WORKING PAPER

N° 2023-8

DORNBUSCH'S OVERSHOOTING AND THE SYSTEMATIC COMPONENT OF MONETARY POLICY IN SOE-SVARS

NICOLAS GROSHENNY, NAVEED JAVED

www.tepp.eu

TEPP – Theory and Evaluation of Public Policies - FR CNRS 2042

Dornbusch's overshooting and the systematic component of monetary policy in SOE-SVARs*

Nicolas Groshenny† Naveed Javed‡

November 12, 2023

Abstract

We estimate Small-Open-Economy SVAR models for Australia, Canada, New Zealand, Norway, Sweden and the United Kingdom to measure the effects of SOE and US monetary policy shocks on bilateral SOE/US exchange rates. Our identification strategy features block exogeneity and sign-restrictions imposed on the coefficients of the SOE and US monetary policy rules. Our approach leaves the response of the exchange rate to domestic and foreign monetary shocks unrestricted, while allowing for instantaneous interactions between the SOE policy rate and the exchange rate. We find that a contractionary SOE (US) monetary shock triggers an immediate appreciation (depreciation) followed by a reversion, in line with Dornbusch's overshooting and uncovered interest rate parity. SOE monetary impulses account for a greater portion of the short-run volatility of the exchange rate than US monetary shocks.

Keywords: Structural vector autoregressions, Small open economies, Monetary policy rules, Exchange rates, Spillovers of US monetary policy, Uncovered interest rate parity, Block exogeneity.

JEL codes **C32**, **E52, F31, F41**.

*For discussions and comments, we thank Cristina Badarau, Fabio Bagliano, Kenza Benhima, Hilde Bjørnland, Efrem Castelnuovo, Edouard Challe, Jamie Cross, Federico Di Pace, Laurent Ferrara, Renée Fry-McKibbin, Francesco Furlanetto, James Graham, Eleonora Granziera, David Guerreiro, Michel Guillard, Qazi Haque, Eleni Iliopulos, Punnoose Jacob, Frédéric Karamé, Bertrand Koebel, Mariano Kulish, François Langot, Junior Maih, Jean-Baptiste Michau, Hugo Minella, James Morley, Bui Dieu Thao Nguyen, Lise Patureau, Niall Peat, Jérémy Pépy, Matthew Read, Tim Robinson, Jamel Saadaoui, Karsten Staehr, David Stephan, Jacek Suda, Olav Syrstad, Anthony Terriau, Grégory Verdugo, Benjamin Wong as well as conference and seminar participants at GAINS (Le Mans), BETA (Strasbourg), EPEE (Evry), LED (Paris 8), CEF 2022, WAMS 2022, AFSE 2023, CEF 2023, ESAM 2023, CEM 2023.

†GAINS, Le Mans Université and CAMA. nicolas.groshenny@univ-lemans.fr.

‡Reserve Bank of New Zealand, 2 The Terrace, Wellington 6140. naveed.javed@rbnz.govt.nz.
The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Reserve Bank of New Zealand.

1 Introduction

How does the exchange rate react to monetary policy shocks? This classic question in international finance is of practical importance to monetary policymakers in small open economies. Even though, this question largely remains unsettled. According to the benchmark theoretical result of Dornbusch (1976), a surprise monetary tightening causes the exchange rate to overshoot on impact, displaying an instantaneous appreciation followed by a gradual depreciation. On the other hand, a vast literature estimating Structural Vector Autoregressions often finds evidence of a gradual appreciation, typically lasting for more than a year, in response to a monetary shock. Such hump-shaped empirical responses are referred to as the delayed overshooting puzzle.[1] Yet, Faust and Rogers (2003) and Bjørnland (2009) argue that the delayed overshooting puzzle may be an artifact caused by incorrect identifying restrictions. In particular, identification schemes that do not allow for simultaneous interactions between money market variables and the exchange rate tend to produce delayed overshooting.[2]

In this paper, we estimate Bayesian SVAR models for six advanced small-open-economies with floating exchange rates (Australia, Canada, New Zealand, Norway, Sweden and the United Kingdom) to measure the effects of monetary shocks on bilateral SOE/US real exchange rates. We identify simultaneously SOE and US monetary impulses and compare the conditional dynamics of the exchange rate in response to these two disturbances. Our identification scheme hinges on two ingredients: i) Block exogeneity, a cornerstone of Small-Open-Economy SVARs (Cushman and Zha, 1997); ii) Sign restrictions imposed on the coefficients of the SOE and US monetary policy rules. Our approach has two main advantages: First, it is agnostic, in the sense that it leaves the response of the exchange rate to domestic and foreign monetary shocks unrestricted. Second, it allows for instantaneous interactions between the exchange rate and the SOE and US policy rates. These two features make our econometric strategy well suited to investigate the robustness of the delayed overshooting puzzle.

Our identification scheme builds on Arias et al. (2019). They identify the systematic

[1] See Eichenbaum and Evans (1995), Cushman and Zha (1997), Kim and Roubini (2000), Scholl and Uhlig (2008) and Kim et al. (2017) among others.

[2] See also Bagliano et al. (1999).

component of monetary policy in the United States by imposing sign and exclusion restrictions on the coefficients of the Federal Reserve's interest-rate rule. We adapt their methodology to a SOE context in two ways. First, we impose a block-exogenous structure on the SVAR model, meaning that for each SOE, the variables in the model are classified into two blocks: a US (i.e., foreign) block and a SOE (i.e., domestic) block. The US block influences the SOE block (both contemporaneously and over time), whereas the SOE block has no effect on the US block. Second, we identify simultaneously the policy rule of the Federal Reserve and of the SOE central bank.To characterize the systematic component of US monetary policy, we require that the response of the federal funds rate be positive to US output and US inflation, and negative to the Baa credit spread (Caldara and Herbst, 2019).[3] For the SOE central bank, in line with Taylor (2001), we assume that it follows an augmented Taylor-type rule that reacts positively to output, inflation and the real SOE/USD exchange rate.[4] Hence, we require that the SOE's central bank never raises its policy rate in response to a real appreciation. The sign-restriction on the exchange-rate response embodies policymakers' rule of thumb that the central bank should lean against fluctuations in the real exchange rate, based on the wisdom that a real appreciation is an opportunity to ease monetary conditions (Obstfeld and Rogoff, 1995; Taylor, 2001).[5] This sign-restriction is supported by estimates of Taylor-type rules in DSGE models (Lubik and Schorfheide, 2007; Kam et al., 2009; Justiniano and Preston, 2010), and by findings from the SOE-SVAR literature (Bjørnland, 2009; Bjørnland and Halvorsen, 2014).

A distinctive feature of our study is to jointly identify SOE and US monetary policy shocks.[6] There is an obvious asymmetry between the Fed and the six SOE central

[3]Curdia and Woodford (2010, 2016) present a normative analysis justifying a negative systematic response of monetary policy to a tightening of credit conditions.

[4]Calvo and Reinhart (2002), Reinhart and Rogoff (2004), Obstfeld (2013) and Ilzetzki et al. (2019) provide evidence that central banks react to movements in the bilateral dollar exchange rate. Gopinath et al. (2020) and Gourinchas et al. (2019) document the central role played by the dollar in international trade and in the international monetary and financial system.

[5]Egorov and Mukhin (2023) show that, under dollar pricing (i.e., when prices are invoiced and sticky in dollars), it becomes desirable for non-US central banks to stabilize the dollar exchange rate.

[6]Several papers focus on US monetary shocks (Eichenbaum and Evans, 1995; Faust and Rogers, 2003; Scholl and Uhlig, 2008; Kim et al., 2017; Rüth, 2020; Castelnuovo et al., 2022). Others study the impacts of non-US monetary shocks (Cushman and Zha, 1997; Kim and Roubini, 2000; Bjørnland, 2009; Bjørnland and Halvorsen, 2014; Kim and Lim, 2018; Terrell et al., 2023). Earlier papers consider relative money shocks without taking a stance on the origin of disturbances (Clarida and Gali, 1994;

banks that we consider. Put bluntly, we live in a dollar world (Gourinchas, 2021), and the Fed is the main driver of global funding costs (Miranda-Agrippino and Rey, 2020; Miranda-Agrippino and Nenova, 2022). Our approach enables us to investigate whether the responses of exchange rates to monetary shocks differ according to the origin of the shocks. We check the extent to which exchange rate responses to SOE and US shocks are consistent with Dornbusch's overshooting and UIP. Finally, we provide new empirical evidence on the spillover effects of US monetary policy on advanced SOEs, controlling for the endogenous response of SOE central banks.

We find no evidence of delayed overshooting. In the six SOEs, a domestic contractionary monetary shock triggers a strong and immediate appreciation of the exchange rate, followed quickly by a gradual depreciation. Symmetrically, a tightening of US monetary policy causes an instantaneous depreciation followed by an appreciation. In all cases, the peak response of the exchange rate occurs very quickly, on impact or shortly after. Our findings support the view that delayed overshooting is not a genuine stylised fact but rather the outcome of dubious identifying restrictions (Faust and Rogers, 2003; Bjørnland, 2009). Moreover, we find little evidence of the forward discount puzzle: the responses of exchange rates to both SOE and US monetary shocks are broadly consistent with UIP, and thus with Dornbusch's overshooting mechanism. These findings are consistent with Bjørnland (2009) and Rüth (2020).[7] SOE and US monetary shocks explain about 20 and 10 percents respectively of the short-run exchange rate volatility. The smaller contribution of US shocks may be due to the endogenous, exchange-rate stabilizing, responses of SOE central banks to US monetary policy (Rey, 2013). Turning to spillovers, a tightening by the Federal Reserve induces output and inflation to fall in the six SOEs. This result echoes the findings of Maćkowiak (2007) for emerging economies. It is also consistent with Gopinath et al. (2020) and Akinci et al. (2022) who show that a monetary tightening by the Fed can generate a global slump.

An early study documenting the delayed overshooting puzzle is Eichenbaum and Evans

Rogers, 1999).

[7] Faust and Rogers (2003) and Scholl and Uhlig (2008) find that the forward discount puzzle is more robust than the delayed overshooting puzzle.

(1995). They employ a recursive identification scheme and find evidence of a gradual and persistent appreciation in both the nominal and real US exchange rates in response to a contractionary US monetary policy shock. Their findings contradict Dornbusch (1976) immediate overshooting hypothesis.[8] Further studies by Faust and Rogers (2003) and Scholl and Uhlig (2008) replace the controversial recursive identification scheme with sign restrictions on the impulse response functions. However, these studies again document puzzling responses with delays lasting for around 3 years. Kim et al. (2017) using sign restrictions similar to Scholl and Uhlig (2008) report findings consistent with Dornbusch's prediction except during Volcker's tenure as Fed Chair. Rüth (2020) uses surprises in Federal funds futures around policy announcements as external instruments to estimate a proxy-SVAR model and measure the effects of U.S. monetary policy shocks on various measures of U.S. exchange rates. His findings are consistent with Dornbusch's predictions, including during Volcker's tenure. Castelnuovo et al. (2022) follow an approach similar to ours to investigate the delayed overshooting puzzle for the United States. They identify their SVAR model by applying restrictions on the structural parameters of the systematic component of US monetary policy and find no evidence of delayed overshooting puzzle.[9]

A stream of the SVAR literature focuses on SOEs. Cushman and Zha (1997) and Kim and Roubini (2000) apply non-recursive zero restrictions to implement block exogeneity and identify monetary policy shocks. Bjørnland (2009) uses data from four SOEs to estimate an SVAR model combining short-run and long-run zero restrictions. Her identification scheme allows for simultaneous interaction between monetary policy and the exchange rate, while requiring that monetary shocks have no impact on the real exchange rate in the long-run. She finds no evidence of delayed overshooting, suggesting that Dornbusch was right after all. Recently, Terrell et al. (2023) estimate a time-varying SVAR model with stochastic volatility using the same data and identi-

[8]With nominal rigidities, the responses of the real and nominal exchange rates are similar in the short run.

[9]Our study complements the work of Castelnuovo et al. (2022). Castelnuovo et al. (2022) concentrate on US monetary shocks and the US economy. Instead, we focus on SOEs, we implement block exogeneity, and we jointly identify SOE and US monetary policy shocks. In addition, Castelnuovo et al. (2022) restrict the IRFs of industrial production and prices to be negative on impact, while we do not impose any sign restriction on IRFs. See also Rüth and Van der Veken (2023).

fication scheme as Bjørnland (2009). Their results are in line with Bjørnland (2009). Other studies applying agnostic identification procedures to analyse the exchange-rate response to monetary shocks in SOEs include Bjørnland and Halvorsen (2014) and Kim and Lim (2018).[10] Bjørnland and Halvorsen (2014) consider six SOEs and identify monetary disturbances by imposing a combination of sign and exclusion restrictions on IRFs. Unlike us, they impose a sign restriction on the impact response of the exchange rate, forcing an instantaneous appreciation, and thus ruling out the so-called exchange rate puzzle by construction (Eichenbaum and Evans, 1995). They do not find evidence of delayed overshooting. Kim and Lim (2018) consider four SOEs and achieve identification by imposing sign-restrictions on IRFs. They confirm the findings of Bjørnland and Halvorsen (2014). In contrast to these two studies, we apply the methodology developed by Arias et al. (2018) to impose some exclusion restrictions for block exogeneity, as well as some sign-restrictions on the coefficients of the systematic component of monetary policy.[11]

The rest of the paper is structured as follows. Section 2 describes the data, the identification scheme and the Bayesian estimation. Section 3 presents our main results. Section 4 contains robustness checks and Section 5 concludes.

2 Econometric strategy

2.1 Data

We consider six advanced small-open economies with flexible exchange rates, namely Australia, Canada, New Zealand, Norway, Sweden and the UK. We use quarterly data from 1992:Q1 to 2019:Q4.[12] The starting date corresponds broadly to the adoption of Inflation Targeting by the six SOEs considered here (Kim and Lim, 2018). The end date marks the onset of the COVID-19 pandemic.[13] Following Cushman and Zha

[10]See also Jääskelä and Jennings (2011), Read (2023) and Fisher and Huh (2023) for related studies focusing on Australia.

[11]Bjørnland and Halvorsen (2014) and Kim and Lim (2018) use the Penalty Function Approach proposed by Uhlig (2005). Arias et al. (2018) criticize the PFA approach for imposing additional restrictions that are not specified by the user. See also Binning (2013).

[12]Data sources are provided in Appendix A.

[13]Estimating the SVAR over a stable monetary policy regime helps solving the delayed overshooting puzzle. See Kim and Lim (2018), Kim et al. (2017) and Castelnuovo et al. (2022).

(1997), we organize the variables into two blocks, a domestic one and a foreign one. The domestic block represents the SOE, while the foreign block stands for the US economy. The domestic block includes real GDP (y), inflation (π) measured as the annualized quarterly rate of change in the consumer price index, the policy rate (r) proxied by the 3-month interbank rate, and the bilateral SOE/US real exchange rate (e).[14] The foreign block consists of four variables: US real GDP (y^*), US inflation (π^*), Moody's Baa corporate credit spread (cs^*), and the US shadow rate (r^*) constructed by Wu and Xia (2016). All variables are expressed in log levels except the credit spread, inflation rates and policy rates, which are expressed in percentage points.

2.2 Model

Our structural model is given by:

$$\mathbf{y_t'}\mathbf{A_0} = \sum_{l=1}^{p} \mathbf{y}_{t-l}'\mathbf{A}_l + \mathbf{c}' + \epsilon_\mathbf{t}' \ , \tag{1}$$

where $\mathbf{y_t'} = \begin{bmatrix}\mathbf{y_{1t}'} & \mathbf{y_{2t}'}\end{bmatrix}$, $\mathbf{y_{1t}'} = [y_t^*, \pi_t^*, cs_t^*, r_t^*]$ and $\mathbf{y_{2t}'} = [y_t, \pi_t, r_t, e_t]$. $\mathbf{y_{1t}}$ is a $(n_1 \times 1)$ vector of US variables and $\mathbf{y_{2t}}$ is a $(n_2 \times 1)$ vector of SOE variables, with $n = n_1 + n_2$ denoting the total number of variables. Similarly, the vector of structural shocks $\epsilon_\mathbf{t}$ is divided into two blocks, $\epsilon_\mathbf{t}' = \begin{bmatrix}\epsilon_{1t}' & \epsilon_{2t}'\end{bmatrix}$. $\mathbf{A_i}$, for $0 \leq i \leq p$, are $(n \times n)$ matrices of structural parameters, with $\mathbf{A_0}$ invertible. $\mathbf{c}$ is a $(n \times 1)$ vector of constants, p is the lag length, and T is the sample size. Conditional on past information and initial conditions $\mathbf{y}_0, ..., \mathbf{y}_{1-p}$, the vector $\epsilon_\mathbf{t}$ is Gaussian with mean zero and covariance matrix I_n. Following Rubio-Ramirez et al. (2010), we can write the SVAR in compact form:

$$\mathbf{y_t}'\mathbf{A_0} = \mathbf{x_t}'\mathbf{A}_+ + \epsilon_t' \ , \tag{2}$$

where $\mathbf{x_t'} = [\mathbf{y_{t-1}'} \dots \mathbf{y_{t-p}'} \ \ 1]$ for $1 \leq \mathrm{t} \leq \mathrm{T}$. $\mathbf{A_0}$ and $\mathbf{A}_+ = [\mathbf{A_1'} \dots \mathbf{A_p'} \ \ \mathbf{c}']$ are matrices of structural parameters.

Post-multiplying equation (2) by $\mathbf{A_0^{-1}}$, we obtain the reduced form VAR model:

$$\mathbf{y_t'} = \mathbf{x_t'}B + u_t' \ , \tag{3}$$

[14] For Sweden and the UK, we use shadow rates constructed by De Rezende and Ristiniemi (2023) and Wu and Xia (2016), respectively.

where $B = \mathbf{A}_{+}\mathbf{A_0}^{-1}, u'_t = \epsilon'_t\mathbf{A_0}^{-1}$ and $\mathbf{E}[u_t u'_t] = \Sigma = (\mathbf{A_0}\mathbf{A'_0})^{-1}$. B is the matrix of reduced-form coefficients and Σ is the variance-covariance matrix of reduced-form residuals.

2.3 Identification

Our strategy aims at identifying simultaneously SOE and US monetary shocks by bringing together two distinct approaches: sign restrictions on policy parameters (Arias et al., 2019) and block exogeneity (Cushman and Zha, 1997).

The first procedure, sign restrictions on policy parameters, offers an agnostic approach to identify the systematic component of monetary policy, and thereby monetary policy shocks.[15] The appeal of this method stems from its agnosticism and robustness as it hinges solely on a few qualitative and fairly uncontroversial restrictions on the structural coefficients of the monetary policy rule. This method only achieves set-identification. A caveat inherent in identification schemes based on sign-restrictions is the so-called multiple shocks problem: many shocks, different from the one we are trying to identify, may satisfy the set of sign-restrictions (Fry and Pagan, 2011). The fact that we impose sign restrictions simultaneously on both US and SOE policy parameters should in principle help to alleviate this partial-identification problem.

The second procedure, block exogeneity, is the hallmark of any SOE model: the SOE is influenced by foreign factors and has no impact on the Rest of the World. In practice, block exogeneity consists in imposing a set of non-recursive zero restrictions. In our setting, block exogeneity complements the minimal set of sign restrictions on policy parameters and augments the information content of our identification scheme. In other words, block exogeneity strengthens the identification of US and SOE monetary shocks through a set of highly plausible zero restrictions.

Our goal in this paper is to assess the robustness of the delayed overshooting puzzle. Importantly for our purpose, our identification strategy allows for a simultaneous relationship between the exchange rate and the SOE policy rate and leaves the response

[15] Leeper et al. (1996) make explicit the link between identifying the systematic component of monetary policy and identifying monetary policy shocks.

of the exchange rate to SOE and US monetary shocks unrestricted at all horizons (Faust and Rogers, 2003; Bjørnland, 2009). We first present details about the way we implement block exogeneity. We then explain the identification of the systematic component of monetary policy in the US and in SOEs through sign restrictions on structural parameters.

2.3.1 Block exogeneity

We adapt the methodology of Arias et al. (2019) to incorporate block exogeneity (Cushman and Zha, 1997). Given the partition of $\mathbf{y_t}' = \begin{bmatrix}\mathbf{y_{1t}}' & \mathbf{y_{2t}}'\end{bmatrix}$, the matrix of contemporaneous relationships, $\mathbf{A_0}$, has the following structure:

$$\mathbf{A_0} = \begin{bmatrix} A_{0,11} & A_{0,12} \\ A_{0,21} & A_{0,22} \end{bmatrix},$$

where $A_{0,11}$ is $(n_1 \times n_1)$, $A_{0,12}$ is $(n_1 \times n_2)$, $A_{0,21}$ is $(n_2 \times n_1)$, $A_{0,22}$ is $(n_2 \times n_2)$. To ensure that SOE variables in $\mathbf{y_{2t}}$ do not influence US variables in $\mathbf{y_{1t}}$ contemporaneously, we apply zero-restrictions on the block $A_{0,21}$:

$$\mathbf{A_0} = \begin{bmatrix} A_{0,11} & A_{0,12} \\ 0 & A_{0,22} \end{bmatrix}.$$

We should also prevent SOE variables from influencing US variables in a dynamic fashion. Put differently, in line with Cushman and Zha (1997), we should impose a block of zero-restrictions on each lag matrix $\mathbf{A}_l$, $1 \leq l \leq p$, in equation (1), so that:

$$\mathbf{A}_l = \begin{bmatrix} A_{11,l} & A_{12,l} \\ A_{21,l} & A_{22,l} \end{bmatrix} = \begin{bmatrix} A_{11,l} & A_{12,l} \\ 0 & A_{22,l} \end{bmatrix},$$

where $A_{11,l}$ is $(n_1 \times n_1)$, $A_{12,l}$ is $(n_1 \times n_2)$, $A_{21,l}$ is $(n_2 \times n_1)$, $A_{22,l}$ is $(n_2 \times n_2)$. Unfortunately, the procedure of Arias et al. (2019) only allows us to impose a maximum of $(n - k)$ zero restrictions per equation, where $k = 1, ..., n$, denotes the order of the k^{th} equation in the system. As a result, we cannot impose $A_{21,l} = \mathbf{0}$.

We bypass this issue by formulating a variant of Minnesota priors on the reduced-form VAR, where the priors for the coefficients governing the influence of lagged SOE variables on US variables are concentrated tightly around zero. To do that, we specify Independent $\mathcal{NIW}$ priors for $\beta = vec(B)$, the vector of reduced-form coefficients, and Σ, the variance-covariance matrix of reduced-form residuals:[16]

$$\beta \sim \mathcal{N}(\beta_0, \Omega_0), \tag{4}$$

$$\Sigma \sim \mathcal{IW}(S_0, \alpha_0).^{17} \tag{5}$$

We center the distribution of every first-order auto-regressive coefficient at 1, and 0 otherwise, as in standard Minnesota priors. The variance-covariance matrix Ω_0 contains the hyper-parameters that control the tightness of the distributions of reduced-form coefficients.[18] The elements of Ω_0 take the following form:

$$\sigma_{c_i}^2 = \sigma_i^2(\lambda_1\lambda_4)^2 \qquad \text{if constant} \tag{6}$$

$$\sigma_{ii}^2 = (\lambda_1/L^{\lambda_3})^2 \qquad \text{if } i = j \tag{7}$$

$$\sigma_{ij}^2 = (\sigma_i/\sigma_j)^2(\lambda_1\lambda_2/L^{\lambda_3})^2 \qquad \text{if } i \neq j \tag{8}$$

$$\sigma_{Ex_{ij}}^2 = (\sigma_i/\sigma_j)^2(\lambda_1\lambda_2\lambda_5/L^{\lambda_3})^2 \qquad \text{if } i \neq j \text{ and } e_x < j \leq n \tag{9}$$

where σ_i^2 and σ_j^2 denote the variances of OLS residuals of the auto-regressive models estimated for variables i and j. L is the lag on the coefficient. λ_1 controls the overall tightness of the distribution. λ_4 is the variance parameter of constants. λ_2 controls the tightness of cross-variable distributions. λ_3 is a decaying parameter that controls the speed at which coefficients of variable's own lags (equation 7) and cross-variable lags (equation 8), greater than 1 converge to 0. Equations (6), (7) and (8) constitute the standard Minnesota priors. Equation (9) is key to implement block exogeneity: it

[16] Arias et al. (2019) specify Natural Conjugate $\mathcal{NIW}$ priors for the reduced-form parameters. Such Natural Conjugate priors are ill-fitted for our purpose: they feature a Kronecker structure for the variance-covariance matrix of the reduced-form parameters, so that variances are proportional to one another. Moreover, the Kronecker structure implies that every equation has the same set of explanatory variables, meaning that if we removed a variable in one equation, that variable would be removed from all equations. Imposing block exogeneity on one equation would then impose it on all equations (Dieppe et al., 2016; Koop et al., 2010). Fortunately, the techniques developed by Arias et al. (2018) work for any prior distributions.

[17] We set the hyperparameters of the inverse Wishart distribution in a conventional way: $\alpha_0 = n+1$ and $S_0 = \mathbb{I}_n$ (Dieppe et al., 2016).

[18] Unlike with Natural Conjugate ($\mathcal{NIW}$) priors, Ω_0 is independent of Σ.

only applies to the US block and features the additional hyper-parameter λ_5, which controls the tightness of the distributions of coefficients appearing in front of SOE variables in the US block (Dieppe et al., 2016). Specifically, in equation (9), $\sigma^2_{Ex_{ij}}$ are the diagonal elements of Ω_0 corresponding to the domestic coefficients in the equations of foreign (exogenous) variables. This corresponds to the same cross-variables as in equation (8) but applies only on the domestic variables in the foreign block. This is controlled by the variable range $e_x < j \leq n$, where e_x denotes the number of foreign (exogenous) variables.

We set $\lambda_5 = 1e{-}8$ to obtain highly informative priors concentrated around zero. We select standard prior variances for the rest of the parameters ($\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 1$). To sum up, we implement block exogeneity through a combination of two ingredients: i) we impose exclusion restrictions on the block $A_{0,21}$ in the structural-form matrix of contemporaneous relationships; ii) we formulate a special case of Independent $\mathcal{NIW}$ priors for the reduced-form VAR, where the reduced-form coefficients follow Minnesota priors with an additional hyper-parameter for block exogeneity.

2.3.2 Sign-restrictions on monetary policy parameters

Our identification scheme builds heavily on Arias et al. (2019). Using the techniques developed by Arias et al. (2018), they impose sign and exclusion restrictions on the coefficients of the Federal Reserve's interest-rate rule. As mentioned above, we adapt their methodology to a SOE context in two ways. First, we impose a block-exogenous structure on the SVAR model, meaning that for each SOE, the variables are classified into a US block and a domestic block, where the SOE block has no effect on the US block. Second, for each SOE, we identify simultaneously the interest-rate rule followed by the Federal Reserve and the SOE central bank. Like in Arias et al. (2019), our identification concentrates on the contemporaneous structural parameters. We identify the first and the fifth shock in the SVAR model as the US and the SOE monetary policy shock, respectively.

2.3.2.1 The systematic component of US monetary policy Abstracting from lagged variables and constant terms, the US monetary policy equation is given by:

$$r_t^* = -a_{0,41}^{-1} a_{0,11} y_t^* - a_{0,41}^{-1} a_{0,21} \pi_t^* - a_{0,41}^{-1} a_{0,31} cs_t^* + a_{0,41}^{-1} \epsilon_{1,t}, \tag{10}$$

where $-a_{0,41}^{-1} a_{0,11} = \psi_{y^*}$, $-a_{0,41}^{-1} a_{0,21} = \psi_{\pi^*}$, $-a_{0,41}^{-1} a_{0,31} = \psi_{cs^*}$ and $a_{0,41}^{-1} = \sigma^*$.
To characterize the systematic component of US monetary policy, we impose the following two restrictions.

Restriction 1. The contemporaneous response of the US policy rate to US output and US inflation is positive: $\psi_{y^*} > 0$ and $\psi_{\pi^*} > 0$.

Restriction 2. The contemporaneous reaction of the US policy rate to the Baa corporate credit spread is negative: $\psi_{cs^*} < 0$.

Restriction 1 is motivated by Taylor (1993) and a large DSGE literature.[19] Restriction 2 is consistent with the SVAR evidence provided by Caldara and Herbst (2019).[20] Combining Restrictions 1 and 2, we obtain the following characterization of US monetary policy:

$$r_t^* = \underbrace{-a_{0,41}^{-1} a_{0,11}}_{\psi_{y^*}>0} y_t^* \underbrace{-a_{0,41}^{-1} a_{0,21}}_{\psi_{\pi^*}>0} \pi_t^* \underbrace{-a_{0,41}^{-1} a_{0,31}}_{\psi_{cs^*}<0} cs_t^* \underbrace{+a_{0,41}^{-1}}_{\sigma^*} \epsilon_{1,t} \tag{11}$$

2.3.2.2 The systematic component of monetary policy in SOEs Abstracting from lags and constant terms, the SOE monetary policy equation can be written as:

$$\begin{aligned} r_t = & -a_{0,75}^{-1} a_{0,15} y_t^* - a_{0,75}^{-1} a_{0,25} \pi_t^* - a_{0,75}^{-1} a_{0,35} cs_t^* - a_{0,75}^{-1} a_{0,45} r_t^* \\ & -a_{0,75}^{-1} a_{0,55} y_t - a_{0,75}^{-1} a_{0,65} \pi_t - a_{0,75}^{-1} a_{0,85} rer_t + a_{0,75}^{-1} \epsilon_{5,t}, \end{aligned} \tag{12}$$

where $-a_{0,75}^{-1} a_{0,55} = \psi_y$, $-a_{0,75}^{-1} a_{0,65} = \psi_\pi$, $-a_{0,75}^{-1} a_{0,85} = \psi_e$ and $a_{0,75}^{-1} = \sigma$.

To identify the systematic component of SOE monetary policy, we impose the following two restrictions.

[19] Regarding the timing assumption implied by Restriction 1, where the policy rate, output and inflation interact simultaneously, we follow the argument of Arias et al. (2019): Monetary authorities crunch a large battery of real-time indicators to nowcast the current state of the economy.

[20] Curdia and Woodford (2010, 2016) present DSGE-based analysis justifying a negative systematic response of monetary policy to a worsening of credit conditions.

Restriction 3. The contemporaneous reaction of the SOE policy rate to domestic output and inflation is positive: $\psi_y > 0$ and $\psi_\pi > 0$.

Restrictions 4: The contemporaneous reaction of the SOE policy rate to the real bilateral SOE/US exchange rate is positive: $\psi_e > 0$.

Restrictions 3 and 4 leave the reaction of the SOE central bank to foreign variables unrestricted as in Cushman and Zha (1997). Restriction 4 means that SOE central bank usually leans against the real SOE/US exchange rate, cutting its policy rate in response to an appreciation of the domestic currency, and lowering it in response to a depreciation. Restriction 4 is consistent with findings based on SVARs (Bjørnland, 2009; Bjørnland and Halvorsen, 2014) and Taylor-type rules embedded in DSGE models (Lubik and Schorfheide, 2007; Kam et al., 2009; Justiniano and Preston, 2010).[21] Taken together, Restrictions 3 and 4 imply that the SOE central bank follows a Taylor-type rule in line with Taylor (2001):

$$\begin{aligned} r_t = & \underbrace{-a_{0,75}^{-1}a_{0,15}}_{unrestricted} y_t^* \underbrace{-a_{0,75}^{-1}a_{0,25}}_{unrestricted} \pi_t^* \underbrace{-a_{0,75}^{-1}a_{0,35}}_{unrestricted} cs_t^* \underbrace{-a_{0,75}^{-1}a_{0,45}}_{unrestricted} r_t^* \\ & \underbrace{-a_{0,75}^{-1}a_{0,55}}_{\psi_y>0} y_t \underbrace{-a_{0,75}^{-1}a_{0,65}}_{\psi_\pi>0} \pi_t \underbrace{-a_{0,75}^{-1}a_{0,85}}_{\psi_e>0} rer_t \underbrace{+a_{0,75}^{-1}}_{\sigma} \epsilon_{5,t} \end{aligned} \tag{13}$$

3 Results

This section presents our main results.[22] First, we discuss the IRFs to a tightening of SOE and US monetary policy. Second, we investigate the importance of Restriction 4 (*leaning against the RER*) and Restriction 2 (*leaning against credit frictions*) for the identification of, respectively, SOE and US monetary shocks. Third, we examine the deviations from UIP conditional on SOE and US monetary disturbances. Finally,

[21] Calvo and Reinhart (2002), Reinhart and Rogoff (2004), Obstfeld (2013) and Ilzetzki et al. (2019) find that many central banks react to the dollar exchange rate. Egorov and Mukhin (2023) argue that, under dollar pricing, stabilizing the dollar exchange rate can be desirable.

[22] We set the lag order $p = 2$. All results are based on 1 million draws from the posterior distributions.

we conduct a Forecast Error Variance Decomposition to evaluate the contribution of SOE and US shocks to the short-run volatility of the SOE/US real exchange rates.

3.1 IRFs to a SOE contractionary monetary shock

Figure 1 plots the IRFs of domestic variables for the six SOEs to one standard deviation contractionary monetary shock. The solid lines depict the point-wise posterior median responses while the grey shaded bands correspond to the 68% equal-tailed point-wise posterior probability bands. For all SOEs, we observe that the policy rate jumps on impact within a range of 15 to 40 basis points, and reaches its peak within the next three quarters. Except for Canada, the policy rate increase remains significant for several quarters. For all SOEs, the posterior median response of output displays an instantaneous contraction and stays below trend for several years after the shock. Except for the UK, the decline in output remains significant for several quarters after the shock. For the UK, the response of output is insignificant, although the bulk of the 68% probability bands lies in the negative region, suggesting that output contracts at least in the short run. For Canada and New Zealand, the response of output stays significantly below trend throughout the entire five-year horizon. Hence, we do not observe any evidence of the output puzzle (Uhlig, 2005).

For all SOEs, inflation falls instantaneously and reverts back to its steady state quickly. The negative impact response of inflation is either significant or borderline significant across all SOEs.

Turning to our focus of interest, in all SOEs, the RER appreciates sharply and significantly on impact. This is a remarkable result: We do not find any evidence of the exchange rate puzzle (an immediate depreciation after the tightening of domestic monetary policy). For Canada, New Zealand and the UK, the instantaneous appreciation is immediately followed by a gradual and monotonous depreciation. For Norway and Sweden, the RER appreciation reaches its peak two quarters after the monetary tightening. Instead, the AUD/US RER displays a hump-shaped response, with the peak appreaciation occuring two years after the shock. Thus, except for Australia, we observe little evidence of the delayed overshooting puzzle (a gradual and persistent

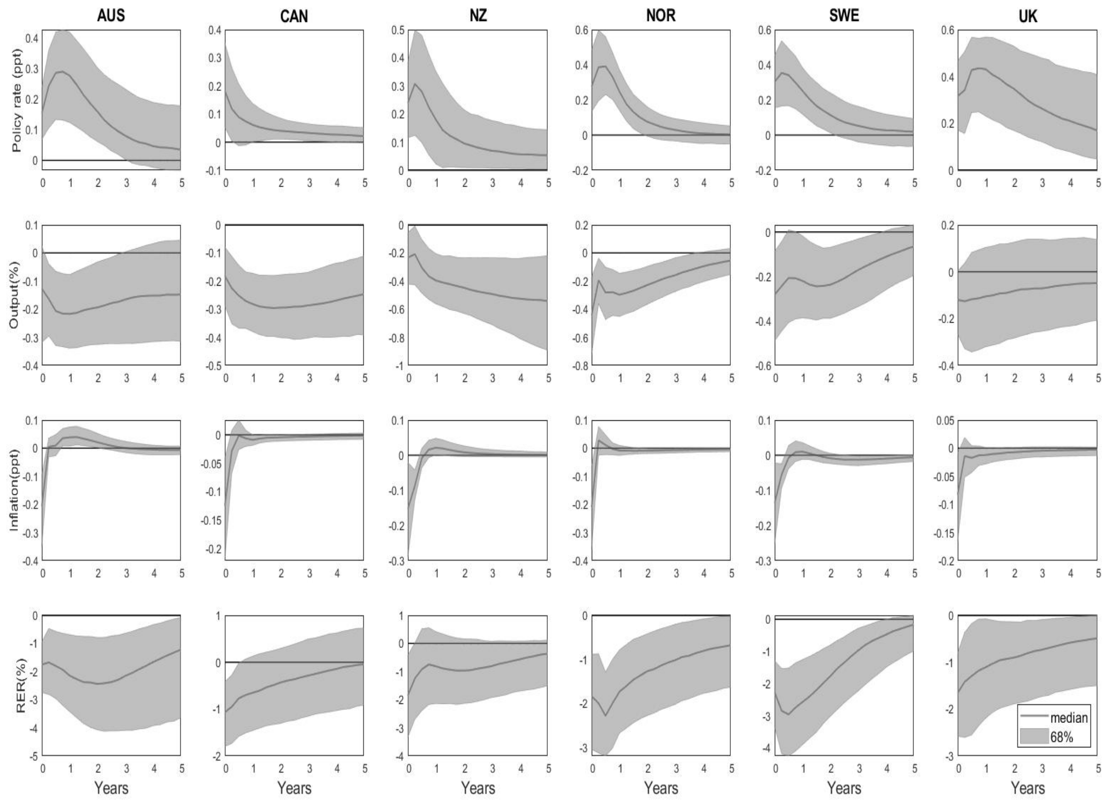

Figure 1: IRFs of SOE variables to a one standard deviation SOE contractionary monetary shock identified using block exogeneity and Restrictions 1 to 4. *Note:* The solid lines depict the point-wise posterior median responses and the shaded bands represent the 68% equal-tailed point-wise posterior probability bands.

appreciation that reaches its peak roughly two years after the shock). The IRFs of the bilateral SOE/US RER to a SOE monetary shock appear broadly consistent with the Dornbusch's overshooting hypothesis. Our findings are in line with the SOE-SVAR studies by Bjørnland (2009), Bjørnland and Halvorsen (2014), Kim and Lim (2018) and Terrell et al. (2023). Our findings reinforce the view that the exchange rate puzzle and the delayed overshooting puzzle may be artefacts caused by dubious identifying restrictions that hinder the simultaneous interactions between monetary policy and the exchange rate.

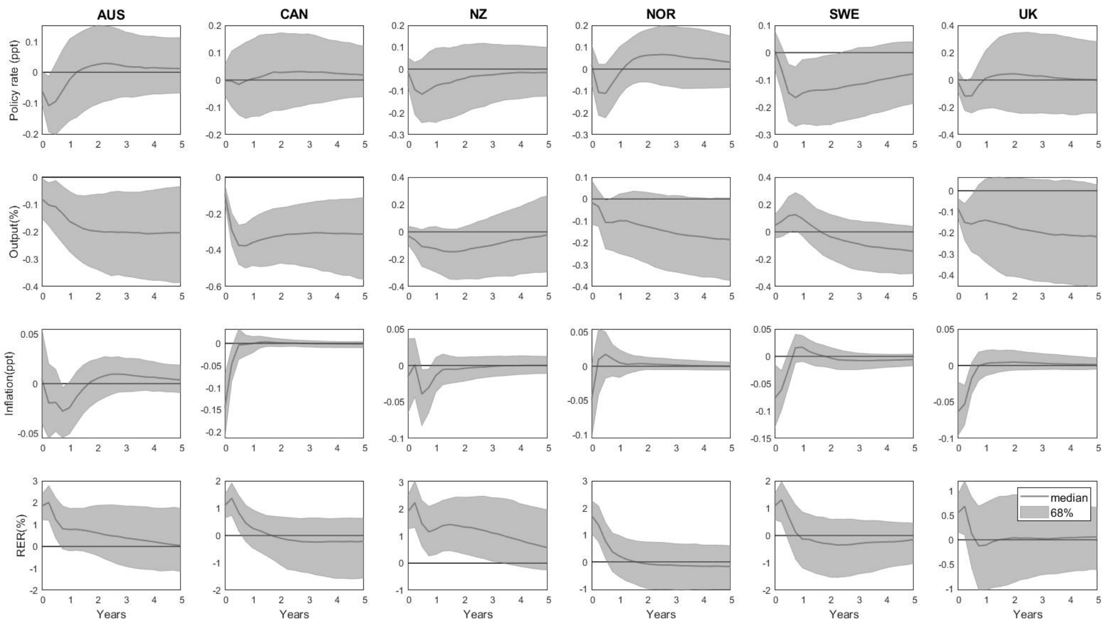

Figure 2: IRFs of SOE variables to a one standard deviation US contractionary monetary shock identified using block exogeneity and Restrictions 1 to 4. *Note:* The solid lines depict the point-wise posterior median responses and the shaded bands represent the 68% equal-tailed point-wise posterior probability bands.

3.2 IRFs to a US contractionary monetary shock

Figure 2 shows the responses of SOE variables to a one standard deviation US contractionary monetary shock. The responses of US variables are reported in the Appendix. They are almost identical across the six SOE-SVARs due to the block-exogeneous structure of the model: the US policy rate jumps significantly on impact to around 20 basis points, US output contracts, US inflation falls and the Baa corporate credit spread increases.

Looking at the RER responses across the six SOEs, we observe that the US dollar appreciates significantly on impact in response to the US monetary tightening (i.e., no exchange rate puzzle). Moreover, the US dollar reaches its peak appreciation within the first quarter after the shock, and gradually depreciates afterwards (i.e., no delayed overshooting). Similar findings are reported in US SVAR monetary policy literature (Kim et al., 2017; Rüth, 2020; Castelnuovo et al., 2022). A distinguishing feature of our study, however, is the inclusion of the ZLB period.[23]

Looking at the response of SOE output to US monetary tightening, we observe a protracted contraction for Australia, Canada, the UK and to a lesser extent Norway. The decline in output is particularly strong in Canada and Australia. The response of output in New Zealand and Sweden is more muted. Following the US monetary tightening, inflation falls in all SOEs. Except for Canada, SOE central banks lower their policy rate slightly to mitigate the negative spillovers of the US monetary tightening. The monetary easing is most visible in Sweden and Australia.

3.3 Importance of Restriction 4 (leaning against the RER)

We now perform a sensitivity analysis to shed light on the importance of Restriction 4 ($\psi_e > 0$) in our identification scheme. We re-estimate the six SOE-SVAR models without Restriction 4 while keeping everything else unchanged. As a result, the contemporaneous response of the SOE policy rate to the real exchange rate is now left unrestricted. The systematic component of SOE monetary policy takes the following form:

$$\begin{aligned} r_t = & \underbrace{-a_{0,75}^{-1}a_{0,15}}_{unrestricted} y_t^* \underbrace{-a_{0,75}^{-1}a_{0,25}}_{unrestricted} \pi_t^* \underbrace{-a_{0,75}^{-1}a_{0,35}}_{unrestricted} cs_t^* \underbrace{-a_{0,75}^{-1}a_{0,45}}_{unrestricted} r_t^* \\ & \underbrace{-a_{0,75}^{-1}a_{0,55}}_{\psi_y>0} y_t \underbrace{-a_{0,75}^{-1}a_{0,65}}_{\psi_\pi>0} \pi_t \underbrace{-a_{0,75}^{-1}a_{0,85}}_{unrestricted} rer_t \underbrace{+a_{0,75}^{-1}}_{\sigma} \epsilon_{5,t}. \end{aligned} \tag{14}$$

.

Figure 3 compares the baseline IRFs (solid lines) of SOE variables to an SOE monetary shock, with Restriction 4 imposed as in Eq.(13), to the sensitivity-analysis IRFs (dashed lines) without Restriction 4, as in Eq.(14). The shaded regions are the 68% equal-tailed point-wise posterior probability bands obtained after relaxing Restriction 4. Figure 3 shows that relaxing Restriction 4 has virtually no effect on the IRFs of the policy rate, output and inflation. Instead, relaxing Restriction 4 greatly alters the IRFs of the RER. Most remarkable is the fact that, for all SOEs, the effects of monetary shocks on the RER are now insignificant, even in the short run. This

[23]Our results are robust to using a shorter sample period from 1992:Q1 to 2008:Q3 that excluds the ZLB period. See the section on robustness checks below.

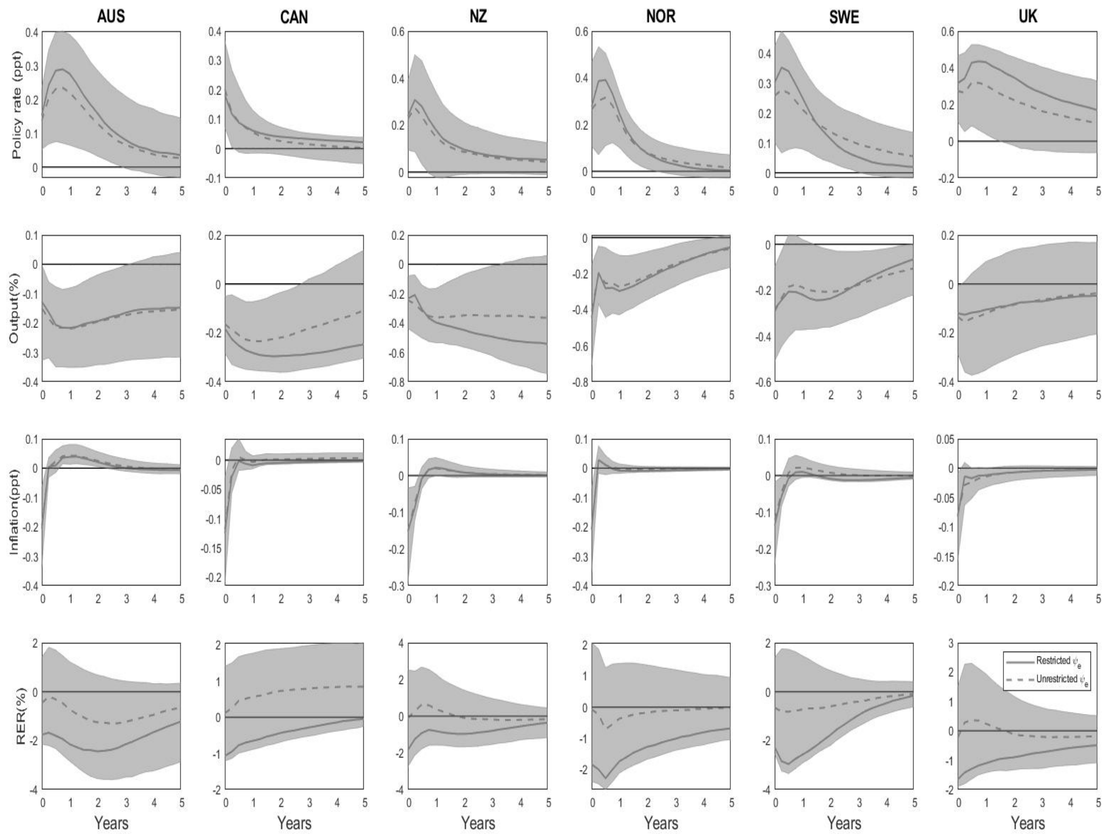

Figure 3: IRFs of SOE variables to a SOE contractionary monetary shock. *Note:* The solid lines are the point-wise posterior median responses under block exogeneity and Restrictions 1 to 4. The dashed lines are the posterior median responses, after relaxing Restriction 4, along with the corresponding 68% equal-tailed posterior probability bands.

finding clearly goes against the consensus view that monetary policy plays a role in accounting for the elevated short-run volatility typically observed in exchange rates. Beyond this striking observation, we also find that the evidence of other puzzles becomes stronger. For Canada, the posterior median response clearly indicates that the exchange rate depreciates instead of appreciating, consistent with the exchange rate puzzle. Taken together, these puzzling findings stand in stark contrast to Dornbusch (1976) overshooting hypothesis according to which a surprise tightening of monetary policy at home causes an instantaneous appreciation of the domestic currency, immediately followed by a gradual depreciation back to the steady state. Considering the puzzling evidence obtained when relaxing Restriction 4 and the assorted motivations for imposing Restriction 4 found in various strands of the literature (Taylor, 2001; Bjørnland, 2009; Lubik and Schorfheide, 2007), we conclude that imposing Restriction 4 contributes usefully to a proper identification of the systematic behavior of SOE central banks.[24]

3.4 Role of Restriction 2 (leaning against the credit spread)

We now evaluate the implications of Restriction 2 ($\psi_{cs^*} < 0$) for the identification of the systematic component of US monetary policy. We re-estimate the six SOE-SVARs without Restriction 2, keeping everything else unchanged. The contemporaneous response of the US policy rate to the credit spread is left unrestricted:

$$r_t^* = \underbrace{-a_{0,41}^{-1} a_{0,11}}_{\psi_{y^*}>0} y_t^* \underbrace{-a_{0,41}^{-1} a_{0,21}}_{\psi_{\pi^*}>0} \pi_t^* \underbrace{-a_{0,41}^{-1} a_{0,31}}_{unrestricted} cs_t^* \underbrace{+a_{0,41}^{-1}}_{\sigma^*} \epsilon_{1,t}. \tag{15}$$

Figure 4 compares the IRFs of the SOE/US RER to a US contractionary monetary policy shock, with and without Restriction 2. As we can see, the main effect of relaxing Restriction 2 is that the 68% posterior probability bands become wider, to the extent that the short-run response of the RER becomes insignificant for the six SOEs. This finding, which suggests that US monetary policy shocks have no material effects on exchange rates even in the short run, goes against the conventional wisdom on the contribution of monetary disturbances to exchange rate volatility. Moreover, the fact that we are here talking about US monetary policy (and not about SOE monetary policy, as in the previous sensitivity analysis of Restriction 4), which is perceived as the main driver of the global financial cycle (Rey, 2013; Miranda-Agrippino and Rey, 2020), makes this finding look somewhat implausible. We generally observe that relaxing Restriction 2 shifts the posterior probability bands towards negative territory, meaning that the indicative evidence of a depreciation of the US dollar (instead of an appreciation, as we would have expected) builds up. In other words, relaxing Restriction 2 makes the exchange rate puzzle more visible (see in particular the IRFs of the GBP/USD, CAD/USD and SEK/USD). Overall, these dubious phenomena

[24] The IRFs to a US monetary shock with and without Restriction 4 are reported in Appendix E. They show that Restriction 4 is irrelevant for identifying US monetary shocks.

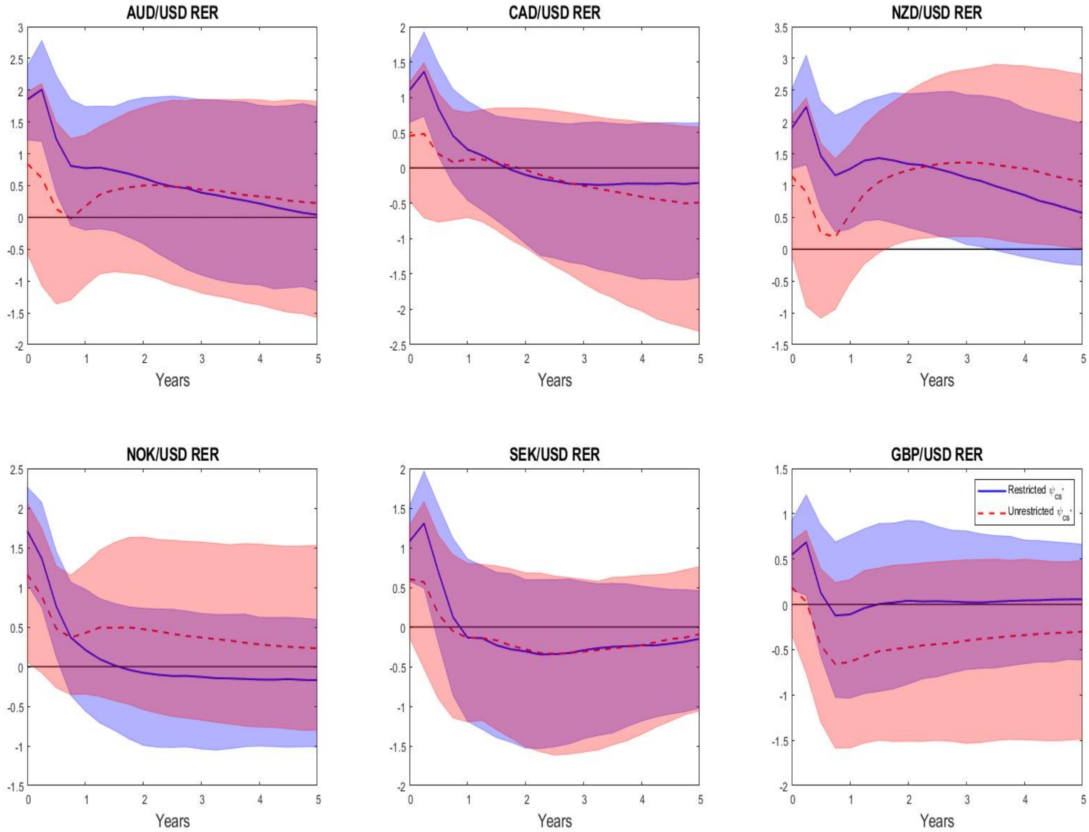

Figure 4: IRFs of the RER to a US contractionary monetary shock. *Note:* The solid lines are the point-wise posterior median responses under block exogeneity and Restrictions 1 to 4. The dashed lines are the posterior median responses after relaxing Restriction 2 ($\psi_{cs^*} < 0$). The shaded regions are the corresponding 68% equal-tailed posterior probability bands.

emphasize the added value of imposing Restriction 2 to correctly characterize the systematic behavior of the Federal Reserve and thereby identify genuine US monetary shocks.

3.5 Deviations from UIP after a monetary policy shock

The uncovered interest rate parity (UIP) condition postulates that a decline in the interest rate differential between the foreign and the domestic policy rates has to be quantitatively offset by an expected depreciation of the nominal exchange rate one period ahead. Examining violations of UIP conditional on monetary disturbances is central to our study as UIP is one of the key building blocks underpinning Dorn-

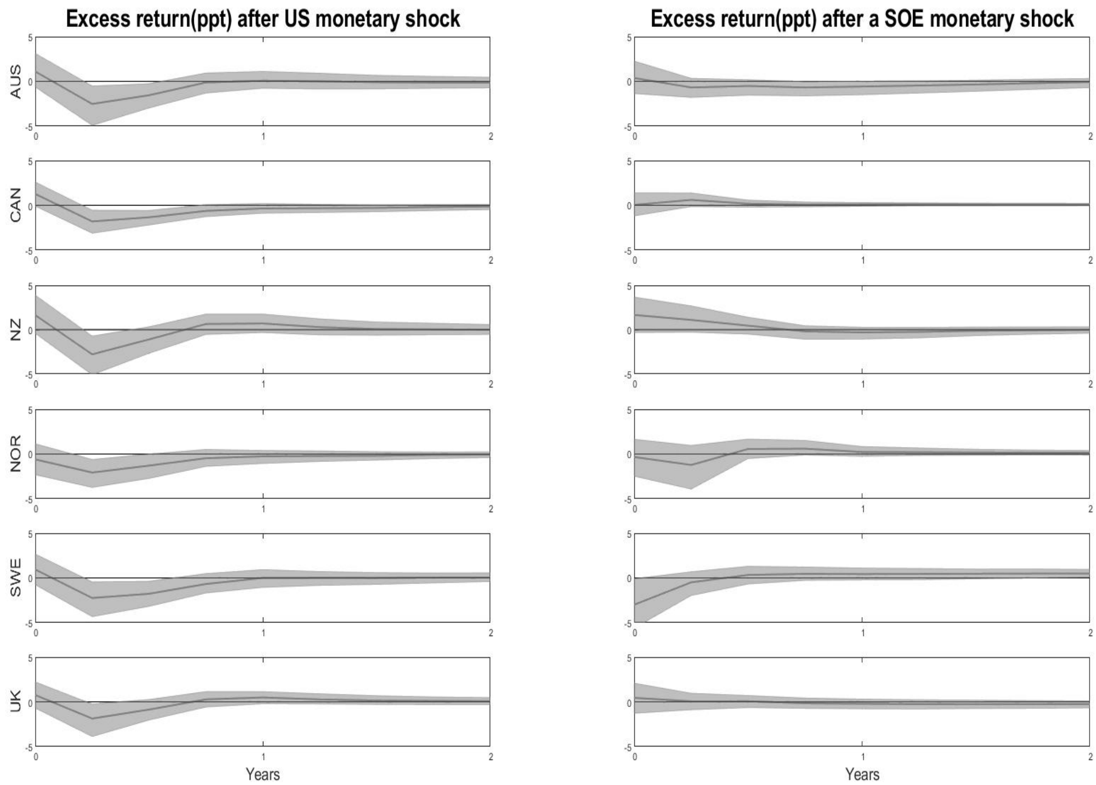

Figure 5: Deviations from UIP conditional on US (lhs) and SOE (rhs) monetary policy shocks. *Note:* The solid lines represent the point-wise posterior median estimates of excess returns. The shaded areas are the 68% posterior probability intervals.

busch's overshooting hypothesis (Rüth, 2020), and more generally the New Open Economy Macroeconomics (Lane, 2001). Following Eichenbaum and Evans (1995) and Bjørnland (2009), we compute the excess return measured in domestic currency, Λ_t, as:

$$\Lambda_t = r_t^* - r_t + 4 \times (\mathbb{E}_\mathbf{t}\{s_{t+1}\} - s_t), \tag{16}$$

where s_t is the nominal exchange rate.[25] According to UIP, the excess return Λ_t should be zero at all horizons:

$$\mathbb{E}_\mathbf{t}\{\Lambda_{t+j}\} = 0 \qquad \text{for all } j \geqslant 0,$$

where $\mathbb{E}_t$ denotes the conditional expectations operator.

[25]As our system includes SOE and US inflation rates along with the SOE/US RER, it is straightforward to construct the IRFs of the nominal exchange to a monetary shock.

Figure 5 reports the point-wise posterior median estimates of excess returns conditional on US (lhs panel) and SOE (rhs panel) monetary policy shocks, along with the 68% posterior probability intervals. We do not find any evidence of UIP violations in response to SOE monetary shocks: Excess returns triggered by SOE disturbances are quantitatively modest and insignificant at all horizons. Deviations from UIP generated by US policy shocks are also moderate and insignificant, except during the quarter after the shock, when they are borderline significant. Thus, overall, the conditional dynamics of exchange rates following US and SOE monetary disturbances appear to be largely consistent with UIP. Our results are in line with Bjørnland (2009), who reports exchange rate movements broadly consistent with UIP conditional on SOE monetary disturbances, and with Rüth (2020) who finds little evidence of UIP violations conditional on US monetary shocks. Instead, Eichenbaum and Evans (1995), Faust and Rogers (2003) and Scholl and Uhlig (2008) report evidence of the forward discount puzzle, i.e. large and significant deviations from UIP, conditional on US monetary shocks.

3.6 Forecast error variance decomposition of the RER

Figure 6 shows the forecast-error variance decomposition of the six SOE/US real exchange rates. With the exception of Canada and New Zealand, domestic monetary policy shocks account for a greater share of the RER volatility than US shocks. Depending on the country, domestic monetary policy shocks roughly explain 10 to 25 percents of the volatility of the exchange rate in the short run, while the share attributed to US shocks varies from 3 to 18 percents. Depending on the country, the joint contribution of US and SOE monetary disturbances to the short-run volatility of the SOE/US RER ranges from 25 to 35 percents.

4 Robustness Checks

We perform two robustness checks. In the first, we re-estimate the six SOE-SVARs over the shorter sample period 1992:Q1 - 2008:Q3 to exclude episodes of unconventional monetary policy and binding zero-lower-bound. In this exercise, we do not use any shadow rates to measure the stance of SOE and US monetary policy. In

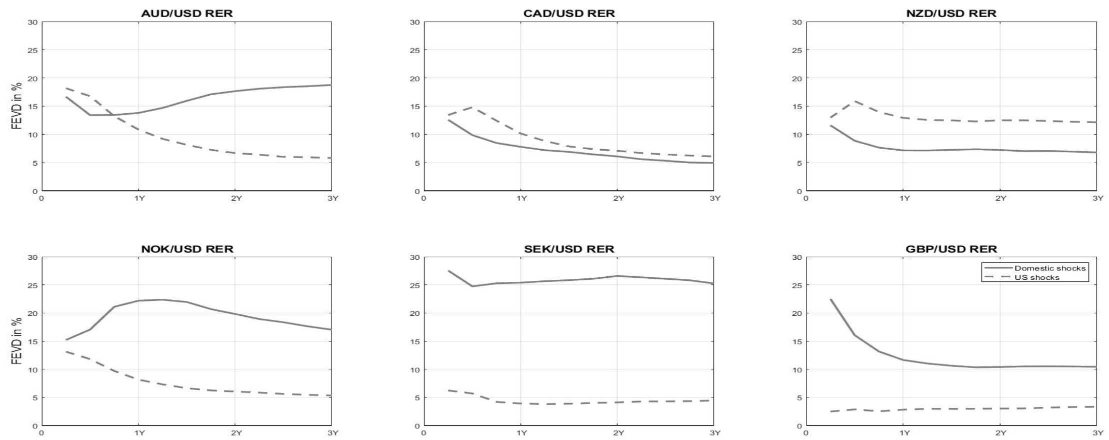

Figure 6: Forecast error variance decomposition of the SOE/US RER. *Note:* In each panel, the solid line represents the posterior median estimate of the contribution of SOE monetary shocks to the forecast-error variance of the RER, while the dashed line shows the contribution of US monetary shocks.

the second robustness check, we estimate a 9-variable SOE-SVAR model for the six SOEs. This larger model includes an SOE corporate credit spread. Due to limited data availability, the estimation period is restricted to 2000:Q1 - 2019:Q4. To sharpen the identification of the systematic component of SOE monetary policy, we impose an additional sign restriction which requires that the SOE central bank leans against the SOE credit spread.

4.1 Excluding ZLB episodes

Figure 7 plots the IRFs of SOE variables to a one standard deviation SOE contractionary monetary policy surprise, when using the sample period 1992:Q1 - 2008:Q3 in estimation.[26] The dashed lines are the posterior median IRFs based on the sample 1992:Q1 - 2008:Q3, and the shaded bands are the associated 68% posterior probability bands. The solid lines, instead, are the posterior median IRFs from the baseline estimation over the full sample 1992:Q1 - 2019:Q4. Figure 8 plots the deviations from UIP based on the estimation period 1992:Q1 - 2008:Q3. Looking at Fig. 7 and Fig. 8, we conclude that our main results are qualitatively and quantitatively robust to excluding the ZLB episodes.

[26]For the US, Sweden and the UK, we replace the shadow rate with the 3-month interbank rate.

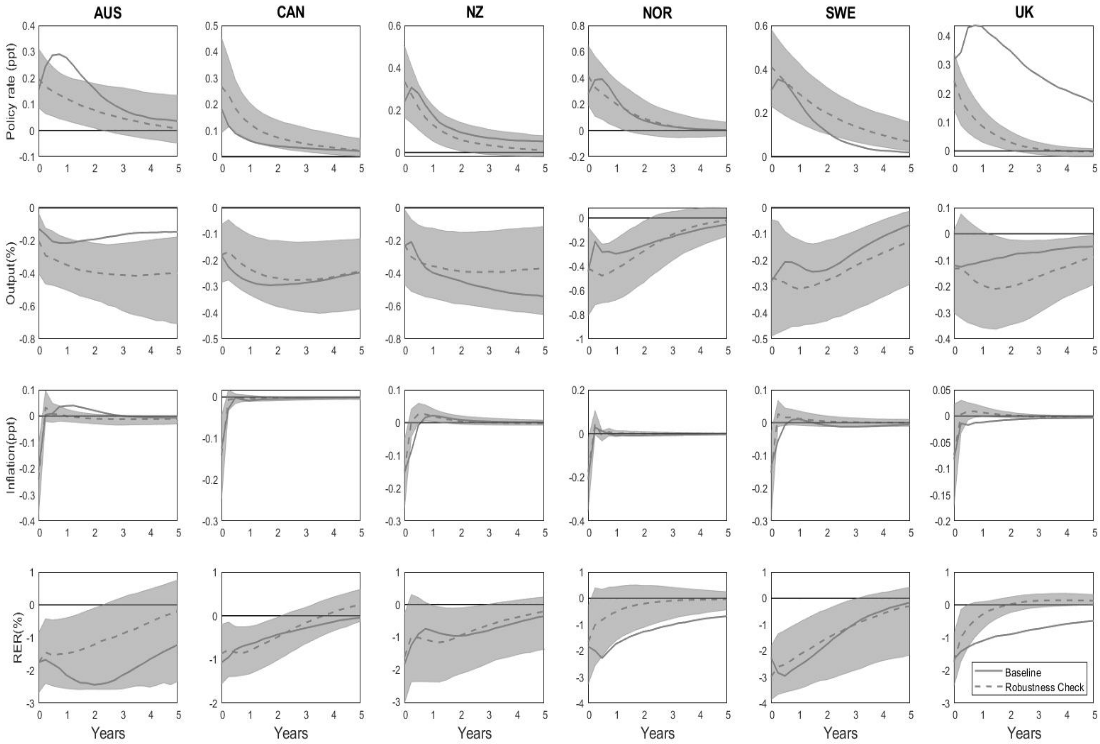

Figure 7: IRFs of SOE variables to a one standard deviation SOE contractionary monetary shock identified through block exogeneity and Restrictions 1 to 4, using the sample period 1992:Q1 to 2008:Q3 in estimation. *Note:* The dashed lines depict the point-wise posterior median responses for the sample period 1992:Q1 to 2008:Q3. The shaded regions represent the corresponding 68% equal-tailed point-wise posterior probability bands. The solid lines depict the posterior median responses for the full sample period 1992:Q1 to 2019:Q4.

4.2 Including the SOE credit spread

We extend our baseline model to include an additional variable, a SOE corporate credit spread, in the domestic block. Due to data availability, the sample period used in estimation is 2000:Q1 to 2019:Q4.[27] Our motivation comes from Caldara and Herbst (2019) and Beckers et al. (2020), who show the importance of including a corporate credit spread measure in the systematic component of US and Australian monetary policy, respectively. For Canada, New Zealand, Sweden and the UK, we construct the SOE credit spread as the difference between the Standard & Poor's investment grade corporate bond yield and the government bond yield. For Australia, we use

[27]We set the lag order $p = 1$.

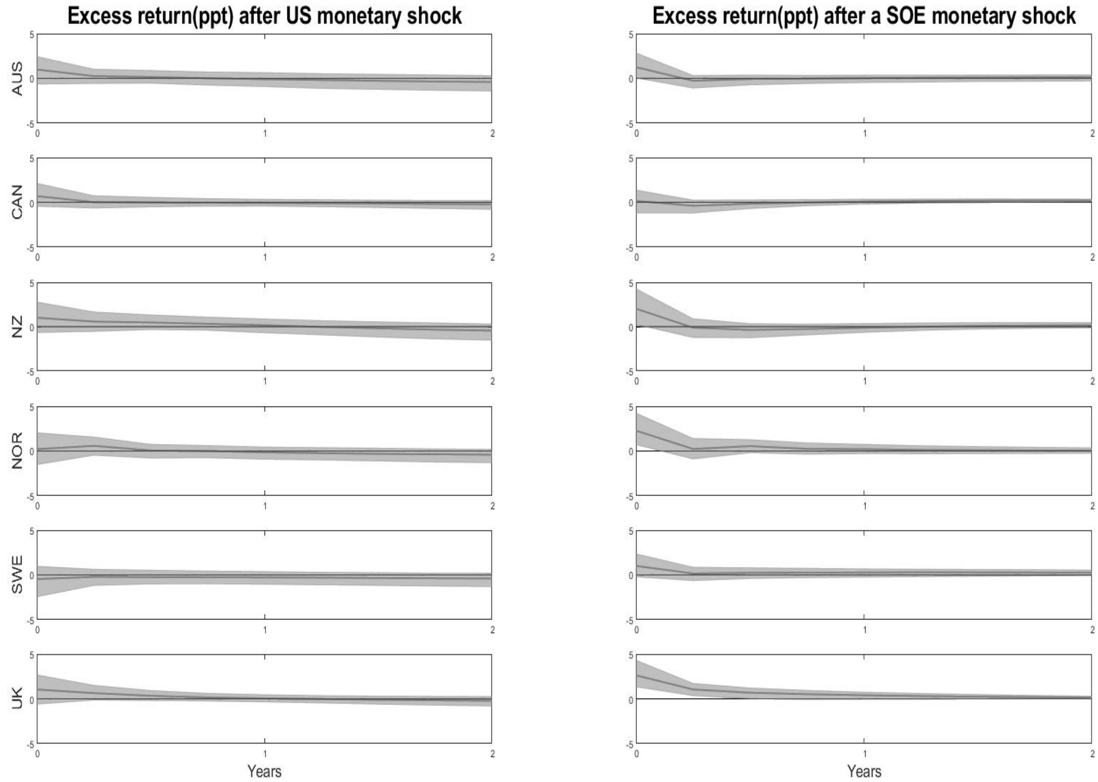

Figure 8: Deviations from UIP when using the shorter estimation sample period 1992:Q1 to 2008:Q3. *Note:* In each panel, the solid line represents the point-wise posterior median estimates of excess returns. The shaded areas are the 68% posterior probability intervals.

the credit spread measure by constructed by Beckers et al. (2020).[28] We extend our baseline identification scheme, based on block exogeneity and Restriction 1 to 4, by formulating a fifth restriction.

Restrictions 5. The contemporaneous response of the SOE policy rate to the domestic credit spread is negative: $\psi_{cs} < 0$.

Restriction 5 means that SOE central bank, guided by a concern for financial stability, typically cuts its policy rate in response to an increase in the domestic credit spread. The SOE monetary policy rule now reads:

[28]Special thanks to Olav Syrstad for help with the Norwegian credit spread data. See Appendix A for further details on SOE credit spread data.

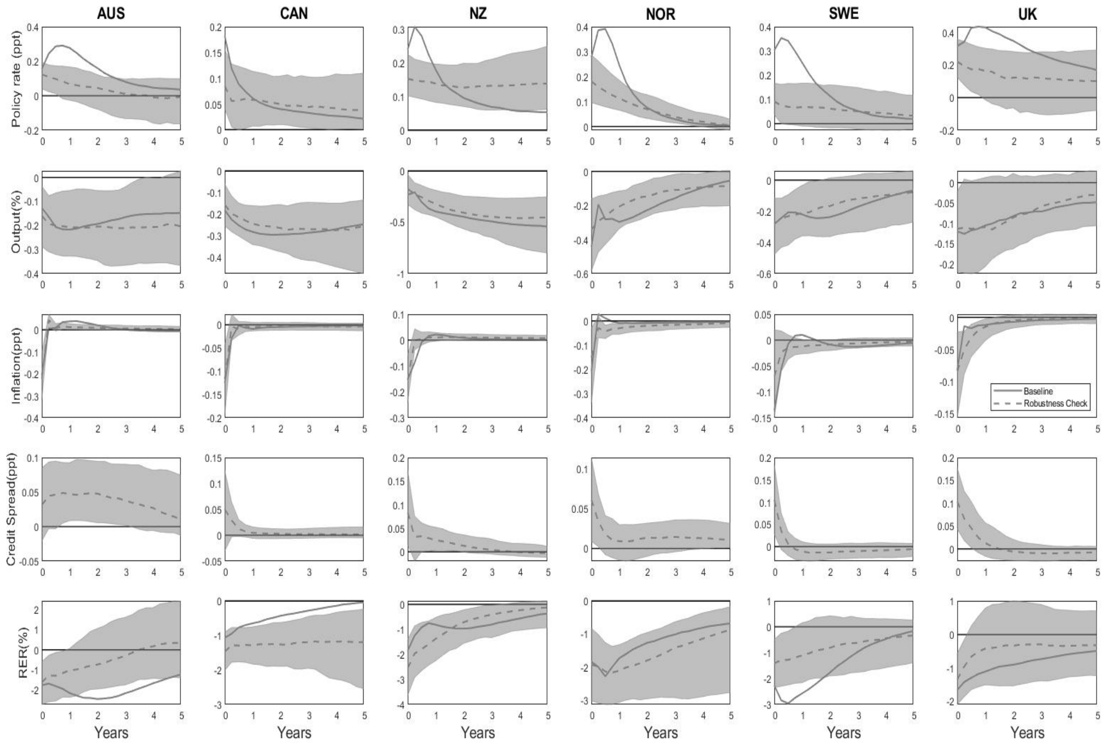

Figure 9: IRFs of SOE variables to a SOE contractionary monetary shock identified using block exogeneity and Restrictions 1 to 5. *Note:* Dashed lines depict point-wise posterior median IRFs when the SOE credit spread is included in the domestic block and Restriction 5 is imposed. The shaded regions represent the associated 68% posterior probability bands. The solid lines correspond to the baseline posterior median IRFs.

$$r_t = \underbrace{-a_{0,85}^{-1}a_{0,15}}_{unrestricted} y_t^* \underbrace{-a_{0,85}^{-1}a_{0,25}}_{unrestricted} \pi_t^* \underbrace{-a_{0,85}^{-1}a_{0,35}}_{unrestricted} cs_t^* \underbrace{-a_{0,85}^{-1}a_{0,45}}_{unrestricted} r_t^*$$
$$\underbrace{-a_{0,85}^{-1}a_{0,55}}_{\psi_y>0} y_t \underbrace{-a_{0,85}^{-1}a_{0,65}}_{\psi_\pi>0} \pi_t \underbrace{-a_{0,85}^{-1}a_{0,75}}_{\psi_{cs}<0} cs_t \underbrace{-a_{0,85}^{-1}a_{0,95}}_{\psi_e>0} rer_t \underbrace{+a_{0,85}^{-1}}_{\sigma} \epsilon_{5,t}. \tag{17}$$

Figure 37 plots the IRFs (posterior median and 68% bands) of SOE variables to a contractionary SOE monetary policy shock for the second robustness check and compares them against the baseline posterior median. Figure 10 reports the deviations from UIP for the second robustness check. Keeping in mind the different sample periods used in baseline and in the second robustness check, Fig. 37 and Fig. 10 suggest that our main findings seem qualitatively robust to incorporating an SOE credit spread and imposing Restriction 5 (*the SOE central bank leans against the*

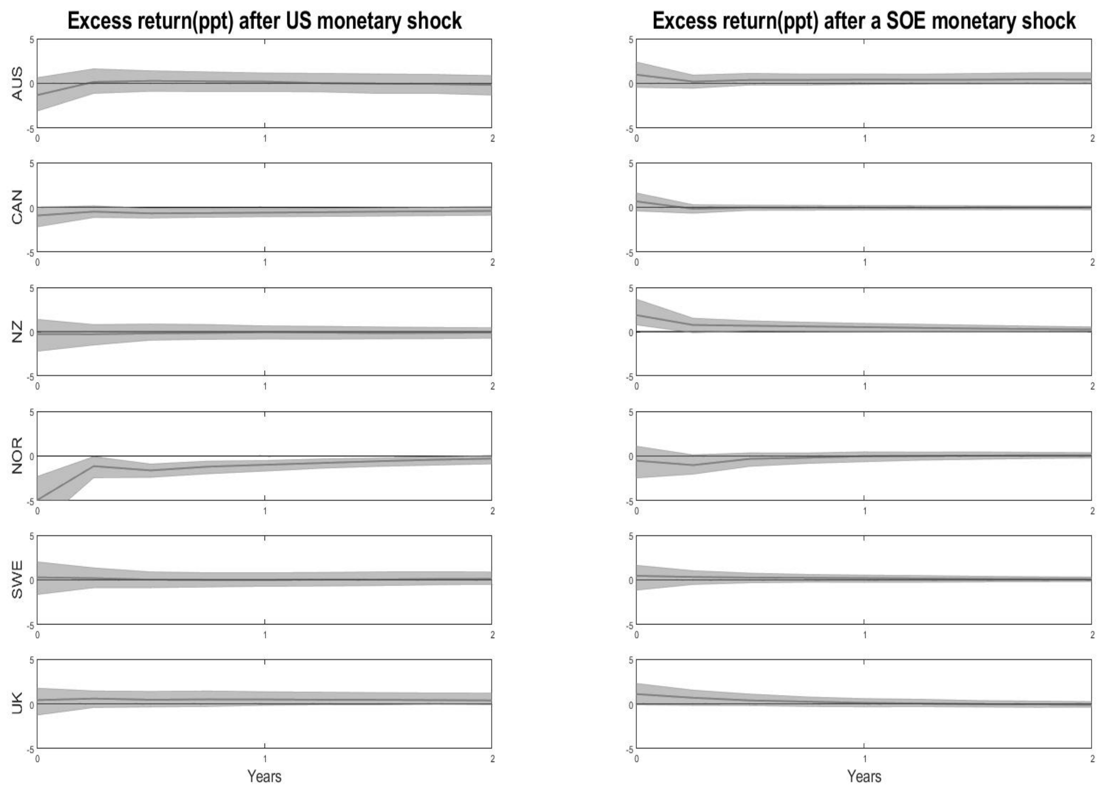

Figure 10: Deviations from UIP for Robustness check 2 (SOE credit spread). *Note:* Solid lines represent point-wise posterior median estimates of excess returns. Shaded areas are the 68% posterior probability intervals.

domestic credit spread).

5 Conclusion

In this paper, we estimate set-identified SVAR models for six small open economies to investigate the effects of domestic and US monetary policy shocks on the real exchange rate. Our identification scheme combines block exogeneity and sign-restrictions imposed directly on the structural parameters describing the systematic behavior of the Federal Reserve and the SOE central banks. In line with Taylor (2001), we require that the SOE monetary authority typically reduces its policy rate in response to a real appreciation of the domestic currency. Our agnostic identification scheme preserves the contemporaneous interaction between the exchange rate and the domestic policy rates, while leaving the response of the exchange rate to domestic and US monetary shocks unrestricted. We find little evidence of delayed overshooting in response to SOE and US monetary disturbances. Overall, our empirical results broadly agree with Dornbusch's overshooting hypothesis and UIP.

References

Akinci, O., Benigno, G., Pelin, S., and Turek, J. (2022). The Dollar's Imperial Circle. *Federal Reserve Bank of New York Staff Reports*, 1045.

Arias, J. E., Caldara, D., and Rubio-Ramirez, J. F. (2019). The systematic component of monetary policy in SVARs: An agnostic identification procedure. *Journal of Monetary Economics*, 101:1–13.

Arias, J. E., Rubio-Ramírez, J. F., and Waggoner, D. F. (2018). Inference based on structural vector autoregressions identified with sign and zero restrictions: Theory and applications. *Econometrica*, 86(2):685–720.

Bagliano, F. C., Favero, C. A., and Franco, F. (1999). Measuring Monetary Policy in Open Economies. *IGIER Working Papers*, 133.

Beckers, B. et al. (2020). *Credit spreads, monetary policy and the price puzzle*. Reserve Bank of Australia.

Binning, A. (2013). Underidentified SVAR models: A framework for combining short and long-run restrictions with sign-restrictions. *Available at SSRN 2350094*.

Bjørnland, H. C. (2009). Monetary policy and exchange rate overshooting: Dornbusch was right after all. *Journal of International Economics*, 79(1):64–77.

Bjørnland, H. C. and Halvorsen, J. I. (2014). How does monetary policy respond to exchange rate movements? New international evidence. *Oxford Bulletin of Economics and Statistics*, 76(2):208–232.

Caldara, D. and Herbst, E. (2019). Monetary policy, real activity, and credit spreads: Evidence from Bayesian proxy SVARs. *American Economic Journal: Macroeconomics*, 11(1):157–192.

Calvo, G. A. and Reinhart, C. M. (2002). Fear of floating. *The Quarterly Journal of economics*, 117(2):379–408.

Castelnuovo, E., Pellegrino, G., Ranzato, G., et al. (2022). *Delayed Overshooting Puzzle: Does Systematic Monetary Policy Matter?* Department of Economics and Management "Marco Fanno", University of Padova.

Clarida, R. and Gali, J. (1994). Sources of real exchange rate fluctuations: how important are nominal shocks? *Carnegie-Rochester Conference Series on Public Policy*, 41:1–56.

Curdia, V. and Woodford, M. (2010). Credit spreads and monetary policy. *Journal of Money, Credit and Banking*, 42:3–35.

Curdia, V. and Woodford, M. (2016). Credit frictions and optimal monetary policy. *Journal of Monetary Economics*, 84:30–65.

Cushman, D. O. and Zha, T. (1997). Identifying monetary policy in a small open economy under flexible exchange rates. *Journal of Monetary economics*, 39(3):433–448.

De Rezende, R. B. and Ristiniemi, A. (2023). A shadow rate without a lower bound constraint. *Journal of Banking & Finance*, 146:106686.

Dieppe, A., Legrand, R., and Roye, B. V. (2016). The BEAR toolbox (ECB Working PaperNo. 1934). *European Central Bank*.

Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of Political Economy*, 84(6):1161–1176.

Egorov, K. and Mukhin, D. (2023). Optimal Policy under Dollar Pricing. *SAFE Working Paper*, 377.

Eichenbaum, M. and Evans, C. L. (1995). Some empirical evidence on the effects of shocks to monetary policy on exchange rates. *The Quarterly Journal of Economics*, 110(4):975–1009.

Faust, J. and Rogers, J. H. (2003). Monetary policy's role in exchange rate behavior. *Journal of Monetary Economics*, 50(7):1403–1424.

Fisher, L. A. and Huh, H.-s. (2023). Systematic monetary policy in a SVAR for Australia. *Economic Modelling*, 128:106519.

Fry, R. and Pagan, A. (2011). Sign restrictions in structural vector autoregressions: a critical review. *Journal of Economic Literature*, 49(4):938–960.

Gopinath, G., Boz, E., Casas, C., Diez, F., Gourinchas, P.-O., and Plagborg-Møller, M. (2020). Dominant Currency Paradigm. *American Economic Review*, 110(3):677–719.

Gourinchas, P.-O. (2021). The Dollar Hegemon? Evidence and Implications for Policymakers. *The Asian Monetary Policy Forum*, in Steven J. Davis, Edward S Robinson and Bernard Yeung (ed.), Ch.7:264–300.

Gourinchas, P.-O., Rey, H., and Sauzet, M. (2019). The International Monetary and Financial System. *Annual Review of Economics*, 11:859–893.

Ilzetzki, E., Reinhart, C. M., and Rogoff, K. S. (2019). Exchange arrangements entering the twenty-first century: Which anchor will hold? *The Quarterly Journal of Economics*, 134(2):599–646.

Jääskelä, J. P. and Jennings, D. (2011). Monetary policy and the exchange rate: Evaluation of VAR models. *Journal of International Money and Finance*, 30(7):1358–1374.

Justiniano, A. and Preston, B. (2010). Can structural small open-economy models account for the influence of foreign disturbances? *Journal of International Economics*, 81(1):61–74.

Kam, T., Lees, K., and Liu, P. (2009). Uncovering the hit list for small inflation targeters: A Bayesian structural analysis. *Journal of Money, Credit and Banking*, 41(4):583–618.

Kim, S. and Lim, K. (2018). Effects of monetary policy shocks on exchange rate in small open Economies. *Journal of Macroeconomics*, 56:324–339.

Kim, S. and Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary economics*, 45(3):561–586.

Kim, S.-H., Moon, S., and Velasco, C. (2017). Delayed overshooting: is it an'80s puzzle? *Journal of Political Economy*, 125(5):1570–1598.

Koop, G., Korobilis, D., et al. (2010). Bayesian multivariate time series methods for empirical macroeconomics. *Foundations and Trends® in Econometrics*, 3(4):267–358.

Lane, P. R. (2001). The new open economy macroeconomics: A survey. *Journal of International Economics*, 54(2):235–266.

Leeper, E. M., Sims, C., and Zha, T. (1996). What does monetary policy do? *Brookings Papers on Economic Activity*, 1996(2):1–78.

Lubik, T. A. and Schorfheide, F. (2007). Do central banks respond to exchange rate movements? A structural investigation. *Journal of Monetary Economics*, 54(4):1069–1087.

Maćkowiak, B. (2007). External shocks, US monetary policy and macroeconomic fluctuations in emerging markets. *Journal of Monetary Economics*, 54(8):2512–2520.

Miranda-Agrippino, S. and Nenova, T. (2022). A tale of two global monetary policies. *Journal of International Economics*, 136:103606.

Miranda-Agrippino, S. and Rey, H. (2020). U.S. Monetary Policy and the Global Financial Cycle. *Review of Economic Studies*, 87(6):2754–2776.

Obstfeld, M. (2013). Crises and the international system. *International Economic Journal*, 27(2):143–155.

Obstfeld, M. and Rogoff, K. (1995). The mirage of fixed exchange rates. *Journal of Economic Perspectives*, 9(4):73–96.

Read, M. (2023). Estimating the effects of monetary policy in Australia using sign-restricted Structural Vector Autoregressions. *Economic Record*, forthcoming.

Reinhart, C. M. and Rogoff, K. S. (2004). The modern history of exchange rate arrangements: a reinterpretation. *The Quarterly Journal of Economics*, 119(1):1–48.

Rey, H. (2013). Dilemma not trilemma: the global financial cycle and monetary policy independence. *Proceedings - Economic Policy Symposium - Jackson Hole*, Federal Reserve Bank of Kansas City:285–333.

Rogers, J. H. (1999). Monetary shocks and real exchange rates. *Journal of International Economics*, 49(2):269–288.

Rubio-Ramirez, J. F., Waggoner, D. F., and Zha, T. (2010). Structural vector autoregressions: Theory of identification and algorithms for inference. *The Review of Economic Studies*, 77(2):665–696.

Rüth, S. K. (2020). Shifts in monetary policy and exchange rate dynamics: Is Dornbusch's overshooting hypothesis intact, after all? *Journal of International Economics*, 126:103344.

Rüth, S. K. and Van der Veken, W. (2023). Monetary policy and exchange rate anomalies in set-identified SVARs: Revisited. *Journal of Applied Econometrics*.

Scholl, A. and Uhlig, H. (2008). New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. *Journal of International Economics*, 76(1):1–13.

Taylor, J. B. (1993). Discretion versus policy rules in practice. In *Carnegie-Rochester Conference Series on Public Policy*, volume 39, pages 195–214. Elsevier.

Taylor, J. B. (2001). The role of the exchange rate in monetary-policy rules. *American Economic Review*, 91(2):263–267.

Terrell, M., Haque, Q., Cross, J. L., and Tchatoka, F. D. (2023). Monetary policy shocks and exchange rate dynamics in small open economies.

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics*, 52(2):381–419.

Wu, J. C. and Xia, F. D. (2016). Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit and Banking*, 48(2-3):253–291.

Appendix

A Data Sources

The dataset spans from 1992:Q1 to 2019:Q4.

A.1 United States

- **Real Gross Domestic Product** (Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate)
  - Source: FRED Economic Data (GDPC1)
- **Consumer Price Index: All Items for the United States** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (USACPIALLMINMEI)
- **Federal Funds Effective Rate** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (FEDFUNDS)
- **Shadow rate** (Percent)
  - Source: Wu and Xia (2016)
- **Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (BAA10YM)

A.2 Australia

- **Real Gross Domestic Product for Australia** (Domestic Currency, Seasonally Adjusted)
  - Source: FRED Economic Data (NGDPRSAXDCAUQ)
- **Consumer Price Index: All Items: Total: Total for Australia** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (AUSCPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for Australia** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01AUQ156N)

- **Exchange rate** **
  - Source: Reserve Bank of Australia (Refinitiv Datastream, AUUSDSP)
- **Credit spread**
  - Description: Credit market spread between Australian large business variable lending rate and 3-month Bank Accepted Bill (BAB) rate.
  - Source: Reserve Bank of Australia
    - https://www.rba.gov.au/publications/rdp/2020/2020-01/supplementary-information.html

A.3 Canada

- **Real Gross Domestic Product for Canada** (Domestic Currency, Seasonally Adjusted)
  - Source: FRED Economic Data (NGDPRSAXDCCAQ)
- **Consumer Price Index: All Items: Total: Total for Canada** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (CANCPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for Canada** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01CAQ156N)
- **Exchange rate**
  - Source: Bank of Canada (Refinitiv Datastream, CNXRUSD)
- **Credit spread**
  - Description: Credit spread is calculated as the yield in the S&P Canada Investment Grade Corporate Bond Index (Code: SPFICAV) less the Canada, Government Bond Yield: 3 Year Benchmark (End Month)(Code: CNB14068; CANSIM-Statistic Canada).

**For each SOE, we calculate real exchange rate from the nominal exchange rate and the US and domestic price levels, such that, $e_t = s_t + p_t^* - p_t$; where e_t and s_t are the logs of real and nominal exchange rates, respectively and p_t^* and p_t are the logs of US and domestic consumer price indices, respectively.

A.4 New Zealand

- **Production-based gross domestic product (GDP)** (Real, NZD, Seasonally Adjusted)
  - Source: Statistics New Zealand (GDP06.Q.QT0.rs)
- **Consumer Price Index: All Items for New Zealand** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (NZLCPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for New Zealand** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01NZQ156N)
- **Exchange rate**
  - Source: Reserve Bank of New Zealand (EXR.MS11.D06)
- **Credit spread**
  - Description: Credit spread is calculated as the yield in the S&P New Zealand Investment Grade Corporate Bond Index (Code: SPNZICZ) less the New Zealand Government Bond Yield, 2 Years (Code:NZGBY2Y; Reserve Bank of New Zealand).

A.5 Norway

- **Real Gross Domestic Product for Norway** (Millions of Chained 2010 National Currency, Seasonally Adjusted)
  - Source: FRED Economic Data (CLVMNACSCAB1GQNO)
- **Consumer Price Index: All Items for Norway** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (NORCPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for Norway** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01NOQ156N)
- **Exchange rate**
  - Source: Norges Bank (Refinitiv Datastream, NWXRUSD)
- **Credit spread**
  - Description: Risk-premium new 5-years bond. Index made up of Norwegian industrial issuers. Percentage points over 3 month NIBOR. (RPREM.IND.M060)

A.6 Sweden

- **Real Gross Domestic Product for Sweden** (Millions of Chained 2010 National Currency, Seasonally Adjusted)
  - Source: FRED Economic Data (CLVMNACSCAB1GQSE)
- **Consumer Price Index: All Items for Sweden** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (SWECPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for Sweden** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01SEQ156N)
- **Shadow rate** (Percent)
  - Source: De Rezende and Ristiniemi (2023)
- **Exchange rate**
  - Source: Sveriges Riksbank Bank (Refinitiv Datastream, SDXRUSD)
- **Credit spread**
  - Description: Credit spread is calculated as the yield in the S&P Sweden Investment Grade Corporate Bond Index (Code: SPSEICR) less the Swedish Government Bond, maturity 2 years (Code: SEGVB2Y; Sveriges Riksbank, Refinitiv Datastream).

A.7 United Kingdom

- **Real Gross Domestic Product for United Kingdom** (Millions of Chained 2010 National Currency, Seasonally Adjusted)
  - Source: FRED Economic Data (CLVMNACSCAB1GQUK)
- **Consumer Price Index of All Items in the United Kingdom** (Index 2015=100, Not Seasonally Adjusted)
  - Source: FRED Economic Data (GBRCPIALLQINMEI)
- **3-Month or 90-day Rates and Yields: Interbank Rates for the United Kingdom** (Percent, Not Seasonally Adjusted)
  - Source: FRED Economic Data (IR3TIB01GBQ156N)
- **Shadow rate** (Percent)

  - Source: https://sites.google.com/view/jingcynthiawu/shadow-rates

- **Exchange rate**
  - Source: Bank of England (Refinitiv Datastream, UKXRUSD)

- **Credit spread**
  - Description: Credit spread is calculated as the yield in the S&P U.K. Investment Grade Corporate Bond Index (Code: SPUKICG) less the Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for the United Kingdom (Code: IRLTLT01GBQ156N; FRED Economic Data).

B Baseline

B.1 IRFs to a one standard deviation SOE monetary policy shocks

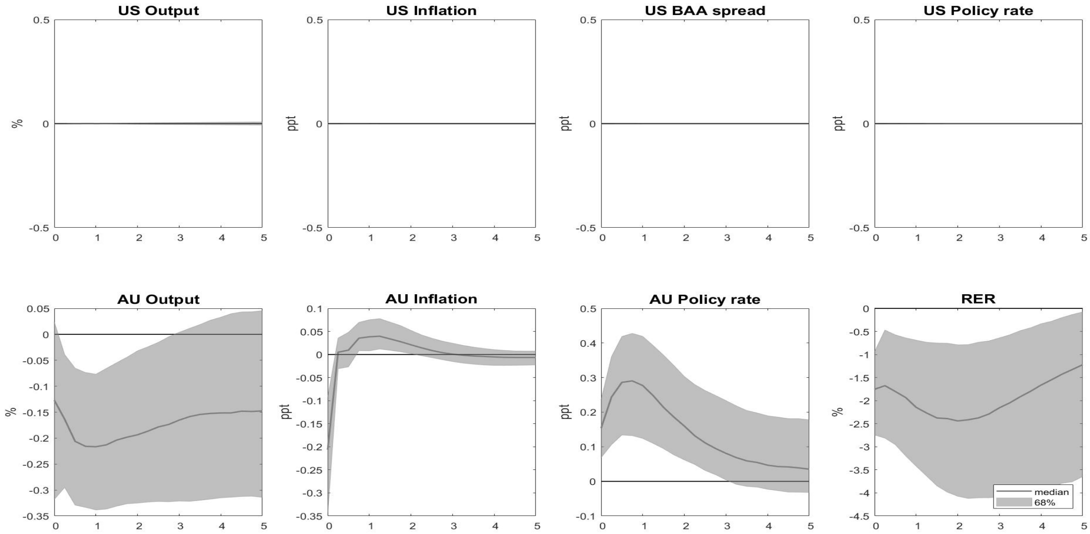

Figure 11: Australia - IRFs to a one standard deviation contractionary monetary policy shock

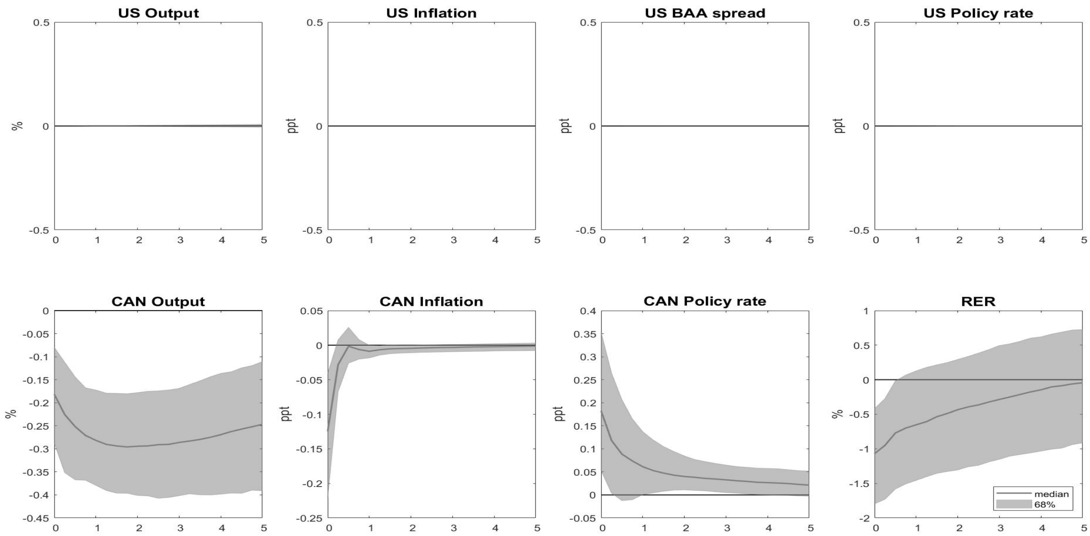

Figure 12: Canada - IRFs to a one standard deviation contractionary monetary policy shock

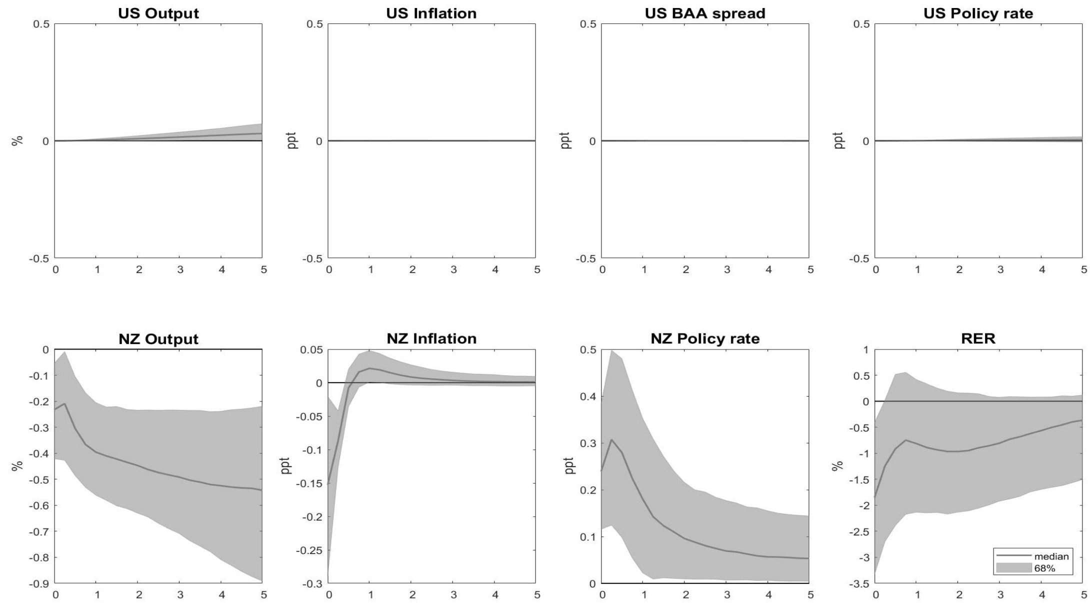

Figure 13: New Zealand - IRFs to a one standard deviation contractionary monetary policy shock

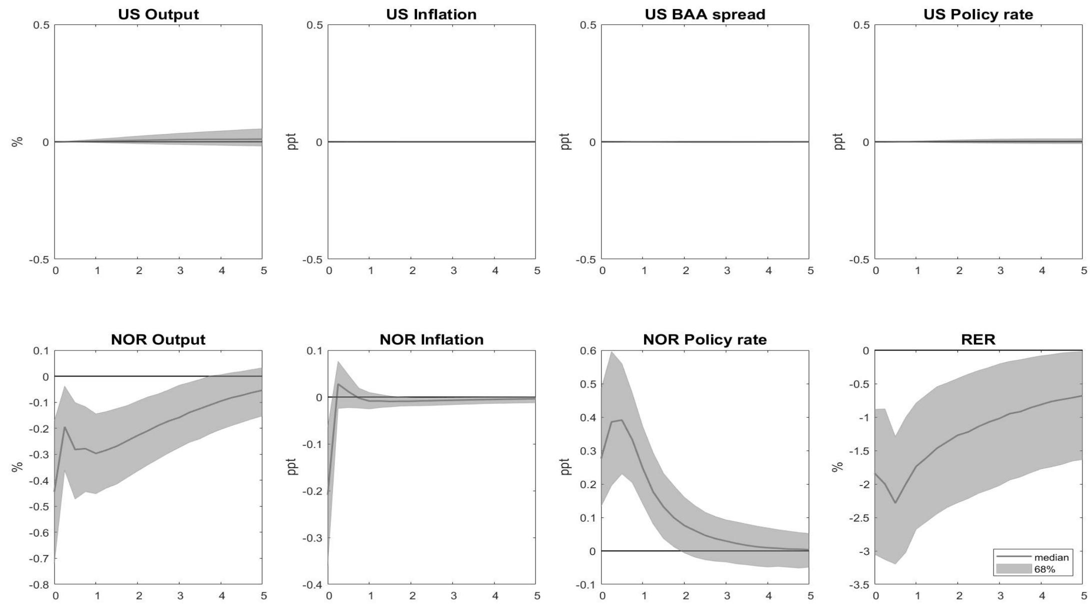

Figure 14: Norway - IRFs to a one standard deviation contractionary monetary policy shock

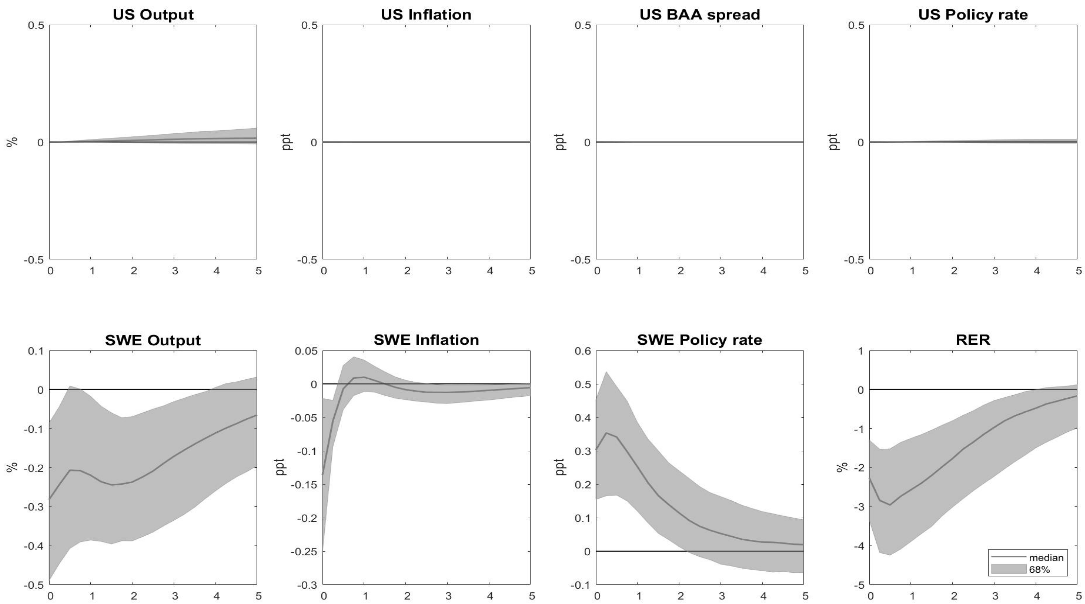

Figure 15: Sweden - IRFs to a one standard deviation contractionary monetary policy shock

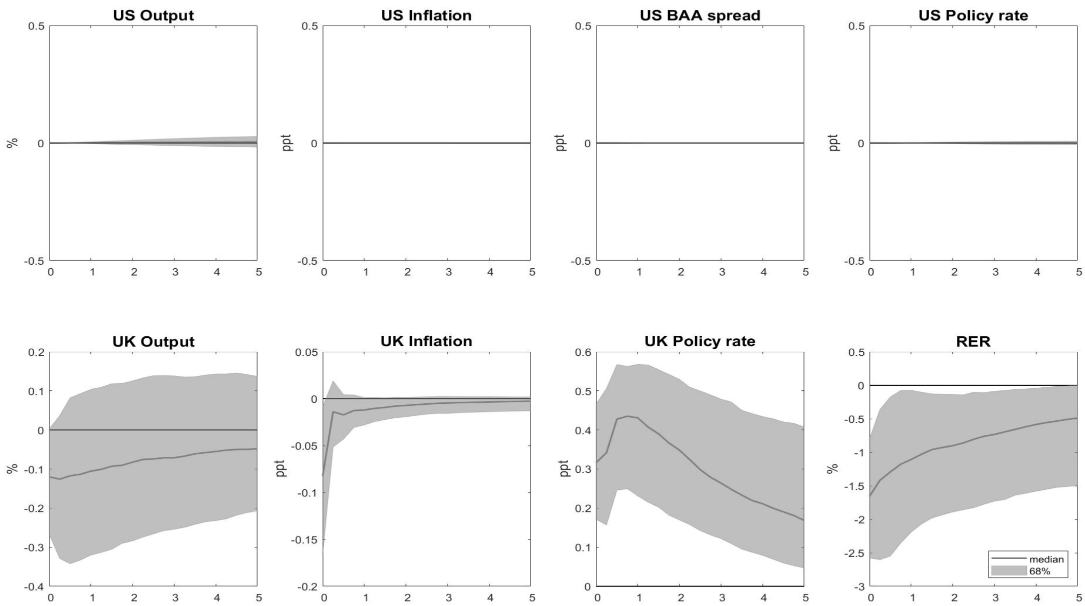

Figure 16: UK - IRFs to a one standard deviation contractionary monetary policy shock

C Baseline

C.1 IRFs to a one standard deviation US monetary policy shocks

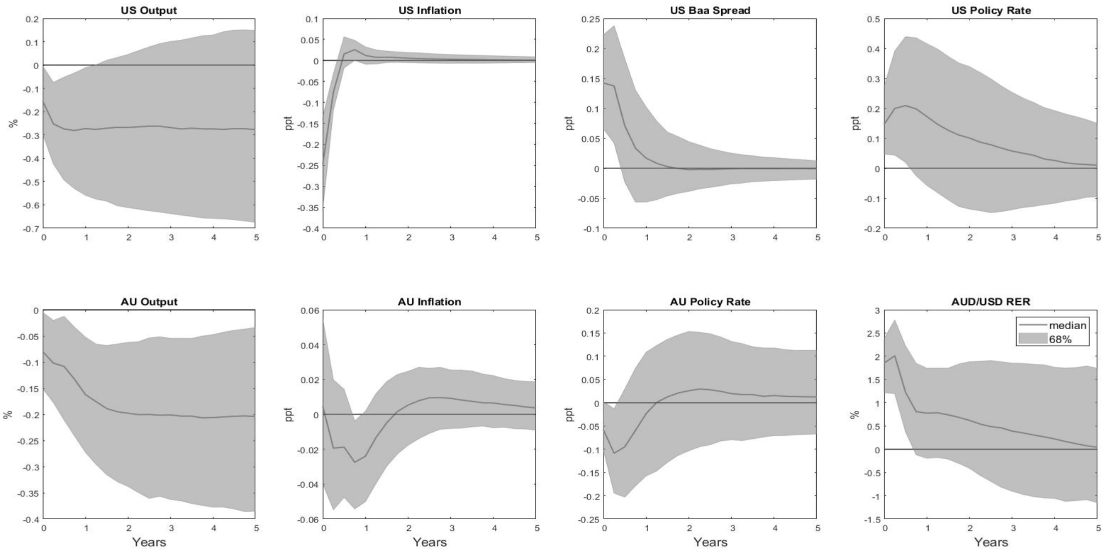

Figure 17: Australia - IRFs to a one standard deviation US contractionary monetary policy shock

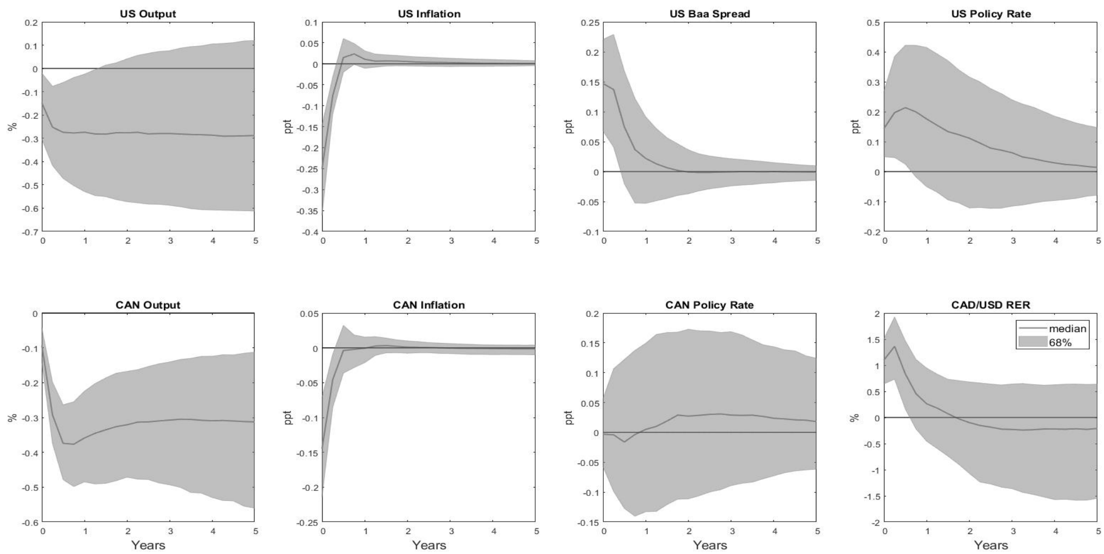

Figure 18: Canada - IRFs to a one standard deviation US contractionary monetary policy shock

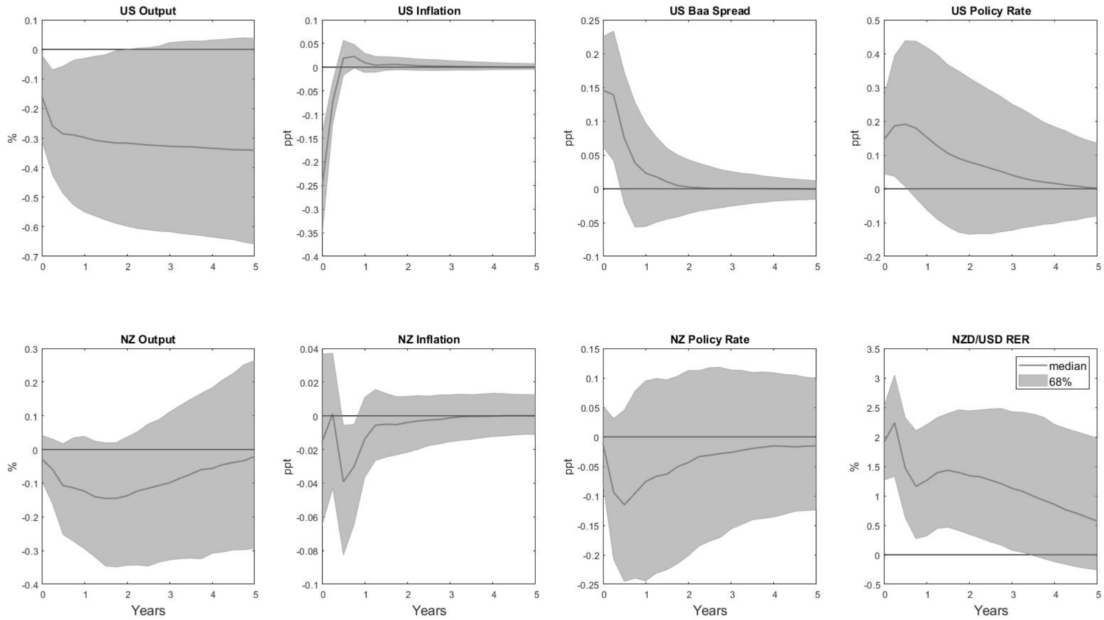

Figure 19: New Zealand - IRFs to a one standard deviation US contractionary monetary policy shock

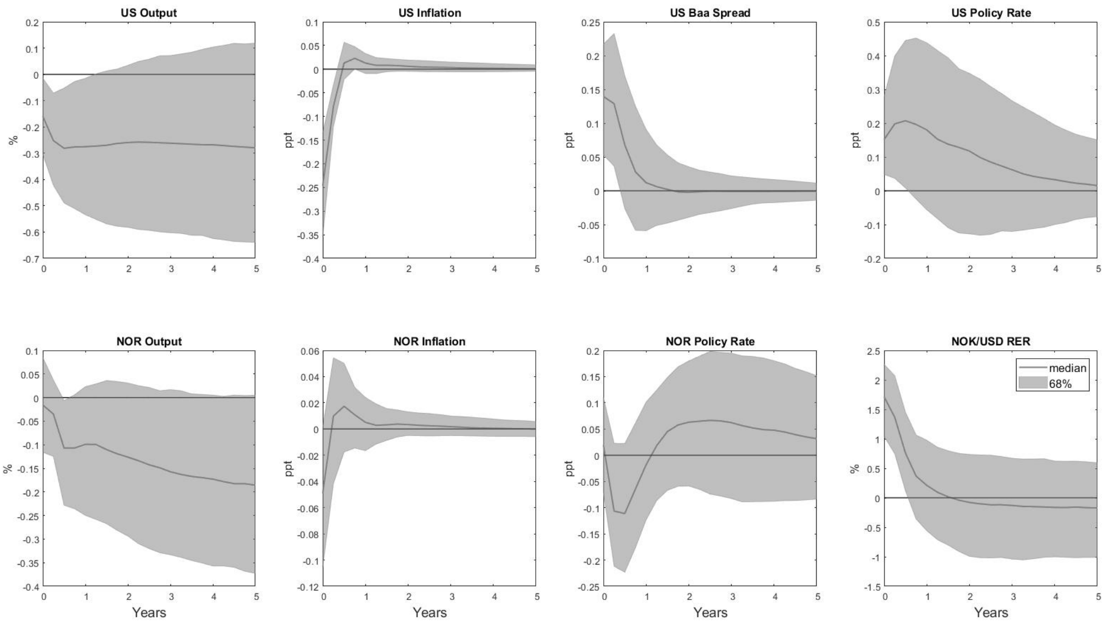

Figure 20: Norway - IRFs to a one standard deviation US contractionary monetary policy shock

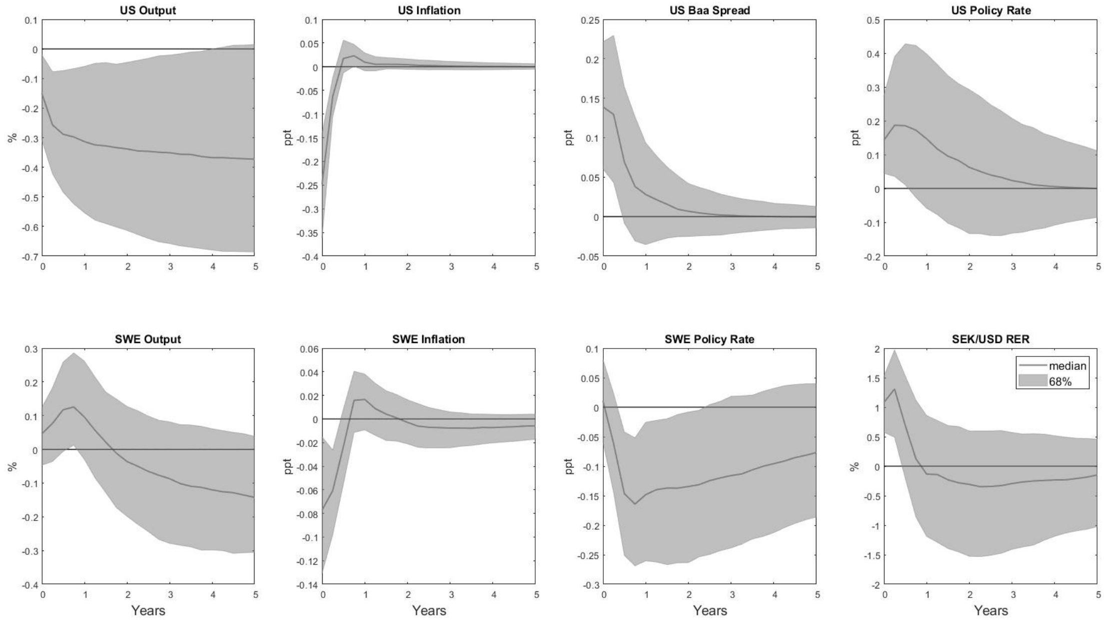

Figure 21: Sweden - IRFs to a one standard deviation US contractionary monetary policy shock

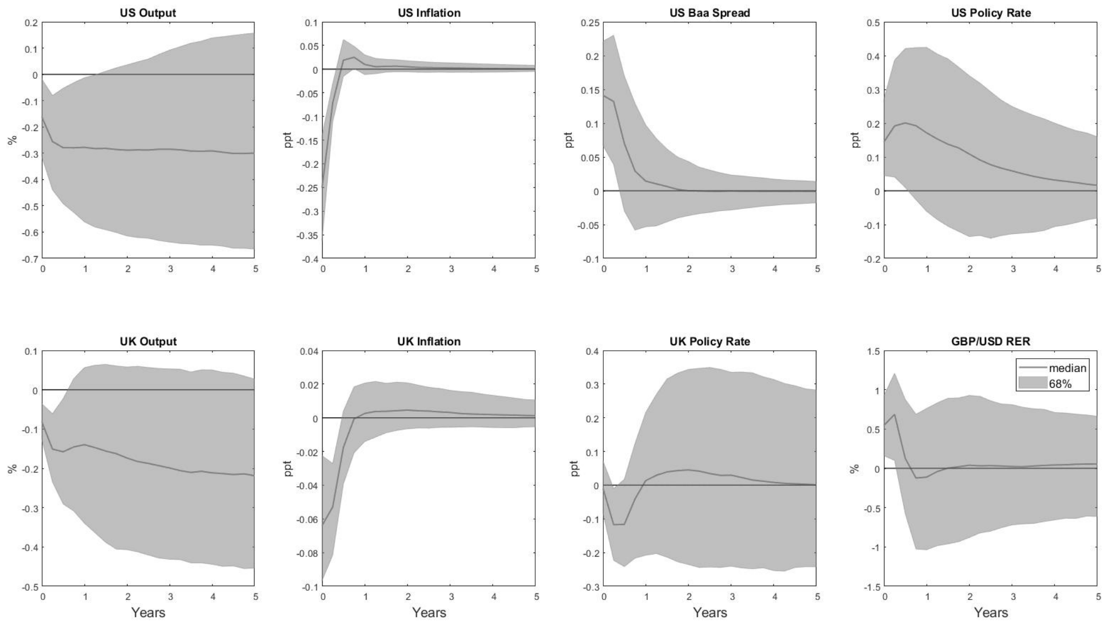

Figure 22: UK - IRFs to a one standard deviation US contractionary monetary policy shock

D Baseline

D.1 Responses of US variables to US shocks

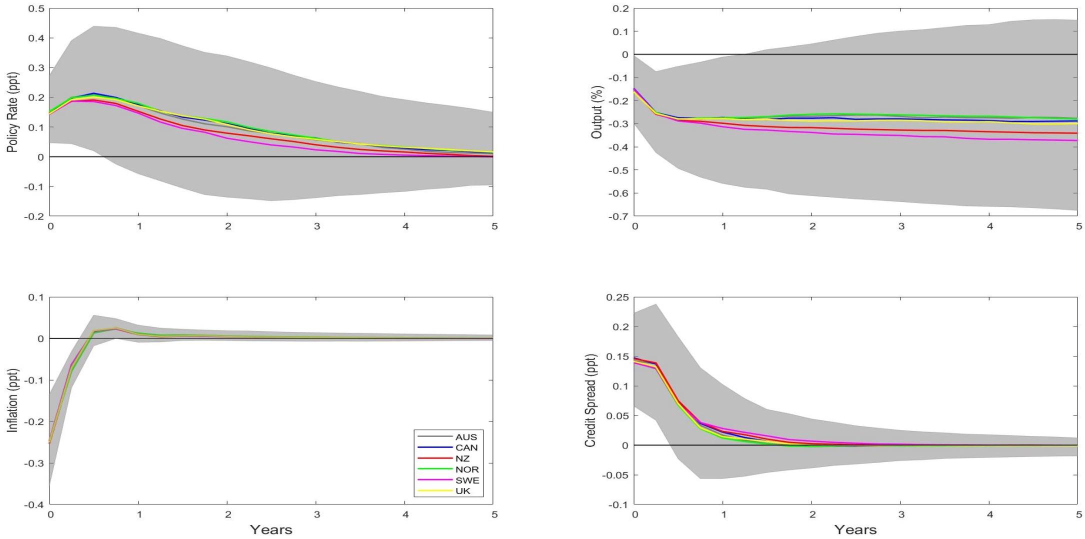

Figure 23: IRFs to a one standard deviation US contractionary monetary policy shock for six SOEs

E Baseline

E.1 IRFs to a one standard deviation SOE monetary policy shocks with/ out $\psi_e > 0$

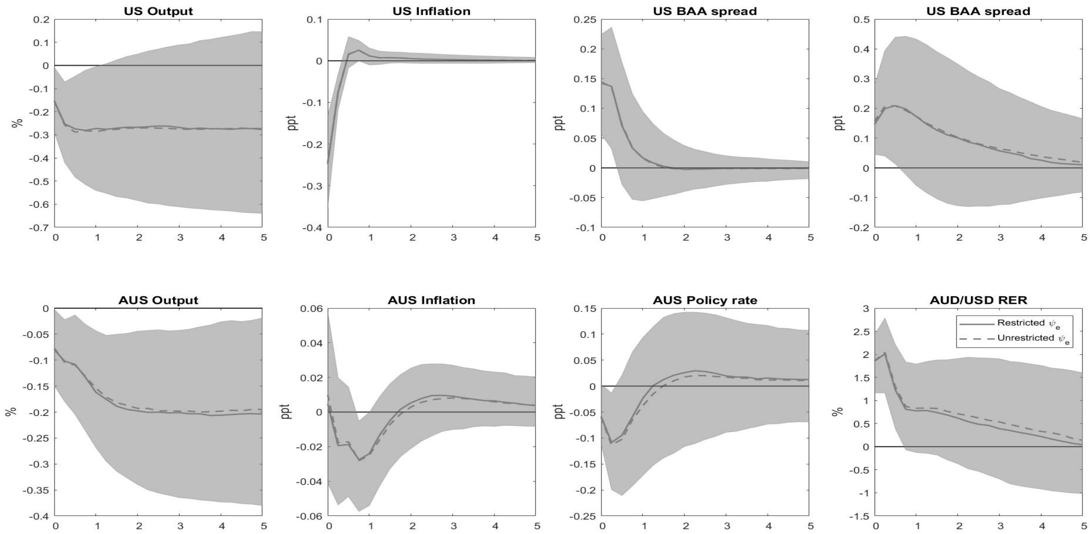

Figure 24: Australia - IRFs to a one standard deviation contractionary monetary policy shock

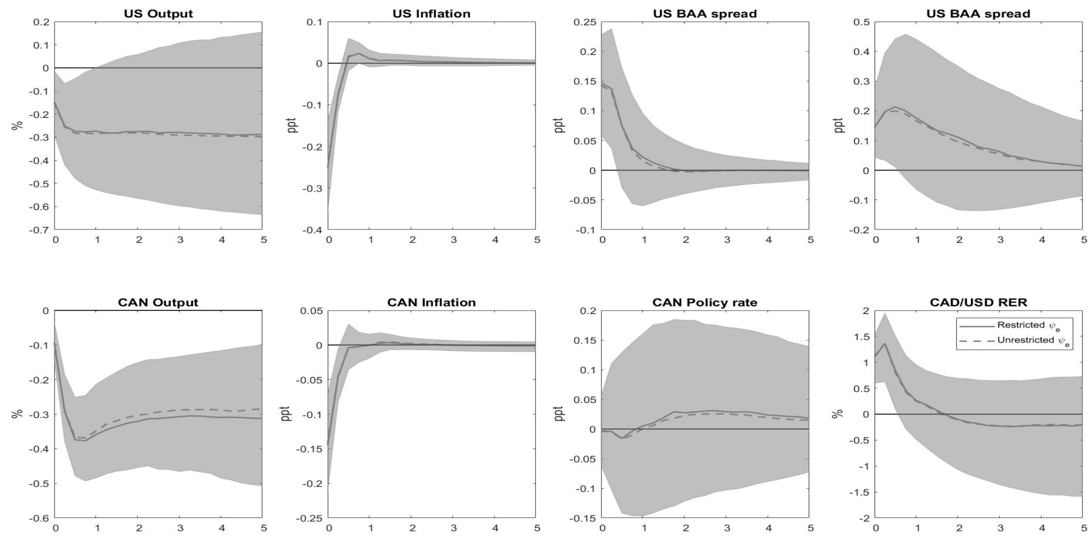

Figure 25: Canada - IRFs to a one standard deviation contractionary monetary policy shock

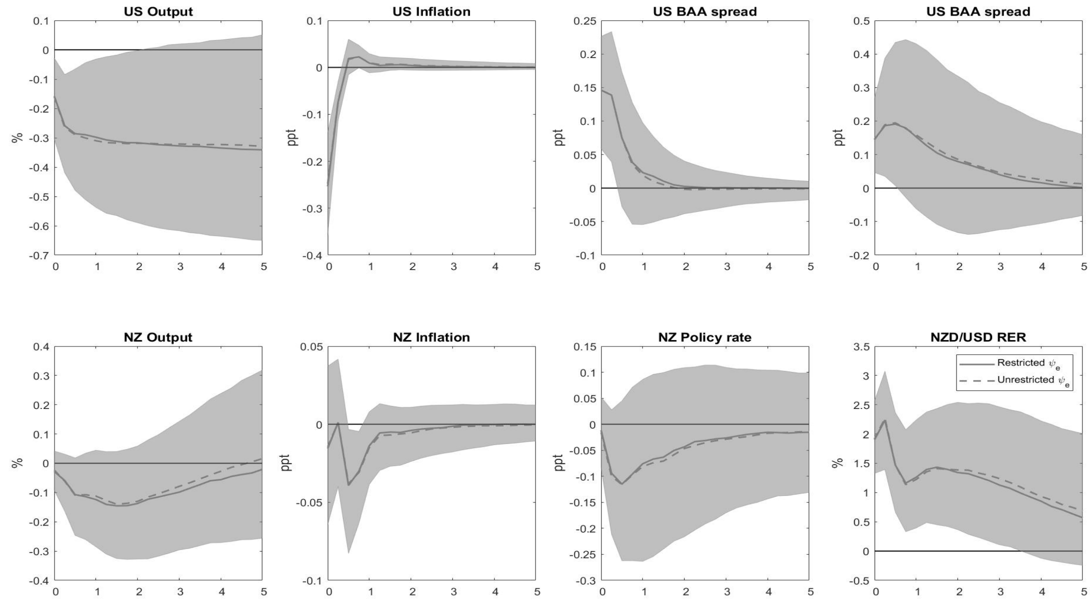

Figure 26: New Zealand - IRFs to a one standard deviation contractionary monetary policy shock

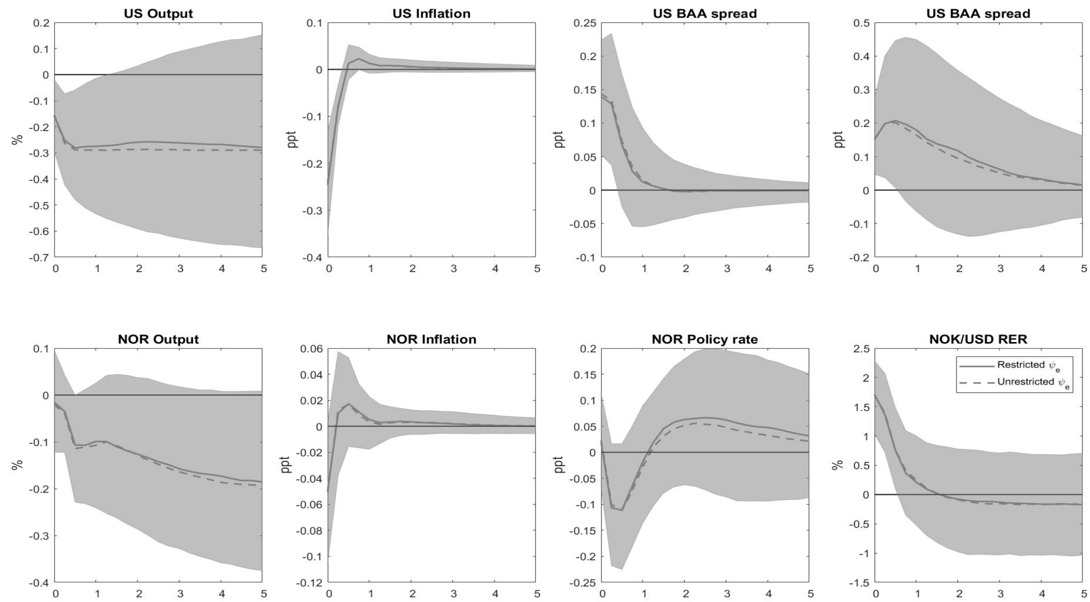

Figure 27: Norway - IRFs to a one standard deviation contractionary monetary policy shock

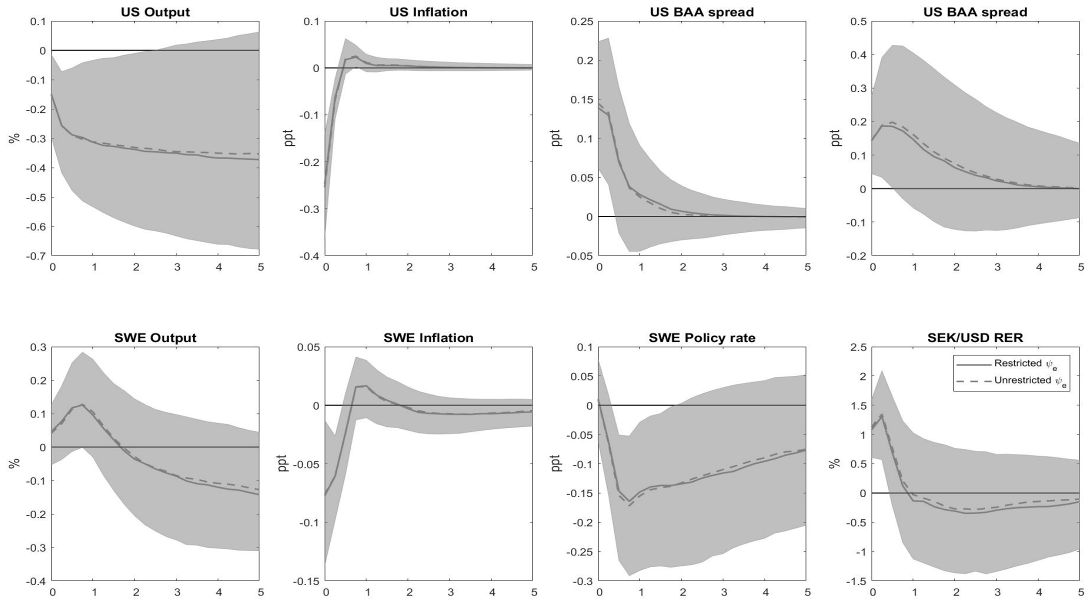

Figure 28: Sweden - IRFs to a one standard deviation contractionary monetary policy shock

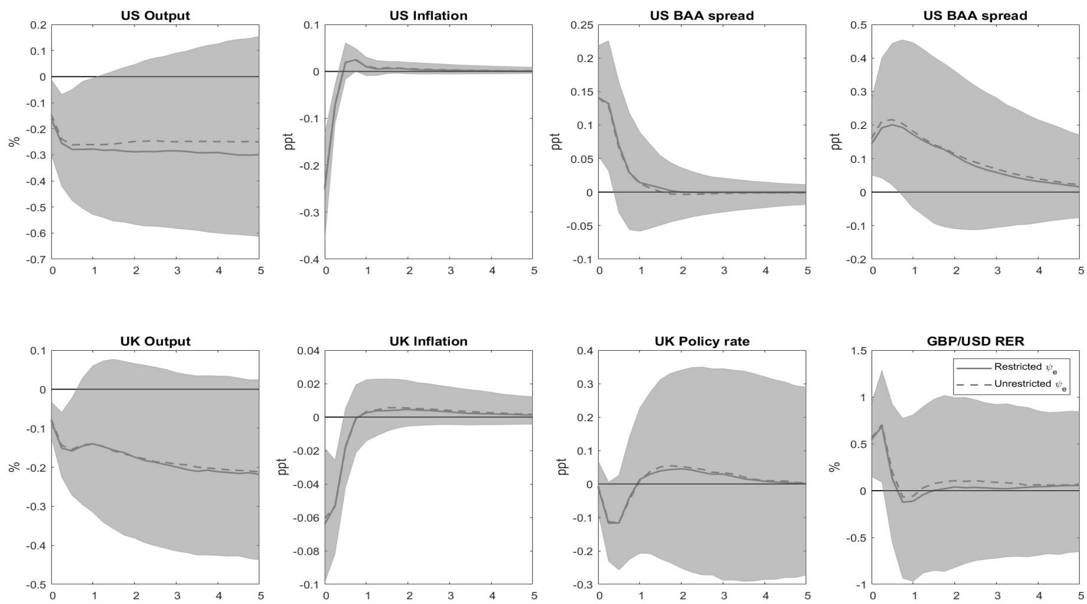

Figure 29: UK - IRFs to a one standard deviation contractionary monetary policy shock

F Baseline

F.1 IRFs to a one standard deviation SOE monetary policy shocks with/out $\psi_{cs^*} < 0$

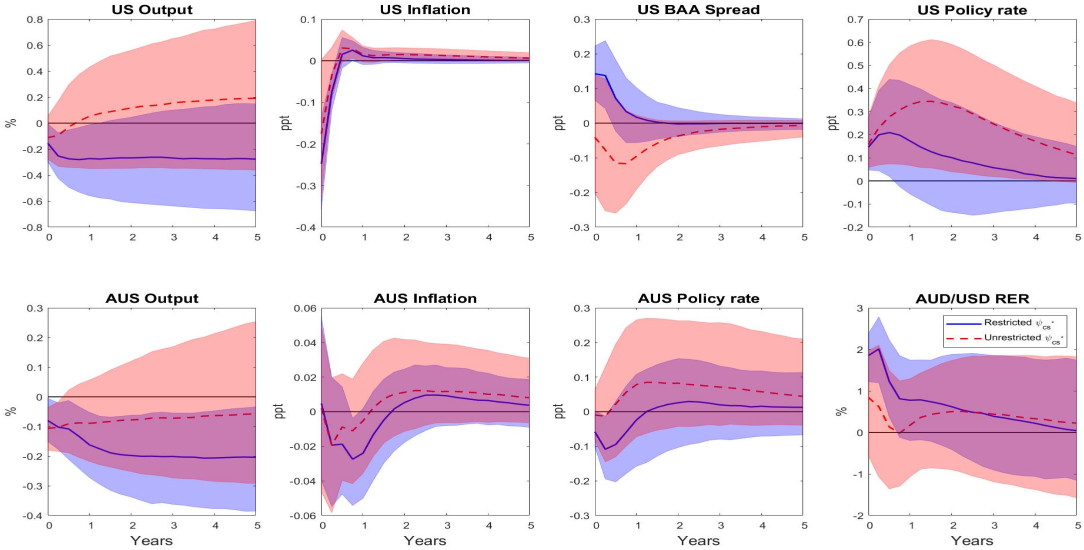

Figure 30: Australia - IRFs to a one standard deviation contractionary monetary policy shock

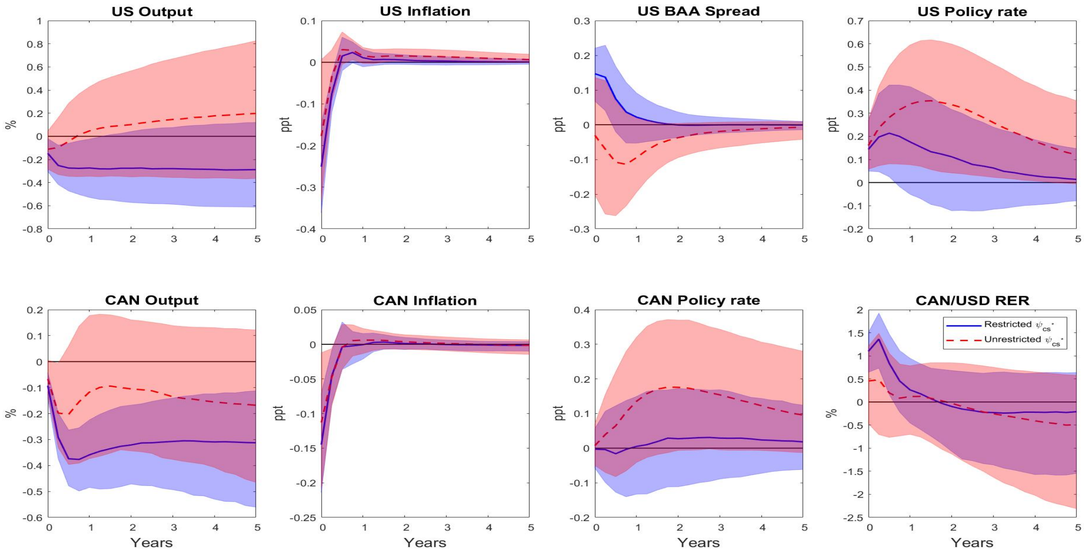

Figure 31: Canada - IRFs to a one standard deviation contractionary monetary policy shock

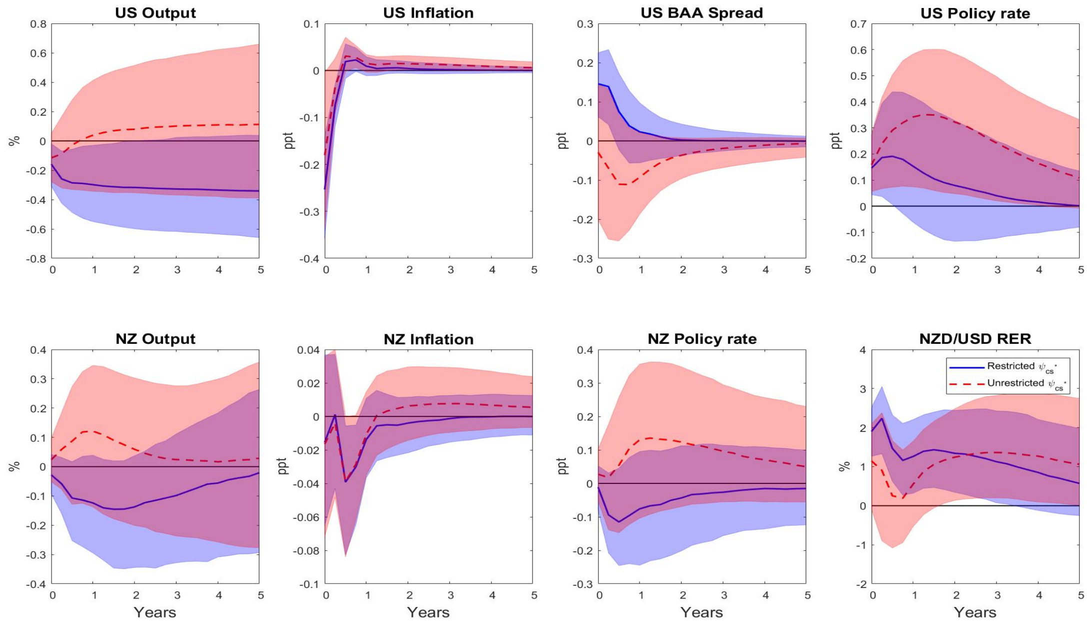

Figure 32: New Zealand - IRFs to a one standard deviation contractionary monetary policy shock

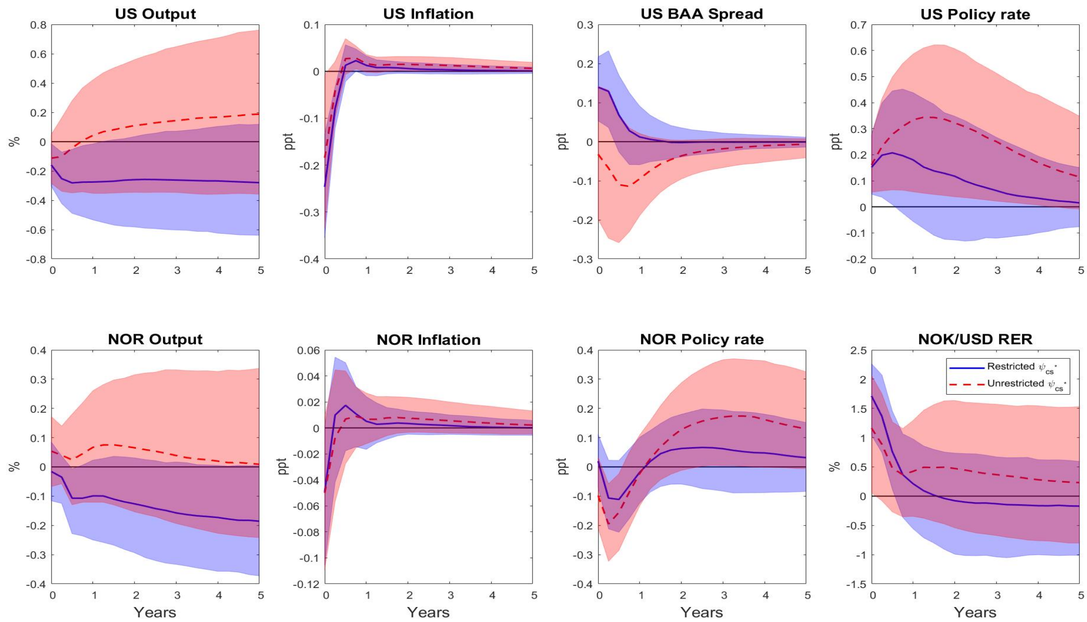

Figure 33: Norway - IRFs to a one standard deviation contractionary monetary policy shock

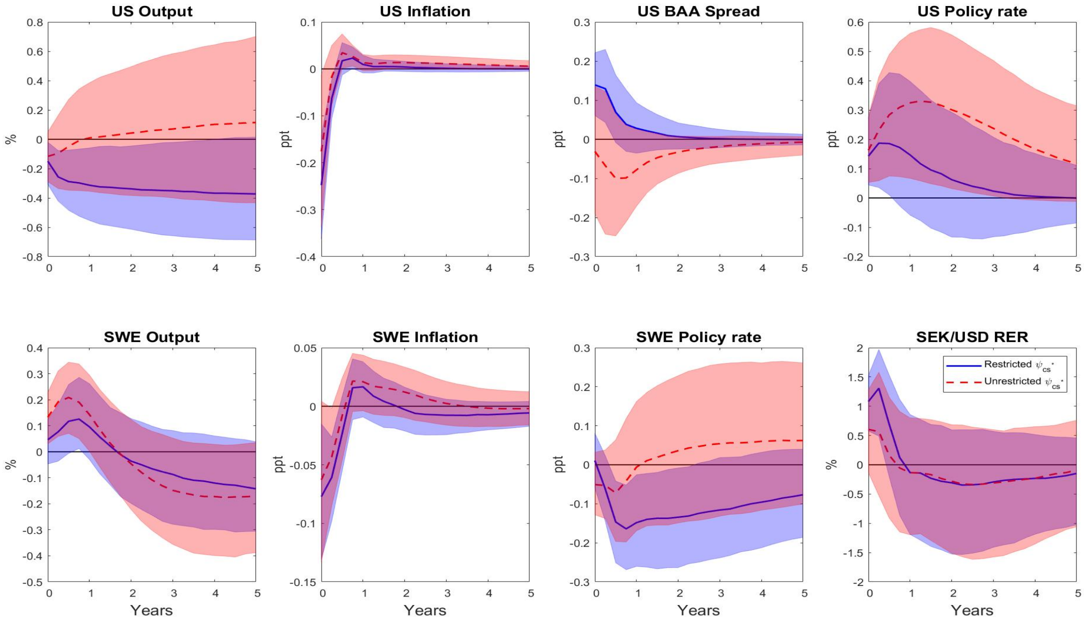

Figure 34: Sweden - IRFs to a one standard deviation contractionary monetary policy shock

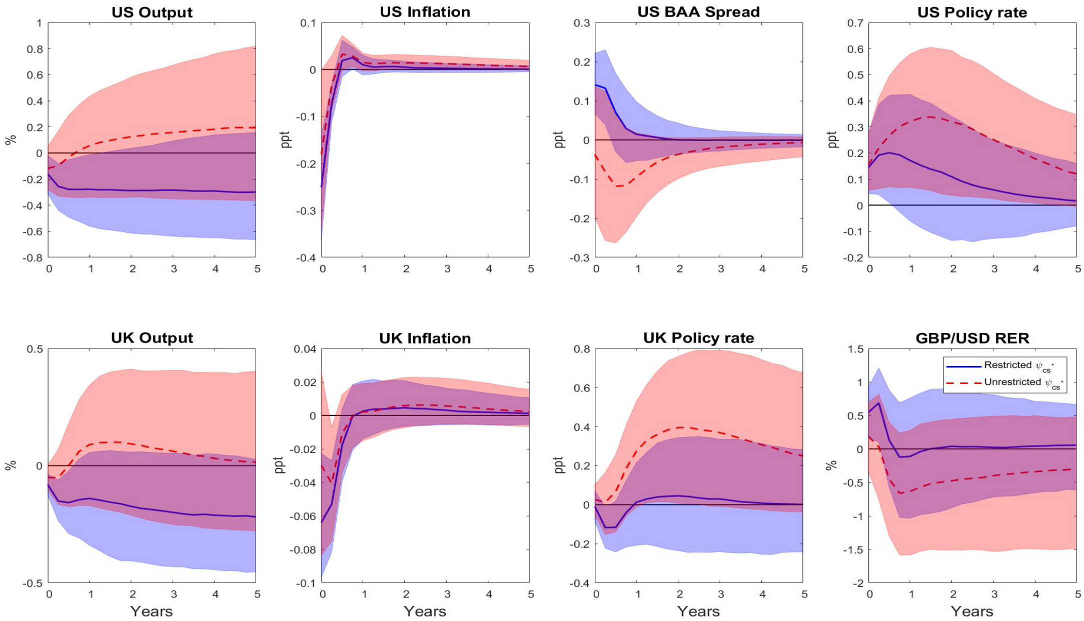

Figure 35: UK - IRFs to a one standard deviation contractionary monetary policy shock

G Robustness check 1

G.1 IRFs to a one standard deviation SOE monetary policy shocks with/out $\psi_e > 0$

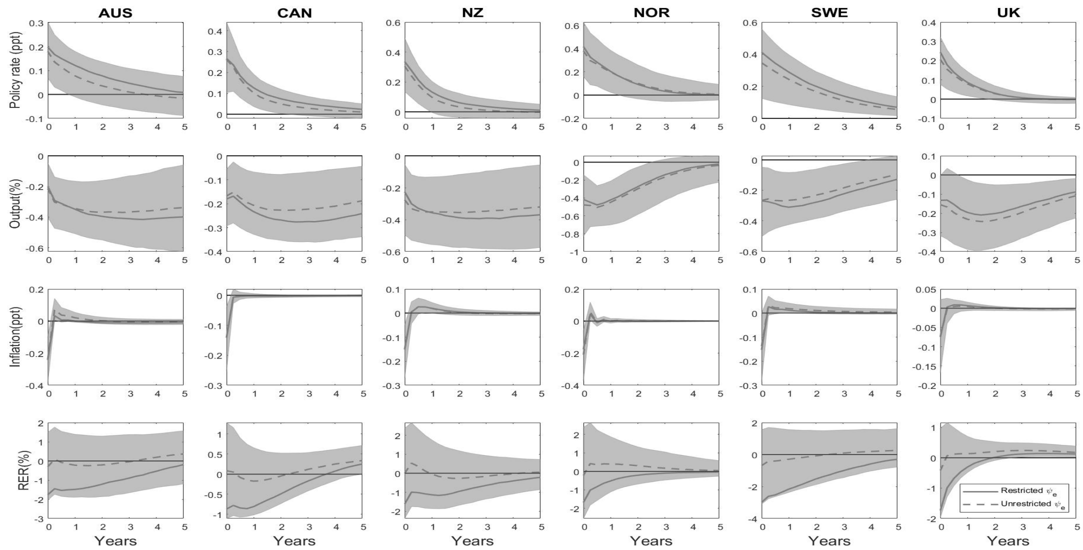

Figure 36: Australia - IRFs to a one standard deviation contractionary monetary policy shock

G.2 Forecast Error Variance Decomposition

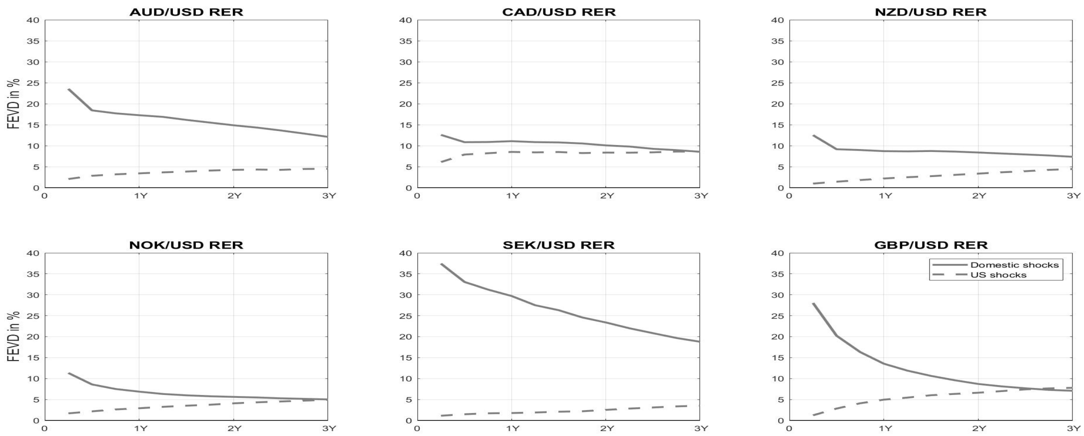

Figure 37: Contribution of one-standard deviation US and domestic monetary policy shocks to time-series fluctuations for shorter sample period (1992:Q1 to 2008:Q3). *Note:* The solid lines are the contribution of domestic monetary policy shock and dashed lines are the contribution of US monetary policy shock.

H Robustness check 2

H.1 Forecast Error Variance Decomposition

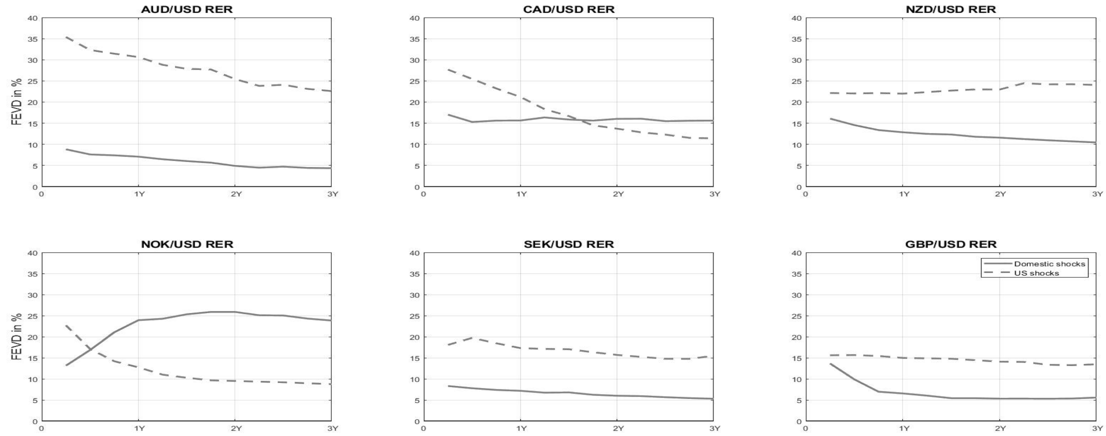

Figure 38: Contribution of one-standard deviation US and domestic monetary policy shocks to time-series fluctuations for Robustness check 2 (SOE credit spread). *Note:* The solid lines are the contribution of domestic monetary policy shock and dashed lines are the contribution of US monetary policy shock.

I Baseline

I.1 Contemporaneous coefficients in SOE monetary policy equations.

	Coefficients		
SOEs	ψ_y	ψ_π	ψ_e
AUS	0.72 [0.24;2.20]	0.65 [0.17;2.75]	0.09 [0.02;0.35]
CAN	0.99 [0.24;3.10]	1.32 [0.37;3.63]	0.16 [0.05;0.49]
NZ	0.87 [0.24;3.99]	1.44 [0.36;5.49]	0.11 [0.03;0.46]
NOR	0.62 [0.16;2.73]	1.31 [0.34;5.80]	0.16 [0.04;0.69]
SWE	0.94 [0.21;4.01]	1.92 [0.58;8.11]	0.14 [0.04;0.64]
UK	1.85 [0.54;7.48]	3.64 [0.79;14.28]	0.18 [0.05;0.72]

Table 1: Contemporaneous coefficients in SOE monetary policy equations using full sample period from 1992:Q1 to 2019:Q4. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

I.2 Contemporaneous coefficients in US monetary policy equations.

	Coefficients		
US/SOEs	ψ_{y^*}	ψ_{π^*}	ψ_{cs^*}
US/AUS	0.41	0.38	-0.57
	[0.11;0.87]	[0.10;1.00]	[-1.36;-0.19]
US/CAN	0.40	0.39	-0.59
	[0.14;0.90]	[0.11;1.00]	[-1.38;-0.17]
US/NZ	0.41	0.40	-0.57
	[0.12;0.99]	[0.12;0.99]	[-1.42;-0.15]
US/NOR	0.43	0.38	-0.55
	[0.13;0.91]	[0.10;0.97]	[-1.33;-0.14]
US/SWE	0.42	0.39	-0.54
	[0.12;0.98]	[0.10;1.09]	[-1.34;-0.16]
US/UK	0.43	0.39	-0.56
	[0.13;0.93]	[0.11;1.00]	[-1.33;-0.15]

Table 2: Contemporaneous coefficients in US monetary policy equations using full sample period from 1992:Q1 to 2019:Q4. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

J Robustness check 1

J.1 Contemporaneous coefficients in SOE monetary policy equations.

	Coefficients		
SOEs	ψ_y	ψ_π	ψ_e
AUS	0.72 [0.19;2.77]	0.73 [0.16;2.56]	0.11 [0.02;0.45]
CAN	1.16 [0.30;4.00]	1.42 [0.46;4.36]	0.24 [0.06;0.70]
NZ	0.99 [0.29;3.80]	1.67 [0.45;6.31]	0.14 [0.04;0.56]
NOR	0.79 [0.21;3.06]	1.80 [0.46;6.93]	0.20 [0.05;0.79]
SWE	1.19 [0.31;4.65]	2.03 [0.55;7.90]	0.15 [0.03;0.72]
UK	1.21 [0.30;5.12]	2.62 [0.87;9.29]	0.14 [0.03;0.65]

Table 3: Contemporaneous coefficients in SOE monetary policy equations using shorter sample period from 1992:Q1 to 2008:Q3. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

J.2 Contemporaneous coefficients in US monetary policy equations.

	Coefficients		
US/SOEs	ψ_{y^*}	ψ_{π^*}	ψ_{cs^*}
US/AUS	0.50 [0.14;1.23]	0.67 [0.18;1.74]	-0.99 [-2.02;-0.29]
US/CAN	0.51 [0.16;1.24]	0.73 [0.20;2.02]	-1.01 [-2.09;-0.31]
US/NZ	0.53 [0.16;1.26]	0.76 [0.20;2.05]	-0.98 [-2.11;-0.31]
US/NOR	0.51 [0.15;1.19]	0.75 [0.21;1.89]	-1.01 [-2.17;-0.30]
US/SWE	0.49 [0.14;1.20]	0.73 [0.20;1.84]	-1.01 [-2.12;-0.34]
US/UK	0.50 [0.15;1.21]	0.72 [0.21;1.88]	-0.96 [-2.12;-0.28]

Table 4: Contemporaneous coefficients in US monetary policy equations using shorter sample period from 1992:Q1 to 2008:Q3. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

K Robustness check 2

K.1 Contemporaneous coefficients in SOE monetary policy equations.

	Coefficients			
SOEs	ψ_y	ψ_π	ψ_{cs}	ψ_e
AUS	0.64	0.70	-3.00	0.10
	[0.16;2.84]	[0.19;2.51]	[-8.48;-0.91]	[0.02;0.50]
CAN	0.63	0.60	-0.90	0.08
	[0.19;1.56]	[0.19;1.86]	[-2.65;-0.33]	[0.02;0.31]
NZ	0.94	0.81	-1.35	0.06
	[0.23;3.89]	[0.23;5.83]	[-7.50;-0.32]	[0.01;0.40]
NOR	0.41	0.64	-2.47	0.11
	[0.13;1.22]	[0.16;2.52]	[-10.21;-0.58]	[0.03;0.45]
SWE	0.27	0.94	-0.74	0.06
	[0.07;1.06]	[0.26;2.09]	[-2.32;-0.23]	[0.02;0.19]
UK	1.19	2.25	-1.74	0.19
	[0.33;3.90]	[0.65;8.46]	[-6.07;-0.57]	[0.04;0.44]

Table 5: Contemporaneous coefficients in SOE monetary policy equations using sample period from 2000:Q1 to 2019:Q4. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

K.2 Contemporaneous coefficients in US monetary policy equations.

	Coefficients		
US/SOEs	ψ_{y^*}	ψ_{π^*}	ψ_{cs^*}
US/AUS	0.43	0.48	-0.55
	[0.14;1.05]	[0.16;1.61]	[-1.38;-0.16]
US/CAN	0.47	0.45	-0.65
	[0.12;1.23]	[0.10;1.10]	[-1.86;-0.21]
US/NZ	0.54	0.46	-0.60
	[0.15;1.39]	[0.09;1.38]	[-1.44;-0.15]
US/NOR	0.40	0.46	-0.53
	[0.14;1.35]	[0.12;1.40]	[-1.44;-0.17]
US/SWE	0.52	0.44	-0.62
	[0.19;1.14]	[0.11;1.17]	[-1.72;-0.21]
US/UK	0.47	0.45	-0.59
	[0.11;1.39]	[0.10;1.39]	[-1.70;-0.15]

Table 6: Contemporaneous coefficients in US monetary policy equations using sample period from 2000:Q1 to 2019:Q4. *Note:* The entries in the table are the posterior median estimates and the entries in the brackets are the respective 68% probability intervals.

TEPP Working Papers 2023

23-7. Is participatory democracy in line with social protest? Evidence from French yellow vests movement
Benjamin Monnery, François-Charles Wolff

23-6. On-the-job search, life-cycle training and the role of transfer fees
Arnaud Cheron, Anthony Terriau

23-5. Estimating the laffer tax rate on capital income : cross-base responses matter!
Marie-Noëlle Lefebvre, Etienne Lehmann, Michaël Sicsic

23-4. The trickle-down theory: a reality in French sports?
Florian Moussi-Beylie

23.3. Robotization and unbalanced changes in high-skill employment
Lucas Parmentier

23.2. Knowledge transmission in the second part of careers: does formal training matter?
Pierre-Jean Messe, Nathalie Greenan

23-1. Phantom cycles
Arnaud Chéron, Bruno Decreuse

TEPP Working Papers 2022

22-21. Utility services poverty : addressing the problem of household deprivation in Mayotte
Dorothée Charlier, Bérangère Legendre, Olivia Ricci

22-20. The effects of disability benefits on the employment of low-skilled youth : evidence from France
Sylvain Chareyron, Naomie Mahmoudi

22-19. Does gender equality bargaining reduce child penality? Evidence from France
Pierre-Jean Messe, Jérémy Tanguy

22-18. The effect of pro diversity actions on discrimination in the recruitment of large companies : a field experiment
Laetitia Challe, Sylvain Chareyron, Yannick L'Horty, Pascale Petit

22-17. Impacts of quota policy and employer obligation to adapt workstations on discrimination against people with disabilities : lesson from an experiment
Sylvain Chareyron, Yannick L'Horty, Philomene Mbaye, Pascale Petit

22-16. Are real merchandise imports per capita a good predictor for the standard of living for the small island world : testing for the imports-led growth and the growth-led imports hypotheses in panels over the period 1970-2019
Jean-François Hoarau, Nicolas Lucic

22-15. Extracting the discrimination components from the callback rates
Emmanuel Duguet, Loïc Du Parquet, Pascale Petit

22-14. Strategic debt in a mixed duopoly: the limited liability effect
Armel Jacques

22-13. Short-time work policies during the COVID-19 pandemic
Julien Albertini, Xavier Fairise, Arthur Poirier, Anthony Terriau

22-12. Immigration and labour market flows
Andri Chassamboulli, Idriss Fontaine, Ismael Galvez-Iniesta

22-11. Short-term impact of tropical cyclones in Madagascar : evidence from nightlight data
Idriss Fontaine, Sabine Garabedian, Maël Jammes

22-10. The current and future costs of tropical cyclones: A case study of La Réunion
Idriss Fontaine, Sabine Garabedian, Helene Veremes

22-9. Wealth and income responses to dividend taxation : Evidence from France
Marie-Noëlle Lefebvre, Eddy Zanoutene

22-8. Soccer labour market equilibrium and efficient training of talents
Marnix Amand, Arnaud Chéron, Florian Pelgrin, Anthony Terriau

22.7. Using short-term jobs as a way to fin a regular job. What kind of role for local context?
Fabrice Gilles, Sabina Issehnane, Florent Sari

22-6. Gender and age diversity. Does it matter for firms' productivity?
Laetitia Challe, Fabrice Gilles, Yannick L'Horty, Ferhat Mihoubi

22-5. How wages respond to the job-finding and job-to-job transition rates? Evidence from New Zealand administrative data
Christopher Ball, Nicolas Groshenny, Özer Karagedikli, Murat Özbilgind, Finn Robinsona

22-4. Endogenous timing of technological choices of flexibility in a mixed duopoly
Armel Jacques

22-3. Reducing ethnic discrimination through formal warning : evidence from two combined field experiments
Sylvain Chareyron, Yannick L'Horty, Souleymane Mbaye, Pascale Petit

22-2. Cream skimming and Discrimination in access to medical care: a field experiment
Sylvain Chareyron, Yannick L'horty, Pascale Petit

22-1. Optimal taxation with multiple incomes and types
Kevin Spiritus, Etienne Lehmann, Sander Renes, Floris T. Zoutman

TEPP Working Papers 2021

21-11. Intermittent collusive agreements : antitrust policy and business cycles
Emilie Dargaud, Armel Jacques

21-10. Endogenous breadth of collusive agreements : an application to flexible technological choices
Emilie Dargaud, Armel Jacques

21-9. How to tax different incomes?
Laurence Jacquet, Etienne Lehmann

21-8. Does optimal capital taxation under stochastic returns to savings
Eddy Zanoutene

21-7. Does the gender mix influence collective bargaining on gender equality? Evidence from France
Anne-Sophie Bruno, Nathalie Greenan, Jérémy Tanguy

21-6. The effects of the non-financial component of business accelerators
Fabrice Gilles, Yannick L'Horty, Ferhat Mihoubi

21-5. Organisational changes and long term sickness absence and injury leave
Mohamed Ali Ben Halima, Nathalie Greenan, Joseph Lanfranchi

21-4. The unexplored discriminations towards youth : equal access to goods and services
David Gray, Yannick L'Horty, Souleymane Mbaye, Pascale Petit

21-3. The zero effect of income tax on the timing of birth: some evidence on French data
Nicolas Moreau

21-2. Tropical cyclones and fertility : new evidence from Madagascar
Idriss Fontaine, Sabine Garabedian, David Nortes-Martinez, Hélène Vérèmes

21-1. On the heterogeneous impacts of the COVID-19 lockdown on US unemployment
Malak Kandoussi, François Langot

TEPP Working Papers 2020

20-8. COVID-19 mortality and health expenditures across European countries: The positive correlation puzzle
Serge Blondel, Radu Vranceanu

20-7. Measuring discrimination in the labour market
Emmanuel Duguet

20-6. The effects of age on educational performances at the end of primary school: cross-sectional and regression discontinuity approach applications from Reunion Island
Daniel Rakotomalala

20-5. Slowdown antitrust investigations by decentralization
Emilie Dargaud, Armel Jacques

20-4. Is international tourism responsible for the pandemic of COVID19? A preliminary cross-country analysis with a special focus on small islands
Jean-François Hoarau

20-3. Does labor income react more to income tax or means tested benefit reforms?
Michaël Sicsic

20-2. Optimal sickness benefits in a principal-agent model
Sébastien Ménard

20-1. The specific role of agriculture for economic vulnerability of small island spaces
Stéphane Blancard, Maximin Bonnet, Jean-François Hoarau

TEPP Working Papers 2019

19-8. The impact of benefit sanctions on equilibrium wage dispersion and job vacancies
Sebastien Menard

19-7. Employment fluctuations, job polarization and non-standard work: Evidence from France and the US
Olivier Charlot, Idriss Fontaine, Thepthida Sopraseuth

19-6. Counterproductive hiring discrimination against women: Evidence from French correspondence test
Emmanuel Duguet, Loïc du Parquet, Yannick L'Horty, Pascale Petit

19-5. Inefficient couples: Non-minimization of the tax burden among French cohabiting couples
Olivier Bargain, Damien Echevin, Nicolas Moreau, Adrien Pacifico

19-4. Seeking for tipping point in the housing market: evidence from a field experiment
Sylvain Chareyron, Samuel Gorohouna, Yannick L'Horty, Pascale Petit, Catherine Ris

19-3. Testing for redlining in the labor market
Yannick L'Horty, Mathieu Bunel, Pascale Petit

19-2. Labour market flows: Accounting for the public sector
Idriss Fontaine, Ismael Galvez-Iniesta, Pedro Gomes, Diego Vila-Martin

19-1. The interaction between labour force participation of older men and their wife: lessons from France
Idriss Fontaine

TEPP Working Papers 2018

18-15. Be healthy, be employed: a comparison between the US and France based on a general equilibrium model
Xavier Fairise, François Langot, Ze Zhong Shang

18-14. Immigrants' wage performance in the routine biased technological change era: France 1994-2012
Catherine Laffineur, Eva Moreno-Galbis, Jeremy Tanguy, Ahmed Tritah

18-13. Welfare cost of fluctuations when labor market search interacts with financial frictions
Elini Iliopulos, François Langot, Thepthida Sopraseuth

18-12. Accounting for labor gaps
François Langot, Alessandra Pizzo

18-11. Unemployment fluctuations over the life cycle
Jean-Olivier Hairault, François Langot, Thepthida Sopraseuth

18-10. Layoffs, Recalls and Experience Rating
Julien Albertini, Xavier Fairise

18-9. Environmental policy and health in the presence of labor market imperfections
Xavier Pautrel

18-8. Identity mistakes and the standard of proof
Marie Obidzinski, Yves Oytana

18-7. Presumption of innocence and deterrence
Marie Obidzinski, Yves Oytana

18-6. Ethnic Discrimination in Rental Housing Market: An Experiment in New Caledonia
Mathieu Bunel, Samuel Gorohouna, Yannick L'Horty, Pascale Petit, Catherine Ris

18-5. Evaluating the impact of firm tax credits. Results from the French natural experiment CICE
Fabrice Gilles, Yannick L'Horty, Ferhat Mihoubi, Xi Yang

18-4. Impact of type 2 diabetes on health expenditure: an estimation based on individual administrative data
François-Olivier Baudot , Anne-Sophie Aguadé,Thomas Barnay, Christelle Gastaldi-Ménager, Anne Fargot-Campagna

18-3. How does labour market history influence the access to hiring interviews?
Emmanuel Duguet, Rémi Le Gall, Yannick L'Horty, Pascale Petit

18-2. Occupational mobility and vocational training over the life cycle
Anthony Terriau

18-1. Retired, at last? The short-term impact of retirement on health status in France
Thomas Barnay, Eric Defebvre

TEPP Working Papers 2017

17-11. Hiring discrimination against women: distinguishing taste based discrimination from statistical discrimination
Emmanuel Duguet, Loïc du Parquet, Pascale Petit

17-10. Pension reforms, older workers' employment and the role of job separation and finding rates in France
Sarah Le Duigou, Pierre-Jean Messe

17-9. Healthier when retiring earlier? Evidence from France
Pierre-Jean Messe, François-Charles Wolff

17-8. Revisting Hopenhayn and Nicolini's optimal unemployment insurance with job search monitoring and sanctions
Sebastien Menard, Solenne Tanguy

17-7. Ethnic Gaps in Educational Attainment and Labor-Market Outcomes: Evidence from France
Gabin Langevin, David Masclet, Fabien Moizeau, Emmanuel Peterle

17-6. Identifying preference-based discrimination in rental market: a field experiment in Paris
Mathieu Bunel, Yannick L'Horty, Loïc du Parquet, Pascale Petit

17-5. Chosen or Imposed? The location strategies of households
Emilie Arnoult, Florent Sari

17-4. Optimal income taxation with composition effects
Laurence Jacquet, Etienne Lehmann

17-3. Labor Market Effects of Urban Riots: an experimental assessment
Emmanuel Duguet, David Gray, Yannick L'Horty, Loic du Parquet, Pascale Petit

17-2. Does practicing literacy skills improve academic performance in first-year university students? Results from a randomized experiment
Estelle Bellity, Fabrices Gilles, Yannick L'Horty

17-1. Raising the take-up of social assistance benefits through a simple mailing: evidence from a French field experiment
Sylvain Chareyron, David Gray, Yannick L'Horty

TEPP Working Papers 2016

16-8. Endogenous wage rigidities, human capital accumulation and growth
Ahmed Tritah

16-7. Harder, better, faster...yet stronger? Working conditions and self-declaration of chronic diseases
Eric Defebvre

16-6. The influence of mental health on job retention
Thomas Barnay, Eric Defebvre

16-5. The effects of breast cancer on individual labour market outcomes: an evaluation from an administrative panel
Thomas Barnay, Mohamed Ali Ben Halima, Emmanuel Duguet, Christine Le Clainche, Camille Regaert

16-4. Expectations, Loss Aversion, and Retirement Decisions in the Context of the 2009 Crisis in Europe
Nicolas Sirven, Thomas Barnay

16-3. How do product and labor market regulations affect aggregate employment, inequalities and job polarization? A general equilibrium approach
Julien Albertini, Jean-Olivier Hairault, François Langot, Thepthida Sopraseuth

16-2. Access to employment with age and gender: results of a controlled experiment Laetitia Challe, Florent Fremigacci, François Langot, Yannick L'Horty, Loïc Du Parquet, Pascale Petit

16-1. An evaluation of the 1987 French Disabled Workers Act: Better paying than hiring
Thomas Barnay, Emmanuel Duguet, Christine Le Clainche, Yann Videau

TEPP Working Papers 2015

15-10. Optimal Income Taxation with Unemployment and Wage Responses: A Sufficient Statistics Approach
Kory Kroft, Kavan Kucko, Etienne Lehmann, Johannes Schmieder

15-9. Search frictions and (in) efficient vocational training over the life-cycle
Arnaud Chéron, Anthony Terriau

15-8. Absenteeism and productivity: the experience rating applied to employer contributions to health insurance
Sébastien Ménard, Coralia Quintero Rojas

15-7. Take up of social assistance benefits: the case of homeless
Sylvain Chareyron

15-6. Spatial mismatch through local public employment agencies. Answers from a French quasi-experiment
Mathieu Bunel, Elisabeth Tovar

15-5. Transmission of vocational skills at the end of career: horizon effect and technological or organisational change
Nathalie Greenan, Pierre-Jean Messe

15-4. Protecting biodiversity by developing bio-jobs: A multi-branch analysis with an application on French data
Jean De Beir, Céline Emond, Yannick L'Horty, Laetitia Tuffery

15-3. Profit-Sharing and Wages: An Empirical Analysis Using French Data Between 2000 and 2007
Noélie Delahaie, Richard Duhautois

15-2. A meta-regression analysis on intergenerational transmission of education: publication bias and genuine empirical effect
Nicolas Fleury, Fabrice Gilles

15-1. Why are there so many long-term unemployed in Paris?
Yannick L'Horty, Florent Sari

TEPP Working Papers 2014

14-14. Hiring discrimination based on national origin and the competition between employed and unemployed job seekers
Guillaume Pierné

14-13. Discrimination in Hiring: The curse of motorcycle women
Loïc Du Parquet, Emmanuel Duguet, Yannick L'Horty, Pascale Petit

14-12. Residential discrimination and the ethnic origin: An experimental assessment in the Paris suburbs
Emmanuel Duguet, Yannick L'Horty, Pascale Petit

14-11. Discrimination based on place of residence and access to employment
Mathieu Bunel, Yannick L'Horty, Pascale Petit

14-10. Rural Electrification and Household Labor Supply: Evidence from Nigeria
Claire Salmon, Jeremy Tanguy

14-9. Effects of immigration in frictional labor markets: theory and empirical evidence from EU countries
Eva Moreno-Galbis, Ahmed Tritah

14-8. Health, Work and Working Conditions: A Review of the European Economic Literature
Thomas Barnay

14-7. Labour mobility and the informal sector in Algeria: a cross-sectional comparison (2007-2012)
Philippe Adair, Youghourta Bellache

14-6. Does care to dependent elderly people living at home increase their mental health?
Thomas Barnay, Sandrine Juin

14-5. The Effect of Non-Work Related Health Events on Career Outcomes: An Evaluation in the French Labor Market
Emmanuel Duguet, Christine le Clainche

14-4. Retirement intentions in the presence of technological change: Theory and evidence from France
Pierre-Jean Messe, Eva Moreno-Galbis, Francois-Charles Wolff

14-3. Why is Old Workers' Labor Market more Volatile? Unemployment Fluctuations over the Life-Cycle
Jean-Olivier Hairault, François Langot, Thepthida Sopraseuth

14-2. Participation, Recruitment Selection, and the Minimum Wage
Frédéric Gavrel

14-1. Disparities in taking sick leave between sectors of activity in France: a longitudinal analysis of administrative data
Thomas Barnay, Sandrine Juin, Renaud Legal

TEPP Working Papers 2013

13-9. An evaluation of the impact of industrial restructuring on individual human capital accumulation in France (1956-1993)
Nicolas Fleury, Fabrice Gilles

13-8. On the value of partial commitment for cooperative investment in buyer-supplier relationship
José de Sousa, Xavier Fairise

13-7. Search frictions, real wage rigidities and the optimal design of unemployment insurance
Julien Albertini, Xavier Fairise

13-6. Tax me if you can! Optimal nonlinear income tax between competing governments
Etienne Lehmann, Laurent Simula, Alain Trannoy

13-5. Beyond the labour income tax wedge: The unemployment-reducing effect of tax progressivity
Etienne Lehmann, Claudio Lucifora, Simone Moriconi, Bruno Van Der Linden

13-4. Discrimination based on place of residence and access to employment
Mathieu Bunel, Emilia Ene Jones, Yannick L'Horty, Pascale Petit

13-3. The determinants of job access channels: evidence from the youth labor market in France
Jihan Ghrairi

13-2. Capital mobility, search unemployment and labor market policies: The case of minimum wages
Frédéric Gavrel

13-1. Effort and monetary incentives in Nonprofit et For-Profit Organizations
Joseph Lanfranchi, Mathieu Narcy

The TEPP Institute

The CNRS **Institute for Theory and Evaluation of Public Policies** (the TEPP Institute, FR n°2024 CNRS) gathers together research centres specializing in economics and sociology:

- L'**Equipe de Recherche sur l'Utilisation des Données Individuelles en lien avec la Théorie Economique** (Research Team on Use of Individuals Data in connection with economic theory), **ERUDITE**, University of Paris-Est Créteil, University of Gustave Eiffel;
- Le **Centre d'Etudes des Politiques Economiques** (Research Centre focused on the analysis of economic policy and its foundations and implications), **EPEE**, University of Evry Paris-Saclay ;
- Le **Centre Pierre Naville** (Research on Work and Urban Policies), **CPN**, University of Evry Paris-Saclay
- Le **Groupe d'Analyse des Itinéraires et des Niveaux Salariaux** (Group on Analysis of Wage Levels and Trajectories), **GAINS**, Le Mans University
- Le **Centre de Recherches en Economie et en Management**, (Research centre in Economics and Management), **CREM**, University of Rennes 1, University of Caen Basse-Normandie ;
- Le **Groupe de Recherche ANgevin en Économie et Management** (Angevin Research Group in Economics and Management), **GRANEM**, University of Angers ;
- Le **Centre de Recherche en Economie et Droit** (Research centre in Economics and Law) **CRED**, University of Paris II Panthéon-Assas ;
- Le **Laboratoire d'Economie et de Management Nantes-Atlantique** (Laboratory of Economics and Management of Nantes-Atlantique) LEMNA, Nantes University ;
- Le **Laboratoire interdisciplinaire d'étude du politique Hannah Arendt – Paris-Est**, **LIPHA-PE**, University of Paris-Est Créteil and University of Gustave Eiffel ;
- Le **Centre d'Economie et de Management de l'Océan Indien**, **CEMOI**, University of La Réunion ;
- Le **Centre de Recherche sur l'intégration Economique et Financière**, **CRIEF**, University of Poitiers ;
- L'UMR **Structures et marchés agricoles, ressources et territoires**, **SMART**, INRAE, Agro Rennes-Angers Institute.

TEPP brings together 230 teacher-researchers and 100 doctoral students. It is both one of the main academic operators in the evaluation of public policies in France, and the largest multidisciplinary federation of research on work and employment. It responds to the demand for impact assessment of social programs using advanced technologies combining theoretical and econometric modeling, qualitative research techniques and controlled experiences.