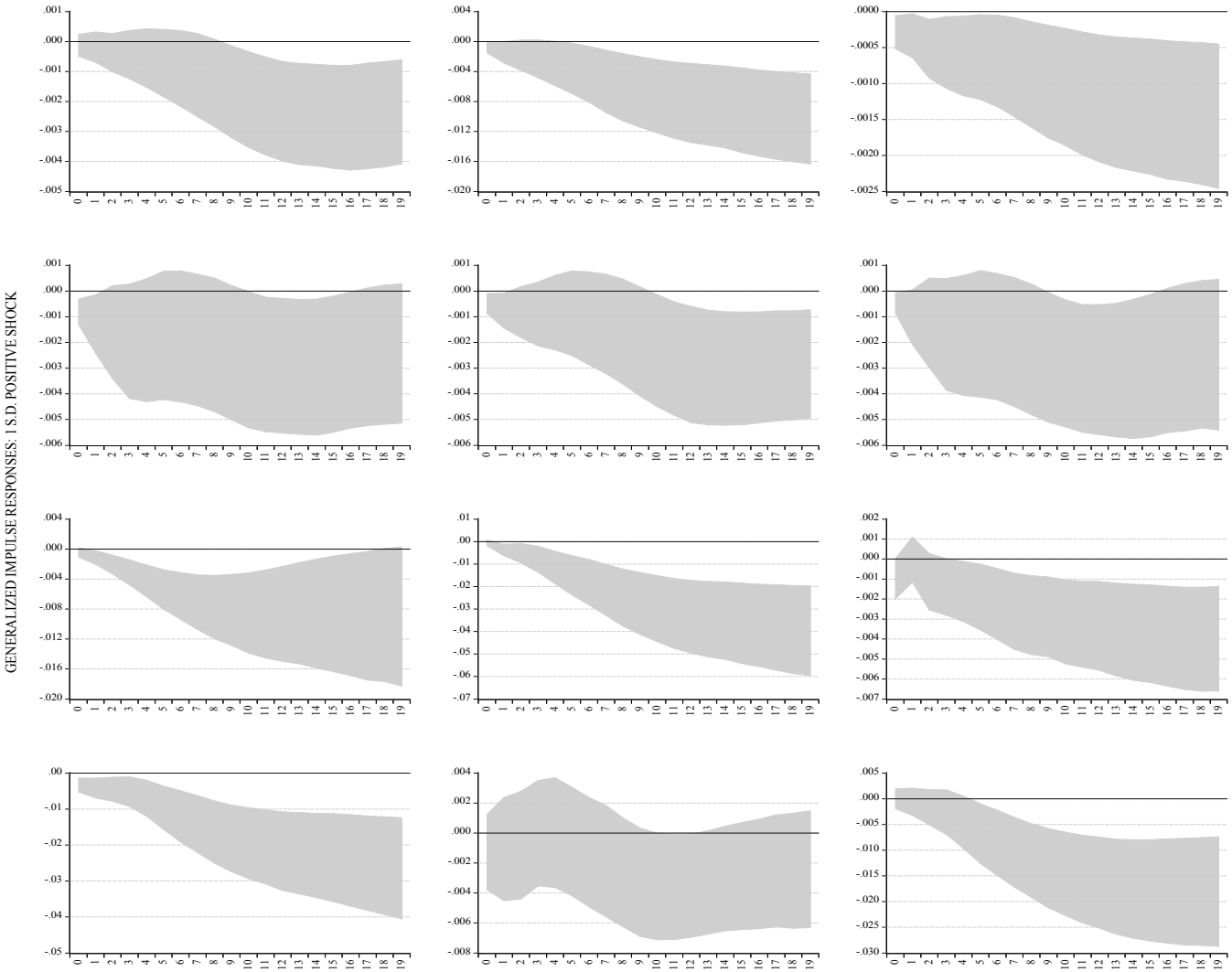
Notes: see notes to Figure 5A. The first two rows show the response of the term spread; the last two rows to total credit. Raw term spread data are in fractions of percent; credit data are log levels of the ratio of total credit to private non-financial sector credit.

Figure 6A Impulse Responses to a Tightening Lending Standards Shock from the Euro area



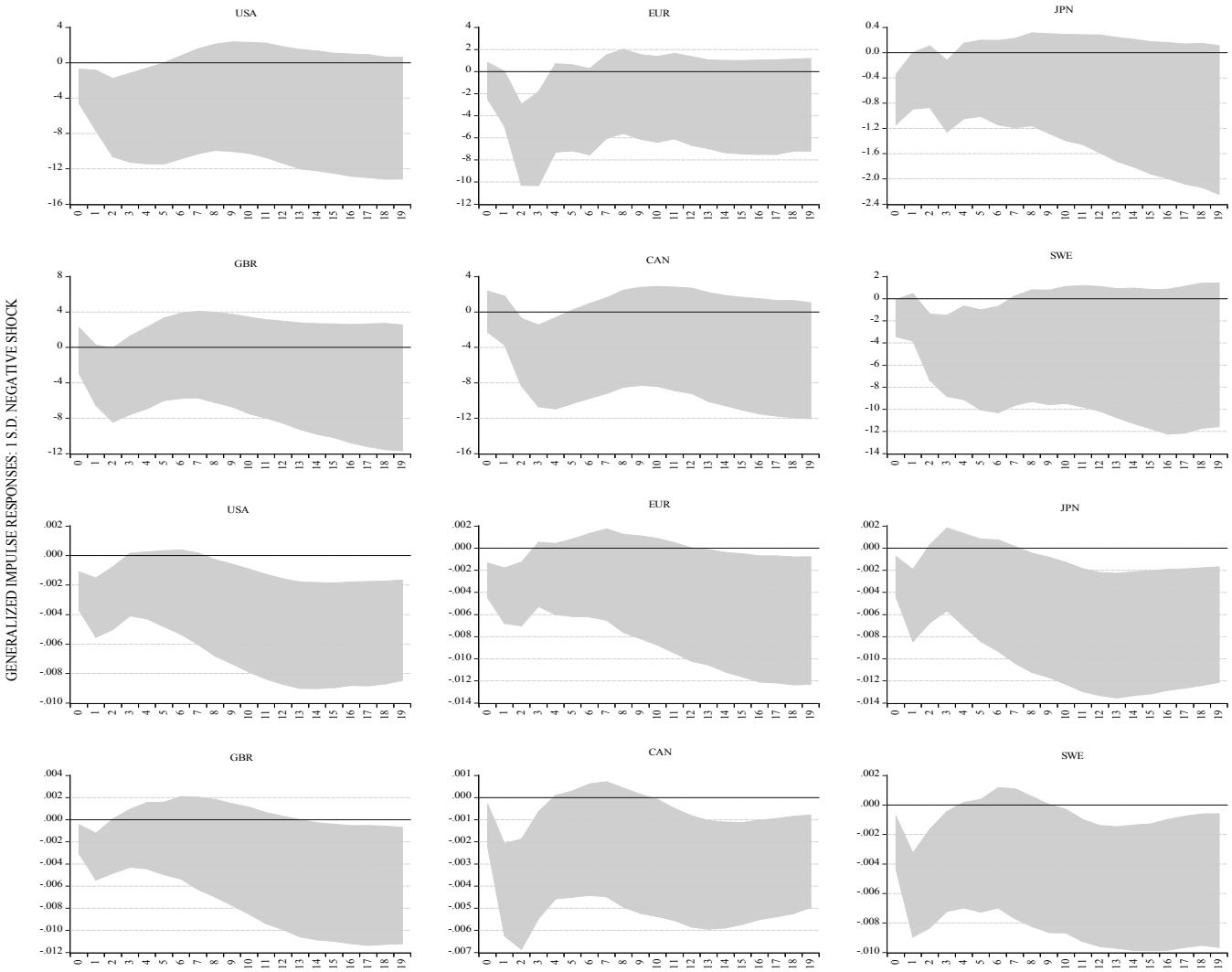
Note: See notes to Figure 5A.

Figure 6B Impulse Responses to a Tightening Lending Standards Shock from the Euro area



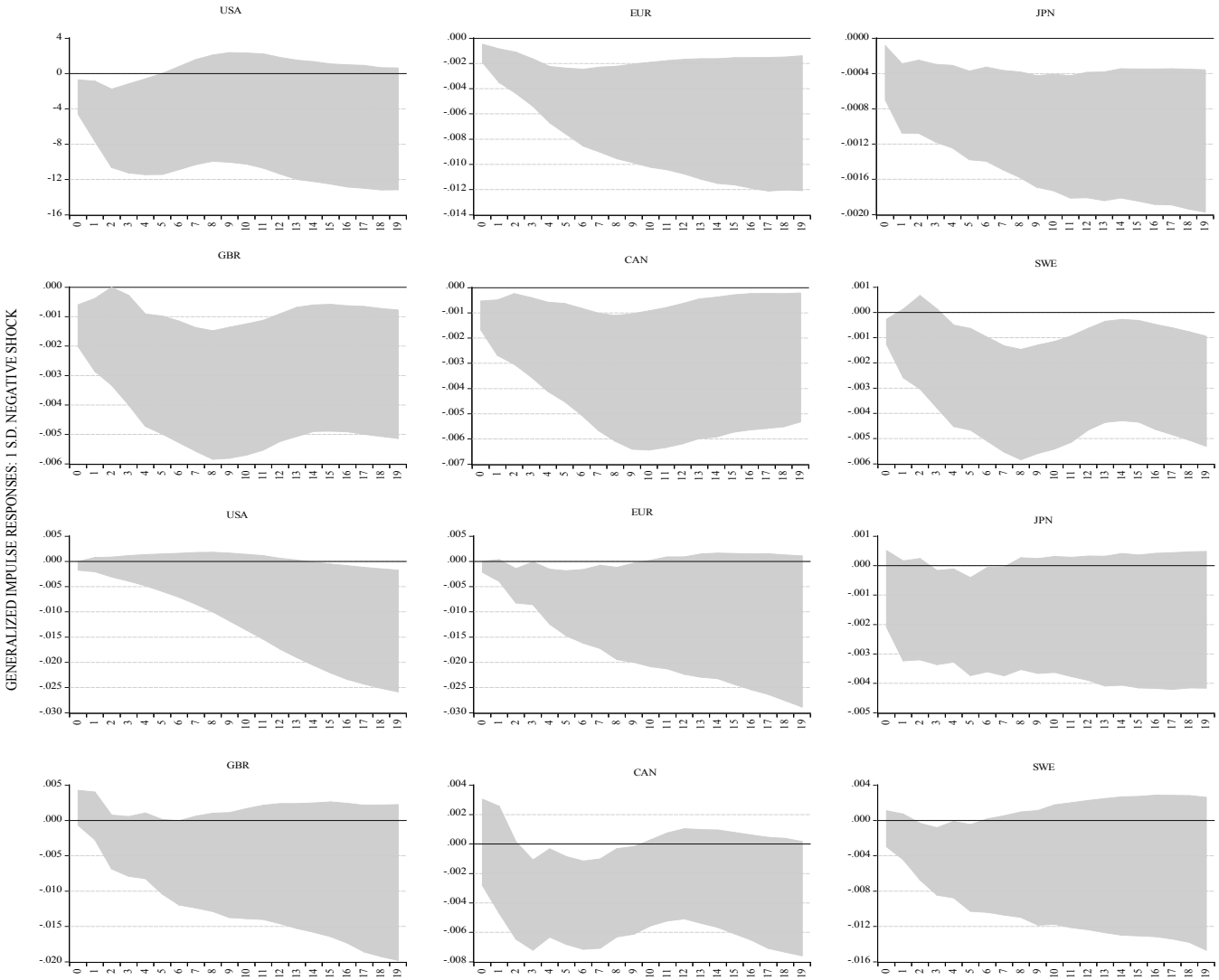
Note: see notes to Figure 5B.

Figure 7A Impulse Responses to a Negative Loan Demand Shock from the UNITED STATES



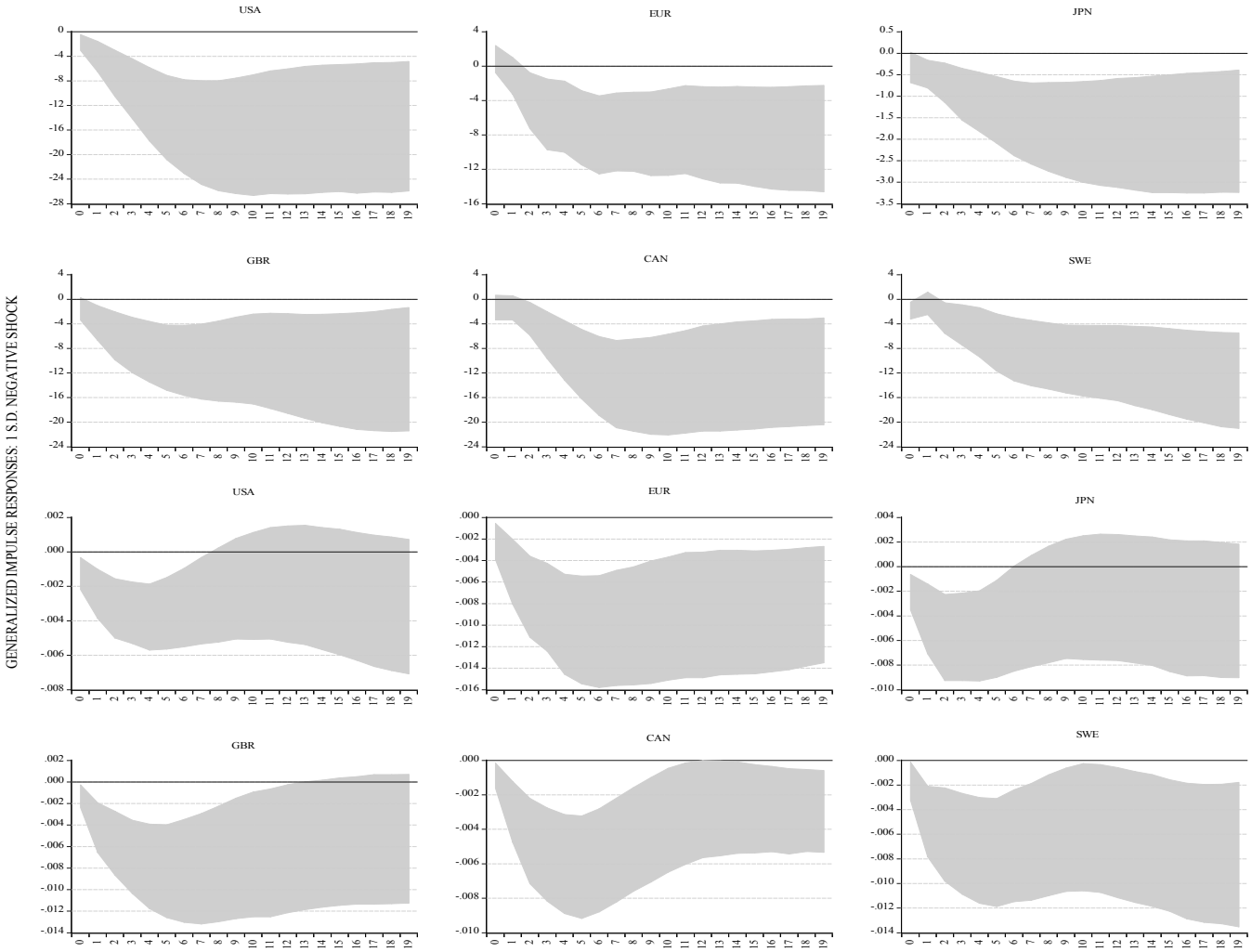
Notes: The ordering of the responses is the same as in Figure 5A. Raw demand for loans series is expressed in the same units as lending standards data. See Figure 5A. A negative shock is a fall loan demand.

Figure 7B Impulse Responses to a Negative Loan Demand Shock from the UNITED STATES



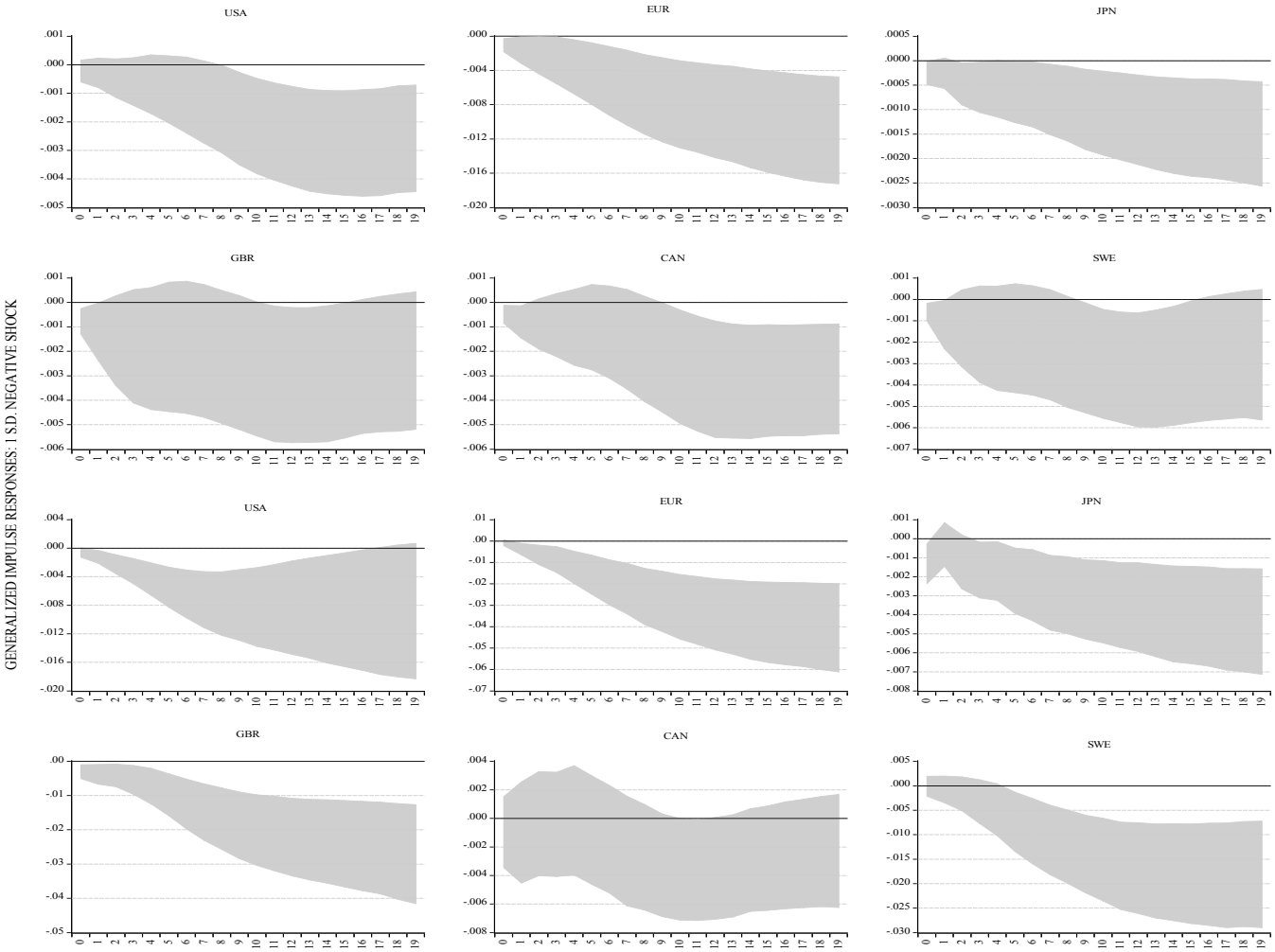
Note: the ordering of the responses is the same as in Figure 5B.

Figure 8A Impulse Responses to a Negative Loan Demand Shock from the Euro area



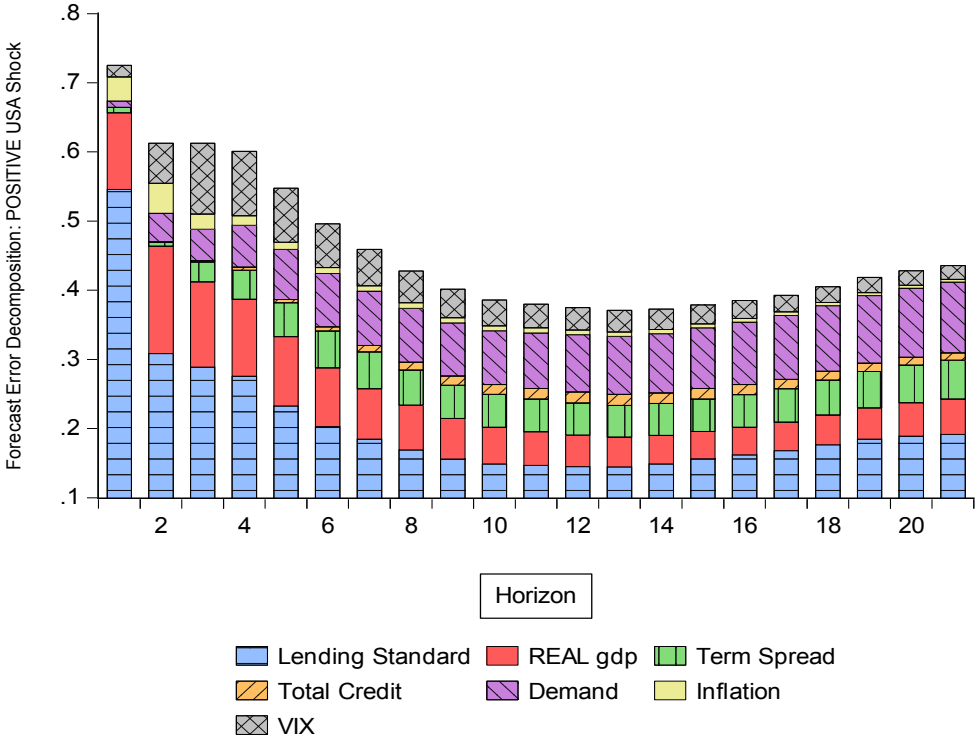
Note: the ordering of the responses is the same as in Figure 5A.

Figure 8B Impulse Responses to a Negative Loan Demand Shock from the Euro area



Note: the ordering of the responses is the same as in Figure 5B.

Figure 9 Forecast Error Variance Decompositions: Positive Lending Standards Shock



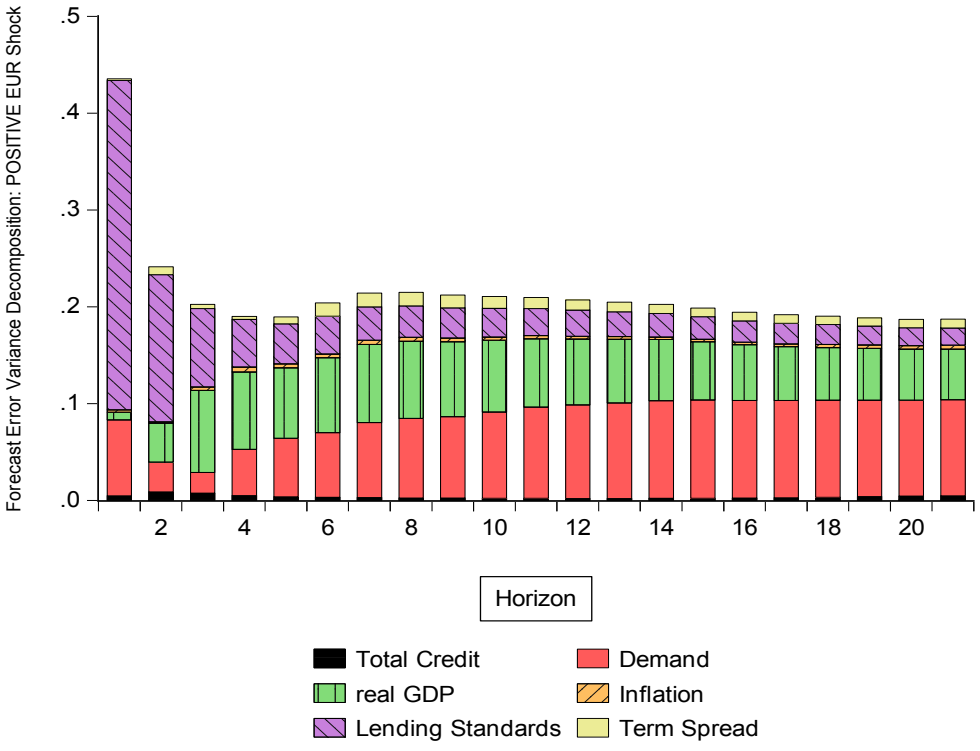
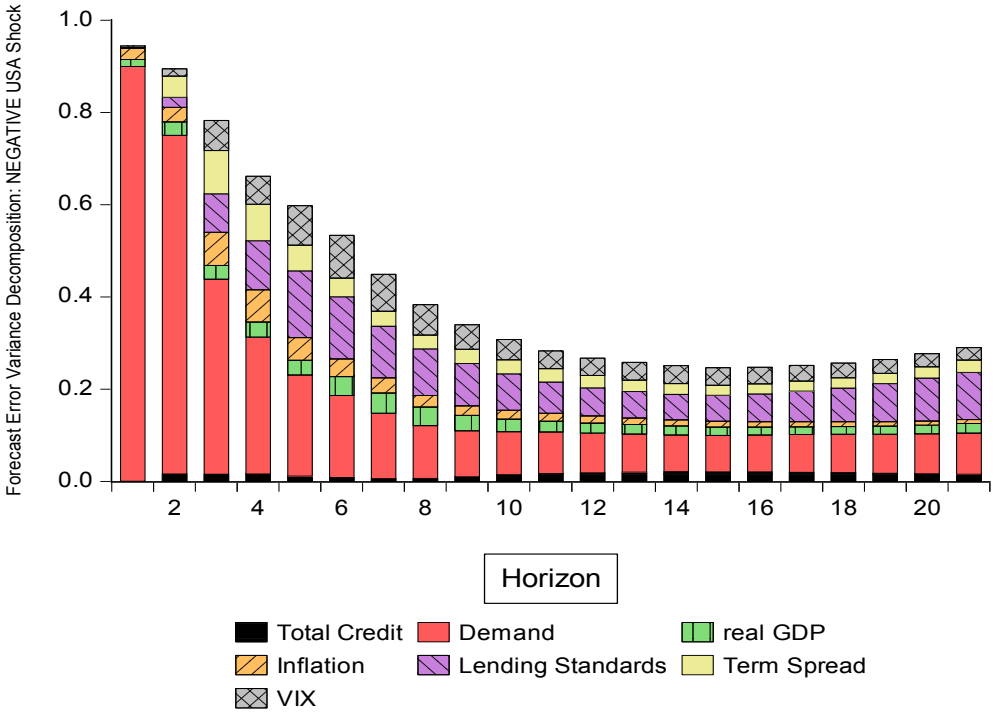


Figure 10 Forecast Error Variance Decompositions: Negative Loan Demand Shock



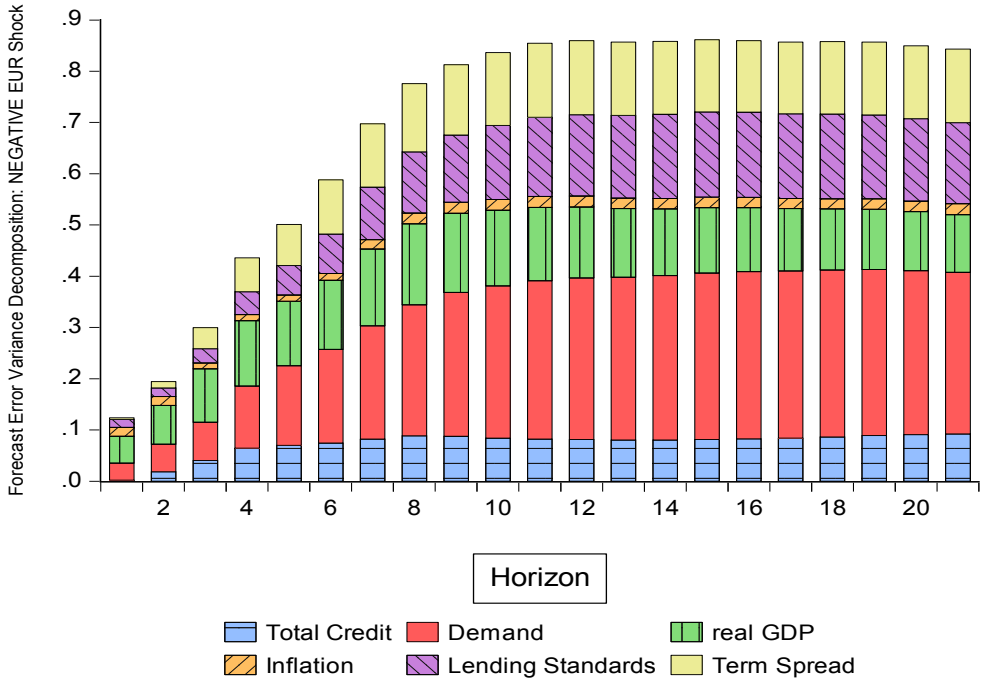
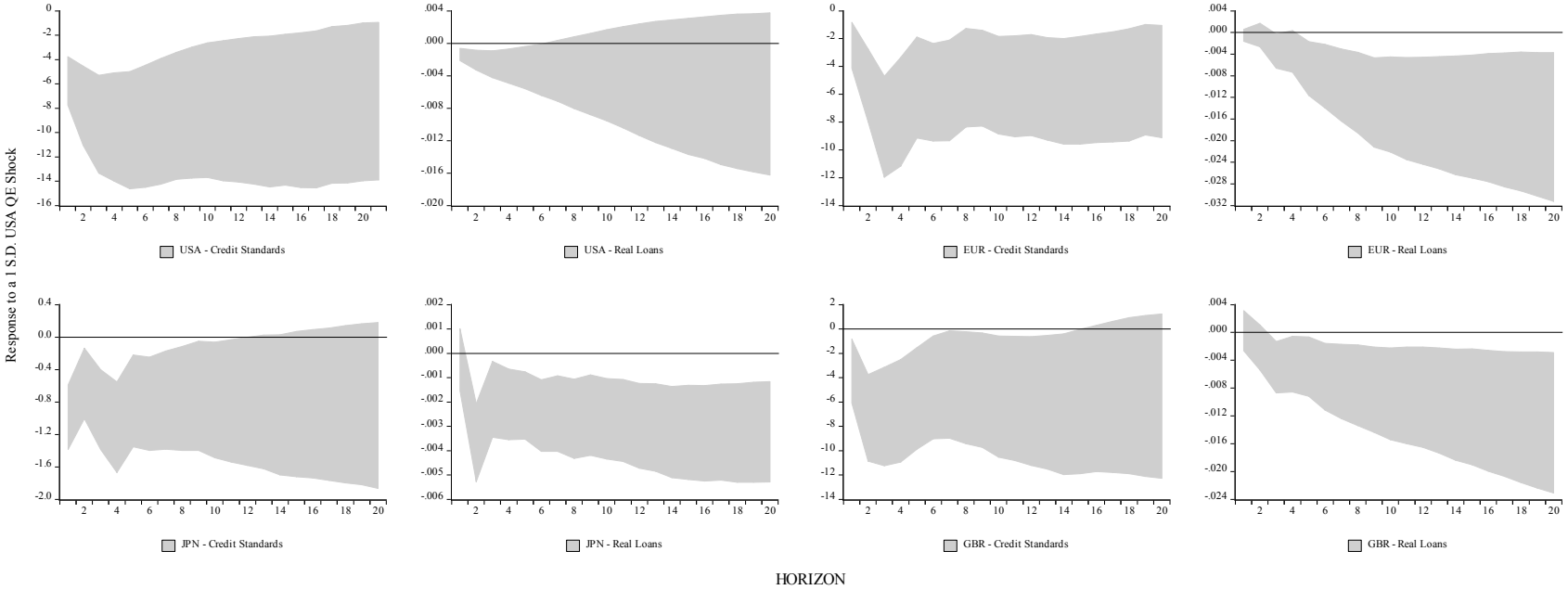


Figure 11 Impulse Responses: Confidence Intervals to a US QE Shock (easing) – 2 Year Maturity



Notes: GVAR estimated earlier is augmented with a global variable, namely the size of QE shocks originating from the United States. Data from Filardo and Nakajima (2018) are used and are measured as the surprise in movements of 2-year US government bond yields. Credit standards are for Business Loans. A reduction, or negative value, indicates a loosening of credit standards. Real Loans are the log of the ratio of real loans to total credit in the private non-financial sector. Data are from the BIS (https://www.bis.org/statistics/totcredit.htm?m=6%7C326).

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