Monetary Integration and Dimensions of Structural Convergence in a Small Open Economy: Evidence from Slovakia*

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Abstract

We study structural convergence of a small open transition economy associated with integration into the euro area. Slovakia provides a particularly informative case, combining a rapid post-transition integration process with the adoption of the euro in 2009. Using a two-country structural VAR for Slovakia and the rest of the euro area, we distinguish convergence in structural relationships, exposure to shocks, and shock propagation. We allow Slovak structural relations to differ across the pre- and post-euro regimes while estimating euro area relationships over the full sample. The results document substantial convergence along all three dimensions. Most prominently, the Slovak Phillips curve flattens markedly and moves close to its euro area counterpart. Accordingly, the inflation-to-output response to domestic demand shocks falls from around 2 before euro adoption to about 0.5 afterwards, closely matching the euro area. At the same time, the sensitivity of Slovak demand to euro area activity roughly doubles, and euro area demand and supply shocks become major sources of Slovak output and inflation fluctuations. Finally, Slovak responses to both domestic and euro area shocks become substantially more similar to corresponding euro area dynamics. The results illustrate how monetary and real integration can reshape the business-cycle structure of small open transition economies entering a currency union.

Keywords: European Monetary Union, Phillips curve, Structural vector autoregressions, Informative priors

JEL-Codes: C11, C30, E30, E52

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1 Introduction

Can the adoption of a common currency and the structural transformation surrounding it change how a small open economy responds to macroeconomic shocks, other than merely transfer monetary-policy authority to a supranational central bank? We study this question using Slovakia's adoption of the euro in 2009. We estimate a two-country structural VAR for Slovakia and the rest of the euro area, allowing the Slovak economy to follow distinct pre- and post-euro regimes. Our results document broad convergence. On the supply side, the Slovak Phillips curve flattens substantially and moves close to its euro area counterpart. On the demand side, greater integration strengthens the influence of euro area activity and makes euro area shocks central sources of Slovak fluctuations. These changes extend to dynamic adjustment: after euro adoption, Slovak output and inflation respond to both domestic and euro area shocks in ways that are substantially more similar to the corresponding euro area responses. Taken together, the results suggest that monetary integration and the structural reforms accompanying it can reshape both the sources and the transmission of macroeconomic fluctuations in a small open economy.

Slovakia provides a particularly informative setting for studying this broader transformation. Small open transition economies are highly exposed to external developments and may experience substantial changes in economic behaviour as their institutions become more closely integrated with those of a monetary union. In Slovakia, the formal institutional change in 2009 was sharp, but the process leading to it was gradual. Monetary policy became increasingly aligned with euro area conditions before adoption, while institutional reforms and deeper trade integration progressively connected the Slovak economy to the rest of the euro area. Euro adoption therefore represented both the endpoint of an extended convergence process and a distinct regime change that eliminated independent monetary and exchange-rate policies. Our pre- and post-euro comparison does not separately identify the effects of the common currency from those of the structural reforms surrounding its adoption. Instead, it captures the combined macroeconomic transformation associated with Slovakia's integration into the monetary union.

Business cycle convergence can take several economically distinct forms. Structural relationships may become more similar, countries may become exposed to the same shocks, or their economies may propagate a given shock in increasingly similar ways. Observed synchronization or convergence in macroeconomic volatility cannot distinguish among these possibilities. This distinction matters because the underlying mechanisms have different implications. Greater exposure to common shocks need not imply that domestic economic structures have changed, while similar structural coefficients need not generate synchronized fluctuations if shocks remain predominantly country-specific. We therefore examine convergence in structural relationships, in the sources of Slovak fluctuations, and in the dynamic responses of Slovak output and inflation.

To distinguish these dimensions of business-cycle convergence, we jointly model the structural relationships governing aggregate supply, aggregate demand, and monetary policy in Slovakia and the rest of the euro area. We build on Camehl and von Schweinitz (2026) and estimate a structural VAR linking output gaps, inflation, interest rates, and the exchange rate. Following Baumeister and Hamilton (2018), informative priors express identification in terms of economically interpretable contemporaneous elasticities and semi-elasticities. For each posterior draw of these structural relationships, the remaining parameters can be estimated separately for each equation and using the observations available for that equation. This flexibility is particularly valuable because euro adoption creates an asymmetric empirical structure across equations: the NBS policy rule and the euro–koruna exchange-rate equation disappear, Slovak supply and demand relations are allowed to differ between the pre- and post-euro regimes, while the equations for the rest of the euro area use the full sample. To ensure that the resulting structural relationships and shocks capture business-cycle dynamics rather than Slovakia's broader transition, we use its monetary and institutional history to distinguish transition-related trends from cyclical fluctuations.

Our first set of results documents two interconnected forms of convergence. The strongest change in structural coefficients occurs in the Slovak Phillips curve. Before euro adoption, it is substantially steeper than its euro area counterpart; afterwards, it flattens markedly and becomes quantitatively similar to the euro area curve. Because changes in the observed inflation-output relationship can reflect both supply- and demand-side forces, rather than the Phillips curve slope alone (Bergholt et al., 2024; Furlanetto and Lepetit, 2025), we also examine the responses of inflation and output to an identified domestic demand shock. The resulting impact ratio of inflation to output falls from around 2 to approximately 0.5, closely matching the euro area estimate. Domestic demand pressure therefore becomes much less inflationary and is absorbed increasingly through output adjustment. By contrast, the domestic demand semi-elasticities show only limited convergence. The more important demand-side change operates through international integration: the elasticity of Slovak demand to euro area activity rises from around 0.5 to approximately 1. As a consequence, euro area shocks account for a substantially larger share of Slovak output-gap and inflation fluctuations. The post-euro composition of Slovak fluctuations also becomes more demand-dominated and therefore more similar to that of the rest of the euro area.

The impulse responses show that convergence extends beyond contemporaneous coefficients and the origin of fluctuations. After euro adoption, Slovak responses to domestic demand and supply shocks become substantially closer to the responses generated by corresponding shocks in the euro area. Slovak responses to euro area shocks also become stronger and more similar to the transmission of those shocks within the euro area. Dynamic convergence is strongest on impact and for output responses over the first two years. Inflation responses become more similar mainly at short horizons, while differences in the timing of adjustment remain. The principal Phillips curve and inflation-output results are robust to alternative treatments of international linkages, sample composition, and the euro area benchmark. These checks also suggest that adjustment began before formal adoption, but that the flattening of the Slovak Phillips curve was substantially larger than the common flattening observed in the euro area. We interpret this joint pattern through two complementary mechanisms. Formal membership consolidated a euro area nominal anchor that had already influenced Slovak monetary policy, while deeper real integration increased the scope for cross-border adjustment and strengthened the transmission of euro area activity to Slovakia.

Our findings contribute to several strands of literature. Research on the macroeconomic effects of euro adoption has primarily examined monetary transmission, business-cycle synchronization, and macroeconomic volatility (Giannone et al., 2010, 2019; Bagliano and Morana, 2025).[1] We complement this work by distinguishing convergence in structural relationships from changes in shock exposure and propagation. In this respect, our results are also compatible with evidence of structural convergence following euro adoption in Kupkovič (2024). The pronounced flattening of the Slovak Phillips curve connects

[1] Most of this literature, including our paper, studies euro adoption from the perspective of the joining country rather than the monetary union, although the perspective of the latter raises important questions of its own (Spiegel, 2001).

our findings to research emphasizing openness, nominal anchoring, and state dependence as sources of variation in the inflation-output relationship (Gali and Monacelli, 2005; Coibion and Gorodnichenko, 2015; Hazell et al., 2022; Faber and Züllig, 2026). Finally, we extend structural VAR evidence for new EU member states (Jarociński, 2010; Petz and Zörner, 2025) by allowing Slovak structural relationships and the set of policy equations to change across monetary regimes while estimating the euro area relationships over the full sample. Our approach thereby complements VAR models based on discrete regimes or fully time-varying parameters (Lanne et al., 2010; Auerbach and Gorodnichenko, 2012; Koop and Korobilis, 2013; Cardamone and De Santis, 2026).

The remainder of the paper is organized as follows. Section 3 introduces the empirical framework, including the data and identification strategy. Section 4 presents the results and discusses their economic interpretation. Section 5 concludes.

2 Institutional background

Slovakia's adoption of the euro was the culmination of a longer process of European and monetary integration rather than a discrete institutional change occurring only at the time of euro area entry. Following the dissolution of Czechoslovakia and the establishment of the Slovak Republic on 1 January 1993, European integration became a central component of Slovakia's policy orientation. Slovakia formally applied for EU membership on 27 June 1995, accession negotiations were concluded at the Copenhagen European Council in December 2002, and the Treaty of Accession was signed on 16 April 2003. In the accession referendum held on 16–17 May 2003, 93.7% of participating voters supported EU membership, and Slovakia joined the European Union on 1 May 2004.

The monetary dimension of this process became explicit shortly thereafter. On 16 July 2003, the Slovak authorities published the *Strategy of the Slovak Republic for the Adoption of the Euro* (NBS, 2003), which set out the broad framework for future euro area entry. The strategy reflected the institutional logic of EU accession: as a new Member State without an opt-out, Slovakia entered the Economic and Monetary Union with a derogation, but with the obligation to adopt the single currency once the convergence criteria were fulfilled. The Slovak Koruna subsequently entered ERM II in November 2005 and ultimately adopted the euro on 1 January 2009.

In light of this chronology, we do not consider euro adoption a single event starting with ERM II participation or with the physical introduction of the euro in 2009. Instead, we view it as the culmination of a sustained period of policy preparation, institutional commitment, and public debate around European integration. The prospect of EU membership, and later of euro area entry, provided an anchor for policy choices well before formal adoption. For this reason, convergence should be regarded as a gradual and anticipatory process, shaped not only by the fulfilment of formal entry criteria, but also by expectations, credibility effects, and the behaviour of policymakers and economic agents under an increasingly binding European institutional framework.

The evolution of the monetary-policy framework mirrored this broader institutional transition.[2] In the 1990s, the NBS operated within a framework centred on monetary and exchange-rate stability, with monetary developments managed largely through quantitative instruments and the regulation of broad money. Following the stabilisation of 1999, the framework gradually shifted towards interest-rate-based monetary policy and implicit

[2]See the description on the website of the National Bank of Slovakia `https://nbs.sk/en/monetary-policy/history-of-nbs-monetary-policy/`

inflation targeting in 2000–2004, before moving to explicit inflation targeting with varying targets under ERM II in 2005–2008. ERM II required exchange-rate stability as a convergence criterion and provided a framework for managing exchange rates prior to euro adoption. The koruna entered ERM II in November 2005 and was revalued twice before the irrevocable conversion rate was fixed. NBS analyses of euro adoption emphasized the elimination of koruna-euro exchange-rate risk as a direct benefit of joining the euro area (Suster et al., 2006). With euro adoption on 1 January 2009, Slovakia's national monetary policy was replaced by participation in the common monetary policy of the Eurosystem.

At the macroeconomic level, SlovakiaâĂŹs path towards the euro was already marked by substantial nominal convergence before formal ERM II participation. Disinflation, exchange-rate appreciation, and a gradual alignment with euro area conditions were underway during the accession period, reflecting both domestic stabilisation policies and the broader European integration process. ERM II then provided a more explicit framework for exchange-rate stability and the fulfilment of the Maastricht criteria. Slovakia's convergence was therefore not simply a technical adjustment to the requirements of euro adoption, but part of a broader shift in the policy and institutional environment.

3 Empirical framework

3.1 Baseline structural model

Our analysis is based on a structural VAR that links output gaps y_t, inflation π_t, and nominal interest rates r_t through aggregate supply, aggregate demand, and monetary policy relationships. Throughout, these variables are interpreted as cyclical measures of real activity and short-term nominal policy rates; precise data definitions and transformations are described in Section 3.4. Our analysis extends the following contemporaneous three-equation structure for a generic economy of Baumeister and Hamilton (2018):

$$
\begin{aligned}
y_t &= \alpha^{\pi}\pi_t + \mathbf{b}^s\mathbf{x}_{t-1} + u_t^s, \\
y_t &= \beta^{\pi}\pi_t + \beta^r r_t + \mathbf{b}^d\mathbf{x}_{t-1} + u_t^d, \\
r_t &= (1-\rho)\big(\psi^y y_t + \psi^{\pi}\pi_t\big) + \mathbf{b}^m\mathbf{x}_{t-1} + u_t^m,
\end{aligned}
$$

where u_t^s, u_t^d, and u_t^m denote mutually orthogonal supply, demand, and monetary policy shocks. The slope parameter α^{π} is the inverse of the usual Phillips curve slope and governs the inflation–output trade-off, while β^{π} and β^r capture the sensitivity of aggregate demand to inflation and interest rates. Monetary policy follows a Taylor-type rule with interest rate smoothing ρ. The vector $\mathbf{x}_{t-1}$ contains lags of the endogenous variables and a constant.

3.2 Two-country extension and monetary regimes

We embed the baseline structural model above in an international two-country setting with Slovakia (SK) and the rest of the euro area (REA) (Camehl and von Schweinitz, 2026), and allow for a regime change associated with Slovakia's adoption of the euro in 2009 (Cardamone and De Santis, 2026). In this section, we first present the full two-country system that applies prior to euro adoption, and then describe how this baseline system is modified by a set of additional restrictions after Slovakia joins the monetary union.

Throughout, we impose time-invariant structural and lag coefficients in the euro area block, reflecting the limited quantitative importance of Slovakia for aggregate euro area dynamics at the union level. Against this background, we use superscripts SKK, $SKEUR$, and REA index regime–country specific structural coefficients, referring respectively to Slovakia before euro adoption, Slovakia after euro adoption, and the rest of the euro area. Superscripts SK and REA are used to differentiate observable economic variables by country. For example, $\alpha^{SKK,\pi}$ denotes the supply-curve slope in Slovakia prior to euro adoption, while y_t^{SK} denotes the Slovak output gap.

3.2.1 Pre-euro baseline system

Prior to Slovakia's adoption of the euro in 2009, the model takes the form of a system of seven structural equations describing aggregate supply, aggregate demand, and monetary policy in Slovakia (SK) and in the rest of the euro area (REA), plus an equation for the koruna-euro exchange rate. In this baseline regime, both regions are characterized by the structural relationships introduced above, while allowing for cross-region interactions. In particular, exchange rates potentially affect all Slovak equations ($\alpha^\sigma, \beta^\sigma, \psi^\sigma$). Moreover, Slovak aggregate demand depends on the euro area output gap through the coefficient $\beta^{y^{REA}}$, capturing external demand spillovers, and Slovak monetary policy is allowed to react to the euro area policy rate through the coefficient $\psi^{r^{REA}}$. The euro area block is closed by an independent monetary policy rule that responds to euro area output and inflation. Finally, exchange rates contemporaneously depend on differences of output gaps, inflation and nominal interest rates ($\phi^{\Delta y}, \phi^{\Delta\pi}, \phi^{\Delta r}$).

Throughout, we work with the common lag vector $\mathbf{x}_{t-1}$ defined above, containing four lags of all endogenous variables and a constant. This formulation preserves a fixed state vector across regimes while allowing for regime-specific dynamic restrictions. The full baseline system in the pre-euro regime can be written as:

$$
\begin{aligned}
\text{(SK supply)} \quad y_t^{SK} &= \alpha^{SKK,\pi}\,\pi_t^{SK} + \alpha^{SKK,\sigma}\,\sigma_t^{SK} + \mathbf{b}^{SKK,s'}\mathbf{x}_{t-1} + u_t^{SK,s}, \\
\text{(SK demand)} \quad y_t^{SK} &= \beta^{SKK,\pi}\,\pi_t^{SK} + \beta^{SKK,r}\,r_t^{SK} + \beta^{SKK,\sigma}\,\sigma_t^{SK} + \beta^{SKK,y^{REA}}\,y_t^{REA} \\
&\quad + \mathbf{b}^{SKK,d'}\mathbf{x}_{t-1} + u_t^{SK,d}, \\
\text{(SK policy)} \quad r_t^{SK} &= (1-\rho^{SKK})\big(\psi^{SKK,y}\,y_t^{SK} + \psi^{SKK,\pi}\,\pi_t^{SK} + \psi^{SKK,\sigma}\,\sigma_t^{SK} \\
&\quad + \psi^{SKK,r^{REA}}\,r_t^{REA}\big) + \mathbf{b}^{SKK,m'}\mathbf{x}_{t-1} + u_t^{SK,m},
\end{aligned}
$$

$$
\begin{aligned}
\text{(REA supply)} \quad y_t^{REA} &= \alpha^{REA,\pi}\,\pi_t^{REA} + \mathbf{b}^{REA,s'}\mathbf{x}_{t-1} + u_t^{REA,s}, \\
\text{(REA demand)} \quad y_t^{REA} &= \beta^{REA,\pi}\,\pi_t^{REA} + \beta^{REA,r}\,r_t^{REA} + \mathbf{b}^{REA,d'}\mathbf{x}_{t-1} + u_t^{REA,d}, \\
\text{(ECB policy)} \quad r_t^{REA} &= (1-\rho^{REA})\big(\psi^{REA,y}\,y_t^{REA} + \psi^{REA,\pi}\,\pi_t^{REA}\big) \\
&\quad + \mathbf{b}^{REA,m'}\mathbf{x}_{t-1} + u_t^{REA,m} \\
\text{(SKK ER)} \quad \sigma_t^{SK} &= \phi^{\Delta y}(y_t^{SK} - y_t^{REA}) + \phi^{\Delta\pi}(\pi_t^{SK} - \pi_t^{REA}) + \phi^{\Delta r}(r_t^{SK} - r_t^{REA}) \\
&\quad + \mathbf{b}^{SKK,\sigma'}\mathbf{x}_{t-1} + u_t^{SKK,\sigma}.
\end{aligned}
$$

3.2.2 Post-euro regime restrictions

From 2009Q1 onwards, we impose a set of restrictions that reflect Slovakia's accession to the monetary union and the resulting loss of an independent national monetary policy.

First, the Slovak monetary policy and exchange rate equations become redundant, and the associated structural shock is restricted to zero. Second, the Slovak policy rate in the Slovak demand equation is replaced by the common euro area policy rate, so that domestic demand depends on r_t^{REA} rather than a separate national instrument. Third, the contemporaneous effect of koruna-euro exchange rates drops from Slovak supply and demand equations. Fourth, the coefficients on lagged Slovak interest and exchange rates are set to zero in all equations (not only euro area ones), implying that Slovak dynamics are driven by the euro area policy rate both contemporaneously and through lagged effects, consistent with the absence of an independent Slovak policy instrument. Fifth, euro area monetary policy is described by a single ECB rule that responds to GDP-weighted averages of euro area and Slovak output gaps and inflation rates, such that Slovak macroeconomic conditions enter common monetary policy only through their (small) weight in the monetary union (Staffa and von Schweinitz, 2023). Finally, only the coefficients in the Slovak supply and demand equations can change across regimes.

Under these restrictions, the Slovak equations in the post-euro regime are given by

$$
\begin{aligned}
\text{(SK supply)} \quad y_t^{SK} &= \alpha^{SKEUR,\pi}\,\pi_t^{SK} + \mathbf{b}^{SKEUR,s'}\mathbf{x}_{t-1} + u_t^{SK,s}, \\
\text{(SK demand)} \quad y_t^{SK} &= \beta^{SKEUR,\pi}\,\pi_t^{SK} + \beta^{SKEUR,r}\,r_t^{REA} + \beta^{SKEUR,y^{REA}}\,y_t^{REA} \\
&\quad + \mathbf{b}^{SKEUR,d'}\mathbf{x}_{t-1} + u_t^{SK,d}
\end{aligned}
$$

Euro area supply and demand continue to follow the baseline structure, while monetary policy is governed by a single ECB rule:

$$
\begin{aligned}
\text{(ECB policy)} \quad r_t^{REA} = (1-\rho^{REA})\big(&\psi^{REA,y}\left(\omega_{REA}y_t^{REA} + \omega_{SK}y_t^{SK}\right) \\
&+\psi^{REA,\pi}\left(\omega_{REA}\pi_t^{REA} + \omega_{SK}\pi_t^{SK}\right)\big) \\
&+ \mathbf{b}^{REA,m'}\mathbf{x}_{t-1} + u_t^{REA,m},
\end{aligned}
$$

with ω_{SK} reflecting Slovakia's GDP weight in the monetary union, and $\omega_{REA}+\omega_{SK} = 1$.

3.2.3 Discussion of parsimonious modeling choices

Before 2009, the empirical model described above can be interpreted as a two-country economy model, where one country (Slovakia) is modeled as an open economy, while the other one (the rest of the euro area) is treated as a closed economy. Afterwards, we model a single currency area split into two regions.

Treating the euro area as a closed economy comes with disadvantages. In reality, the euro area is not immune to the influence of foreign shocks – the economic effects of oil supply shocks and wars are a painful reminder. Importantly, our model does not assume that these foreign shocks do not exist. Instead, all foreign shocks are mapped into the set of shocks included in our model. In a series of robustness checks, we change this mapping by explicitly adding global variables such as global industrial production, global economic policy uncertainty or gas prices to our model.

A second disadvantage lies in the identification of constant structural coefficients for Slovakia in each of period. The transition of Slovakia from a communist economy towards membership in the euro area could instead be modelled using time-varying coefficients. Such a rich model comes with extreme identification problems. Instead, we remove trends that can be associated with transition dynamics (like time-varying inflation and exchange rate targets) from the data, as described in section 3.4. This should limit the need for a complete time-varying model, a fact that we can confirm in robustness checks where parts of the sample are dropped. Yet, our results should still be interpreted as a comparison of sample averages, where we cannot differentiate between a clean structural break or a smooth transition.

A third disadvantage comes from the use of vector autoregressive models for structural identification, which cannot fully account for shifts in expectation formation. Our model draws heavily on small-scale New-Keynesian models, both in terms of the formulation of structural equations and the derivation of the priors in the following subsection. Theory puts a strong emphasis on the forward-looking behaviour of households and firms. We emulate this in two ways. First, Baumeister and Hamilton (2018) show that the assumption of steady-state dynamics is sufficient to derive priors on current-period elasticities from future-period coefficients in theoretical models. Second, we test whether our results are vulnerable to insufficient information problems (Forni and Gambetti, 2014) by adding forward-looking variables like global economic policy uncertainty, energy prices and the VSTOXX to our baseline model in a set of robustness checks.

3.3 Identification and estimation

Following Baumeister and Hamilton (2018), we achieve identification by combining informative priors on the contemporaneous structural elasticities and semi-elasticities in the supply, demand, monetary policy, and exchange rate equations with the assumption that the associated structural shocks are mutually orthogonal.

Normalization is imposed as in Baumeister and Hamilton (2018) by setting the coefficient on the left-hand-side variable in each structural equation to unity. The same normalization is used in all regimes. This ensures that regime-specific coefficients are directly comparable and retain a common economic interpretation as (semi-)elasticities. Structural shocks are uniformly interpreted as one-unit shocks, which implies that they are comparable in terms of their economic size, but not necessarily in terms of their likelihood (which would be the case for one standard-deviation shocks).

We adjust the Minnesota prior for lag coefficients to account for the fact that Slovak economic developments are likely irrelevant for the rest of the euro area (i.e., in $\mathbf{b}^{REA,s}, \mathbf{b}^{REA,d}, \mathbf{b}^{REA,m}$). To capture this, we multiply the prior variance of the coefficients on lagged Slovak output gaps and inflation in these equations with 0.1^2, which heavily shrinks posterior distributions towards zero. The coefficients on lagged Slovak interest rates and exchange rates (which only exist in the pre-euro regime) are restricted to be zero and therefore excluded from the estimation. The soft restrictions embody our prior belief on the importance of Slovakia for the rest of the euro area, while the hard restrictions allow us to estimate common lag coefficients for these equations across the two regimes.

Crucially, euro adoption affects the economic environment captured by the model – most notably the loss of an independent Slovak monetary policy and changes in the contemporaneous ECB reaction function – but not the identifying assumptions themselves. Posterior inference is based on a Metropolis-within-Gibbs sampler as in Baumeister and Hamilton (2018), but adapted to two countries and two regimes (see Camehl and von Schweinitz, 2026; Cardamone and De Santis, 2026). Prior distributions for all structural coefficients are specified in Baumeister and Hamilton (2018) and are held identical across regimes. As a result, differences between pre- and post-euro posterior distributions primarily reflect differences in the data-generating process rather than differences in prior information. Details on the prior distributions and details on the estimation algorithm are provided in Appendix B.

3.4 Data and variable construction

The empirical analysis uses quarterly data on output gaps, inflation, and short-term policy interest rates for Slovakia (SK) and the rest of the euro area (REA). The sample runs from 1999Q1 to 2025Q4 and is split according to Slovakia's adoption of the euro on January 1st 2009.

Our model comprises seven observable variables: the Slovak and euro area output gaps y_t^{SK} and y_t^{REA}, inflation rates π_t^{SK} and π_t^{REA}, nominal policy rates r_t^{SK} and r_t^{REA}, and the koruna-euro exchange rate σ_t. All interest and exchange rates are expressed as quarterly averages.

The Slovak output gap is computed by the National Bank of Slovakia using a unobserved component model - production function approach similarly to Tóth (2021); national estimates of potential GDP are aggregated by the ECB to obtain a euro area measure. Inflation is measured as the year-on-year growth rate of the Harmonised Index of Consumer Prices (HICP) for Slovakia and for the euro area, respectively. After euro adoption, published euro area aggregates include Slovak observations. We therefore use the Slovak GDP weight $\omega_{SK} = 0.007$ together with Slovak output gaps and inflation rates to decompose aggregate euro area series into a Slovak component and a rest-of-the-euro-area (REA) component. The same GDP weight is later used to recombine Slovak and REA variables into GDP-weighted aggregates in the ECB monetary policy rule.

The pre-euro period from 1999Q1 to 2008Q4 features an independent Slovak monetary policy rate r_t^{SK}. As discussed in Section 2, it is characterized by constant structural changes to the monetary, fiscal and legal framework with the final goal of euro introduction. These transformations result in trends in the Slovak data. However, we are mostly interested in business cycle fluctuations around these trends. To detrend the data, we would ideally have knowledge about the steady-state path in each quarter. We could statistically approximate this path using an HP filter. In practice, however, this filter would also interpret a part of the inflationary spike in 2022 as trend rather than cycle. Therefore, we provide results based on HP-filtered data only in a robustness check. As our baseline, we use simple economic assumptions instead to replace time-varying trends x_t^* in Slovak inflation, interest rates and exchange rates with a constant $\bar{x}$:

$$\begin{aligned}
\tilde{\pi}_t^{SK} &= \pi_t^{SK} - \pi_t^* + \bar{\pi} \\
\tilde{r}_t^{SK} &= r_t^{SK} - r_t^* + \bar{r} \\
\tilde{\sigma}_t^{SK} &= \sigma_t^{SK} - \sigma_t^* + \bar{\sigma}
\end{aligned}$$

This simple approach results in Slovak data that are fluctuating around a constant trend which is comparable to the one in the rest of the euro area data. We display euro area data as well as the original and detrended data for Slovakia in Appendix Figures A.1 to A.3.

For inflation, we split the pre-sample period in three distinct phases with different inflation trends π_t^*: first, the time from 1999Q1 to 2001Q4 is characterized by a temporary inflationary spike due to a wave of deregulation, most importantly of energy prices. For this time, we assume a constant inflation trend of $\pi_t^* = 6\%$. This corresponds roughly to the average inflation before the deregulation in 1997 and 1998. The second phase, from 2002Q1 to 2005Q3, reflects a continuous improvement of the monetary policy framework by the National Bank of Slovakia, starting with a switch to implicit inflation targeting at the beginning of 2002 and ending with explicit inflation targeting under ERM II in 2005Q4. We model this with a linearly decreasing inflation trend from 6% (2001Q4) to 3.5% (2005Q4). The third phase, from 2005Q4 to 2008Q4, covers the time under ERM

II. In this time, the national bank of Slovakia used explicit inflation targets (3.5% for 2005Q4, 2.5% for 2006Q4, 2% from 2007Q4 onwards), aimed at bringing inflation rates within the bands defined by the convergence criteria. We use the three inflation targets as breakpoints in a piecewise linear function. The constant inflation target is set to $\bar{\pi} = 2\%$.

For interest rates, there is no administrative target that we could use or derive. However, the adjustment term $(-r_t^* + \bar{r})$ for nominal interest rates is the same as the one for inflation $(-\pi_t^* + \bar{\pi})$, if we assume a constant real interest rate r_{real} between 1999Q1 and 2008Q4:

$$-r_t^* + \bar{r} = -(r_{real} + \pi_t^*) + (r_{real} + \bar{\pi}) = -\pi_t^* + \bar{\pi}.$$

For exchange rates, we use the same three phases as for inflation. In the first phase (1999Q1-2001Q4), we set the exchange rate trend to the average during that time, $\sigma_t^* =$ 43.34 SKK/EUR. In the second phase, we use a linear appreciating exchange rate trend, reaching 38.455 SKK/EUR in 2005Q4. This was the official exchange rate target when Slovakia joined the ERM II in November 2005. These targets where changed twice (to 35.4424 SKK/EUR in March 2007 and 30.13 SKK/EUR in May 2008). As with inflation, we use these official targets as breakpoints of a piecewise linear function for σ_t^* in the third phase (2005Q4-2008Q4).[3]

The post-euro subsample runs from 2009Q1 to 2025Q1. In this sample, the Slovak policy rate and exchange rate are no longer observed, and monetary conditions are summarized by the common euro area policy rate r_t^{REA}. To account for the effective lower bound on nominal interest rates, we replace the euro area policy rate with the Wu-Xia shadow rate (Wu and Xia, 2020) from 2009Q2 to 2022Q3. Outside this period, the observed policy rate is used. Observations associated with the COVID-19 pandemic are downweighted following the approach of Cascaldi-Garcia (2022). We adapt his pandemic-prior methodology to our multi-country structural VAR setting in order to mitigate the influence of extreme observations during the pandemic period without discarding them entirely. Details on the implementation of this procedure are provided in Appendix A.

4 Results

In this section, we show that euro adoption was followed by a broad convergence of Slovak macroeconomic dynamics towards those of the euro area. This convergence happens across two tightly connected dimensions as discussed in Subsection 4.1. First, the Slovak Phillips curve flattens and moves substantially closer to its euro area counterpart. Second, the Slovak economy becomes increasingly integrated with the rest of the euro area, such that euro area shocks become the main drivers of Slovak output gap and inflation.

Convergence also appears in the way structural shocks propagate through the economy. After euro adoption, Slovak responses to domestic and foreign demand and supply shocks become increasingly similar to those of the euro area. This is particularly clear for demand shocks, which generate a stronger output response relative to inflation and bring the Slovak inflation-output trade-off in-line with the euro area pattern (Subsection 4.2). In the final Subsection 4.3, we assess the robustness of our main results across a wide range of alternative specifications and assumptions.

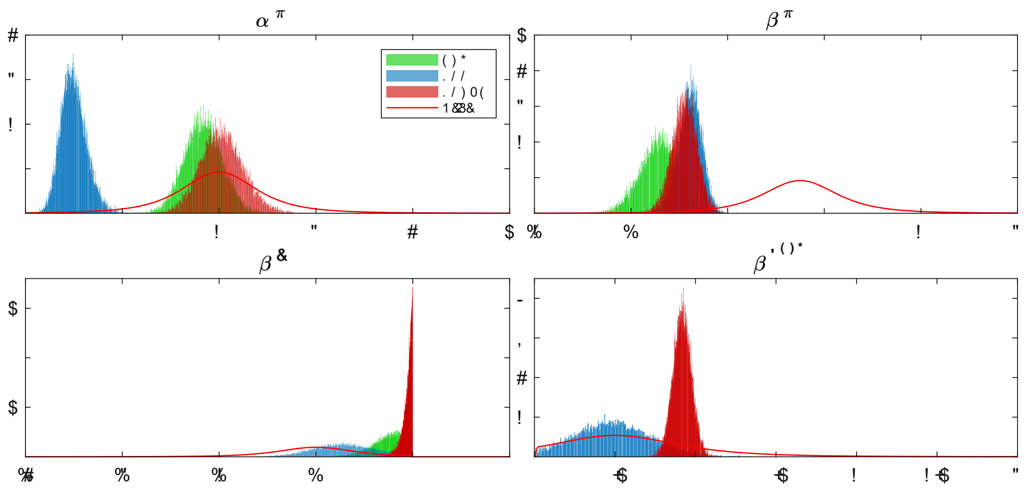
[3] The constant $\bar{\sigma}$ does not matter for the interpretation of results and is set to zero.

4.1 Structural convergence of Slovakia towards the euro area

Business cycle convergence in general can imply convergence of the coefficients describing structural economic relationships, or convergence of the sources of business cycle fluctuations. We show that Slovakia experienced both types of convergence. On the supply side, convergence occurs mainly through the flattening of the Phillips curve. On the demand side, it operates primarily through greater openness and the resulting increase in the importance of euro area shocks, rather than through a general convergence of domestic demand elasticities. We interpret these interconnected developments as reflecting two complementary mechanisms: the formalization of the euro area nominal anchor and deeper real-side integration with the euro area.

First, our results point to a substantial flattening of the Slovak Phillips curve. Pre euro introduction, its slope is much steeper than in the euro area. Post euro introduction, the slope flattens and converges fully towards the euro area counterpart. In our model, the supply curve coefficient α^{π} can be interpreted as the inverse slope of the Phillips curve. We plot the posterior distribution of this parameter in the first tile of Figure 1. In the pre-euro period (blue color), the Slovak posterior distribution is concentrated at relatively low values, with a posterior median around 0.5. This implies a comparatively steep Phillips curve. After euro adoption, the Slovak posterior (now in red) shifts markedly to the right, with a posterior median close to 2. This coefficient is extremely close to the euro area posterior (in green). This indicates that the euro area and Slovakia under the euro share a similarly flat Phillips curve.

Fig. 1: Contemporaneous coefficients in supply and demand equations



Note: Prior (red lines) and posterior distributions (histograms) of contemporaneous coefficients. Different colors correspond to the euro area, Slovakia in the pre-euro period, and Slovakia in the post-euro period. Other structural contemporaneous coefficients are reported in Appendix Figure C.6.

The convergence of the Slovak Phillips curve implies that its inflation-output trade-off induced by demand pressure converges towards the pattern observed in the euro area. We measure the trade-off through the impact ratio of inflation to output following domestic demand shocks. This ratio is around 2 in Slovakia prior to euro introduction, meaning that demand shocks create substantially higher inflation than output fluctuations on impact. The flattening of the Phillips curve substantially weakens the inflation and strengthens the output response. After euro introduction, the posterior median of the inflation-to-output ratio for Slovakia is approximately 0.5, closely matching the corresponding estimate for the euro area. The relative response of inflation and output to demand shocks in Slovakia therefore appears to have converged towards the euro area pattern following monetary integration.

The most natural interpretation of the flattening of the Slovak Phillips curve is that euro adoption strengthened the nominal anchor relevant for Slovak price setters. Our monetary-policy-rule estimates indicate that this anchoring process had already begun before formal adoption. In the pre-euro Slovak policy rule, the posterior distribution of the coefficient on euro area interest rates shifts decisively away from its prior centered at zero and has a posterior median of about 2.6; see Figure C.6 in the Appendix. The NBS therefore imported a substantial part of the euro area nominal anchor before 2009. Nevertheless, its policy rate remained a domestic instrument embedded in Slovakia's own inflation-targeting and exchange-rate-stabilization regime. Formal adoption replaced this hybrid instrument with the ECB rate itself. Under this interpretation, delegating monetary policy to the ECB tied firms' inflation expectations more closely to the euro area price-stability regime, reducing the inflationary response to domestic demand pressures. This interpretation is consistent with evidence that inflation expectations are central for Phillips curve dynamics and that better anchoring lowers the sensitivity of inflation to domestic slack (Coibion and Gorodnichenko, 2015; Hazell et al., 2022). Stronger trade integration may have reinforced the supply-side pattern. This implies that domestic demand expansions are increasingly accommodated through imports rather than domestic price increases, while supply disturbances can be partly absorbed through cross-border sourcing and production networks. For Slovakia, the scale of this integration was large: exports and imports jointly amounted to around 60% of GDP in 1999, rose to 170% in 2008, and averaged 182% after euro adoption.

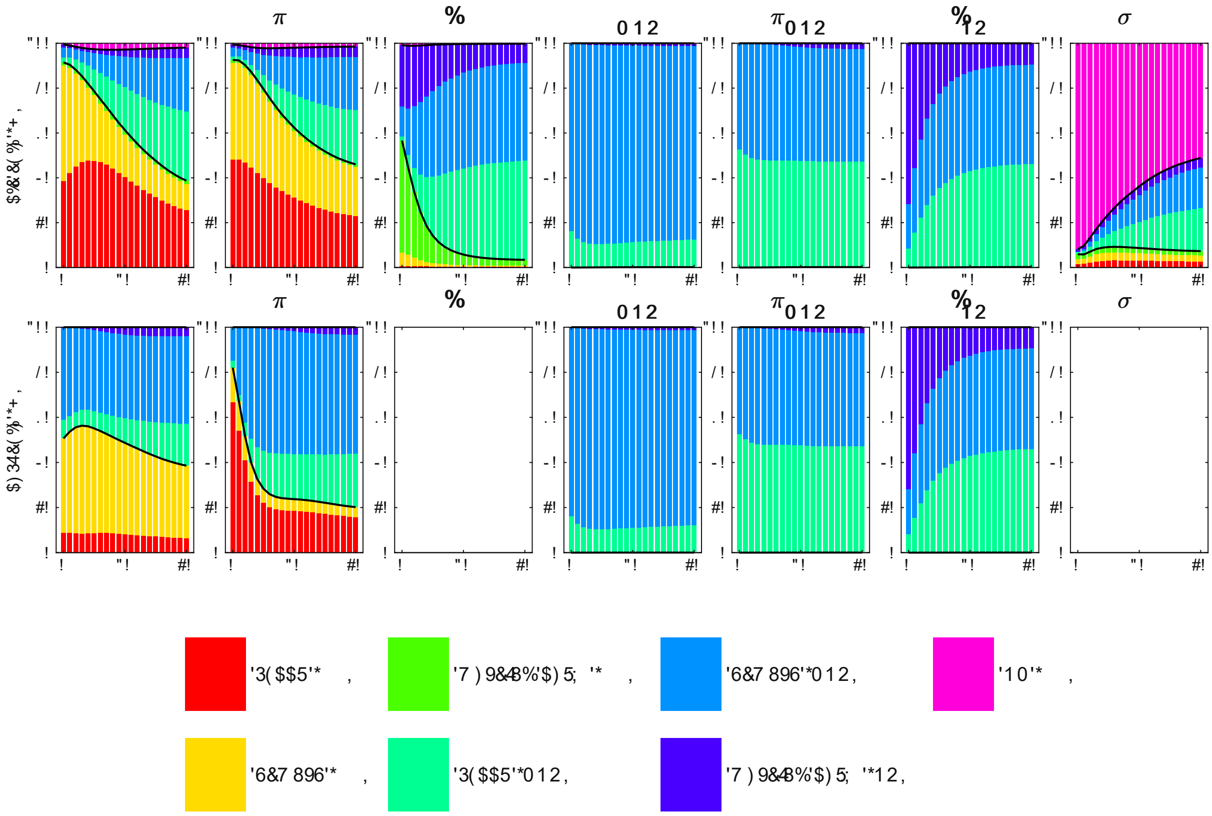
Beyond the slope of the Phillips curve, stronger trade integration has a second, more direct convergence effect: shocks that cause euro area business cycle fluctuations spill over to Slovakia via demand channels. As trade increases, euro area shocks become significantly more important for Slovak business cycle fluctuations. This is most easily seen in the forecast error variance decomposition in Figure 2. Additionally to the different colors for different structural shocks, we use black solid lines to group shocks into different "countries of origin". During the post-euro period depicted in the second row, euro area shocks play a much larger role much more quickly. At short horizons, their contribution increases from less than 10% pre euro introduction to 20% for inflation and 50% for the output gap post euro. At long horizons, they explain around 40–60% of output and inflation fluctuations, slightly more than pre euro introduction.

The increasingly dominant role of euro area shocks also shows up in the elasticity of Slovak demand to euro area output gaps, $\beta^{y^{REA}}$. This coefficient increases strongly from around 0.5 to close to 1, see the last tile in Figure 1.[4] Because the coefficient is positive, higher euro area output gaps endogenously shift Slovak demand outward. This results in higher Slovak output gaps and inflation as determined by the slope of the Phillips curve. After 2009, the importance of euro area shocks increases because stronger spillovers imply a larger demand shift after the same shock. The flattening of the Phillips curve implies that demand shifts load more on the output gap than inflation, which is why the increasing role of euro area shocks is particularly relevant for Slovak output gaps.

In line with the convergence of the Phillips curve, the forecast error variance decomposition also shows that the balance between demand and supply disturbances moves closer to that observed in the euro area. Before adoption, fluctuations in the Slovak output gap

[4]The rise in import shares would imply a similar increase of this coefficient in theoretical structural open economy models such as Lubik and Schorfheide (2007).

Fig. 2: Forecast Error Variance decomposition



Note: Structural forecast-error variance decompositions for Slovak and rest of euro area variables (in columns) across forecast horizons. The first (second) row shows the decomposition pre (post) euro introduction. Black solid lines separate the combined contribution of Slovak, euro area and exchange rate shocks.

are equally driven by supply and demand shocks at all horizons, with the role of euro area shocks increasing over time. Afterwards, demand shocks—combining domestic and euro area disturbances—account for 70 to 80% of the variation, closely resembling the strongly demand-dominated decomposition for the rest of the euro area. On the inflation side, the most pronounced change is that euro area demand shocks replace Slovak demand shocks post euro introduction.

The observed convergence patterns are also consistent with relatively limited movement in the semi-elasticity of demand with respect to inflation and interest rates, β^π and β^r. Slovak demand semi-elasticities were already fairly close to those of the euro area before adoption, leaving less scope for structural convergence along this margin, see the second and third tile of Figure 1.

Table 1: Similarity measures of structural supply and demand coefficients with REA counterpart

	P(closer to EA)	Overlap (pre)	Overlap (post)
α^π	99.3%	0.0%	65.2%
β^π	59.8%	31.4%	41.2%
β^r	74.3%	33.5%	35.1%

Note: The first column reports the posterior probability that Slovak coefficients are closer to euro area coefficients after euro adoption than before. For a given parameter θ, we calculate $P(|\theta^{SKEUR} - \theta^{REA}| < |\theta^{SKK} - \theta^{REA}|)$. The second and third columns report the density overlap between the posterior distributions of Slovak and euro area coefficients before and after euro adoption, $\int \min(f_{SKK}(\theta), f_{REA}(\theta))d\theta$ and $\int \min(f_{SKEUR}(\theta), f_{REA}(\theta))d\theta$. The last row reports averages across the three coefficients.

Table 1 complements the visual evidence on structural contemporaneous coefficients by reporting quantitative similarity measures for the three coefficients that are directly comparable across the three regimes: α^π, β^π, and β^r. The first measure, reported in the column "P(closer to EA)", is the posterior probability that the Slovak coefficient is closer to its euro area counterpart after euro adoption than before euro adoption.[5] The second measure is the overlap coefficient (Inman and Bradley Jr, 1989), reported separately for the pre-euro and post-euro Slovak posterior distributions relative to the euro area posterior. It measures the share of posterior mass that is common to the compared distributions. For both statistics, higher values indicate greater similarity between Slovakia and the euro area benchmark.

Not surprisingly, the strongest evidence of convergence comes from the supply equation. The Slovak coefficient α^π moves closer to the euro area coefficient in 99.3% of posterior draws, and the overlap with the euro area posterior increases to 65.2%. The demand-side coefficients β^π and β^r are already relatively close to the euro area benchmark before euro adoption, with overlaps slightly above 30%, leaving limited scope for further convergence. For β^π, the overlap rises moderately to 41.2%, while the probability of moving closer to the euro area coefficient is 59.8%. Its negative and relatively stable estimate is consistent with a purchasing-power channel, through which current inflation depresses real demand, rather than with a relationship transformed by the monetary-policy regime (D'Acunto et al., 2021; Weber et al., 2022; Bachmann et al., 2015). The interest-rate semi-elasticity β^r changes more substantially: it moves towards zero and closer to the euro area coefficient in 74.3% of posterior draws, although the overlap with

[5]Formally, for a given coefficient θ, we calculate the absolute distances $\Delta^{SKK,REA} = |\theta^{SKK} - \theta^{REA}|$ and $\Delta^{SKEUR,REA} = |\theta^{SKEUR} - \theta^{REA}|$, and report $P(\Delta^{SKEUR,REA} < \Delta^{SKK,REA})$.

the euro area posterior barely increases. Before euro adoption, the Slovak policy rate reflected not only the intertemporal price of consumption but also domestic credibility and exchange-rate-stabilization concerns. After adoption, these Slovakia-specific components largely disappeared. The movement of β^r towards zero is therefore consistent with the policy rate becoming a cleaner monetary instrument, rather than with the disappearance of monetary transmission. The strong pre-euro dependence of Slovak rates on ECB policy also helps explain why the demand coefficients were already partially comparable to their euro area counterparts before formal adoption.

Taken together, the results reveal two interconnected forms of post-euro convergence. On the supply side, the formalization of the euro area nominal anchor flattened the Slovak Phillips curve and changed how domestic demand pressures were divided between inflation and output. On the demand side, deeper integration strengthened the transmission of euro area activity and made euro area shocks increasingly important sources of Slovak fluctuations. These changes in contemporaneous relationships and the origin of shocks also affect how disturbances propagate over time. The next subsection therefore examines whether the dynamic responses of Slovak output and inflation became more similar to those observed in the euro area.

4.2 Convergence of dynamic responses

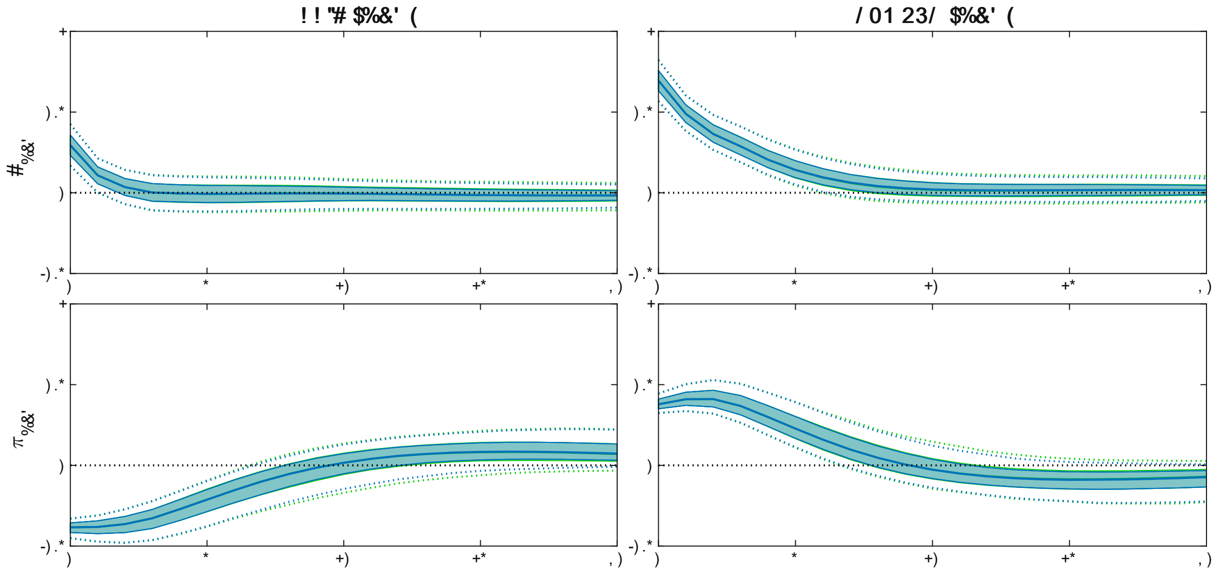
The convergence documented in the estimated coefficients and the sources of fluctuations is also evident in the dynamic responses to structural shocks. After euro adoption, two sets of impulse response functions converge. First, the responses of Slovak output gaps and inflation are much closer to the responses observed in the euro area after each are hit by domestic (Slovak on Slovak, euro area on euro area) supply and demand shocks. This convergence is strongest on impact and for output responses over the first two years, while inflation responses become more similar mainly at short horizons. This short-run convergence of responses to domestic shocks reflects the convergence of contemporaneous elasticities. Second, the responses of Slovak output gap and inflation converges towards the responses of euro area variables after they are hit by euro area supply and demand shocks. This similarity holds for a longer time, especially for inflation responses. It reflects the similarity of forecast error variance decompositions of Slovak and euro area variables at longer horizons.

We document these results using IRFs of output gaps and inflation to supply and demand shocks.[6] Figure 3 (responses of euro area variables to domestic shocks) serves as a benchmark, which we compare to Figure 4 (responses of Slovak variables to domestic shocks) and Figure 5 (responses of Slovak variables to foreign shocks). Shocks are always one unit of the respective equation. Each Figure plots pre euro responses in green, and post euro responses in blue.

The euro area responses in Figure 3 provide a stable benchmark. The estimated euro area dynamics are very similar across the two subsamples, which is expected since the euro area block is estimated over the full sample and Slovakia has only negligible feedback effects on the euro area by assumption. Demand shocks are absorbed somewhat more through output than inflation, with an impact ratio of inflation to output of around 0.5. Supply shocks generate output and inflation responses of similar magnitude, though both are strongly muted at around 0.3–0.4 in absolute terms. After impact, output gaps begin converging back to zero immediately, while inflation displays a delay of two to four quarters before converging. These patterns provide the reference dynamics against which

[6] A set of full impulse response functions is reported in Appendix Figures C.7 and C.8.

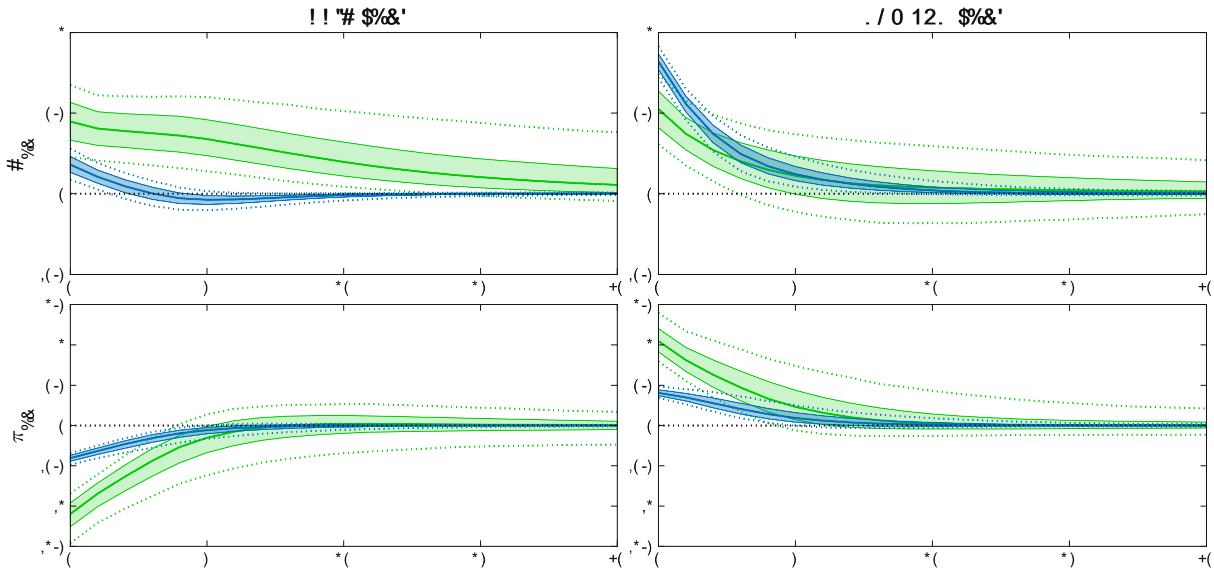
Fig. 3: Impulse response functions to domestic shocks, rest of the euro area



Note: Structural impulse-response functions of euro area output gap and inflation to one-unit domestic supply and demand shocks. Solid green (blue) lines denote posterior medians for the pre-euro (post-euro) subsamples. Shaded regions indicate the 68% posterior credible set, while dotted lines represent the 95% posterior credible set.

we evaluate Slovak convergence.

Fig. 4: Impulse response functions to domestic shocks, Slovakia

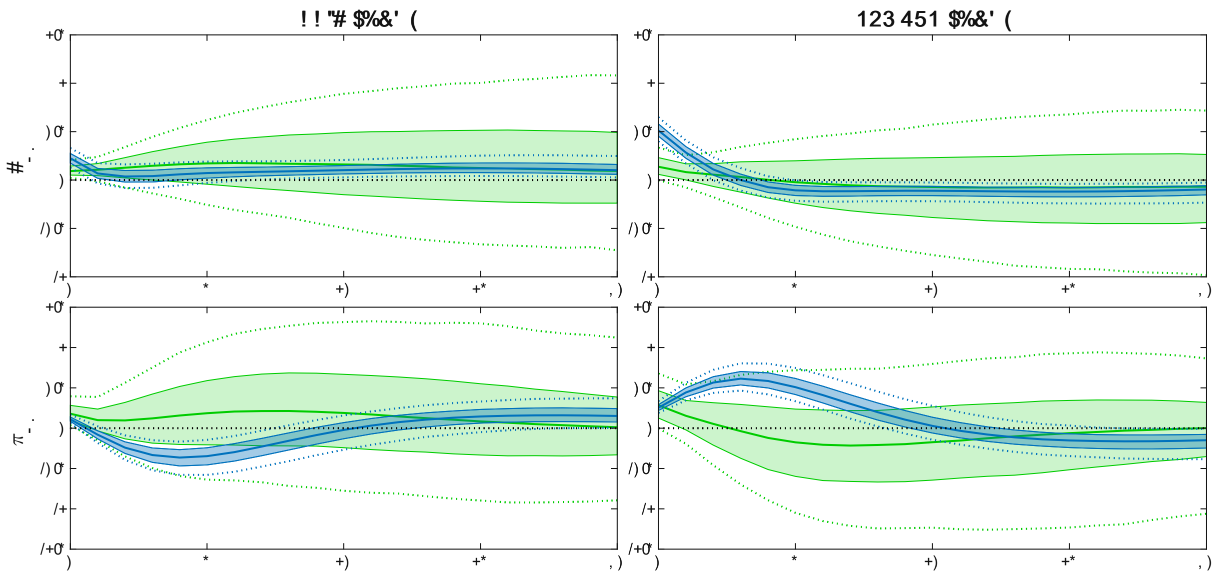


Note: Structural impulse-response functions of Slovak output gap and inflation to one-unit domestic supply and demand shocks. Solid green (blue) lines denote posterior medians for the pre-euro (post-euro) subsamples. Shaded regions indicate the 68% posterior credible set, while dotted lines represent the 95% posterior credible set.

For Slovak demand shocks (second column of Figure 4), the main change is the composition of adjustment. Before euro adoption, domestic demand shocks were absorbed disproportionately through inflation: the impact response of inflation was more than twice as large as the output response. After euro adoption, the inflation response falls sharply while the output response increases, reducing the impact ratio of inflation to output from around 2.1 to roughly 0.5. This brings the Slovak response close to the euro area benchmark and dynamically confirms the flattening of the Slovak supply curve documented above. Demand disturbances therefore become less inflationary after euro adoption and are absorbed increasingly through quantity adjustments rather than price changes.

For Slovak supply shocks (first column of Figure 4), the main change is the scale of propagation. The responses of both Slovak output and inflation are much smaller after euro adoption, at roughly one third of their pre-euro magnitudes. This attenuation is consistent with the coefficient evidence that both the supply and demand schedules became flatter. Domestic supply disturbances therefore generate less pronounced movements in both output and inflation after euro adoption. Overall, Slovak responses to domestic supply and demand shocks are far from their euro area counterparts before euro adoption, but become much more similar afterwards. The main remaining visual difference is that Slovak inflation responses do not display the delayed convergence pattern observed for the euro area.

Fig. 5: Impulse response functions to euro area shocks, Slovakia



Note: Structural impulse-response functions of Slovak output gap and inflation to one-unit euro area supply and demand shocks. Solid green (blue) lines denote posterior medians for the pre-euro (post-euro) subsamples. Shaded regions indicate the 68% posterior credible set, while dotted lines represent the 95% posterior credible set.

With the introduction of the euro, the Slovak responses to euro area shocks become much more sharply identified and stronger than before 2009. They are very much in line with responses from the rest of the euro area. The only exception is the short-run response of inflation to euro area supply shocks. The underlying reason for this shift in responses is the stronger integration of the Slovak economy with the euro area, and the more precisely estimated Slovak coefficients. To the degree that shocks affect euro area output gaps on impact and at larger horizons, they create continuous demand pressure in Slovakia. This explains why euro area demand shocks create a positive and decaying response of Slovak output gaps, and a hump-shaped inflation response – just as in the euro area. Supply shocks from the euro area feel like demand shocks in Slovakia for the first one to two quarters, increasing output and inflation. The usual response of falling prices can only be observed after demand spillovers subside because output gaps are closed.

The IRFs thus provide the dynamic counterpart to the coefficient evidence. The coefficient estimates show that the contemporaneous supply and demand schedules changed after euro adoption. The impulse responses show that these changes continue to matter for shock propagation. In an AS–AD interpretation, the sharp decline in the inflation-output ratio following demand shocks is primarily driven by the flattening of the supply curve. The smaller responses to supply shocks reflect the joint flattening of supply and demand curves. On top of this, increased openness and the growing importance of euro area fluctuations result in a greater similarity of responses to euro area shocks. Slovakia therefore did not merely move closer to the euro area in static elasticities. It also began to absorb both domestic and euro area shocks in a more euro area-like way.

Taken together, these results show that convergence went beyond the estimated coefficients. After euro adoption, both domestic and euro area shocks propagated through the Slovak economy in ways that were increasingly similar to those observed in the euro area. Slovakia's post-euro adjustment mechanism therefore moved substantially closer to the euro area benchmark.

4.3 Robustness

This subsection assesses the robustness of the main empirical findings to a range of alternative specifications and identification choices. We focus on the slope of the Phillips curve and the impact inflation-to-output ratio in this section, since they are representative for most of our results.

Across all robustness checks considered, the Slovak Phillips curve moves decisively towards the euro area benchmark after euro adoption, see the statistics reported in Table 2. We find (as in the baseline) that the Slovak Phillips curve is quite steep under the Slovak Koruna, and becomes marginally flatter than in the euro area after 2009. Results also indicate that this development may have been gradual, and that the convergence dynamics flattens the Slovak Phillips curve by more than global trends. Inflation-to-output ratios are consistently around 0.5 for the euro area and Slovakia post 2009, see Table 3. Before 2009, we find a Slovak ratio around 2 for the majority of specification, with some variation depending on the slope of the Phillips curve.

In a first set of robustness checks, we vary the level of detail of the links between Slovakia and the rest of the euro area, see the first block of Table 2. In a first set of model variations, we add direct dependences between the Slovak and euro area economy through *cost-push spillovers* in the Slovak supply curve, an interpretation of NBS rates as the ECB rate plus an *interest spread*, and the explicit inclusion of *imports*. In a second set of variations, we allow for common fluctuations of demand in Slovakia and the rest of the euro area due to global developments (stock market volatility *VSTOXX*, global economic policy uncertainty *log gEPU* or world industrial production growth *world IP growth*). Contemporaneously, these variables enter demand curves, and depend on euro area variables only. In a third set of variation, we treat common sources of supply fluctuations (*oil price growth* and *gas price growth*) similar to the previous group of tests – with the difference that the additional variable enters supply curves instead. More detailed sources of common variation and spillovers does not qualitatively affect our results. In all cases, the slope of the Slovak Phillips curve is almost surely closer to the euro area slope than post euro introduction.

In a second group of tests, we vary the importance of special periods in our data, see

Table 2: Average similarity measures of Phillips curve slopes α^{π}, robustness checks

	P(closer to EA)	Overlap (pre)	Overlap (post)
baseline	99.3%	0.0%	65.2%
cost-push spillovers	96.3%	0.0%	30.1%
interest spread	99.5%	0.0%	65.3%
incl. imports	99.9%	0.0%	93.8%
incl. VSTOXX	99.2%	0.0%	66.4%
incl. log gEPU	99.1%	0.0%	60.2%
incl. world IP growth	96.9%	0.1%	45.3%
incl. oil price growth	99.0%	0.0%	54.5%
incl. gas price growth	95.9%	0.1%	37.2%
drop adj period (07Q1-10Q4)	99.9%	0.0%	87.9%
drop quant manag (99Q1-01Q4)	94.4%	3.1%	67.6%
more crisis dummies	99.9%	0.0%	92.3%
HP filter	98.5%	0.0%	48.3%
separate coefficients, EA	76.6%	9.0%	69.4%

Note: The first column shows the probability that the slope of the Slovak Phillips curve is closer to the EA slope post euro introduction compared to before. The second and third column report the density overlap between the posterior distributions of Slovak (pre/post) and euro area coefficients.

the second block of Table 2. Our results suggest that the slope of the Slovak Phillips curve varies with time – although we cannot document this perfectly in a model that does not allow for full time-varying structural coefficients. We drop a four year adjustment period from 2007Q1 to 2010Q4 altogether from the data, or the three-year period at the beginning of our sample (1999Q1-2001Q4) when the Slovak National Bank still conducted monetary policy through quantitative management of money supply. Convergence is even stronger than in the baseline in the first test, and weaker in the second. This indicates that the slope differences between Slovakia and the rest of the euro are most severe at the beginning of our sample, but already much smaller towards the end of the pre-euro period, after many structural reforms had already been taken. These results reinforce the interpretation that convergence was not confined to the formal adoption of the euro. Rather, the adjustment appears to have unfolded progressively in the years preceding accession, as Slovakia became increasingly integrated into the euro area monetary and macroeconomic environment.

The exclusion of 2007Q1–2010Q4 also removes the global financial crisis, an episode dominated by unusually large macroeconomic disturbances. The third set of checks therefore considers whether the estimated slope is sensitive to the influence of exceptional episodes and to the treatment of low-frequency movements. In the first variation, we extend the outlier-variance treatment used for the pandemic to the global financial crisis and the sovereign debt crisis. In the second, we replace the baseline detrending procedure with HP-filtered cyclical components of Slovak and euro area inflation and interest rates. As discussed in Section 3.4, the latter transformation reduces the influence of the persistent inflation movements surrounding the 2022 energy-price shock. Both specifications continue to imply strong convergence. The different degrees of post-euro overlap suggest that the exact estimated slope is sensitive to the composition of macroeconomic fluctuations: downweighting demand-driven crisis periods produces less overshooting, whereas reducing the influence of the recent supply-driven inflation episode produces somewhat more. These differences affect the magnitude of the post-euro slope but not the conclusion that the steep pre-euro Slovak Phillips curve disappeared.

Our final robustness check allows the euro area coefficients to vary between the pre- and post-euro samples. This specification effectively estimates two separate structural VARs and therefore sacrifices some of the cross-regime pooling used in the baseline. The resulting posterior distributions are consequently less precise, and the probability that the Slovak coefficient moves closer to the euro area coefficient declines to 76.6 percent. Nevertheless, the overlap between the Slovak and euro area slopes rises from 9.0 percent before euro adoption to 69.4 percent afterwards. This implies that Slovakia converges to the same slope than the euro area has. The euro area Phillips curve also flattens in the later sample, but substantially less than the Slovak curve. Slovak convergence therefore cannot be attributed simply to a common flattening of Phillips curves over time.

Table 3: Impact inflation-to-output ratios after demand shocks

	Ratio (pre)	Ratio (post)	Ratio (EA)
baseline	2.00	0.49	0.54
cost-push spillovers	1.86	0.44	0.54
interest spread	2.00	0.50	0.55
incl. imports	1.98	0.47	0.54
incl. VSTOXX	1.99	0.50	0.55
incl. log gEPU	1.99	0.49	0.55
incl. world IP growth	2.03	0.50	0.59
incl. oil price growth	1.83	0.46	0.54
incl. gas price growth	1.66	0.42	0.53
drop adj period (07Q1-10Q4)	4.41	0.56	0.55
drop quant manag (99Q1-01Q4)	1.29	0.49	0.54
more crisis dummies	2.01	0.57	0.56
HP filter	1.95	0.42	0.49

Note: The table reports the median impact inflation-to-output ratio of a demand shock. The first columns contains the ratio for Slovakia before the introduction of the euro, the second column the ratio after the introduction of the euro, and the third column gives the ratio of the euro area for comparison. When we split the euro area in two subsamples, the euro area ratios are 1 (pre 2009) and 0.5 (post 2009).

Having established the robustness of the Phillips curve result, we next examine whether its main implication for the transmission of demand shocks is equally stable. Table 3 reports the impact ratio of the inflation response to the output response. Across all specifications, the post-euro Slovak ratio is close to 0.5 and therefore approximately equal to the corresponding euro area ratio. In specifications retaining the full pre-euro sample, the Slovak ratio remains close to 2, as in the baseline. The estimated pre-euro ratio is higher when we exclude the four-year adjustment period from 2007Q1 to 2010Q4, but lower when we exclude the period of monetary-aggregate targeting from 1999Q1 to 2001Q4. This pattern is again consistent with part of the adjustment having occurred gradually before formal euro adoption.

For completeness, Table C.3 in the appendix reports average similarity measures across the coefficients of the supply and demand equations for each robustness check. These results provide complementary, although less conclusive, evidence than the Phillips curve estimates. Differences in overlap measures arise because the interest-rate semi-elasticity are sensitive to specification choices and to the proximity of the estimated coefficients to zero.

Taken together, the robustness checks provide consistent evidence that the Slovak Phillips curve moved decisively towards the euro area benchmark. The estimated extent of the movement varies across specifications, and some models imply that the post-euro slope overshoots the euro area value. None of the alternatives, however, restores the steep Phillips curve estimated for the koruna period. Moreover, the convergence remains visible after allowing for additional international spillovers, alternative sample periods, different treatments of exceptional observations, and time variation in the euro area benchmark.

5 Conclusion

Using the example of Slovakia, we study how the adoption of the euro and the associated structural reforms was associated with changes in the structural relationships governing inflation, output, and monetary policy. Using a two-country structural VAR with regime-specific restrictions, we compare Slovakia before and after euro adoption with the rest of the euro area. Our results document broad convergence along three interconnected dimensions: structural relationships, the sources of business cycle fluctuations, and the dynamic propagation of shocks.

The clearest change in structural relationships occurs on the supply side. Before euro adoption, the Slovak Phillips curve was substantially steeper than its euro area counterpart. Afterwards, it flattens markedly and becomes quantitatively similar to the euro area curve. As a consequence, the impact inflation-to-output ratio following domestic demand shocks falls from around 2 to approximately 0.5, closely matching the euro area estimate. Demand pressures therefore become much less inflationary and are accommodated increasingly through output adjustment. By contrast, the domestic demand semi-elasticities show only limited convergence. The more important demand-side change operates through Slovakia's growing openness to the rest of the euro area. The elasticity of Slovak demand to euro area activity rises substantially, euro area shocks become central drivers of Slovak output and inflation fluctuations, and the balance between demand and supply disturbances moves closer to the euro area pattern.

The impulse responses show that these changes extend beyond contemporaneous coefficients and the origin of fluctuations. After euro adoption, Slovak output and inflation respond to domestic demand and supply shocks in ways that are substantially closer to the corresponding euro area responses. Slovak responses to euro area shocks also become more similar to the responses observed within the euro area. This dynamic convergence is strongest on impact and for output over the first two years. Inflation responses become more similar mainly at short horizons, while differences in the timing of adjustment remain. The principal findings are robust to alternative treatments of international spillovers, sample composition, and the euro area benchmark. The results also suggest that adjustment began before formal adoption but that the change in the Slovak Phillips curve was substantially larger than the common flattening observed in the euro area.

Although our empirical framework does not separately identify the underlying microeconomic channels, the joint pattern of results is consistent with two complementary mechanisms. First, euro adoption formalized a nominal anchor that had already influenced Slovak monetary policy before 2009. Our estimated policy rule indicates that the NBS depended strongly on ECB interest rates during the pre-euro period. Nevertheless, the Slovak rate remained a domestic policy instrument shaped by the country's own inflation-targeting and exchange-rate-stabilization regime. Formal membership consolidated the euro area nominal anchor by replacing this hybrid instrument with the ECB rate itself. This change is consistent with inflation expectations becoming more firmly tied to the euro area price-stability regime and price setting becoming less sensitive to domestic demand pressures. Second, deeper real integration increased the scope for adjustment through trade and cross-border production networks. It thereby reinforced the shift from price towards quantity adjustment and strengthened the transmission of euro area activity to Slovakia.

Taken together, these findings suggest that euro adoption should be understood not merely as a change in the institution setting the policy rate, but as a broader regime shift affecting the environment in which firms and households make pricing, production, and spending decisions. As a single-country study, our analysis does not imply that monetary integration will produce the same changes in every small open economy. The Slovak experience nevertheless shows how formal currency-union entry can reshape private-sector propagation mechanisms when it consolidates an existing nominal anchor and accompanies deep real integration. Monetary integration can therefore alter both the sources and the transmission of macroeconomic fluctuations well beyond the mechanical loss of an independent policy instrument.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used ChatGPT 5.6 Sol for language editing. The authors reviewed and edited the output as needed and take full responsibility for the content of the published article.

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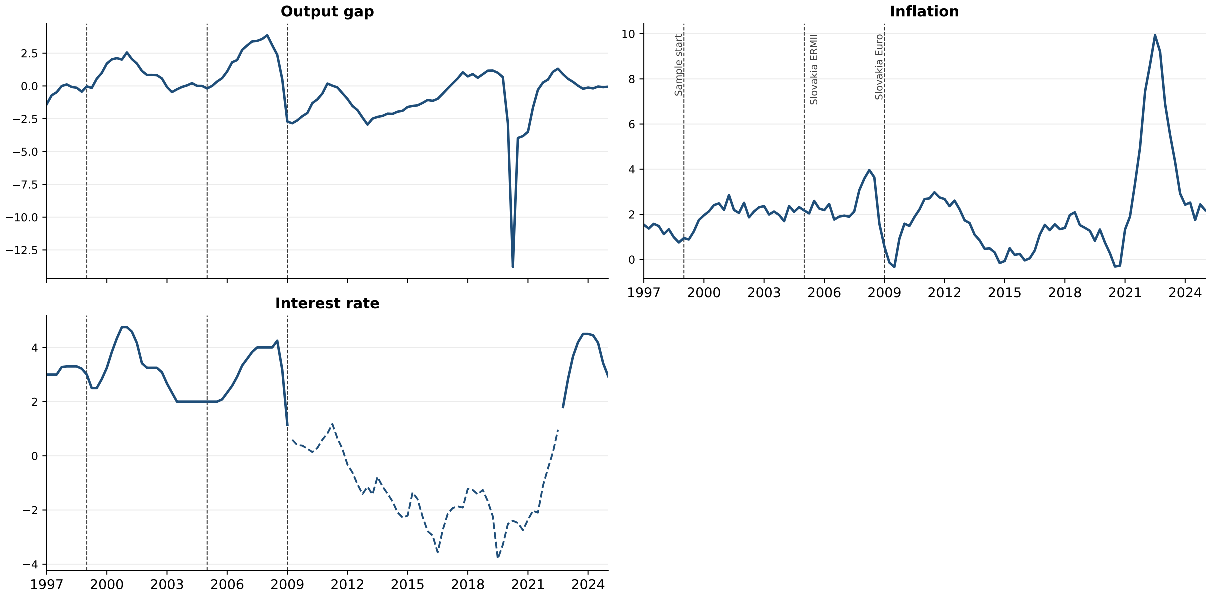
A Data

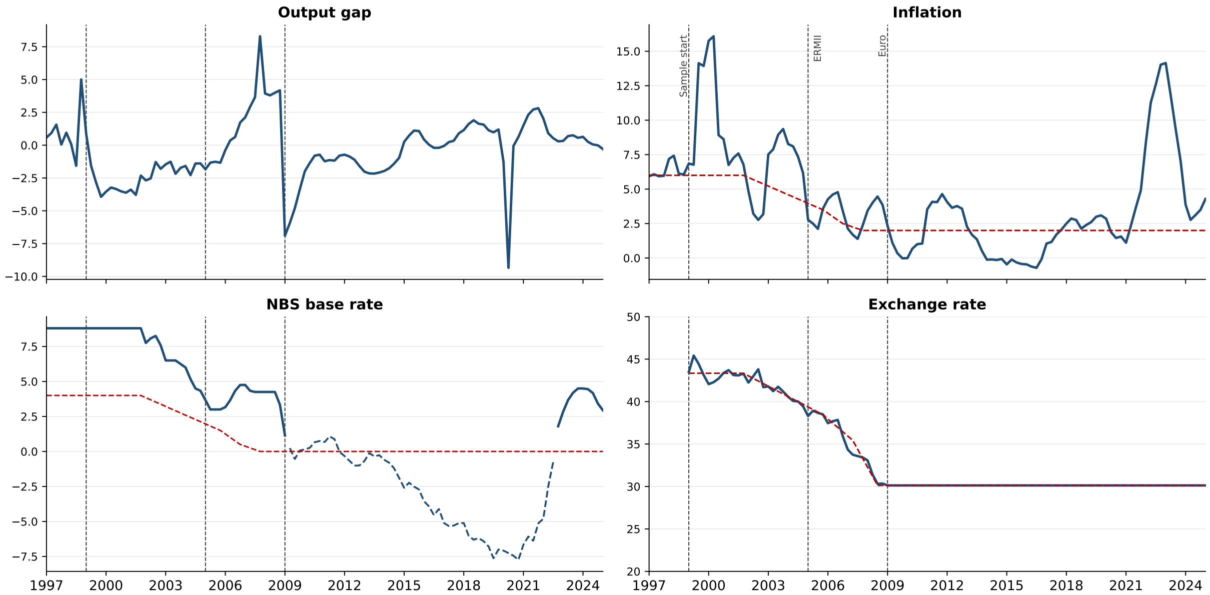
This section provides additional details on the data. Table A gives a data description, Figure A.1 plots EA data, and Figures A.2 and A.3 show original and detrended Slovak data. Section A.1 describes how we combine the pandemic priors of Cascaldi-Garcia (2022) with the structural VAR framework of Baumeister and Hamilton (2015).

Fig. A.1: Endogenous variables, euro area



Note: The original data are shown in blue. During the ZLB (dashed lines), we replace the ECB base rate with Wu-Xia shadow rates.

Fig. A.2: Original endogenous variables, Slovakia



Note: Original Slovak data are shown in blue. We replace NBS base rate with the ECB base rate after 2009. Red dashed lines indicate the time-varying trends explained in section 3.4: π_t^* for inflation, $r_t^* - \bar{r}$ for the NBS base rate and σ_t^* for the exchange rate.

Table A.1: Data description

Variable	Description	Source	Treatment
		Baseline model	
y	output gap	ECB and NBS (confidential)	none
π	year-on-year inflation rate calculated from harmonized indices of consumer prices (all items)	ECB	detrended (SK)
r	monthly policy rates and Wu-Xia shadow rates	ECB, NBS, and Cynthia Wu's website	quarterly average, detrended (SK)
σ	nominal exchange rate, Slovak crowns per euro	Macrobond	quarterly average, detrended
		Robustness checks	
VSTOXX	European stock market volatility	Macrobond	
gEPU	global economic policy uncertainty	Baker et al. (2016)	log
world IP	IP index, OECD + 6 NME	Baumeister and Hamilton (2019)	yoy growth
oil	Crude Oil $/BBl	ECB	yoy growth
gas	Consumer Price Index: Energy for OECD Europe [OECDECPGREN01GYQ]	FRED	yoy growth
		Country weights	
$GDP(real)$	use to calculate *GDP weights* $\omega_{SK}, \omega_{REA}$	Eurostat	average (post-euro)

A.1 Outlier treatment

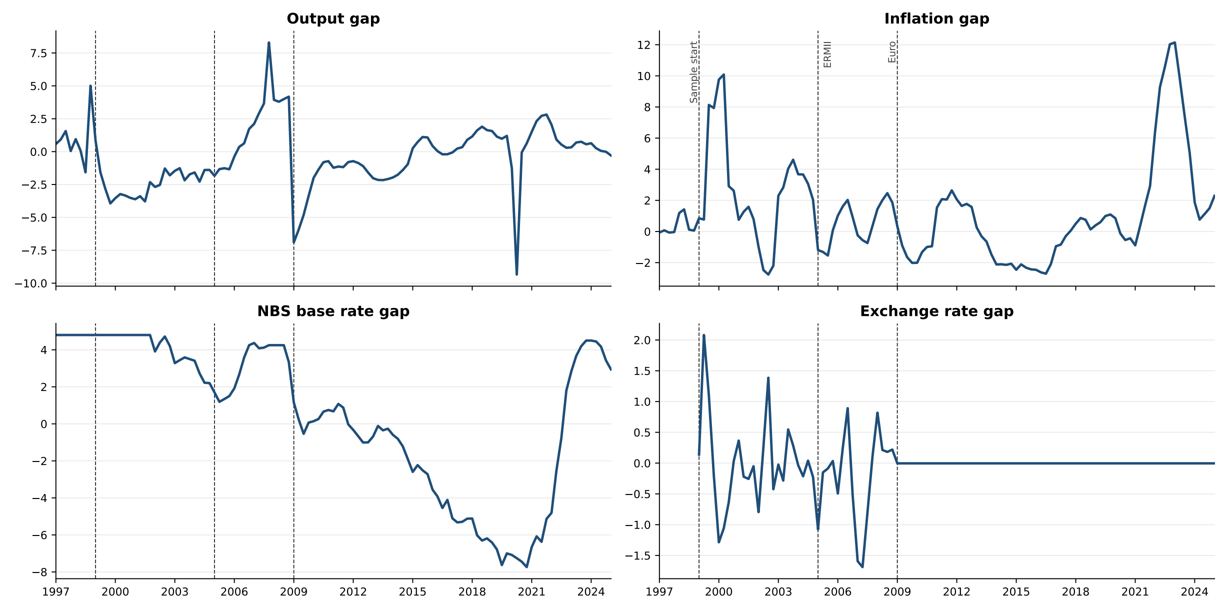
We treat the outliers occuring in periods of extreme fluctuations like Covid using the pandemic priors of Cascaldi-Garcia (2022). These priors use dummy observations for Covid observations in a Minnesota prior framework. By increasing or decreasing the prior precision ϕ of these dummies, we can choose the degree of downweighting. The optimal precision ϕ maximizes the marginal likelihood of the data.

The important feature for us is that the optimal precision ϕ depends on the specification of the reduced form model, and is independent of priors on the structural form. That is, we integrate the approach of Cascaldi-Garcia (2022) into the informative prior framework of Baumeister and Hamilton (2015) by performing the following steps:

- Specify a Minnesota prior for reduced form lags and variances. Include a dummy for Covid observations (2020Q1-2020Q3) with yet-unknown precision ϕ.
- Choose precision ϕ^* that maximizes the marginal likelihood of the data. We find $\phi^* = 0.69$ in the baseline model.
- Use the same Minnesota prior given ϕ^*, together with the priors on structural contemporaneous coefficients $\mathbf{A}$ (see below) to identify the structural VAR.

On top of a single dummy for all Covid observations, we tested individual weights for each period (which effectively removes the observations). We also ran regressions where we used the same approach to reduce the role of observations during the financial crisis (2008Q3-2009Q1) and sovereign debt crisis (2011Q3-2012Q2). Results are robust to these alternative specifications.

Fig. A.3: Detrended endogenous variables, Slovakia



Note: Detrended Slovak data are shown in blue.

B Empirical model

This section summarizes the empirical implementation of the model, including the treatment of sample splits, prior specification, and posterior sampling.

B.1 Dealing with sample splits

To formalize the two-country structural VAR described in the main text, we aim to write the model in matrix notation as

$$\mathbf{A}^{(r)}\mathbf{y}_t = \mathbf{B}^{(r)}\,\mathbf{x}_{t-1} + \mathbf{u}_t, \qquad \mathbf{u}_t \sim \mathcal{N}(0, \mathbf{D}^{(r)}), \qquad r \in \{\text{pre}, \text{post}\}, \tag{B.1}$$

where $r \in \{\text{pre}, \text{post}\}$ indexes the two regimes. The $(n \times 1)$ vector of endogenous variables is $\mathbf{y}_t = (y_t^{SK}, \pi_t^{SK}, r_t^{SK}, \sigma_t^{SK}, y_t^{REA}, \pi_t^{REA}, r_t^{REA})'$. The $(k \times 1)$ vector $\mathbf{x}_{t-1}$ stacks $p = 4$ lags of all endogenous variables and a constant. The $(n \times 1)$ vector of structural shocks $\mathbf{u}_t = (u_t^{SK,s}, u_t^{SK,d}, u_t^{SK,m}, u_t^{SK,\sigma}, u_t^{REA,s}, u_t^{REA,d}, u_t^{REA,m})'$ is independently normally distributed with mean zero and (regime-dependent) variance $\mathbf{D}^{(r)}$.

The notation above brushes across three features of our model: first, the number of endogenous and lagged variables is not identical across structural equations. Second, the number of structural equations is not the same in each regime. Third, the equations in the rest of the euro area are restricted to be equal across regimes in the baseline model. In the following, we break these features down. To do so, we need to introduce some notation first, which we will use to define selection matrices. These selection matrices map the structural model in equation-by-equation form into the matrix notation.

Our baseline model consists of $n_s = 9$ distinct structural equations (indexed j): four Slovak equations in the pre-euro regime, two Slovak equations in the post-euro regime, and three euro area equations that are common across regimes. For each equation j, let $R_j \subseteq \{\text{pre}, \text{post}\}$ denote the set of regimes in which the equation is active. Within each active regime $r \in R_j$, equation j corresponds to a unique type of structural equation $i \in \{1, \cdots, 7\}$, where the first four equations relate to Slovakia (supply, demand, monetary policy and exchange rates) and the last three to the rest of the euro area. Because of the structural break, Slovak supply and demand appears twice. The correspondence between j, r and i by the mappings $m(r,i) = j$ and $i = m^{-1}(r,j)$.

Overall, we have $n = 7$ endogenous variables $\mathbf{y}_t$. However, for Slovakia during the post regime and for equations on the rest of the euro area, this number drops to five as Slovak interest and exchange rates drop out. Let $\mathcal{N}_j \subset \{1,\ldots,n\}$ denote the (sub-)set of contemporaneous variables included in equation j, and $\mathbf{y}_t^{(j)}$ the corresponding vector of endogenous variables. We can formalize these subsets using a selection matrix S_j^y: For each structural equation j, let $\mathcal{N}_j \subset \{1,\ldots,n\}$ denote the (sub-)set of contemporaneous variables included in that equation. Then, the $(|\mathcal{N}_j| \times n)$-matrix S_j^y is the corresponding selection matrix for which $\mathbf{y}_t^{(j)} = S_j^y \mathbf{y}_t$.

We work with three different selection matrices. First, Slovak equations prior to euro introduction include all variables. Second, Slovak equations post euro introduction and REA equations exclude Slovak interest and exchange rates. Third, ECB monetary policy post euro introduction adds size weights for output gaps and inflation.

$$
\begin{aligned}
S_j^y &= \mathbf{I}_7, && j \in \{m(r,i)|r = pre; i \in 1,\ldots,4\} \\
S_j^y &= \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}, && \begin{aligned} j \in \{m(r,i)|(r = pre; i \in \{5,6,7\}) \cap \ldots \\ (r = post; i \in \{1,2,5,6\})\} \end{aligned} \\
S_j^y &= \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ \omega_{SK} & 0 & 0 & 0 & \omega_{REA} & 0 & 0 \\ 0 & \omega_{SK} & 0 & 0 & 0 & \omega_{REA} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}, && j \in \{m(r,i)|(r = post; i = 7)\}
\end{aligned}
$$

Similarly, the vector $\mathbf{x}_t^{(j)}$ contains the subset of variables relevant in equation j from the $(k \times 1)$ vector $\mathbf{x}_{t-1}$ (which stacks $p = 4$ lags of all seven endogenous variables and a constant). We define the $(|\mathcal{K}_j| \times k)$-matrix S_j^x be the corresponding selection matrix that selects the $\mathcal{K}_j \subset \{1,\ldots,k\}$ the (sub-)set of lagged regressors, i.e. $\mathbf{x}_{t-1}^{(j)} = S_j^x \mathbf{x}_{t-1}$. Here, we work with two different selection matrices because we keep the role of lagged variables for ECB monetary policy fixed across regimes.

$$
\begin{aligned}
S_j^x &= \mathbf{I}_k, && j \in \{m(r,i)|r = pre; i \in 1,\ldots,4\} \\
S_j^x &= \begin{pmatrix} kron\left(\mathbf{I}_p, \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}\right) & \mathbf{0}_{|\mathcal{K}_j|-1,1} \\ \mathbf{0}_{1,k-1} & 1 \end{pmatrix}, && \begin{aligned} j \in \{m(r,i)|(r = pre; i \in \{5,6,7\}) \cap \ldots \\ (r = post; i \in \{1,2,5,6,7\})\} \end{aligned}
\end{aligned}
$$

These selection matrices allow us to write the structural equations in vector form

$$
\begin{aligned}
& \mathbf{a}_j^{'} \mathbf{y}_t^{(j)} = \mathbf{b}_j^{'} \mathbf{x}_{t-1}^{(j)} + u_t^{(j)} \\
\Longleftrightarrow & \left(\mathbf{a}_\mathbf{j}^{'} S_j^y\right) \mathbf{y}_t = \left(\mathbf{b}_\mathbf{j}^{'} S_j^x\right) \mathbf{x}_{t-1} + u_t^{(j)}.
\end{aligned}
$$

Using the mapping $j = m(r, i)$, the vectors of structural contemporaneous coefficients $\mathbf{a}_j'$ during the Slovak pre-regime are:

$$\begin{aligned}
\mathbf{a}_{SK,s}^{pre} &= (1,\ -\alpha^{SKK,\pi},\ 0,\ -\alpha^{SKK,\sigma},\ 0,\ 0,\ 0)',\\
\mathbf{a}_{SK,d}^{pre} &= (1,\ -\beta^{SKK,\pi},\ -\beta^{SKK,r},\ -\beta^{SKK,\sigma},\ -\beta^{SKK,y^{REA}},\ 0,\ 0)',\\
\mathbf{a}_{SK,m}^{pre} &= \big(-(1-\rho^{SKK})\psi^{SKK,y},\ -(1-\rho^{SKK})\psi^{SKK,\pi},\ 1,\ ...\\
&\qquad -(1-\rho^{SKK})\psi^{SKK,\sigma},\ 0,\ 0,\ -(1-\rho^{SKK})\psi^{SKK,r^{REA}}\big)',\\
\mathbf{a}_{SK,\sigma}^{pre} &= (-\phi^{\Delta y},\ -\phi^{\Delta\pi},\ -\phi^{\Delta r},\ \phi^{\Delta y},\ \phi^{\Delta\pi},\ \phi^{\Delta r},\ 1)'.
\end{aligned}$$

Slovak interest and exchange rates do not appear in equations j corresponding to the REA (both regimes) or Slovakia post euro introduction. The corresponding $\mathcal{N}_j \times 1$ vectors of structural contemporaneous coefficients are therefore:

$$\begin{aligned}
\mathbf{a}_{SK,s}^{post} &= (1,\ -\alpha^{SKEUR,\pi},\ 0,\ 0,\ 0)',\\
\mathbf{a}_{SK,d}^{post} &= (1,\ -\beta^{SKEUR,\pi},\ -\beta^{SKEUR,y^{REA}},\ 0,\ -\beta^{SKEUR,r})',\\
\mathbf{a}_{REA,s}^{pre} = \mathbf{a}_{REA,s}^{post} &= (0,\ 0,\ 1,\ -\alpha^{REA,\pi},\ 0)',\\
\mathbf{a}_{REA,d}^{pre} = \mathbf{a}_{REA,d}^{post} &= (0,\ 0,\ 1,\ -\beta^{REA,\pi},\ -\beta^{REA,r})',\\
\mathbf{a}_{REA,m}^{pre} = \mathbf{a}_{REA,m}^{post} &= \big(0,\ 0,\ -(1-\rho^{REA})\psi^{REA,y},\ -(1-\rho^{REA})\psi^{REA,\pi},\ 1\big)'.
\end{aligned}$$

Since $\left(\mathbf{a}_\mathbf{j}' S_j^y\right)$ is a $(1 \times n)$ vector (and $\left(\mathbf{b}_\mathbf{j}' S_j^x\right)$ a $(1 \times k)$ vector) for all equations j, we can stack the vectorized structural equations. For each regime r, this results in the matrix formulation in B.1 with:

$$\mathbf{A}^{(r)} = \left(\mathbf{a}_\mathbf{j}' S_j^y\right)_{j=m(r,\cdot)} \qquad \mathbf{B}^{(r)} = \left(\mathbf{b}_\mathbf{j}' S_j^x\right)_{j=m(r,\cdot)} \qquad \mathbf{D}^{(r)} = diag(d_j)_{j=m(r,\cdot)}$$

Note that $\mathbf{A}^{post}$ is a (5×7) matrix. In some instances, squared matrices are needed, for example for the computation of impulse response functions. In this case, we remove the 3rd and 4th column, which correspond to Slovak interest and exchange rates.

In the following, we will first describe our priors for the different elements in $\mathbf{A}^{(r)}, \mathbf{B}^{(r)}, \mathbf{D}^{(r)}$. Afterwards, we will describe the posterior sampler.

B.2 Informative priors on contemporaneous parameters

We implement prior beliefs on the structural contemporaneous coefficients $p(\mathbf{A}^{pre}, \mathbf{A}^{post})$ as in Baumeister and Hamilton (2018). We set a t-distribution with a prior scale of 0.4 and three degrees of freedom for the majority of parameters, allowing for heavier tails compared to a normal distribution. We follow Baumeister and Hamilton (2018) in the prior specifications for the parameters of their closed-economy model, shown in the upper block of Table B.2. For the elasticity of Slovak demand with respect to euro area output, $\beta^{SKK,y^{REA}}$, $\beta^{SKKEUR,y^{REA}}$, we follow the prior specification of Camehl and von Schweinitz (2026). The coefficient $\psi^{SKK,r^{REA}}$ is chosen to be relatively uninformatively centered at zero.

Following Baumeister and Hamilton (2018), we impose two additional sets of priors related to impact responses to economic shocks. For these priors, we use non-dogmatic asymmetric t-distributions with location parameter μ, scale parameter σ, degrees of freedom ν, and shape parameter λ, the latter one controlling the degree of asymmetry. First, we assume for every regime-country combination that the output response to a contractionary domestic monetary policy shock is smaller than the interest rate response

Table B.2: Prior on contemporaneous parameters

Parameter	Prior mode	Prior scale	Restrictions
Parameters set as in Baumeister and Hamilton (2018) for regime-country $c \in \{SKK, SKEUR, REA\}$			
Student-t distribution with 3 degrees of freedom			
$\alpha^{c,\pi}$	2	0.4	≥ 0
$\beta^{c,r}$	-1	0.4	≤ 0
$\beta^{c,\pi}$	0.75	0.4	
$\psi^{c,\pi}$	1.5	0.4	≥ 0, drop for $c = SKEUR$
$\psi^{c,y}$	0.5	0.4	≥ 0, drop for $c = SKEUR$
Beta(2.6,2.6)			
ρ^c	0.5	0.2	$0 \leq \rho^c \leq 1$, drop for $c = SKEUR$
Additional parameters for Slovakia			
Student-t distribution with 3 degrees of freedom			
$\beta^{SKK,y^{REA}}$	0.5	0.4	≥ 0
$\beta^{SKEUR,y^{REA}}$	0.5	0.4	≥ 0
$\psi^{SKK,r^{REA}}$	0	0.4	

($\mu = -0.3; \sigma = 0.5; \nu = 3; \lambda = -2$). This prior leaves 12.5% chance that the output reaction is (in absolute terms) larger than the interest rate response, and a 4.5% chance that it is positive. Second, we set a prior distribution on $\beta^{c,\pi} - \beta^{c,r}(1-\rho^c)\psi^{c,\pi}$ as in Baumeister and Hamilton (2018). In a New-Keynesian model, this element describes the slope of the IS curve after replacing nominal interest rates by the monetary policy rule. Because we assume a negative slope, we use an asymmetric t-distribution with mode $\mu = -0.1$, scale $\sigma = 1$, degrees of freedom $\eta = 3$ and asymmetry parameter $\lambda = -4$, allowing for a 6.5% chance of a positive slope.

B.3 Remaining priors

We use normal-inverse gamma prior distributions for the structural lag and variance coefficients in each equation j, $p(d_j|\mathbf{A}^{pre}, \mathbf{A}^{post})$ and $p(\mathbf{b}_j|\mathbf{A}^{pre}, \mathbf{A}^{post}, d_j)$ (Baumeister and Hamilton, 2018). These priors come from a standard Minnesota prior which is cast into a structural form using the structural contemporaneous coefficients. Priors are defined for all structural equations j. When we calculate these priors, we account for differences in equations and regimes.

Let $\mathbf{S}^{(r)}$ be the variance-covariance matrices of reduced-form residuals from AR(p) regressions of the endogenous variables, and T_r the number of observations in regime r. Let T be the total number of observations. Using the mapping $i = m^{-1}(r, j)$, the prior distribution of structural variances in equation j is given by:

$$p(d_j^{-1}|\mathbf{A}^{pre},\mathbf{A}^{post}) = \gamma(\kappa,\tau_j)$$
$$\kappa = 2$$
$$\tau_j = \kappa \sum_{r\in R_j} \frac{T_r}{T}\mathbf{a}_i^{(r)}\mathbf{S}^{(r)}\mathbf{a}_i^{(r)'}$$

For Minnesota scaling, we require regressor-specific variance estimates constructed from the reduced-form AR(p) residual covariances. Let $s_q^{(r)} \equiv \mathbf{S}_{q,q}^{(r)}$ denote the reduced-form residual variance of variable $q \in \{1,\ldots,7\}$ in regime r, and let $\bar{s}_q \equiv \sum_{r\in\{\text{pre,post}\}} \frac{T_r}{T} s_q^{(r)}$ denote the corresponding observation-weighted pooled variance. For euro area variables we use the pooled variance $\bar{s}_q$ throughout. For Slovak variables, the appropriate regressor scale depends on whether the structural equation is regime-specific or estimated over both regimes: if $R_j = \{r\}$ (Slovak equations) we use $s_q^{(r)}$, whereas if $R_j = \{\text{pre,post}\}$ (REA equations) we use $\bar{s}_q$. We denote the resulting regressor scale by $s_q(j)$.

Let the $n \times k$ matrix η encode standard Minnesota prior means for reduced-form autocorrelation of variables with value 0.75 for the first own lag of the dependent variable and zero otherwise. However, remember that the vector of structural lagged coefficients $\mathbf{b}_j \in \mathbb{R}^{|\mathcal{K}_j|}$ does not include coefficients on excluded variables. Therefore, we rely on the selector matrix S_j^x to pick the right columns of η. Moreover, let us introduce a regressor index $\iota \in \mathcal{K}_j$, and let $q(\iota) \in \{1,\ldots,n\}$ denote the associated variable and $\ell(\iota) \in \{1,\ldots,p\}$ the associated lag order.

Then, the prior distribution of $\mathbf{b}_j$ is (conditional on $\mathbf{A}$ and d_j)

$$p(\mathbf{b}_j|\mathbf{A}^{pre},\mathbf{A}^{post},d_j) = \mathcal{N}(\mathbf{b}_j;\mathbf{m}_j,d_j\mathbf{M}_j)$$
$$\mathbf{m}_j = \left(\mathbf{a}_j^{'}\eta_j\right)^{'}$$

where $\tilde{\mathbf{M}}_j$ is diagonal with ι-th diagonal element

$$\left(\tilde{\mathbf{M}}_j\right)_{\iota,\iota} = \begin{cases} \lambda_0^2 \frac{\lambda(j,\iota)^2}{\ell(\iota)^2} \frac{1}{s_{q(\iota)}(j)} & \text{if } \iota \text{ corresponds to lagged endogenous} \\ 100 & \text{if } \iota \text{ corresponds to constant} \\ \frac{1}{(\phi^*)^2} & \text{if } \iota \text{ corresponds to Covid dummies} \end{cases}.$$

We introduce two different confidence factors: $\lambda_0 = 0.1$ describes our overall confidence in the Minnesota prior, and $\lambda(j,\iota)$ is an additional scaling parameter which we set to 0.1 for Slovak variables in REA equations, and 1 otherwise. This parameter embodies our belief that Slovak developments have little to no influence on euro area economic outcomes.

In the two monetary policy equations, we additionally incorporate our belief that the central banks smooth interest rate adjustments over time. Therefore, we add a second prior for this equation that the first lag coefficient on domestic interest rates should be centered around ρ^{SKK}, ρ^{REA}, and set a variance of $V = 10$ around these two priors (Baumeister and Hamilton, 2018).

B.4 Posterior sampling

Posterior inference is based on a Metropolis-within-Gibbs algorithm that targets the joint posterior distribution

$$p\big(\mathbf{A}^{pre},\mathbf{A}^{post},\{d_j,\mathbf{b}_j\}_{j=1}^{n_s} \mid \mathbf{Y}_T\big)\,.$$

Following Baumeister and Hamilton (2015, 2018) and Camehl and von Schweinitz (2026), marginal posterior draws of the contemporaneous coefficient matrices $\mathbf{A}^{pre}$ and $\mathbf{A}^{post}$ are obtained using a Metropolis–Hastings step, while structural variances d_j and lag coefficients $\tilde{\mathbf{b}}_j$ are drawn from their known conditional posterior distributions.

The marginal posterior density of the contemporaneous coefficients is given by

$$p(\mathbf{A}^{pre}, \mathbf{A}^{post} \mid \mathbf{Y}_T) \propto \; p(\mathbf{A}^{pre}, \mathbf{A}^{post}) \prod_{r \in \{\text{pre,post}\}} \left[\det(\mathbf{A}^{(r)} \mathbf{S}^{(r)} \mathbf{A}^{(r)\prime}) \right]^{T_r/2} \times \prod_{j=1}^{n_s} \frac{|\mathbf{M}_j^*|^{1/2}}{|\mathbf{M}_j|^{1/2}} \frac{(\tau_j)^{\kappa}}{(2\tau_j^*/T_j)^{\kappa_j^*}} \frac{\Gamma(\kappa_j^*)}{\Gamma(\kappa)}, \tag{B.2}$$

where $\mathbf{S}^{(r)}$ denotes the reduced-form residual covariance matrix in regime r. The posterior hyperparameters $\mathbf{M}_j^*$, $\mathbf{m}_j^*$, κ_j^*, and τ_j^* are obtained using standard Bayesian updating formulas for the normal–inverse-gamma model. Because of the independence of structural shocks, we can do this equation-by-equation. In each equation, we can use the appropriate selection matrices S_j^x and the number of observations T_j. Importantly, this differentiates our model from a VAR identified through restrictions on the reduced form, where cross-equation dependencies would not easily allow for differences in the number of regressors and observations across equations.

Conditional on $\mathbf{A}^{pre}$ and $\mathbf{A}^{post}$, the posterior distributions of structural variances and lag coefficients in each structural equation j are given by

$$p(d_j^{-1} \mid \mathbf{A}^{pre}, \mathbf{A}^{post}, \mathbf{Y}_T) \sim \gamma\big(\kappa_j^*, \tau_j^*\big)\,, \tag{B.3}$$

$$p(\mathbf{b}_j \mid \mathbf{A}^{pre}, \mathbf{A}^{post}, d_j, \mathbf{Y}_T) \sim \mathcal{N}\big(\mathbf{m}_j^*,\, d_j \mathbf{M}_j^*\big)\,. \tag{B.4}$$

It is not possible to sample directly from the posterior density $p(\mathbf{A}^{pre}, \mathbf{A}^{post} \mid \mathbf{Y}_T)$. Therefore, we proceed in two steps. First, starting from the posterior mode, we conduct an initial presampling phase with 520,000 draws, discarding the first 400,000 draws as burn-in and retaining every 500th draw. These draws are used to obtain suitable starting values and proposal directions for the final Metropolis–Hastings step. Second, the full posterior sampler retains 20,000 draws (5,000 draws for robustness checks) after a burn-in of 200,000 draws and thinning every 50 iterations.

Trace plots of selected parameters (Figure B.4) and autocorrelation functions of the retained draws (Figure B.5) indicate satisfactory convergence of the algorithm.

C Additional model results

Fig. B.4: Trace plot of structural contemporaneous coefficients

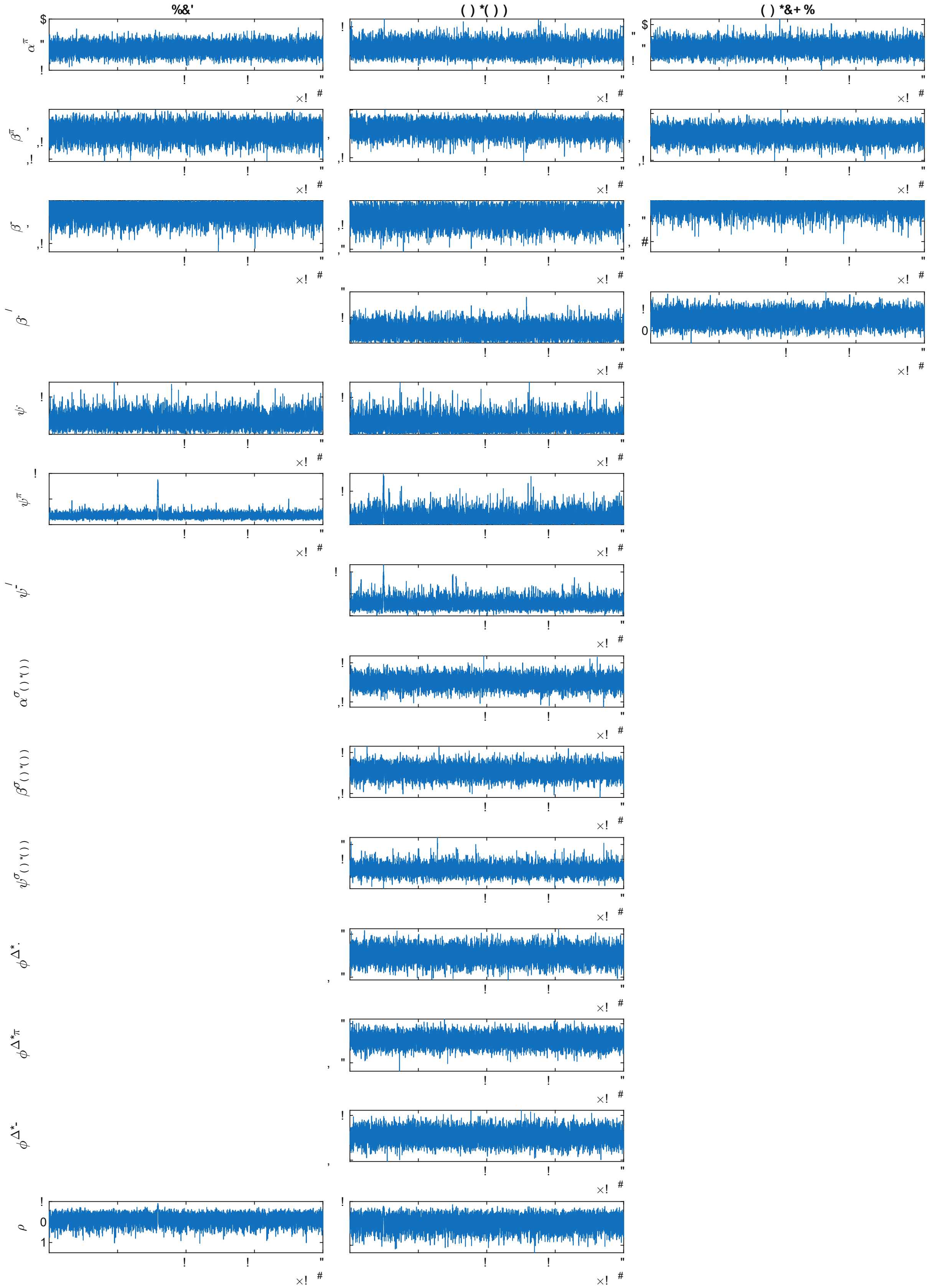


Fig. B.5: Autocorrelation plot of retained draws of structural contemporaneous coefficients

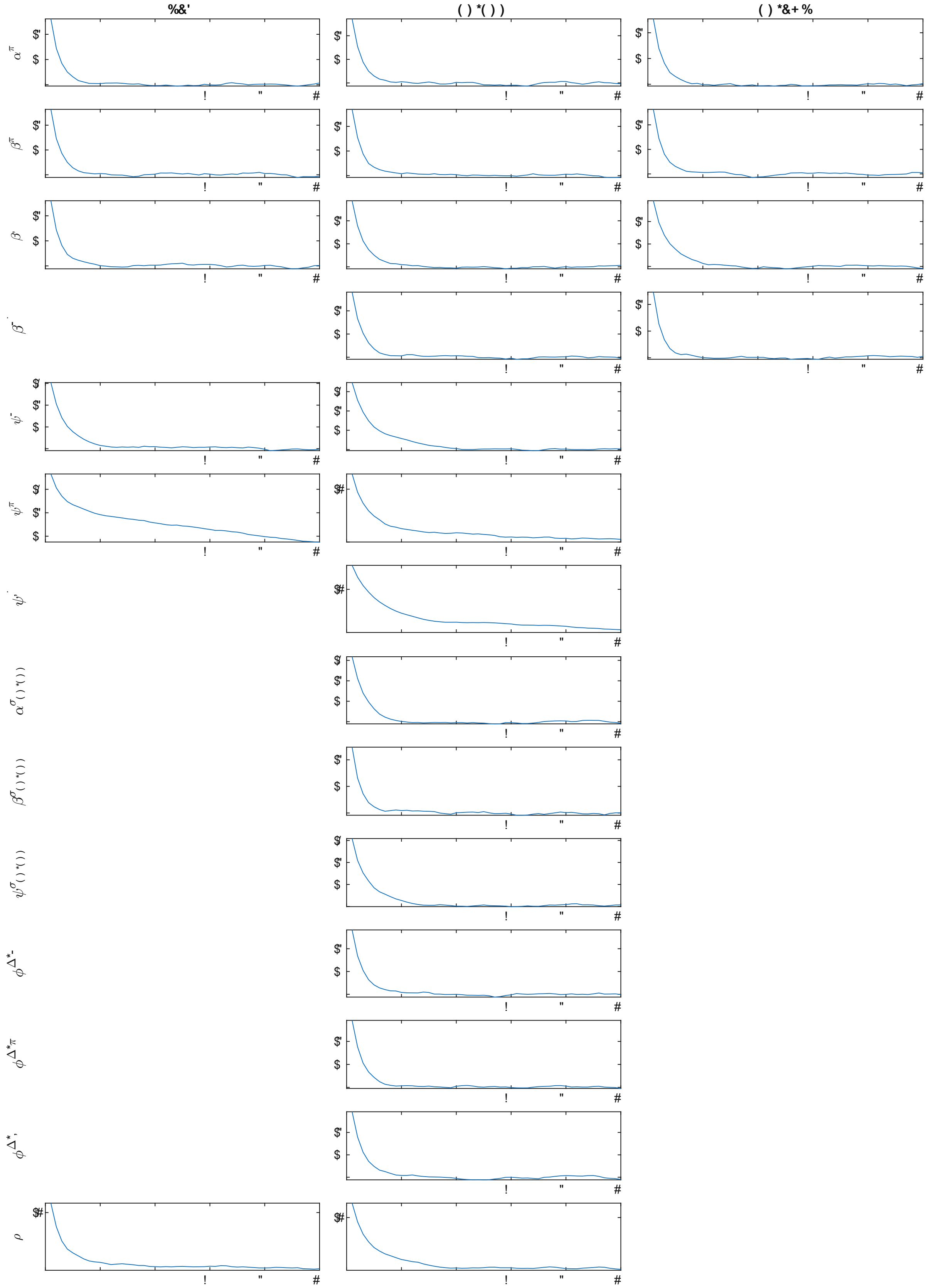
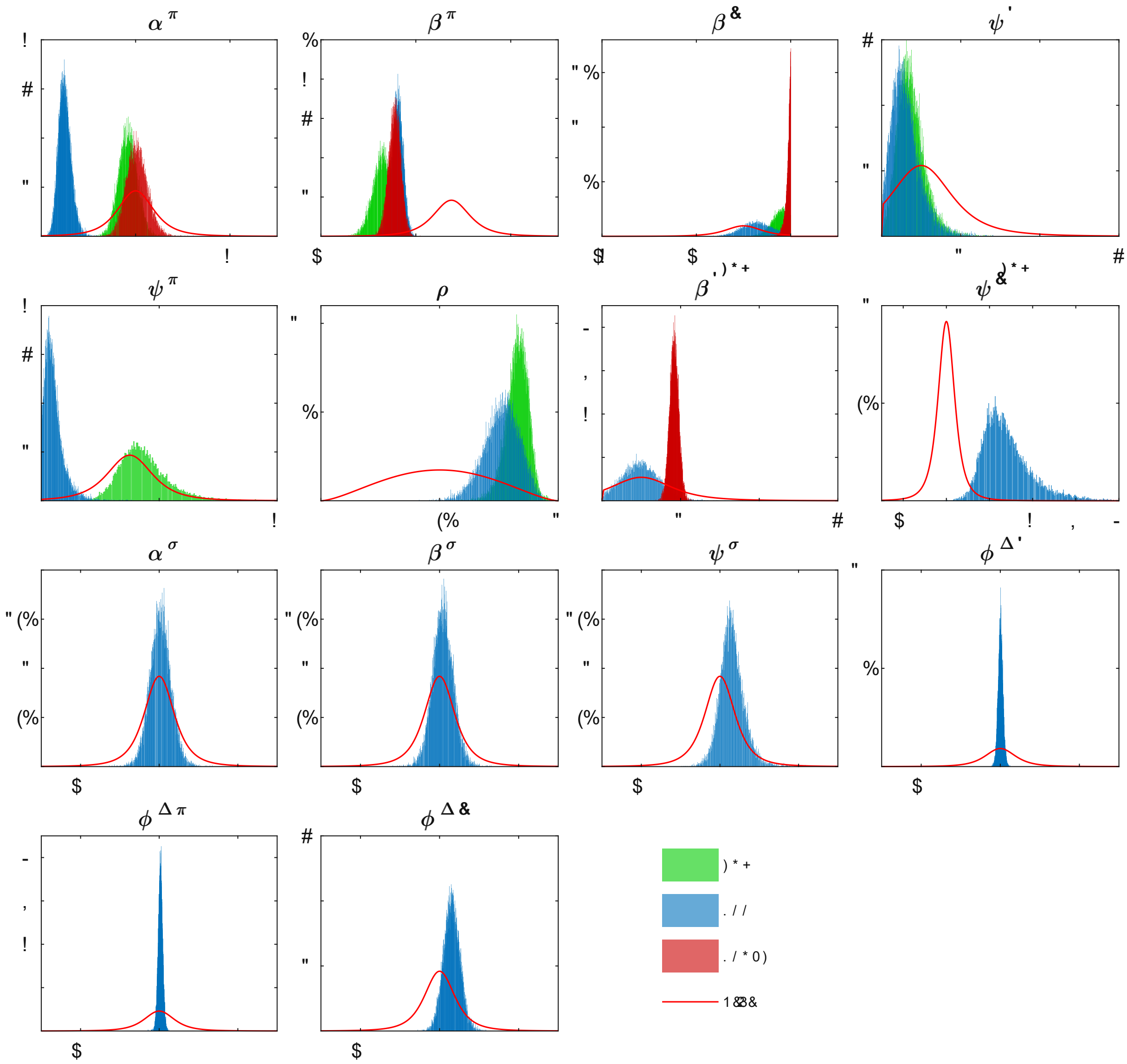
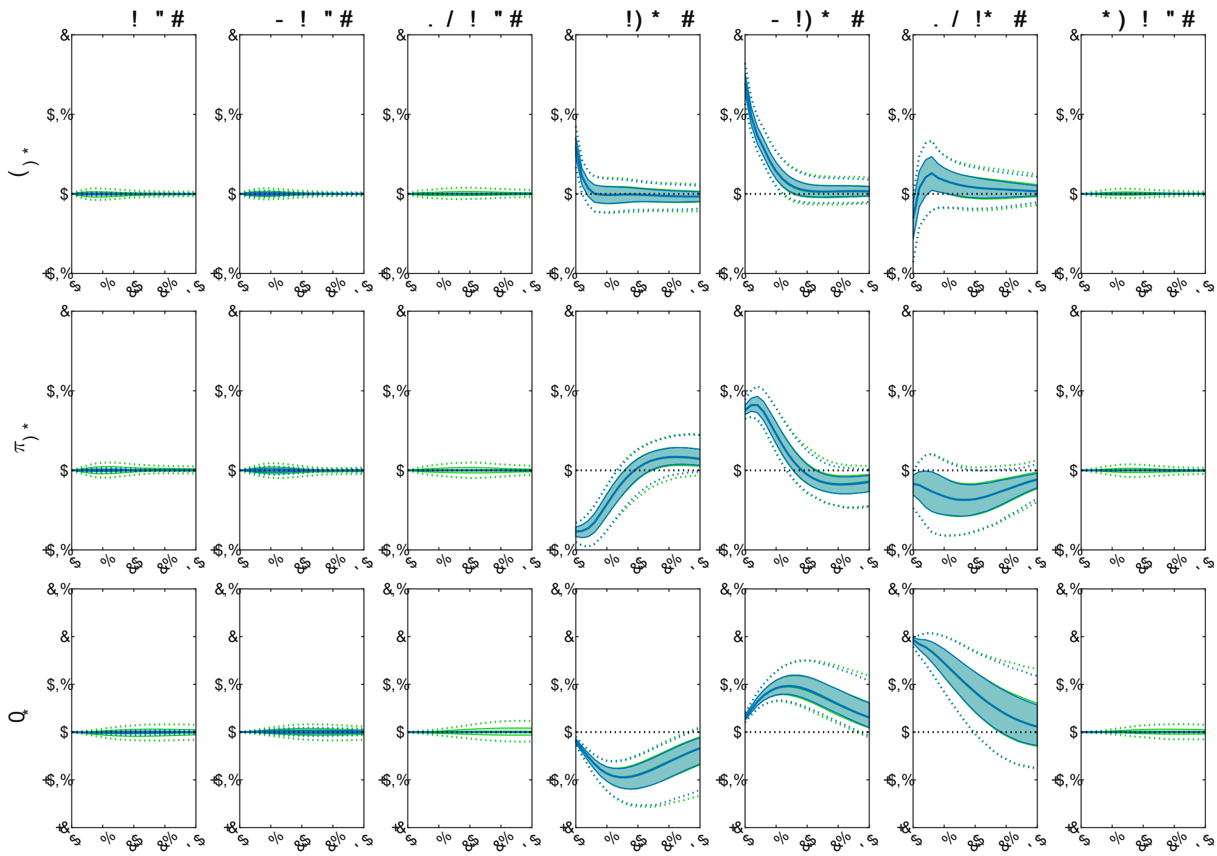


Fig. C.6: Contemporaneous coefficients, all equations



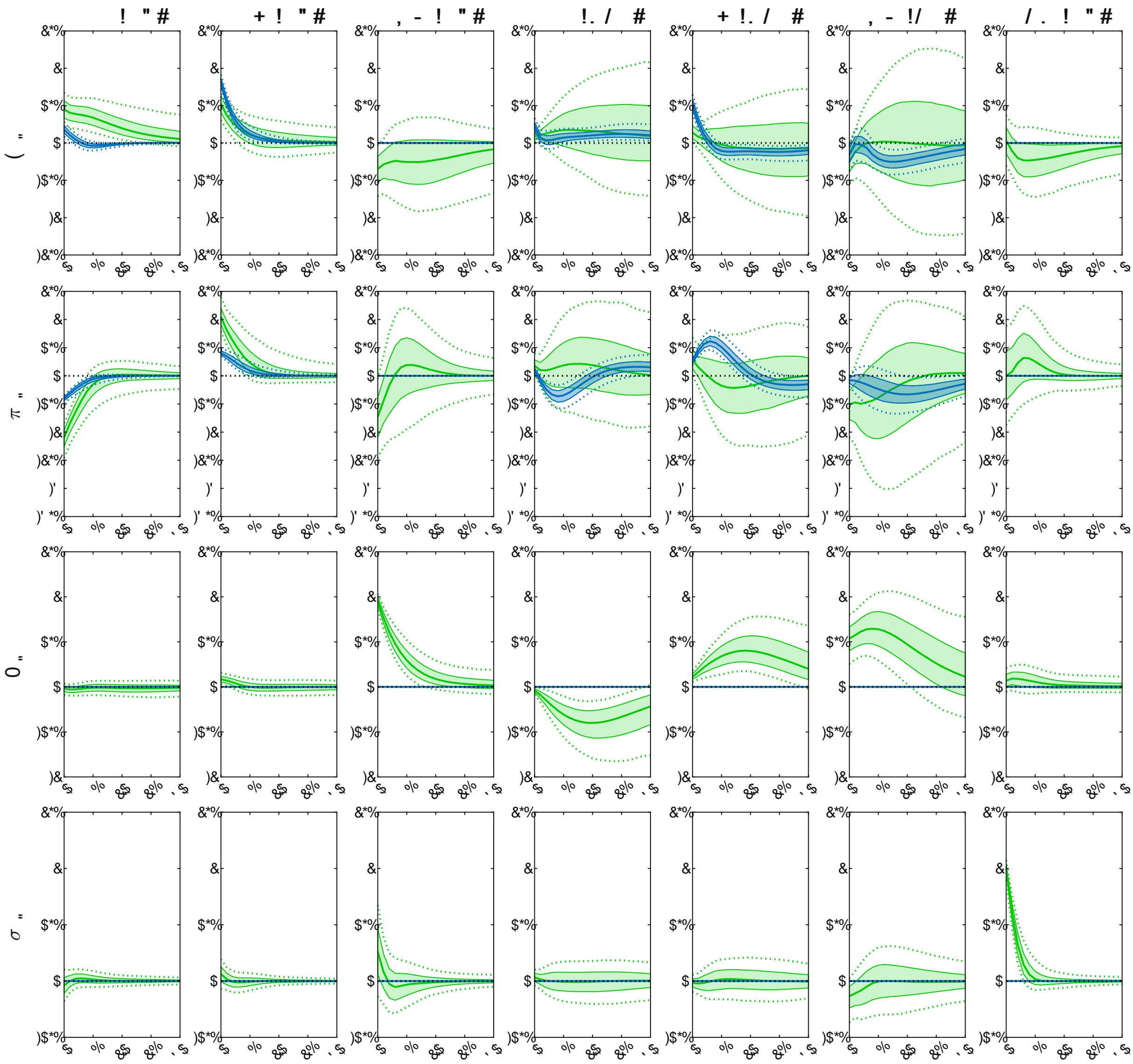
Note: Prior (red lines) and posterior distributions (histograms) of contemporaneous coefficients. Different colors correspond to the euro area, Slovakia in the pre-euro period, and Slovakia in the post-euro period.

Fig. C.7: Impulse response functions to all shocks, rest of the euro area variables



Note: Structural impulse-response functions of euro area variables to one unit structural shocks. Solid green (blue) lines denote posterior medians for the pre-euro (post-euro) subsamples. Shaded regions indicate the 68% posterior credible set, while dotted lines represent the 95% posterior credible set.

Fig. C.8: Impulse response functions to all shocks, Slovak variables



Note: Structural impulse-response functions of Slovak variables to one unit structural shocks. Solid green (blue) lines denote posterior medians for the pre-euro (post-euro) subsamples. Shaded regions indicate the 68% posterior credible set, while dotted lines represent the 95% posterior credible set.

Table C.3: Average similarity measures of structural supply and demand coefficients, robustness checks

	P(closer to EA)	Overlap (pre)	Overlap (post)	Δ(Overlap)
baseline	77.8%	21.6%	47.2%	25.5%
cost-push spillovers	75.5%	21.4%	33.9%	12.4%
interest spread	80.8%	17.9%	46.7%	28.8%
incl. imports	79.1%	20.1%	55.3%	35.2%
incl. VSTOXX	74.8%	25.1%	46.1%	21.0%
incl. log gEPU	75.8%	25.3%	44.5%	19.2%
incl. world IP growth	57.0%	32.8%	24.8%	-8.0%
incl. oil price growth	77.5%	21.1%	40.6%	19.5%
incl. gas price growth	73.1%	20.2%	33.2%	13.1%
drop adj period (07Q1-10Q4)	71.5%	28.0%	41.1%	13.1%
drop quant manag (99Q1-01Q4)	70.0%	33.9%	47.0%	13.1%
more crisis dummies	60.9%	19.7%	42.4%	22.7%
HP filter	84.2%	15.5%	40.7%	25.2%
separate coefficients, EA	42.8%	16.5%	28.9%	12.4%

Note: The first column shows the probability that Slovak coefficients are closer to EA coefficients post euro introduction compared to before. The second and third column report the density overlap between the posterior distributions of Slovak (pre/post) and euro area coefficients. The fourth column reports the gain in overlap between pre- and post-euro periods. For each robustness check, we report the average of statistics across $(\alpha^{\pi}, \beta^{\pi}, \beta^{r})$.