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Giancarlo Corsetti, Keith Kuester, Gernot J. Müller,
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Abstract

We confront the notion that flexible exchange rates insulate countries from external disturbances with new evidence for the euro area (EA) and 20 of its neighbors. Using high-frequency data, we first establish that countries with flexible exchange rates (“floats”) let their currencies depreciate in response to EA monetary policy shocks, while “pegs” raise interest rates. Yet at business cycle frequency, these depreciations do not translate into insulation: floats contract just as much as pegs—not only in response to monetary policy shocks but also to other shocks originating in the EA. This result appears puzzling in light of received wisdom, but we show that it can be rationalized within a state-of-the-art HANK model and flesh out the underlying transmission channels.

Keywords: Exchange-rate regime, Insulation, External shock,
Exchange-rate disconnect, Monetary Policy

JEL-Codes: F41, F42, E31

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1 Introduction

How much insulation can flexible exchange rates afford the open economy? The classics argue: a lot—because the exchange rate operates as a shock absorber which adjusts to soften the impact of external shocks (Eichengreen and Sachs, 1985; Friedman, 1953; Meade, 1951). This view is echoed and reinforced in a number of very recent contributions (Cloyne et al., 2025; Fukui et al., 2025; McLeay and Tenreyro, 2026). Yet skepticism about the virtues of exchange rate flexibility has been building for decades. For one, prices and quantities of internationally traded goods and services are relatively insensitive to currency fluctuations, as exchange-rate pass-through and trade elasticities are low in the short run (Devereux and Engel, 2003; Boehm et al., 2023). Moreover, a U.S.-dominated global financial cycle may constrain monetary policy even under flexible exchange rates (Rey, 2013). Finally, business cycle moments are very similar across exchange rate regimes—an instance of the “exchange rate disconnect” (Baxter and Stockman, 1989; Itskhoki and Mukhin, 2021).

Against this background, we revisit the insulation properties of flexible exchange rates using a data set that is particularly well suited to this question. We analyze spillovers of shocks originating in the euro area (EA) to 20 neighboring countries—a relatively homogeneous group that nonetheless exhibits meaningful variation in exchange rate arrangements vis-à-vis the euro, both across countries and over time, which we exploit in our analysis. We first provide novel high-frequency evidence that countries in our sample classified as “floats” let their exchange rates depreciate against the euro in response to contractionary EA monetary policy shocks, while their interest rates increase considerably less than in the EA and in countries classified as “pegs,” at both the short and long ends of the yield curve. Second, turning to macroeconomic outcomes, we show that economic activity contracts in neighboring countries much as it does in the EA itself: the contraction is virtually identical for pegs and floats, although inflation rises somewhat more among the latter. We find a similar lack of insulation for other EA shocks.

Our finding of no insulation challenges both received wisdom and modern theory. We therefore reconsider the international transmission mechanism in a two-country heterogeneous agent New Keynesian (HANK) model featuring income, intertemporal, and balance sheet channels. Using a theoretical decomposition, we show that household heterogeneity is the key ingredient to rationalize the lack of insulation. On the one hand, it dampens the direct contractionary effects of monetary policy (Kaplan et al., 2018), so that mirroring EA policy under a peg is less detrimental to economic activity. On the other hand, it amplifies the contractionary effects of depreciations under a float through declines in real income (Auclert et al., 2021b) and the revaluation of foreign-currency debt (De Ferra et al., 2020). These forces align the predictions of the calibrated model closely with the empirical evidence.

The sample of European countries on which we base our empirical analysis has several desirable features for studying the insulation properties of flexible exchange rates. First, focusing on the EA as a source of external monetary policy shocks allows us to abstract from a global financial cycle potentially driven by U.S. monetary policy (Ca’Zorzi et al., 2023). Second, there is substantial variation in the exchange rate regimes that neighboring countries maintain vis-à-vis the euro over our sample period, which spans more than 25 years, from the introduction of the euro in 1999 to April 2025. We classify observations as pegs and floats—allowing for changes at a monthly frequency—by binarizing the fine classification of exchange rate regimes proposed by Ilzetzki et al. (2019). In our baseline, about one-third of the roughly 6,200 country-month observations are classified as floats and two-thirds as pegs. Third, the neighboring countries are relatively homogeneous. In the run-up to the euro, the region underwent a sustained process of trade and economic integration, driven by the institutional development of the European Union and a range of trade agreements with neighboring countries outside the EU.

Consistent with this, we find that pegs and floats do not differ materially in their macroeconomic characteristics; for instance, they display similar degrees of openness to trade and financial integration. Unconditionally, business cycle moments are also very similar across the two exchange rate regimes—even though the standard deviation of exchange rate changes is roughly four times higher for floats. In other words, our sample exhibits exchange rate disconnect.

To assess the stabilizing properties of flexible exchange rates, we focus much of our analysis on EA monetary policy shocks as identified by Jarociński and Karadi (2020). These shocks are purged of information effects that are likely to contaminate high-frequency monetary policy surprises (Melosi, 2017; Nakamura and Steinsson, 2018). We build on and extend earlier work by Gürkaynak et al. (2021), who study high-frequency responses of the EUR/USD exchange rate to EA and U.S. monetary policy shocks. We document that the differential high-frequency responses of bilateral euro exchange rates, as well as those of government bond yields at short (two-year) and long (ten-year) maturities, across pegs and floats are consistent with the received wisdom.¹

This lends support to our exchange rate classification and sets the stage for our main analysis of macroeconomic insulation at the business cycle frequency using monthly time series data. In our baseline, we pool the data across neighboring countries, allowing for country fixed effects and country-specific controls. We then estimate impulse responses to an EA monetary policy shock, interacting the shock with a time-varying exchange rate regime dummy.

We find that the economic contraction in the EA—whether measured by industrial

¹This is also consistent with earlier evidence by ter Ellen et al. (2020), who study spillovers of EA monetary policy shocks to Sweden, Denmark, and Norway and find stronger interest rate spillovers for Denmark, which pegs its currency to the euro, than for the floats Sweden and Norway.

production or the unemployment rate—spills over fully to neighboring countries, and does so equally for pegs and floats. Consistent with the high-frequency evidence, we find differential responses of interest rates and exchange rates: interest rates tend to rise in pegs, while exchange rates depreciate in floats. Consumer prices also increase somewhat in floats but not in pegs, consistent with partial exchange rate pass-through. We also broaden the scope of our analysis and show that lack of insulation is not specific to EA monetary policy shocks. To this end, we identify the main EA business cycle shock following Angeletos et al. (2020), as well as the main EA exchange rate shock—that is, the shock that contributes most to fluctuations in the effective euro exchange rate. For both shocks, we find strong spillovers and no evidence of insulation under flexible exchange rates.

In the last part of the paper, we revisit exchange rate insulation in a state-of-the-art open-economy framework. Specifically, within a two-country HANK model, we take the perspective of the neighboring country (“Home”) and study its exposure to a monetary policy shock in the EA (“Foreign”). In our calibration, we discipline the model by relying on earlier work—most notably Auclert et al. (2021b)—as well as on key moments in the data, such as Home’s net foreign liability position (De Ferra et al., 2020). Importantly, however, our calibration does not target the estimated impulse response functions. Yet, the calibrated model closely matches the empirical impulse responses. The model predicts that Home is equally exposed to the shock whether it pegs or floats—there is no insulation under a float. The calibrated model also matches the unconditional moments of the data, featuring exchange rate disconnect.

We offer a theoretical decomposition of the underlying transmission channels that sheds new light on the working of exchange rate regimes. A float does not provide more insulation than the peg when the additional contraction induced by higher interest rates under a peg is matched by the combined effects of a currency depreciation under a float: the expansionary expenditure-switching and export profit channels and the contractionary real income and foreign-currency debt channels. De Ferra et al. (2020) emphasize the latter, while Auclert et al. (2021b) and earlier work by Corsetti et al. (2008) highlight the possibility of contractionary depreciations driven by adverse real income effects. We show that, when expenditure switching is limited, the combination of these two channels with household heterogeneity rationalizes the lack of insulation. Indeed, we find empirically that the responses of exports and imports to EA monetary policy shocks are very similar for pegs and floats, even though import prices rise and export prices adjust in line with standard theory. Importantly, even with limited expenditure switching, a representative-agent (RANK) version of the model cannot account for the lack of insulation.

A novel contribution of our analysis is to highlight the key role of openness in enhancing or limiting insulation. Facing a foreign monetary contraction, greater openness

reduces the adverse demand effects of higher interest rates under a peg, while strengthening the contractionary effects of currency depreciations, especially when these are inflationary. Hence, the more open an economy, the less insulation a float affords relative to a peg. Under our calibration—disciplined by our sample of countries—the level of openness lies at what can be described as a “sweet spot,” where the contractionary effect of a foreign monetary tightening is roughly the same under a peg and a float. For lower levels of openness, the contraction would be smaller under a float, implying insulation, whereas for higher levels it would be larger. Differences in openness thus help reconcile our empirical evidence with that of Cloyne et al. (2025). Studying spillovers from monetary contractions in Germany prior to the introduction of the euro, they find clear evidence of insulation. A key feature of their sample is the substantially lower degree of openness of countries exposed to spillovers.²

The remainder of the paper is structured as follows. We conclude the Introduction by placing our paper in the context of the literature. Section 2 describes our data set. Section 3 presents the evidence, focusing on differences (or the lack thereof) in the behavior of pegs and floats at both high frequency and the business cycle frequency. Section 4 revisits the results in a two-country HANK model. The final section concludes.

Related literature. Our results relate to contemporaneous work that revisits the stabilizing role of exchange rates. In addition to the work of Cloyne et al. (2025), discussed above, Fukui et al. (2025), using annual data for a sample consisting mainly of middle- and low-income countries, find that exchange rate depreciations (against the U.S. dollar) are expansionary, with effects operating primarily through financial channels rather than expenditure switching. McLeay and Tenreyro (2026), in contrast, emphasize the importance of expenditure switching for monetary policy transmission, particularly in commodity-exporting economies. In our sample of EA neighboring countries—that is, predominantly high- and middle-income economies—we find that expenditure switching is largely absent, echoing Fukui et al. (2025). The absence of exchange rate insulation, however, suggests that the expansionary financial channel highlighted by Fukui et al. (2025) may be specific to depreciations against the dominant global currency—the U.S. dollar.³

But earlier work has also highlighted the possibility that exchange rate depreciations can be contractionary (Frankel, 2005), due to declines in real income (for instance Cooper, 1969; Krugman and Taylor, 1978) and adverse balance sheet effects (e.g. Aghion et al., 2001; Kalemli-Ozcan et al., 2016; Krugman, 1999). We show that, when incorporated

²In their sample, openness, measured as the sum of exports and imports relative to GDP, is on average (GDP-weighted) 62.6% (53.5%), compared with 114.2% (81.9%) in our sample.

³For earlier work investigating how output performance depends on the exchange rate regime, both unconditionally and in response to external shocks, see, for instance, Bayoumi and Eichengreen (1994), Broda (2004), Levy Yeyati and Sturzenegger (2003), and di Giovanni and Shambaugh (2008).

into a state-of-the-art HANK model along the lines of Auclert et al. (2021b) and De Ferra et al. (2020), these channels can jointly rationalize the lack of insulation we document for our sample.

Our paper also relates to the literature on spillovers of U.S. monetary policy, see, for instance, Georgiadis (2016) or Degasperi et al. (2024). In this context, global financial conditions have been identified as a key transmission channel, which in turn constrains the policy space in recipient countries. Influential work by Miranda-Agrippino and Rey (2020), in particular, shows that contractionary U.S. monetary policy shocks give rise to a global financial cycle that worsens the policy trade-offs faced by foreign central banks, thereby limiting their ability to insulate their economies under flexible exchange rates. This motivates our focus on Europe. Consistent with this, Miranda-Agrippino and Nenova (2022) find that EA (non-conventional) monetary policy shocks have “sensibly smaller” effects on global financial conditions than U.S. monetary policy shocks.⁴

Finally, there is a growing literature that analyzes the effects of external shocks in HANK models. In addition to the work referenced above, this includes studies of distributional effects in open economies (for instance, Bayer et al., 2024; Giagheddu, 2020; Guo et al., 2023; Oskolkov, 2023) and how these may shape exchange rate policies (Acharya and Challe, 2025). The literature also revisits the international transmission of shocks in open economies (e.g., Druedahl et al., 2025, 2022).

2 Sample and empirical methodology

This section lays the groundwork for the empirical analysis in Section 3. First, we describe the unique sample we build for this study. Then, we explain the empirical methodology we apply. Next, we document the variation in exchange rate regimes that we exploit. Lastly, we present descriptive statistics for the sample.

2.1 Countries in the sample

The sample period begins with the inception of the euro in January 1999 and ends in April 2025. It includes the EA defined as an aggregate of the 11 countries that formed the monetary union in 1999 (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain) and 20 EA neighbors. The latter are Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Greece, Hungary, Iceland, Latvia, Lithuania, Malta, Norway, Poland, Romania, Slovakia, Slovenia, Sweden, Switzerland, and the United Kingdom (UK). By the end of the sample period, the set of EA neighboring countries comprises the entire European Union (EU), plus the UK and

⁴Jarociński (2022) studies transatlantic monetary policy spillovers between the EA and the U.S., with a particular focus on the co-movement of bond yields and the role of information effects.

the three largest countries of the European Free Trade Association (EFTA).⁵ Several of the neighboring countries joined the EA during our sample period, at which point, as we explain below, we classify them as operating a peg vis-à-vis the euro.

This sample choice has three important advantages when mapping our results onto international macroeconomic theory. First, the EA is a large trade bloc, and the euro is freely convertible (unlike the yuan), while the euro is not central to the global financial system (unlike the U.S. dollar). Thus, the transmission of an EA monetary policy shock should comply with “standard” international macroeconomic theory. Second, there is considerable variation in exchange-rate regimes vis-à-vis the euro across and within neighbor countries over time. Third, theory suggests that the exchange rate regime should be the main difference in the transmission of monetary shocks across the 20 neighboring countries, as they are rather homogeneous in terms of institutions, economic development, and policy frameworks.

For a subset of the countries in our sample, minute data are available that allow us to examine high-frequency movements in interest rates and the bilateral exchange rates vis-à-vis the euro around monetary policy announcements. In addition, we collect monthly macroeconomic and financial data for all the countries in our sample. This data allows us to assess the transmission of shocks to the macroeconomies of neighboring countries. Appendix A provides details on the data sources.

2.2 Methodology

We are interested in how EA monetary policy shocks affect neighboring economies and how these effects depend on the neighboring country’s exchange-rate regime vis-à-vis the euro. As the identification of such shocks is outside of the scope of the current paper, we rely on existing work. The monetary policy shocks are taken from Jarociński and Karadi (2020), who combine a high-frequency approach to identification with sign restrictions. Specifically, they capture those surprises in 3-month interest-rate forwards around EA monetary policy events that go in hand with an opposite response of the stock market, covering both the ECB press release and the subsequent press conference.⁶

In Section 3.1, we conduct an event study of the high-frequency effects of these EA monetary policy shocks on exchange rates and interest rates for the EA itself and for neighboring pegs and floats using the minute data. In Section 3.2, we estimate the

⁵The composition of EFTA remained stable throughout the sample period. The EU, however, experienced several waves of accession (and the exit of the UK in January 2020). Free access to the European single market typically predates EU membership by several years. For example, Croatia has had preferential access to the single market since 2000, as formalized by its signing of a Stabilization and Association Agreement with the EU in 2001. This occurred before Croatia applied for EU membership in 2003 and before it joined the EU in 2013. All other neighbors that joined the EU during our sample period had applied for membership prior to 1999.

⁶Specifically, we use the shock series *MP_median*, obtained with the median rotation that implements the sign restrictions, updated to 2025:M04, and downloaded from Marek Jarocinski’s webpage.

transmission of EA monetary policy to neighboring economies at monthly frequency. To this end, we employ local projections of EA monetary policy shocks on the variables of interest, à la Jordà (2005).

2.3 Variation in exchange-rate regimes

Our analysis requires us to classify a neighbor’s exchange-rate regime as either a “float” or a “peg.” We apply this classification to each of the neighbors in our sample, allowing for variation over time at a monthly frequency. In other words, we specify the exchange rate regime of each neighbor for each month in our sample. Rather than relying solely on our judgment, we use the careful work of Ilzetzi, Reinhart, and Rogoff (2019)—referred to as IRR—as much as possible. We corroborate their evidence for our sample of countries, based on a reading of central bank communication, communication by the European Commission through its bi-annual “Convergence Reports,” and the IMF’s Annual Report on Exchange Arrangements. IRR finely classifies the de facto exchange-rate regime for a large sample of countries (including all the neighbors analyzed here) using categories 1 (no separate legal tender or currency union) to 15 (dual market in which parallel market data is missing). No instance of the latter category is in our sample. In the case of a peg, IRR also provide the reference currency. If there is an official exchange rate arrangement, they verify whether the country’s exchange rate against the reference currency follows the preannounced rule. Otherwise, they classify the regime based on its observed exchange rate volatility.⁷

Since we operate under the premise that a flexible exchange rate may provide insulation against external shocks, we use a stringent criterion to classify neighbors as floats. This helps us avoid accidentally labeling what is a peg as a float. We classify as floats only those neighbors in IRR’s categories 9 through 14. At the lower end, category 9 includes neighbors that have broad bands or managed floats against the euro. The upper end includes the three percent of our observations that IRR classify as “freely floating” (their category 13) and a few observations of IRR’s category 14 “freely falling”, namely Romania in 1999/2000. This definition of floats is narrow in the sense that it allows the neighbor countries room to use the exchange rate as a shock absorber. For example, for managed floats, arguably the most restricted category among our floats, IRR require that the exchange rate does not fluctuate by more than two percent *per month* in 80 percent of months over a five-year window. Clearly, this still allows for exchange-rate movements that are larger than two percent in about two months per year, and for notable cumulative changes in the exchange rate. We verify that we observe a great deal of exchange rate flexibility for country-time observations that qualify as a float according to our criterion,

⁷IRR’s classification ends in December 2019. Based on the available evidence, we leave the exchange-rate classification into pegs and floats unchanged for all countries in the subsequent months.

Table 1: Exchange-rate regimes 1999–2025

1999M1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	1	1	1
1999M2	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	1	1
2000M1	0	0	0	1	0	0	0	1	0	1	1	1	1	1	1	0	0	0	1	1
2000M11	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	0	0	1	1
2001M1	0	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	0	1	1
2001M4	0	0	0	1	0	0	0	1	1	1	1	0	1	1	0	0	0	0	1	1
2001M9	0	0	0	1	0	0	0	1	1	0	1	0	1	1	0	0	0	0	1	1
2002M2	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	1
2004M8	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1
2005M1	0	0	0	1	0	0	0	1	1	1	0	0	1	1	1	0	0	0	1	1
2006M7	0	0	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	0	1	1
2008M9	0	0	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	1	1	1
2009M4	0	0	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	1	1	1
2009M7	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1
2011M9	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1
2014M1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1
2015M2	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1
	Bulgaria	Croatia	Cyprus	Czechia	Denmark	Estonia	Greece	Hungary	Iceland	Latvia	Lithuania	Malta	Norway	Poland	Romania	Slovakia	Slovenia	Sweden	Switzerland	United Kingdom

Notes: rows report the exchange-rate regime for a month in which there is a change of the exchange-rate regime for at least one country relative to previous month. Darker cells (1) indicate a floating exchange rate, while lighter cells (0) indicate a peg, including eurozone membership; floats are categories 9 through 14 in the fine classification of Ilzetzki et al. (2019).

see Figure A.1 in Appendix A.

Table 1 provides a compact overview of how we sorted the monthly country-time observations according to their exchange-rate regime. Each column refers to one of the 20 neighboring countries in our sample. Each row corresponds to a month in which the classification for at least one country changes relative to the previous month. In the table, the darker cells indicate a float, and the brighter cells indicate a peg, including membership in the EA. Under our baseline specification, 2,209 out of 6,320 observations, or about 35 percent, qualify as a float.

Examples. Discussing a few examples best illustrates the nature of our classification. More details can be found in Appendix B. We are interested in whether a country’s exchange rate is flexible vis-à-vis the euro. The clearest cases for a floating exchange rate regime are the UK, Norway, Poland, and, for the largest part of the sample period,

also Iceland.⁸ Bulgaria is a clear-cut example of a peg. Throughout the sample period, it operates a currency board under which its currency is pegged to the euro (prior to joining in January 2026). Next to Bulgaria, the clearest case of a peg outside the EA in our sample period is Denmark, which operated a hard peg throughout.

Malta’s case, in turn, demonstrates how we handle a neighbor’s transition toward euro membership. As a stepping stone to euro membership, a country must maintain a stable exchange rate against the euro for a period of time. Namely, under the Maastricht Treaty’s convergence criteria (now codified in Article 140 (1) of the Treaty on the Functioning of the European Union), adopting the euro requires “the observance of the normal fluctuation margins provided for by the exchange-rate mechanism of the European Monetary System, for at least two years, without devaluing against the euro,” where the latter is typically interpreted as a policy-induced devaluation out of intent. In principle, the exchange-rate mechanism allows for the exchange rate to fluctuate in a band of $\pm 15\%$ around an agreed exchange rate between the euro and the country’s currency, and this is what Malta announced on May 2, 2005 when entering the Exchange Rate Mechanism (ERM). In practice, neighboring countries that aim to eventually adopt the euro operate with much tighter bands. Indeed, the exchange rate of the Maltese lira against the euro was essentially constant during Malta’s ERM membership, as shown in Figure A.1 in the Appendix.

In January 2008 Malta joined the EA. Throughout, we assume that Malta and other late adopters of the euro are too small relative to the EA economy as a whole to materially affect policy decisions or the EA macroeconomy, and we therefore continue to treat them as neighbors even as they join the euro. At the end of the sample period, the combined GDP of all late adopters was less than five percent of the EA’s GDP.⁹ Once in the euro, we classify Malta and the other late adopters of the euro as having a hard peg to the euro.¹⁰ In robustness analysis, nonetheless, we exclude Greece and Cyprus from the sample because they may have had a non-negligible effect on EA policies during the sovereign debt crisis. However, we find that the results are basically unchanged relative to the baseline.

2.4 Descriptive statistics

This section reports descriptive statistics for the neighboring countries. We first show that pegs and floats do not differ systematically in terms of standard determinants of

⁸In the early part of the sample, Lithuania maintained a soft peg vis-à-vis the US dollar; this, in turn, implies that its currency fluctuated against the euro. Hence, we classify it as a float during this period.

⁹During the sample period, the euro became legal tender in eight countries of our sample: in Greece (2001), Slovenia (2007), Cyprus (2008), Malta (2008), Slovakia (2009), Estonia (2011), Latvia (2014), Lithuania (2015), and Croatia (2023).

¹⁰Indeed, with the exception of Latvia, all ERM members that eventually joined the euro are classified as operating a peg throughout the sample period.

Table 2: Pegs vs. Floats

Panel A: Potential determinants of the exchange-rate regime									
	Peg			Float					
Size (percent of EA GDP)	0.9			4.8					
Trade openness (percent of GDP, goods and services)	112.7			116.7					
Trade vis-à-vis EA (percent of GDP, goods only)	47.9			35.5					
Capital account openness (Chinn–Ito index)	1.9			2.0					
Terms of trade volatility	5.7			5.3					

Panel B: Business cycle moments in the data									
	EA			Float			Peg		
	σ_x	$\rho_{x,Y}$	$\rho_{x,x-1}$	σ_x	$\rho_{x,Y}$	$\rho_{x,x-1}$	σ_x	$\rho_{x,Y}$	$\rho_{x,x-1}$
Y_t	2.11	1.00	0.69	4.30	1.00	0.81	4.80	1.00	0.87
i_t	1.28	0.41	0.95	1.92	0.42	0.92	1.85	0.30	0.90
π_t	0.48	0.36	0.61	0.87	0.30	0.54	0.85	0.28	0.48
$\Delta\mathcal{E}_t$	—	—	—	3.61	-0.04	0.16	0.96	-0.06	0.12
Comovement with EA				ρ_{x,x^*}		ρ_{x,Y^*}	ρ_{x,x^*}		ρ_{x,Y^*}
Y_t				0.63		0.69	0.54		0.54
i_t				0.70		0.28	0.57		0.14
π_t				0.43		0.25	0.63		0.28
$\Delta\mathcal{E}_t$				—		-0.01	—		-0.03

Notes: Panel A reports averages across pegs and floats, based in turn, on annual averages for size (1999–2024), trade openness measured as the sum of exports and imports in percent of GDP (since 2002 only) and capital-account openness (1999–2023); country-years classified as floats if country floats for at least one month of the year. Capital-account openness is measured using the Chinn–Ito index (Chinn and Ito, 2006). Terms-of-trade volatility is the standard deviation (in percent) over 2002–2024, with countries classified as float if they operate a float in more than 50 percent of the sample. Panel B reports unconditional quarterly moments (1999:Q1–2025:Q1), detrended using a quadratic trend, averaged across countries within each group (minimum 10 observations per regime). $\Delta\mathcal{E}_t$ is the quarter-on-quarter percent change in the nominal exchange rate; Y_t log GDP; i_t annualized nominal interest rate; and π_t quarter-on-quarter CPI inflation. For each variable x , the table reports σ_x , $\rho_{x,Y}$, and $\rho_{x,x-1}$; where applicable, the bottom panel reports ρ_{x,x^*} or ρ_{x,Y^*} . Romania in the early 2000s is excluded from interest-rate volatility due to it being an outlier exceeding 10 standard deviations.

the exchange-rate regime. We then show that, unconditionally, exchange-rate disconnect characterizes the neighboring-country sample.

The choice of the exchange-rate regime is, in principle, endogenous—a point recognized at least since Mundell (1961). We therefore, first, revisit the determinants that the literature identifies as predictors of regime choice in larger cross-country samples (e.g. Levy Yeyati et al., 2010). Panel A of Table 2 reports the results. We find no large differences between pegs and floats, except that floats are larger, on average, than pegging

countries, consistent with earlier findings.¹¹

Second, we examine business-cycle statistics more broadly, including comovement with the EA. Panel B of Table 2 report variances and cyclical moments at a quarterly frequency for the EA, for floating neighbors, and for pegging neighbors. At the bottom of Panel B we also report the comovement of the latter two groups with the EA.¹² The focus is on GDP, the nominal interest rate, inflation, and changes in the nominal exchange rate. Business-cycle fluctuations are more volatile in the small open neighboring economies than in the EA, as reflected in the standard deviation of GDP in the top panels. In addition, two features of the moments for floating regimes stand out. First, as expected, nominal exchange rates are substantially more volatile under floating than under pegging regimes. Second, at least unconditionally, pegs and floats do not appear materially different in any other dimension.

3 Evidence

This section provides novel evidence on insulation—or rather, the lack thereof. Throughout, we treat the EA both as source of monetary policy shocks and as (potential) anchor country to neighboring countries that peg or float. As discussed above, we estimate the EA response to its own shock focusing on the original 11 EA members.¹³ Section 3.1 provides novel evidence on the high-frequency responses of exchange rates and interest rates to monetary announcements in the EA. The evidence on asset price and currency responses aligns with conventional wisdom: floats behave like floats and pegs behave like pegs. Section 3.2 then asks what this means for macroeconomic insulation and at longer time horizons. The main finding is that the response of economic activity is not materially different for pegs and floats.

3.1 High-frequency responses to EA monetary policy shocks

In this section, we build on Gürkaynak et al. (2021), who document high-frequency responses of the EUR/USD exchange rate to EA and U.S. monetary policy shocks, extending their analysis in two key respects. First, we present evidence on the high-frequency responses of bilateral euro exchange rates of the neighbor currencies (where data are available), distinguishing between pegs and floats. Second, we also study the response of government bond yields at short (two-year) and long (10-year) maturities, distinguish-

¹¹This difference partly reflects the United Kingdom, whose GDP is approximately 20 percent of EA GDP. Excluding the UK reduces the average size of a floating neighbor to 2.5 percent of EA GDP.

¹²We use quarterly data because these moments are used to calibrate the model in Section 4.

¹³Appendix A provides details on how we construct aggregate time series for the EA. In any case, as stressed in the previous section, late adopters of the euro (which are pegs in our classification) have a small weight in EA GDP. Thus, results for the standard EA time-series with changing composition are very similar.

ing again between pegs and floats. Thus, we obtain an initial indication of potential differences in the monetary stance across exchange rate regimes.

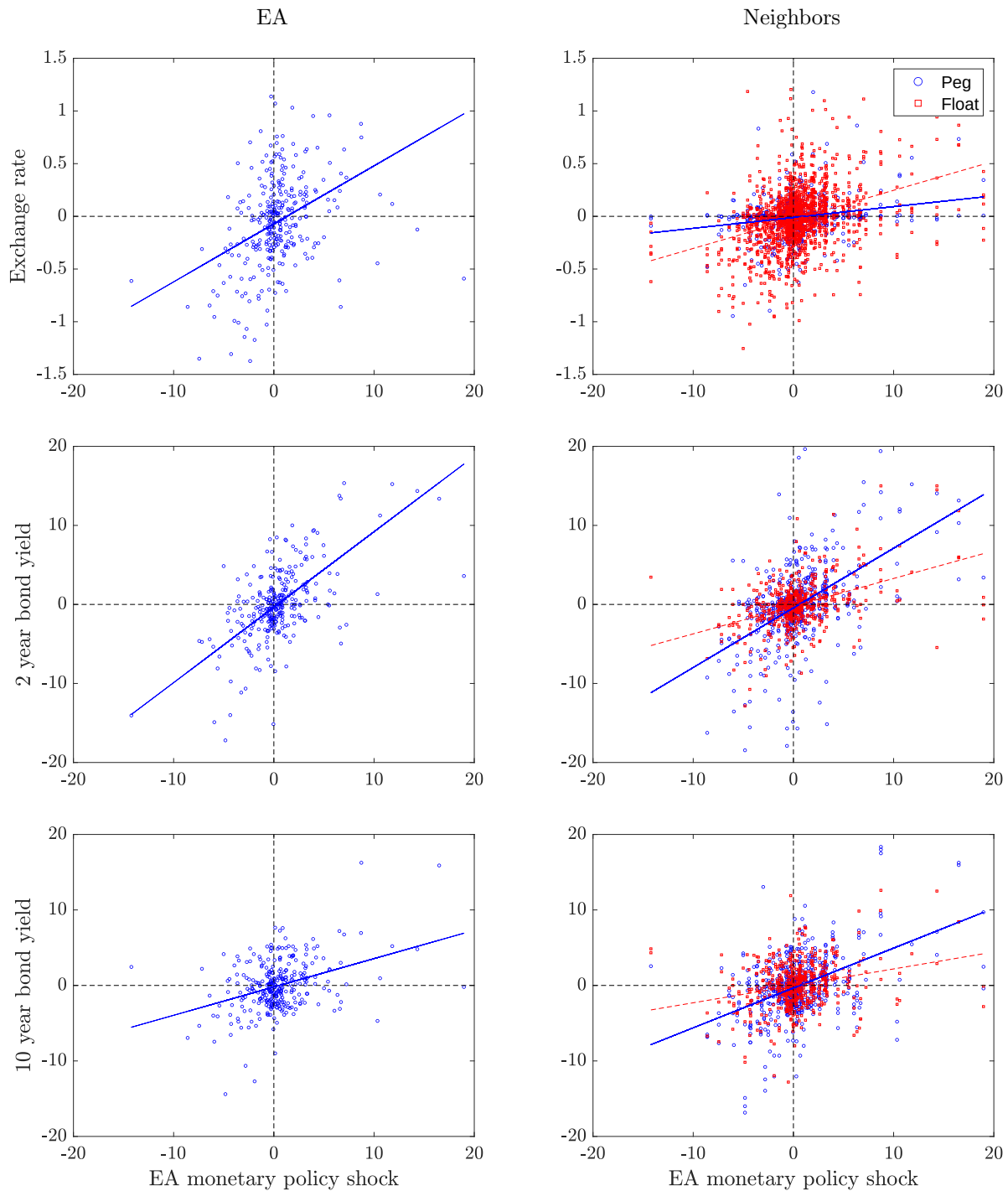
Figure 1 shows the results. On the vertical axis, the panels measure changes in exchange rates and government bond yields within the monetary policy event window (in percent and basis points, respectively) and on the horizontal axis, they measure the monetary policy shock identified by Jarociński and Karadi (2020), in basis points. For the EA (left column), the top panel shows the response of the EUR/USD exchange rate (defined as U.S. dollars per euro). For the neighboring countries (right column), we report bilateral exchange rates vis-à-vis the euro (defined as units of the neighbor’s currency per euro), distinguishing floats (red squares) from pegs (blue circles) based on the classification scheme introduced above. Each point marks an observation of the exchange-rate change in the event window on one event day. To illustrate the findings more clearly, each panel also shows regression lines. The fitted regression lines exhibit the expected patterns. For exchange rates, a surprise tightening of EA monetary policy leads to an appreciation of the euro against both the U.S. dollar (left panel, blue solid line) and the currencies of floating neighbors (right panel, red dashed line), as reflected by the upward-sloping regression lines. However, the slope of the regression line is flatter for the currency of the neighbor countries, relative to the U.S. dollar.¹⁴ In contrast, the regression line for currencies pegged to the euro (right panel, blue solid line) is nearly flat, corroborating our regime classification: pegs behave like pegs, also conditional on EA monetary policy shocks. Table C.1 in the Appendix presents the estimated coefficients and standard errors from the event-study regressions.

Next, consider the responses of two-year government bond yields in the second row and of 10-year bond yields in the third row, respectively. For EA government bond yields, due to the lack of a common safe asset, we use the yield on the German Bund as a proxy. An unexpected tightening of monetary policy in the EA leads to an increase in EA yields with the short end responding more than the long end, as expected. The bond yields of neighboring countries with a peg behave similarly to the German bond yields. However, the bond yields of floating neighbors respond considerably less to EA monetary policy shocks, at both the short and the long end. This lack of interest rate alignment suggests that floats are taking some advantage of the additional degree of freedom provided by a flexible exchange rate.

The question is whether this use of the “degree of freedom” actually provides insulation from EA monetary policy shocks. For this, we have to “zoom out” and turn to lower-frequency data. Before turning to this in the next section, we offer a first indication—again based on high-frequency responses to a monetary policy shock: We find that

¹⁴Some individual exchange-rate responses do not display the expected sign. In certain cases, a surprise tightening of EA monetary policy coincides with a euro depreciation—a phenomenon stressed by Gürkaynak et al. (2021), too, for the response of USD/EUR exchange rate to U.S. and EA target surprises.

Figure 1: Exchange rates and government bond yields around monetary policy events



Notes: Horizontal axis measures EA monetary policy shocks (measured in basis points) due to Jarociński and Karadi (2020); vertical axis measures associated changes in exchange rates (in percent) and government bond yields (annualized, in basis points) around monetary event window, see Appendix A.1 for details. For EA (left) we show USD/EUR exchange rate and German government bond yields. Peg/float (right) classification allows for changes at monthly frequency, see Section 2.3, for country coverage see Appendix A.1. Solid/dashed lines are regression lines fitted to the data shown in the scatter plots.

a surprise tightening of EA monetary policy tends to lead to a decline in stock prices both in Germany and in EA neighboring countries, even as they float their currencies against the euro, thus providing suggestive evidence of a lack of insulation (see Figure C.1 in the Appendix).

3.2 Dynamic adjustment to EA monetary policy shocks

To assess whether a flexible exchange rate provides insulation, we use local projections and estimate how the 20 neighbors in our sample adjust dynamically to EA monetary policy shocks.¹⁵ More specifically, we estimate the projection

$$x_{n,t+h} = \alpha_{n,h} + \mathbf{z}'_{n,t} \cdot \boldsymbol{\beta}_h + \gamma_h^p (1 - \mathbb{I}_{n,t-1}) \epsilon_t^{EA} + \gamma_h^f \mathbb{I}_{n,t-1} \epsilon_t^{EA} + u_{n,t+h}. \quad (1)$$

Here $x_{n,t+h}$ is the dependent variable of interest for neighbor n in period $t + h$. $\alpha_{n,h}$ is a neighbor fixed effect for horizon h . $\mathbf{z}_{n,t}$ is a vector of controls. As controls we include 12 lags of both, the EA monetary policy shock and the dependent variable. In addition, we include U.S. monetary policy shocks, U.S. industrial production, and U.S. consumer prices.¹⁶ The time series of the controls are neighbor-specific, but we apply the same number and type of controls to each neighbor. Accordingly, $\boldsymbol{\beta}_h$ is a conforming vector that is identical for all neighbors. The indicator variable $\mathbb{I}_{n,t-1}$ indicates the exchange-rate regime of neighbor n at time $t - 1$. It is equal to one when neighbor n operates a flexible exchange-rate regime vis-à-vis the euro at date $t - 1$ and zero otherwise. ϵ_t^{EA} is the EA monetary policy shock. The error terms $u_{n,t+h}$ are allowed to be heteroskedastic and correlated both in the cross section of neighbors and over time. We compute robust standard errors as in Driscoll and Kraay (1998). We emphasize that our shock measure ϵ_t^{EA} is a generated regressor. The standard errors that we show later are asymptotically valid under the null hypothesis that the coefficients γ_h^p and γ_h^f are zero (Pagan 1984, Coibion and Gorodnichenko 2015).

We will compare the estimated impulse responses $\{\gamma_h^p\}_{h=0}^H$ and $\{\gamma_h^f\}_{h=0}^H$ with those obtained from the corresponding local projections for the EA:

$$x_{t+h}^{EA} = \alpha_h^{EA} + \mathbf{z}_t^{EA'} \boldsymbol{\beta}^{EA} + \gamma_h^{EA} \epsilon_t^{EA} + u_{t+h}^{EA}, \quad (2)$$

¹⁵Recall that the sample of monthly observations ranges from 1999:M01 to 2025:M04, yielding a maximum of $T = 316$ observations for each country. We miss some observations for some countries. The monetary policy shock measure of Jarociński and Karadi (2020) is aggregated to the monthly frequency by summing over all shocks within a given month and displayed in Figure C.2.

¹⁶For the U.S. variables, the specification includes two lags of each variable and the contemporaneous U.S. monetary policy shock. As shown in the robustness analysis below, controlling for U.S. variables generally does not materially affect the results, see Figure E.1. We nevertheless include these controls in the baseline specification to account for the dominant role of the dollar in shaping global co-movement (Georgiadis et al., 2025).

where we again allow the error terms to be heteroskedastic and serially correlated.

Figures 2.A and 2.B show the results, comparing the responses of selected macroeconomic and financial variables in the EA (left column) and the responses in the neighboring countries (right column). Here the blue solid line shows the response for pegs, and the red dashed line shows the response for floats. Shaded areas indicate 90 percent confidence bounds. The figures show the responses to a contractionary one-standard deviation monetary policy shock in the EA. In each panel, the horizontal axis measures time in months while the vertical axis measures the deviation of a variable from its pre-shock level in percent or in percentage points.

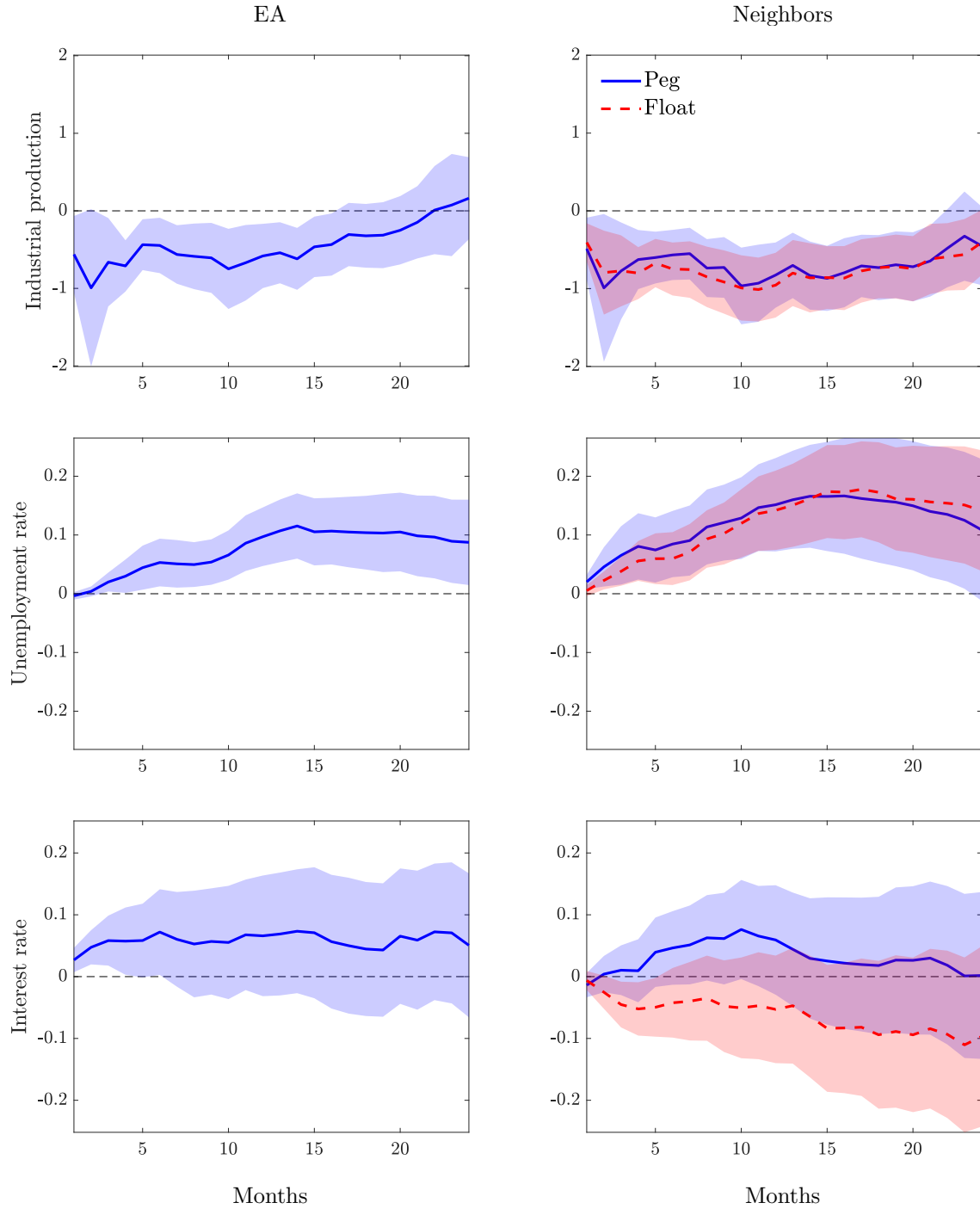
The first two rows of Figure 2.A show the responses of two key indicators of real activity that are available at a monthly frequency: industrial production and the unemployment rate. According to the point estimates, a one-standard-deviation monetary contraction in the EA reduces EA industrial production by about one percent (top-left panel) and the unemployment rate rises by about 0.1 percentage point (second row, left). As expected, the shock affects neighbors that *peg* to the euro in much the same way as the EA itself, as shown in the right panels. What is surprising, instead, is that, contrary to the received wisdom, there are also sizable spillovers to the neighbors that let their currencies *float* against the euro. In other words, there is no evidence that flexible exchange rates insulate economic activity in neighboring countries. The contraction for floats (dashed lines in the right panels) is no weaker than for pegs (solid lines in the right panels).

At these lower frequencies, the monetary policy response keeps being different across currency regime. The bottom row of Figure 2.A displays the interest rate response, which, in case of the EA we again proxy by the German Bund yield. As our sample period covers a decade marked by a broad set of unconventional monetary policies in the euro area—including asset purchase programs and forward guidance—we rely on the one-year rate as an indicator of the monetary policy stance (Gertler and Karadi, 2015). Its response is shown in the bottom-left panel (in annualized percentage points): it increases persistently by about 5 basis points. The spillovers from this change in the EA’s monetary stance are clearly detectable in the interest rates of neighboring countries.¹⁷ As with the high-frequency responses shown above, we see short-term interest rates rise for pegs (bottom-right panel, solid line), while they actually decline over time in countries that float (dashed line).

Figure 2.B shows the response of two additional variables. The top row shows the adjustment of consumer price inflation, which is measured by the log change of the harmonized consumer price index (HICP) on a year-over-year basis and expressed in

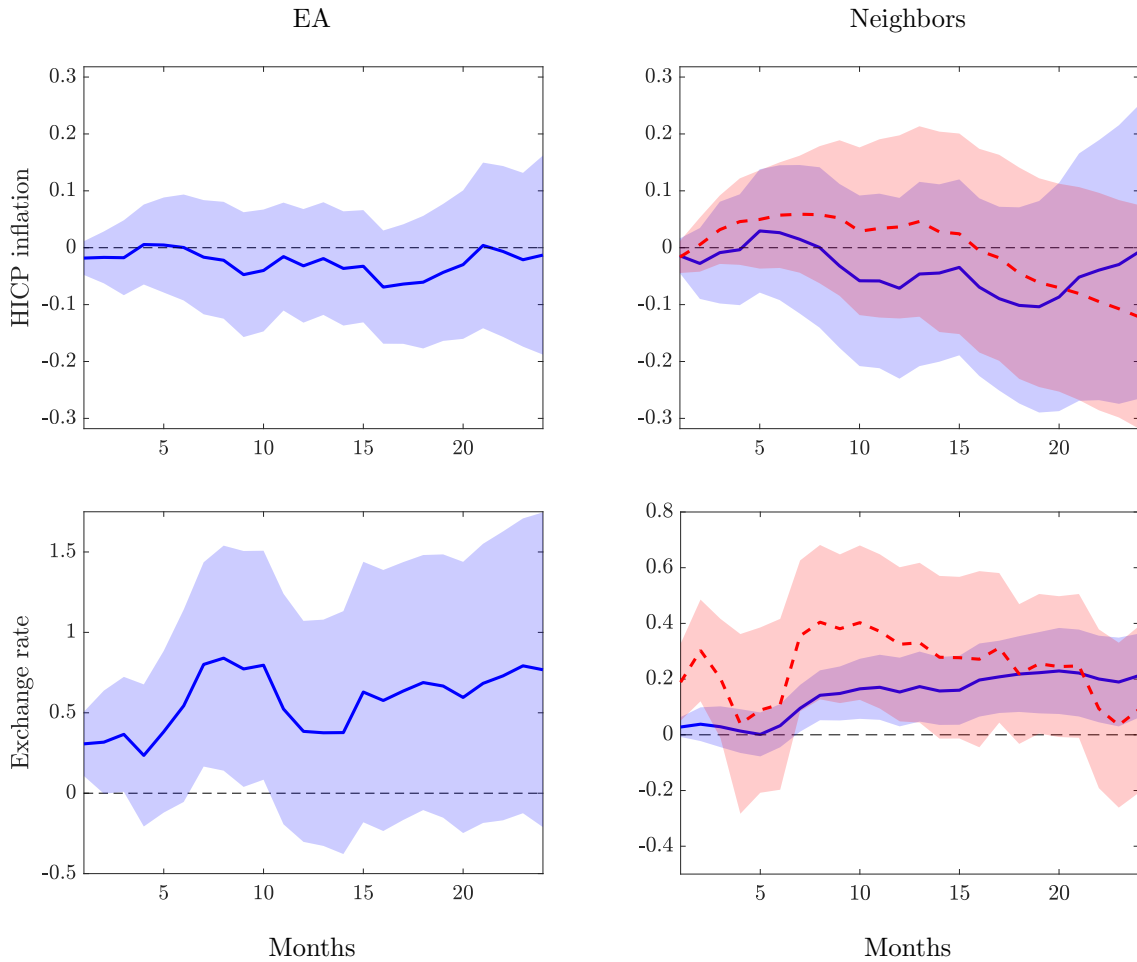
¹⁷Here we rely on short-term rates because their sample coverage is broader than that of one-year rates.

Figure 2.A: Adjustment to EA monetary policy shock



Notes: one-standard deviation shock identified by Jarociński and Karadi (2020); lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Horizontal axis is time in months, vertical axis measures deviation in percent/percentage points. Right column: solid (blue) line is estimate for peg, dashed (red) line is estimate for float. Bottom panel shows response of interest rates (annualized pp.); left: one-year bund rate; right: short-term interest rate.

Figure 2.B: Adjustment to EA monetary policy shock c'd



Notes: same as Figure 2.A. The bottom panel shows the response of the euro-USD exchange rate (left) and the neighbors' bilateral euro exchange rate (right): price of euro in dollar or neighbor currency.

percent. In response to the shock, consumer price inflation falls slightly in the EA. But the response is weak and not significant. The response in neighboring countries is also weak, but while inflation tends to fall in countries that peg, consumer prices tend to rise in countries that float.

The second row of Figure 2.B shows the responses of the exchange rate, which is defined, as above, as the price of the euro in either U.S. dollars (left) or the currencies of neighboring countries (right) and measured in percentage deviations from the pre-shock level. As expected, in response to the contractionary monetary shock in the EA the euro appreciates persistently both against the dollar (left panel) and against the currencies of neighboring countries that float (red dashed line, right panel). Instead, in line with the construction of our sample, there is no economically significant response of the exchange rate among neighbors that maintain a (hard or soft) peg (blue solid line, right panel). As with the high-frequency responses shown in Figure 1 above, the response of the euro against the floaters' currencies is weaker than against the dollar. That said, floaters'

currencies depreciate by about 0.4 percent against the euro, and this depreciation is fairly persistent.¹⁸ Appendix D.1 shows responses of exports and imports of the neighboring countries, and of the corresponding prices. For pegs and floats alike, exports and imports fall by similar amounts, implying rather stable net exports. This is the case in spite of sizable differences in the corresponding price dynamics, where for floats import prices rise, and export prices fall after a foreign monetary tightening (and the devaluation in the home country), as predicted by standard theory.

Robustness. We verify that our results are robust across a number of alternative specifications. First, we check that the spillovers to floats are not driven by financial conditions, which may themselves respond to EA monetary policy shocks, by including the VIX and the VSTOXX as controls in our empirical specification (Miranda-Agrippino and Rey, 2020; Rey, 2013).¹⁹ In this context, we also explore whether the results are driven by large shocks and the extent to which our findings depend on U.S. variables that enter our baseline specification as control variables. In all instances, we find that the spillovers to floats are not systematically weaker than the spillovers to pegs, see Appendix E.1.

Second, we assess the robustness of the results with regard to the classification of the exchange-rate regime. We omit intermediate regimes (the 15% of country-month observations from our sample for which the classification of IRR is between 5 and 9) or use ERM2 membership as a criterion. We find that differences relative to the baseline are moderate only—as one would expect when the exchange-rate regime has little bearing on the extent of spillovers; see Appendix E.2.

Third, we look at different subsets of countries. First, we select countries that consistently peg or float throughout the entire sample period and compute the mean group estimate. Next, we exclude all EMU accession countries or run the regressions on a subsample of only Central and Eastern European countries as well as on a subsample which excludes precisely these countries. Lastly, we extend our sample to include additional pegs (from Africa) and floats (from Asia). The results in all these cases are very similar to the baseline; see Appendix E.3.

Fourth, we consider the role of the sample period and the specification. The results are very similar when we exclude Cyprus and Greece from the sample. Their role in the EA sovereign debt crisis, therefore, is not a driving force behind our results. In another specification, we drop observations for the years 2008–09, years that are dominated by the global financial crisis. The output responses are generally smaller, but both pegs and floats continue to track the EA’s response. We also document that the lag length chosen

¹⁸In the working paper version of this paper, which relied on a shorter sample, we found the exchange rate response of floaters to be insignificant (Corsetti et al., 2021).

¹⁹In a distinct exercise, we investigate whether EA monetary policy shocks induce significant movements in the VIX or the VSTOXX as measures of the global financial cycle. We find that they do not; see Appendix D.2.

for the controls is inconsequential. Appendix E.4 provides details.

Finally, we verify that alternative measures of EA monetary policy shocks yield results similar to our baseline. In this context, we also assess whether pegs and floats vis-à-vis the euro respond differently to U.S. monetary policy shocks. In this case, both groups float against the dollar and hence we expect similar spillovers across pegs and floats. This is indeed what we find, further corroborating our assumption of homogeneity between pegs and floats among euro-area neighboring countries; see Appendix E.5.

In sum, our main result regarding (the lack of) insulation in the face of EA monetary policy shocks is robust across a wide range of alternative specifications: spillovers from EA monetary policy shocks on its neighbor countries are no smaller for countries with flexible exchange rates than for countries which peg their currencies to the euro.

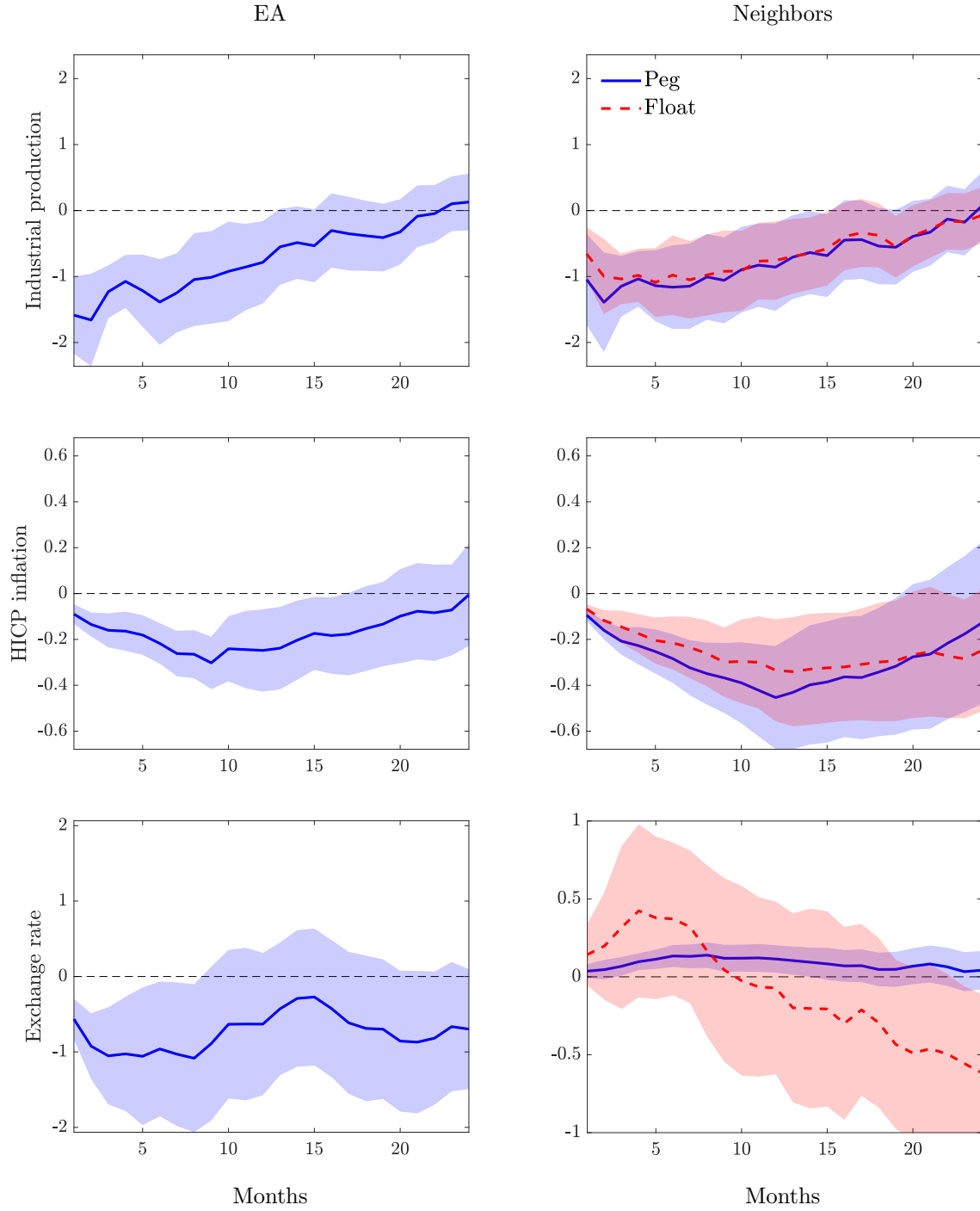
3.3 Other shocks

This result raises the question of whether the failure of exchange-rate insulation under floats is conditional only on EA monetary shocks, or whether it is a general feature in our sample. To address this issue, we identify the *main business-cycle shock* for the EA as the shock that accounts for the largest share of the volatility of industrial production over the frequency band associated with the business cycle.²⁰ This approach follows Angeletos et al. (2020), who identify the main business-cycle shock in U.S. data. They emphasize that the resulting shock may be understood as a linear combination of *several* structural shocks, which makes it particularly well suited to assessing whether the lack of insulation observed in the EA’s neighboring economies extends beyond monetary policy shocks.

To proceed, we first estimate a Bayesian VAR model for the EA using monthly time series data for the five variables shown in Figures 2.A and 2.B, and then extract the main business-cycle shock along the lines of Angeletos et al. (2020), see Appendix F for details. We estimate the same local projections as for the monetary policy shock above, that is, equations (1) and (2), to trace the adjustment dynamics to the EA main business cycle shock in the EA and its neighbors. Figure 3 shows the results for a contractionary main business cycle shock in the EA. The panels are organized as in Figure 2, with results for the EA shown in the left column and those for the neighbors in the right. Here, as before, the blue solid line represents the adjustment of pegs and the red dashed line of floats. The top panels show sizable adverse spillovers: as industrial production falls sharply and persistently in the EA, industrial production contracts also strongly in neighboring countries. Importantly, as with monetary policy shocks, responses do not differ across exchange rate regimes—there is no evidence of insulation for floats. Also, unemployment rises, and interest rates fall in the EA, and for pegs and floats alike (see Appendix F).

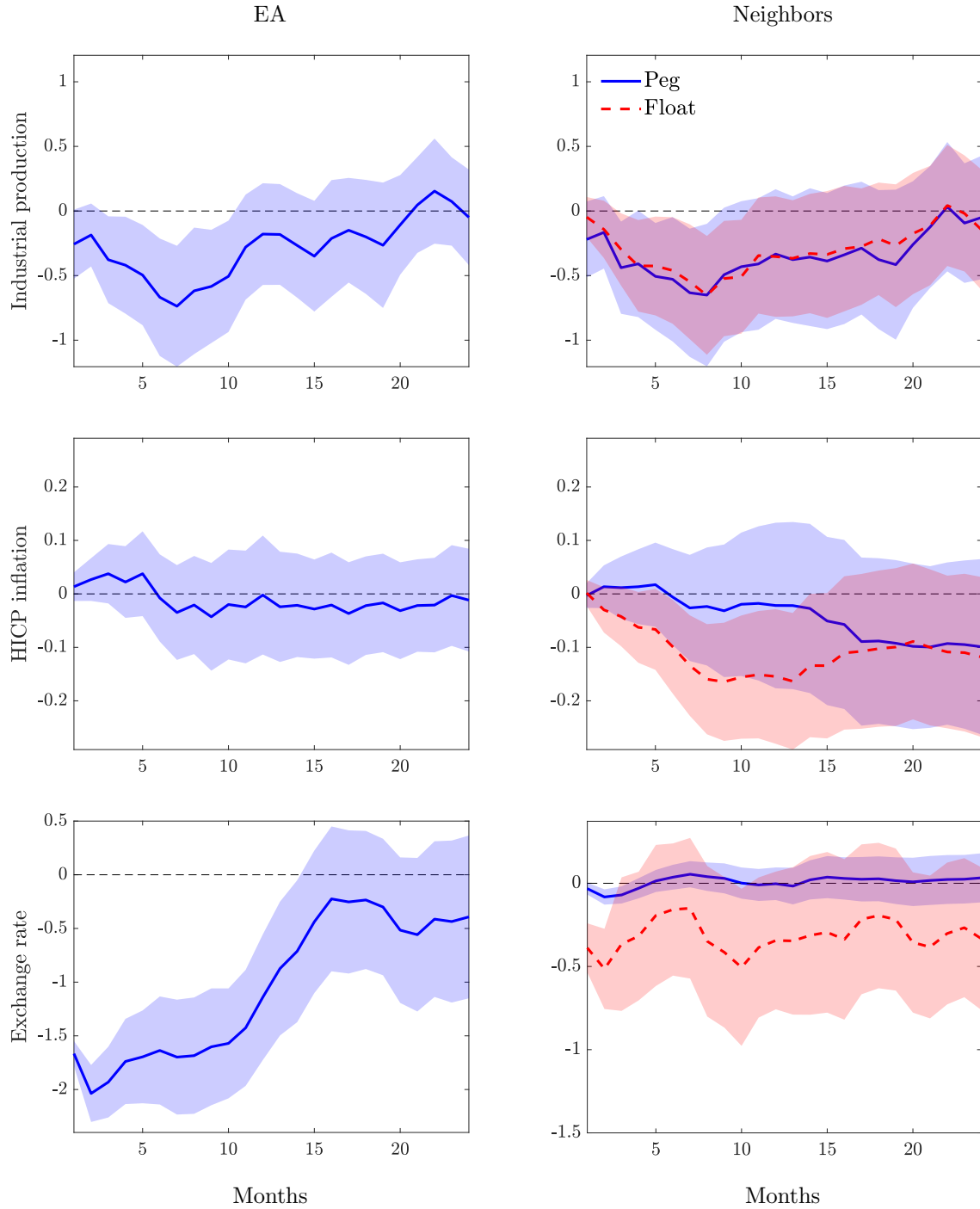
²⁰At quarterly frequency, Stock and Watson (1999) define this frequency band as $[\frac{2\pi}{6}, \frac{2\pi}{32}]$, which we adapt to monthly frequency accordingly.

Figure 3: Adjustment to EA main business cycle shock



Notes: one-standard EA main business cycle shock; for details on identification, see Appendix F; lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Horizontal axis is time in months, vertical axis measures deviation in percent/percentage points. Bottom panels show responses of exchange rates: price of euro in U.S. dollars (left) and in currencies of neighboring countries (right). Figure F.1 in the Appendix reports responses of unemployment and interest rates.

Figure 4: Adjustment to EA main exchange rate shock



Notes: one-standard EA main exchange rate shock; for details on identification, see Appendix F; lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Horizontal axis is time in months, vertical axis measures deviation in percent/percentage points. Bottom panels show responses of exchange rates: price of euro in U.S. dollars (left) and in currencies of neighboring countries (right). Figure F.2 in the Appendix reports responses of unemployment and interest rates.

Turning back to Figure 3, the middle panels of the figure also show that the shock induces a decline in HICP inflation, which in the neighboring countries is slightly weaker for floats than for pegs. This pattern is consistent with the exchange rate dynamics triggered by the shock, shown in the bottom panels: the euro depreciates against the dollar (left), while floating currencies depreciate against the euro, albeit only mildly (right), which in turn induces some upward pressure on inflation not seen in pegs.

However, the exchange rate response under floating regimes is rather moderate, and hence the spillovers of the main business-cycle shock in the EA do not directly speak to the issue of exchange rate insulation. We therefore turn once again to the Bayesian VAR model and extract the *main exchange rate shock*. To do so, we proceed analogously to the case of the main business-cycle shock: the main EA exchange rate shock is the linear combination of VAR residuals that accounts for the largest share of the volatility of the euro’s nominal effective exchange rate over the frequency band associated with the business cycle.²¹

Figure 4 displays the responses to the EA main exchange rate shock, normalized to induce a depreciation of the euro against the dollar (bottom-left panel). The associated appreciation of the U.S. dollar is contractionary in the EA, in line with Georgiadis et al. (2024), who document that dollar appreciations are contractionary both in the U.S. and globally. Industrial production in the EA drops persistently (upper-left panel). Floating currencies appreciate substantially against the euro (bottom-right panel). Nevertheless, this appreciation does not translate into different real outcomes in neighboring countries: the responses of industrial production under pegs and floats are nearly identical. By contrast, inflation responses again differ across exchange rate regimes (middle panel), as was the case for the impulse responses to a monetary policy shock. While inflation in the EA and in pegged economies remains essentially flat, inflation in floating economies declines significantly, consistent with notable pass-through of the currency appreciation into consumer prices. To prevent an exchange rate appreciation, pegging countries reduce their short-term interest rates by even more than floaters, while the response of unemployment is virtually identical, again in line with the evidence for the monetary policy shock (see Appendix F).

4 A model of the euro area and its neighbours

The current section explains the apparent lack of exchange rate insulation using international macro theory. To do so, it relies on the latest vintage of open-economy models with heterogeneous households, leading examples of which are Auclert et al. (2021b) and De Ferra et al. (2020). Section 4.1 introduces the model, Section 4.2 the calibration to

²¹See also Chahrour et al. (2024), who, while focusing on the U.S. dollar, extract the “main exchange rate” shock.

the euro area and its neighbors. Section 4.3 shows that the model's impulse responses to foreign monetary shocks align with our empirical results and uses the model to shed light on the channels behind the lack of insulation. Section 4.4 reconciles our empirical findings with the earlier literature by documenting that the model implies that rising trade integration induces a fall in insulation. All these sections focus on impulse responses to foreign monetary shocks. Appendix G provides additional results showing that the model also matches standard business cycle moments more generally when also calibrating the other shocks.

4.1 Model setup and notation

The exposition closely follows Auclert et al. (2021b), from which we borrow the model's core. We abstract from modeling delayed international substitution patterns and non-homothetic preferences to keep the model tractable analytically, a tractability we use later. To the core, we add a financial channel of the exchange rate (De Ferra et al., 2020) and imperfect exchange rate pass-through (Corsetti et al., 2010; Engel, 2011). Many of the model's features are standard in the New Keynesian class of models. Our exposition deliberately is concise.

There are two countries, Home H and Foreign F , which the reader may think of as a neighboring country and the EA, respectively. There is a mass n of households residing in Home and a mass $1 - n$ in Foreign. Time is discrete, the horizon infinite. As countries are symmetric, we focus our exposition on Home. Variables for Foreign are marked with a star. When needed, lowercase marks individual-level variables, uppercase the aggregate counterparts. Aggregates are in per-capita terms.

Households. Each country is populated by a continuum of ex-ante identical households indexed by $i \in [0, 1]$. Their idiosyncratic labor productivity $e_{i,t}$ follows a first-order Markov process with unit mean, autocorrelation ρ_e , and cross-sectional log standard deviation σ_e . In the following we drop the i subscript. Households self-insure against idiosyncratic shocks buying assets worth a_t that are claims on a domestic mutual fund.

A household chooses non-negative asset holdings, consumption of domestic and foreign goods, $c_{H,t}$ and $c_{F,t}$ – and thereby its consumption basket, c_t – solving the program

$$V_t(a_{t-1}, e_t) = \max_{c_{H,t}, c_{F,t}, c_t, a_t \geq 0} \frac{c_t^{1-\gamma}}{1-\gamma} - \psi \frac{N_t^{1+\varphi}}{1+\varphi} + \beta E_t[V_{t+1}(a_t, e_{t+1})], \quad \gamma, \psi, \varphi > 0, \quad (3)$$

where E_t marks conditional expectations and the consumption bundle is given by

$$c_t = \left[\alpha^{1/\eta} c_{F,t}^{(\eta-1)/\eta} + (1-\alpha)^{1/\eta} c_{H,t}^{(\eta-1)/\eta} \right]^{\eta/(\eta-1)}. \quad (4)$$

$\eta > 0$ marks the elasticity of substitution between domestic and foreign goods. $\alpha \in [0, 1)$ determines the import share of the economy. The household's budget constraint is

$$\frac{P_{F,t}}{P_t} c_{F,t} + \frac{P_{H,t}}{P_t} c_{H,t} + a_t = (1 + r_{a,t}) a_{t-1} + e_t (1 - \tau_t) \frac{W_t}{P_t} N_t. \quad (5)$$

$P_{F,t}$, $P_{H,t}$, and P_t are, respectively, the domestic-currency prices of the imported foreign good, the domestic good, and the consumption basket. $r_{a,t}$ is the realized return on the household's assets, τ_t an income tax, W_t the nominal wage. Households do not choose labor supply. The notation anticipates that all households supply the same hours, N_t .

Given these preferences, the optimal intratemporal allocation of spending across goods yields a standard CES demand system. Aggregating across all households, one arrives at the aggregate demand schedule for imports and domestic goods

$$C_{F,t} = \alpha \left(\frac{P_{F,t}}{P_t} \right)^{-\eta} C_t, \quad (6)$$

$$C_{H,t} = (1 - \alpha) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} C_t. \quad (7)$$

with C_t being aggregate consumption and

$$P_t = \left[\alpha P_{F,t}^{1-\eta} + (1 - \alpha) P_{H,t}^{1-\eta} \right]^{1/(1-\eta)}. \quad (8)$$

the associated consumer price index.²²

Hours and wages. Labor supply is determined by labor unions. They differentiate homogeneous labor services provided by households and sell these with an average gross markup of $\mu_W > 1$ to competitive labor aggregators that operate a CES production technology and in turn supply the firms in the economy. Each period, nominal wages for the differentiated types of labor are updated only with probability $1 - \theta_W$, as in Erceg et al. (2000). As in Hagedorn et al. (2019) the unions' objective is to maximize the utility of a household with average consumption C_t . This gives rise to wage Phillips curve

$$\pi_{W,t} = \kappa_W \left(\frac{\psi N_t^\varphi C_t^\gamma}{\frac{(1-\tau_t) W_t}{\mu_W P_t}} - 1 \right) + \beta E_t[\pi_{W,t+1}], \quad (9)$$

where $\pi_{W,t} \equiv W_t/W_{t-1} - 1$ denotes nominal wage inflation and $\kappa_W = \frac{(1-\beta\theta_W)(1-\theta_W)}{\theta_W}$.

²²The foreign counterparts are defined analogously, with α^* and η^* as the Foreign economy's import share and elasticity of substitution. Foreign consumption demand for Home's goods is given by $C_{H,t}^* = \alpha^* (P_{H,t}^*/P_t^*)^{-\eta^*} C_t^*$, where C_t^* is aggregate foreign consumption and $P_{H,t}^*$ is Home's export-price index.

Production and prices. There is a continuum of monopolistically competitive wholesalers labeled $k \in [0, 1]$ that produce their variety using a linear production technology

$$y_{k,t} = n_{k,t}, \quad (10)$$

and discount the future at the steady-state real interest rate $\bar{r}$. Selling to a competitive retailer for the domestic market, wholesalers can flexibly set their price as a markup over marginal costs. The price of domestic goods sold in the domestic market is

$$P_{H,t} = (\mu_P + \varepsilon_t^\mu) W_t. \quad (11)$$

$\mu_P > 1$ marks the average price markup. ε_t^μ is a zero-mean shock. Inflation for domestic goods up to first order, thus, is given by $\pi_{H,t} = \pi_{w,t} + \Delta \varepsilon_t^\mu$.

Exporting to the foreign market, wholesalers instead set prices in foreign currency units. Each period they can update these prices with Calvo reset probability $1 - \theta_H^*$. Faced with a standard CES demand schedule, the optimal pricing decision up to first order yields the export-price Phillips curve

$$\pi_{H,t}^* = \kappa_H^* \left(\mu_P \frac{W_t}{\mathcal{E}_t P_{H,t}^*} - 1 \right) + \frac{1}{1 + \bar{r}} E_t[\pi_{H,t+1}^*], \quad (12)$$

where $\pi_{H,t}^* \equiv P_{H,t}^*/P_{H,t-1}^* - 1$ is export-price inflation, $\mathcal{E}_t$ is the nominal exchange rate, and $\kappa_H^* = (1 - \theta_H^*)(1 - 1/(1 + \bar{r})\theta_H^*)/\theta_H^*$.

Ownership and dividends. All domestic production firms are owned by domestic mutual funds. Equity of the entire domestic firm sector is traded through a unit number of shares which only domestic mutual funds can own. For future use, let j_t mark the real ex-dividend price per share. After-tax real dividends, div_t , are given by the difference between revenues from selling in the domestic and foreign market and production costs

$$div_t = (1 - \tau_t) \left(\frac{P_{H,t}}{P_t} [C_{H,t} + G_{H,t}] + \frac{1 - n}{n} \frac{\mathcal{E}_t P_{H,t}^*}{P_t} [C_{H,t}^* + G_{H,t}^*] - \frac{W_t}{P_t} N_t \right). \quad (13)$$

Government spending is isomorphic to household demand. G_t and G_t^* would be the baskets the domestic and foreign governments buy. The current paper entertains G_t and G_t^* as an exogenous shifter of demand only: they follow exogenous AR(1) processes with zero mean. $G_{H,t}$ and $G_{H,t}^*$ denote the respective government's spending on Home's goods.

Mutual funds. In each country there is a unit mass of representative risk-neutral mutual funds. They trade domestic assets. In addition, the mutual funds of the two countries can, between them, enter into safe one-period nominal contracts, in Foreign's

currency. In real terms, the balance sheet of a domestic mutual fund is given by

$$j_t s_t + B_t = A_t + Q_t D_t. \quad (14)$$

On the asset side, there is the ex-dividend value of the shares held and the value, B_t , of safe nominal one-period domestic-currency bonds that the fund holds. On the liability side, A_t is the real value of households' claims on the mutual fund. Next, there is the mutual fund's position in Foreign-currency-denominated debt: D_t being the real value in units of the Foreign households' consumption basket. The real exchange rate, $Q_t = P_t^* \mathcal{E}_t / P_t$, revalues this to the domestic consumption basket. From Home's perspective, an increase in $\mathcal{E}_t$ or Q_t corresponds to a nominal or real depreciation, respectively.

At the beginning of each period, after shocks have realized, the fund transfers any net income to the households that own claims on the fund. In real terms, the payments are

$$(1 + r_{a,t}) A_{t-1} = \text{div}_t + j_t s_{t-1} + \frac{1 + i_{t-1}}{1 + \pi_t} B_{t-1} - \left[\frac{1 + i_{t-1}^* + \varepsilon_t^Q}{1 + \pi_t^*} \frac{Q_t}{Q_{t-1}} \right] Q_{t-1} D_{t-1}, \quad (15)$$

where i_{t-1} and i_{t-1}^* are the nominal interest rates on home and foreign bonds and $\pi_t = P_t/P_{t-1} - 1$ and $\pi_t^* = P_t^*/P_{t-1}^* - 1$ the respective consumer-price inflation rates. ε_t^Q follows an exogenous AR(1) process and acts as an exogenous international portfolio shifter in the spirit of Itskhoki and Mukhin (2021). Foreign-currency debt means that the mutual fund's income, and thus the return to households' savings, is exposed to surprise changes in the real exchange rate Q_t , introducing revaluation effects as in De Ferra et al. (2020). For future reference, also define next period's ex-ante real return on domestic government debt as $(1 + r_t) = E_t[(1 + i_t)/(1 + \pi_{t+1})]$.

In equilibrium *ex ante* returns on all the fund's assets and liabilities need to be equalized, that is

$$E_t \left[\frac{1 + i_t}{1 + \pi_{t+1}} \right] = E_t \left[\frac{1 + i_t^* + \varepsilon_{t+1}^Q}{1 + \pi_{t+1}^*} \frac{Q_{t+1}}{Q_t} \right] \quad (16)$$

$$E_t \left[\frac{1 + i_t}{1 + \pi_{t+1}} \right] = E_t \left[\frac{\text{div}_{t+1} + j_{t+1}}{j_t} \right]. \quad (17)$$

Equation (16) is the familiar uncovered interest rate parity (UIP) condition expressed in terms of the real exchange rate Q , equation (17) the standard asset-pricing condition.

Monetary and fiscal policy. Unless it pegs, the central bank sets the nominal interest rate according to a real rate rule as in Holden (2024) or Auclert et al. (2024), namely,

$$i_t = \bar{r} + E_t[\pi_{t+1}] + \varepsilon_t^m. \quad (18)$$

Here ε_t^m is an AR(1) monetary policy shock with persistence ρ^m . This rule implements a neutral monetary stance in response to foreign shocks and, therefore, appears a natural reference point. If it pegs, instead, the central bank sets the nominal interest rate so as to target $Q_t = 0$, thus perfectly stabilizing the real exchange rate. This representation of a peg facilitates analytical results later in the paper and allows for some minimal variation in the nominal exchange rate $\mathcal{E}_t$, in line with the data presented earlier in Table 2.

The government budget constraint is given by

$$G_t + \frac{1 + i_{t-1}}{1 + \pi_t} B_{t-1} = B_t + \tau_t \frac{W_t}{P_t} N_t + \frac{\tau_t}{1 - \tau_t} \text{div}_t. \quad (19)$$

The government pays for G_t and the interest on the outstanding bonds. On the income side, the government issues fresh bonds of value B_t and it collects income taxes on wages and dividends. Since a sophisticated fiscal sector is not the current paper's focus, we shall assume that the government balances its budget every period, so that $B_t = 0$.

Market clearing and balance of payments. In equilibrium, all markets clear. The notation above already implicitly assumed market clearing for labor, households' claims on the funds, government bonds, and individual varieties $y_{k,t}$. Letting $Y_t = N_t$ be per-capita production of final domestic goods, the market for Home's goods clears if

$$Y_t = (1 - \alpha) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} (C_t + G_t) + \alpha^* \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\eta^*} (C_t^* + G_t^*) \Delta_{H,t}^*, \quad (20)$$

where $\alpha^* \equiv \alpha^*(1 - n)/n$ captures the effective weight of foreign demand in domestic output. $\Delta_{H,t}^*$, the standard price dispersion term, equals one up to first order. Market clearing for shares requires $s_t = 1$. The market for cross-country debt clears if

$$nD_t = (1 - n)D_t^*, \quad (21)$$

D_t^* denoting the foreign mutual funds' position. Aggregating across all budget constraints implies that the net foreign liabilities of Home up to first order evolve as

$$Q_t D_t = \frac{1 + i_{t-1}^* + \varepsilon_t^Q}{1 + \pi_t^*} Q_t D_{t-1} - \left[\frac{\mathcal{E}_t P_{H,t}^*}{P_t} (Y_t - C_{H,t} - G_{H,t}) - \frac{P_{F,t}}{P_t} (C_{F,t} + G_{F,t}) \right], \quad (22)$$

the right-hand side being the difference of interest rate payments to Foreign and the trade balance.

4.2 Calibration and solution method

We calibrate the model to the EA and a representative neighboring economy. The sample is the same as in Section 2. One period is a quarter. We solve the linearized model using

Table 3: Calibration – targets and parameters

Param.	Description	Value	Source or target
n	Share of househ. residing home	≈ 0	small open economy
Idiosyncratic labor productivity			
ρ_e	persistence of $\log(e_t)$	0.912	Auclert et al. (2021b).
σ_e	cross-sect. std. dev $\log(e_t)$	0.883	— ” —
Households			
β	househ. time-discount factor	0.956	MPC 0.25, Kaplan and Violante (2014).
γ	coeff. of relative risk aversion	1	Auclert et al. (2021b).
φ	inv. Frisch elast. labor supply	2	— ” —
ψ	scaling param. disutil. labor	0.883	normalizing $\bar{N} = 1$.
Wages			
θ_W	prob. no update wages.	0.938	Auclert et al. (2021b).
Pricing			
θ_H^*	prob. no update export price	0.3	pass-through; see text.
μ_P	avg. gr. mark-up home prod.	1.04	$4 \cdot \bar{r} = 0.04$.
μ_P^*	avg. gr. mark-up foreign prod.	1.03	De Ferra et al. (2020), $\frac{\bar{D}}{4Y} = 21\%$.
Trade			
α	home import share	0.4	trade openness of 80%, see text
α^*	home export share	0.405	$\bar{N}^* = 1$.
η	price elasticity imports	0.0625	Auclert et al. (2021b), see text
Monetary policy			
ρ^m	persistence monetary shock	0.9	Auclert et al. (2025).

Notes: Calibrated model parameters. See Table G.2 in Appendix G.2 for shock-process parameters. When parameters are identical in Home and Foreign, we report only the Home value. For example, $\theta_F = \theta_H^*$, $\eta^* = \eta$, and $\kappa_F = \kappa_H^*$. We set $\mu_W = 1.1$. This is inconsequential for equilibrium allocations given the steady-state employment targets. The implied slope of the wage Phillips curve is $\kappa_W = 0.0068$. The slope of the export-price Phillips curve is $\kappa_H^* = 1.64$. The weight of Home-good consumption in the foreign consumption basket follows from $\alpha^* = \alpha^* n / (1 - n)$ and is roughly zero.

the methods of Boppart et al. (2018) and Auclert et al. (2021a), and compare its impulse responses to foreign (EA) monetary shocks with the empirical responses in Section 3. Throughout, we focus on the small-open-economy limit for Home, $n \rightarrow 0$, which simplifies the solution because foreign variables can be solved independently of the home economy.

We adopt a deliberately parsimonious calibration strategy, as the model remains stylized. Except for country size, we impose symmetry between Home and Foreign wherever possible and follow the references closest to our paper, Auclert et al. (2021b) in particular. Table 3 reports the parameter values and calibration targets for those parameters that shape the impulse responses to foreign monetary shocks, listing foreign parameters only when they differ from Home’s. Equipped with processes for government-demand, markup, monetary policy, and UIP shocks, the model also matches the unconditional evidence in Table 2. As this is not our main focus, we leave these results and the shock-process calibration to Appendix G.

For comparability, we take the parametrization of the idiosyncratic income process directly from Auclert et al. (2021b) and examine the robustness later. We target five steady-state moments. First, the annualized real interest rate is 4 percent. Second, in Home we target an average quarterly marginal propensity to consume out of windfall gains in income of 25 percent, in line with Kaplan and Violante (2014). Third and fourth, as a normalization, steady-state employment equals one in both Home and Foreign. Fifth, we target Home’s steady-state net foreign liability position, which we assign entirely to foreign-currency debt as in De Ferra et al. (2020). The GDP-weighted average position in our empirical sample is 21 percent of annualized GDP.²³

For household preferences, the targets above jointly imply $\beta = 0.956$. We use conventional values for the coefficient of relative risk aversion ($\gamma = 1$) and the Frisch elasticity of labor supply ($1/\varphi = 1/2$), both as in Auclert et al. (2021b). The value of $\psi = 0.883$ follows from the steady-state target for Home employment. The value $\theta_W = 0.93$ for wage rigidity follows Auclert et al. (2021b), who match the dynamics of non-traded goods prices in devaluations. This parsimoniously dampens both wage and producer-price inflation. The slope of the wage Phillips-curve is in line with other papers in the literature, for example, Fukui et al. (2025).

Turning to price setting, export prices remain unchanged within the quarter with probability $\theta_H^* = 0.3$. Exchange-rate pass-through to import prices in European countries is documented to be fast but incomplete in the short run, see, for example, Campa and Goldberg (2005) and Bonadio et al. (2020). Importantly, moderate stickiness is consistent with our empirical evidence; recall the discussion in Section 3.2 and Appendix D.1.

As regards trade, for comparability we follow Auclert et al. (2021b) and Galí and Monacelli (2005) and set $\alpha = 0.4$. Under complete symmetry, this implies trade openness (imports plus exports over GDP) of 80 percent, close to the GDP-weighted sample average of 82%. In practice, with unit steady-state employment and unit output in both countries, Home’s steady-state export share α^* must be slightly larger than its import share to service foreign liabilities, bringing the implied trade openness even closer to the data. It remains to determine the price elasticity of imports, η . Again following Auclert et al. (2021b), we set $\eta = 0.0625$, implying a trade elasticity of $(1-\alpha)\eta + \eta^* = 0.1$.²⁴ Interpreted as a short-run trade elasticity, the value is reasonable for three reasons. First, even if the trade elasticity is empirically dynamic (Boehm et al., 2023), a constant trade elasticity preserves analytical tractability. In an extension of our core setting, Auclert et al. (2021b) explicitly model time variation in trade elasticities and obtain dynamics over horizons up to 24 months that are similar to those under a permanent elasticity of 0.1. Second, the empirical evidence (see, for example, Hooper et al., 2000) suggests that for transitory

²³In computing this average, we exclude Switzerland and Norway. Their positions are exceptional, reflecting Switzerland’s safe-haven currency and Norway’s commodity sovereign wealth fund, respectively.

²⁴The trade elasticity is defined as the sum of price elasticities with respect to relative prices at home ($P_{F,t}/P_{H,t}$) and abroad ($P_{H,t}^*/P_{F,t}^*$). This is the elasticity entering the Marshall-Lerner condition.

shocks to exchange rates the elasticity may be small in the short-run, indeed. Third, and most important, for the EA monetary shock in our sample, short-run expenditure-switching effects are indeed limited; see Section 3.2 and the corresponding appendix. Last, we set the persistence of the monetary policy shock to $\rho^m = 0.9$, a standard value for interest-rate smoothing.

Next, we examine the calibrated model’s implications for exchange rate insulation. Further to this, Appendix G shows that the results are robust to alternative interest-rate rules (Appendix G.3), trade pricing under dominant currency pricing (Appendix G.4), and idiosyncratic income risk calibrated as in Kaplan et al. (2018) (Appendix G.5).

4.3 Missing insulation: a model-based interpretation

This section first derives model-based impulse responses to a foreign monetary tightening. It then examines the transmission channels and assesses which channels quantitatively account for the results. The section, thus, provides a model-based explanation for the empirical lack of exchange rate insulation documented earlier.

Figure 5 compares the model’s impulse responses with their empirical counterparts. The layout matches Figures 2.A and 2.B: the left column shows euro area responses, the right column those of pegs and floats. Solid blue and red dashed lines denote the empirical estimates, and dots the model counterparts. From top to bottom, the panels report output, the nominal interest rate, consumer price inflation, and the nominal exchange rate. Despite its stylized structure, the model tracks the empirical responses well across both the foreign (euro area) and home (neighboring) economies, under both pegs and floats. In particular, output spillovers (first row, right panel) are sizable under both regimes, implying little exchange rate insulation. Appendix G.6 further shows that the model also matches the empirical responses of the trade balance and related prices.

Proposition 1 extends the “International Keynesian Cross” of Auclert et al. (2021b) to our setting by decomposing the domestic output response to a foreign monetary tightening into six direct channels and a general equilibrium multiplier. It serves as the basis for assessing the quantitative importance of the channels behind the lack of insulation. In what follows, $d\mathbf{X} \equiv (d\hat{X}_0, d\hat{X}_1, \dots)$ denotes the impulse responses of X_t .²⁵

Proposition 1. *Consider the model economy in Section 4. Suppose Home becomes infinitesimally small and government consumption is zero in both economies. Let the steady state feature unit output, consumption, and relative prices, and let $\mathcal{M}^X$ denote the Jacobian of the consumption function with respect to a path for X_t , evaluated at the steady state. Then, to first order, the impulse response of Home’s output to a shock to the foreign interest rate is given by*

²⁵For the ex-ante real rate r_t ($d\mathbf{r}$), responses are measured in level deviations; for all other variables, in percentage deviations.

$$\begin{aligned}
dY = & \underbrace{\alpha^* \cdot dC^*}_{\text{foreign demand}} + \underbrace{\alpha \cdot \eta \cdot [dP_F - dP] - \alpha^* \cdot \eta^* \cdot [dP_H^* - dP^*]}_{\text{expenditure switching}} \\
& + (1 - \alpha) \cdot \left(\underbrace{\mathcal{M}^{div} \cdot \alpha^* \cdot [d\mathcal{E} + dP_H^* - dP_H]}_{\text{export profits, law-of-one-price gap}} \right. \\
& \quad \left. - \underbrace{\mathcal{M}^D \cdot dQ}_{\text{revaluation of FX debt}} - \underbrace{\mathcal{M}^Y \cdot [dP - dP_H]}_{\text{real income}} \right) \\
& + (1 - \alpha) \cdot \left(\underbrace{\mathcal{M}^r \cdot d\mathbf{r}}_{\text{monetary response}} + \underbrace{\mathcal{M}^Y \cdot dY}_{\text{multiplier}} \right). \tag{23}
\end{aligned}$$

Proof: The proof follows Auclert et al. (2021b), extended to incorporate the foreign demand, export profits, and revaluation channels. Starting from the market-clearing condition (20), itself derived in Appendix H, the proof is presented in Appendix I.

When foreign interest rates change, foreign incomes, international relative prices, the value of net foreign assets, and domestic monetary policy change, all of which affect demand for the domestic good. The first term on the right-hand side of (23) is the “foreign demand channel.” The larger the export share of Home in foreign consumption α^* , the stronger the effect of this channel on the domestic good production. The second term is the conventional “expenditure switching channel:” following a foreign tightening (that depreciates the Home currency), some firms in both countries will re-optimize their prices, causing a rise in the relative price of imports at home, $dP_F - dP$, and a drop in the relative price of Home exports in the Foreign market, $dP_H^* - dP^*$. The import and export shares, α and α^* , and the demand elasticities in the two markets, η and η^* , affect the size of the resulting shift in demand.

Nominal exchange rate movements also affect domestic households’ real income and thus their consumption. The related channels are captured by the third, fourth, and fifth terms, all in brackets, on the right-hand side of (23). The coefficient $(1 - \alpha)$ in front of these three terms is the share of domestic consumption spent on domestic goods. Within the brackets, we start with a term capturing the “export profits channel.” Under local currency pricing, export prices are sticky in the destination currency. A depreciation ($d\mathcal{E}$ rising) raises exporters’ revenues in own currency and thus profits—indexed by the deviation from the law of one price in squared brackets. The mutual fund rebates the higher profits to domestic households, recall (15). Demand for domestic goods rises more, the larger the marginal propensities to consume out of the dividend income, $\mathcal{M}^{div}$, and the larger is the export share, α^* . Next, we have the “revaluation of foreign-currency debt channel,” emphasized by De Ferra et al. (2020): a depreciation raises the mutual funds’ foreign-currency liabilities in real terms, reducing domestic households’ capital income. The entries in $\mathcal{M}^D$ reflect that the contractionary effect of this will be the stronger, the larger the foreign-currency debt position and the higher the marginal propensities to con-

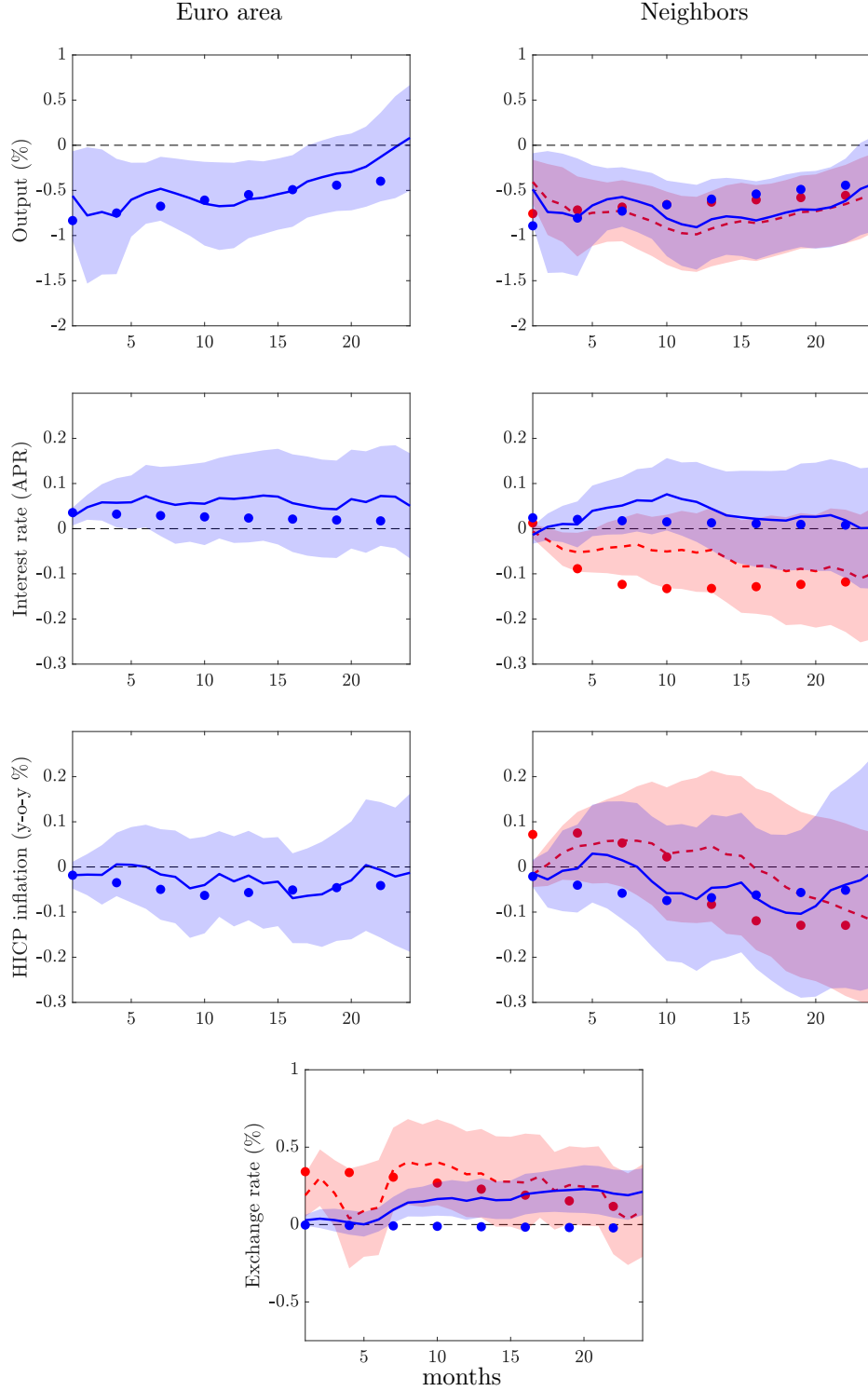
sume out of capital income. Finally, we have the “real income channel” emphasized by Auclert et al. (2021b). To the extent that a depreciation passes through to import prices, consumer prices rise relative to producer prices. This lowers real (consumption-valued) income and depresses demand more, the larger the marginal propensities to consume out of total income, $\mathcal{M}^Y$. The last two terms in (23) are the monetary response and the multiplier channels. The domestic “monetary response channel” reflects changes in the path of the domestic ex-ante real interest rate, which affect consumption through valuation effects and intertemporal substitution, both captured in $\mathcal{M}^r$. The general-equilibrium “multiplier channel” is the standard Keynesian multiplier in a demand-determined economy.

Proposition 1 can be used to state the conditions for exchange rate insulation to fail. To fix ideas, suppose Home and Foreign have symmetric steady states (in per-capita terms), though there may still be foreign-currency debt. Lack of insulation means that a peg and a float generate exactly the same output response, $d\mathbf{Y}$, to a foreign monetary shock. Then both regimes share the same left-hand side of (23), the same general-equilibrium multiplier, and also, by construction, the same strength of the foreign demand channel. Under a float, by monetary rule (18), the ex-ante real interest rate r_t does not respond to a foreign shock. But international relative prices adjust. The net effect of the four channels related to this can be positive or negative: the expenditure-switching and export profits channels stabilize output, while the real income and foreign-currency debt channels deepen the downturn. Under a peg, by contrast, relative prices do not adjust, but domestic monetary policy raises the interest rate, which unambiguously is contractionary. In the model, the exchange rate fails to provide insulation precisely when its depreciation has a net contractionary effect through real incomes and relative prices—much in the spirit of Krugman and Taylor (1978), and Frankel (2005). That is, if the combined effect of the four price-related channels is as contractionary as the interest-rate response used to defend the peg.

Figure 6 uses the calibrated model to quantify the contribution of each channel to the output response. It decomposes the average output response over eight quarters (24 months), that is, the average over the horizon shown in Figure 5. Each bar reports the contribution of one channel, or set of channels, from Proposition 1, in the same order as in the proposition. The horizontal dashed line marks the output response in the data. The figure has two aims. First, it shows in the full model how much each channel contributes to the similarity of output responses under pegs and floats (top row, HANK). Second, it examines the role of household heterogeneity in generating this similarity. To this end, the bottom row reports the same decomposition for a representative-household version of the model.²⁶

²⁶We keep the foreign economy and all foreign parameters unchanged, but replace the heterogeneous-household block in Home with a representative household. The calibration follows Section 4.2, except

Figure 5: Foreign monetary shock: impulse responses in the model and the data



Notes: Unless noted otherwise, the empirical responses (solid and dashed lines) use the same format and shading as Figures 2.A and 2.B. To align the quarterly model responses with the monthly local projections, the figure plots three-month trailing moving averages for empirical flow variables. APR denotes annual percentage rate. Dots mark the quarterly model counterparts, shown in the first month of each quarter. The model shock is scaled to match the average depreciation under a float in the data. Because the model measures output as GDP, while the empirical responses use industrial production, we follow Georgiadis et al. (2024) and Ider et al. (2024) and scale the model-implied output response by the sample-average ratio of GDP-growth to industrial-production-growth variances, weighting the EA and each neighbor equally. This yields a factor of 3.3.

Starting with the HANK model, the top panels of Figure 6 focus on domestic output under a peg (left panel) and a float (right panel). In both panels, the left-most black bar shows the total response of output, which falls by 0.64 and 0.65 percent over two years, close to the decline in the data (black dashed line). This is the lack of insulation. The remaining bars decompose this effect. By construction, the foreign demand channel (orange, second from left) is identical across model variants and policy regimes; here it lowers output by 0.24 percent, or about two-fifths of the total decline.

As discussed above, under a peg (the top-left panel), the four price-related channels are inactive (the middle bar). With the domestic central bank moving to defend the peg, the implied monetary contraction accounts for a 0.15 percent fall in output, about one-quarter of the total (blue bar, second from right). Multiplier effects (right-most gray bar) explain roughly another two-fifths.

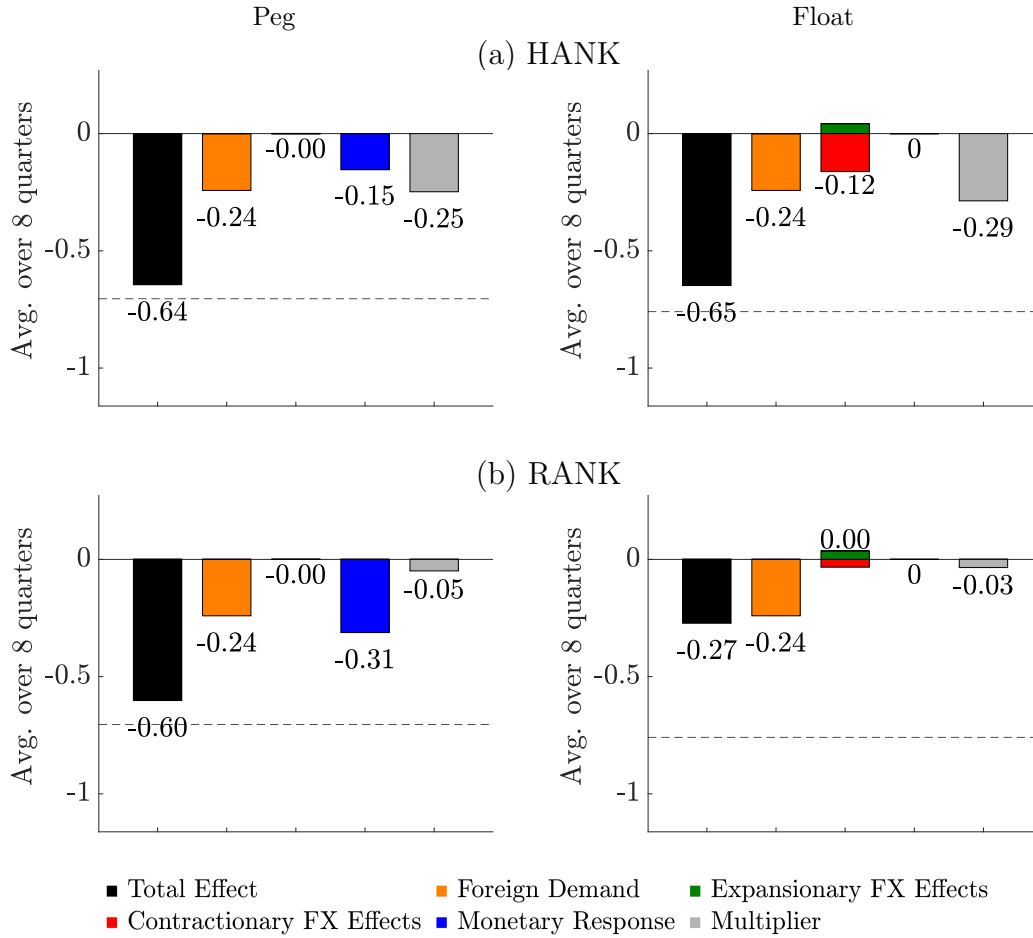
Under a float (the top-right panel), the channels' contributions are different. Similar to a peg, the foreign demand channel (orange, second bar from left) and the multiplier channel (right-most gray) keep contributing significant shares of the contraction. But under a float, a monetary policy response is absent by the nature of the regime (second bar from right). Instead, the channels related to international prices become active. Together, these channels lower output by 0.12 percent, about one-fifth of the total decline. Since these channels work in different directions, the middle bars separate the expansionary and contractionary effects: The green positive bar combines expenditure switching and higher exporter profits, which raise output by less than 0.04 percent, while the red negative bar combines the adverse revaluation of foreign-currency debt and lower real incomes. The drag on output is about as strong as the monetary policy effect under a peg, helping explain the lack of insulation in the data.²⁷

Household heterogeneity under borrowing constraints is central to the insulation equivalence across regimes. This is evident in the bottom row of Figure 6, which reports the output decomposition for the RANK variant of our model. In RANK, under a peg, multiplier effects are weaker because marginal propensities to consume out of income are small (gray bars at the right of each panel). Transmission under the peg (bottom-left panel) operates mainly through the need to move monetary policy to defend the currency. In RANK a weaker multiplier is offset by stronger intertemporal substitution; see Kaplan et al. (2018). Accordingly, under a peg the monetary policy channel contributes about twice as much to the output decline in RANK as in HANK (blue bars second from right), almost fully compensating for the smaller multiplier.

that we drop the MPC target and instead choose the Home discount factor β so that both model versions share the same steady-state interest rate. International financial markets remain incomplete, implying imperfect cross-country risk sharing.

²⁷The real-income channel accounts for about 85% of this effect, reflecting our cautious approach to debt revaluation. In our calibration, households do not borrow and are therefore not leveraged. Foreign-currency borrowing by poorer households would likely strengthen the debt revaluation channel and thus further weaken insulation; compare De Ferra et al. (2020).

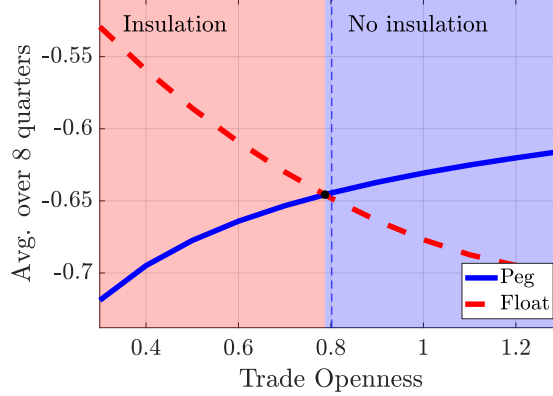
Figure 6: Decomposition of the spillovers from a foreign monetary policy shock



Notes: Decomposition of response of domestic output to a foreign monetary tightening. Uses equation (23) in Proposition 1. Average over the first 8 quarters after the shock. The response of output and the size of the shock are scaled the same way as in Figure 5. Top row: decomposition for the calibrated heterogeneous-household model. Bottom row: decomposition for a representative household counterpart. Left: response for peg. Right: float. Bar "expansionary FX effects" sums up the contribution of the expenditure switching channel and export profits channel. Bar "contractionary FX effects" sums up the contribution of the foreign-currency debt revaluation and real income channel. See Figure G.1 in Appendix G for a detailed breakdown of the contractionary and expansionary exchange-rate effects.

A degree of monetary autonomy under a float (bottom-right panel)—i.e., the fact that the domestic central bank does not have to follow the foreign monetary stance—naturally mutes this transmission. In addition, the real income and foreign-currency debt revaluation channels are much weaker than in HANK because lower marginal propensities to consume dampen their effects—indeed, the contractionary price-related channels are quantitatively negligible in RANK (center bar). In light of our empirical findings, this means that RANK implies a counterfactually high degree of insulation under floating exchange rates relative to pegs. Household heterogeneity resolves this discrepancy between model and data.

Figure 7: Openness and exchange rate insulation



Notes: Average two-year output response to a foreign monetary policy shock under pegs (blue solid line) and floats (red dashed line), by trade openness. Trade openness is defined as imports plus exports relative to GDP, $(\alpha\bar{C} + \alpha^*\bar{C}^*)/\bar{Y}$. The vertical blue dashed line marks the baseline calibration. Red (blue) shading indicates values of trade openness for which a float (peg) provides more insulation.

4.4 (De-)globalization and exchange rate insulation

So far, the paper has delivered three findings on the international transmission of contractionary monetary policy shocks. First, euro-area monetary policy shocks affect exchange rates exactly the way received wisdom suggests. Second, despite this, a euro-area monetary tightening affects economic activity in neighboring countries with flexible exchange rates as much as in those pegged to the euro. Third, this lack of insulation is consistent with results from the latest generation of open-economy heterogeneous-household models.

Our empirical findings challenge the conventional view that flexible exchange rates provide insulation, from Meade (1951), Friedman (1953), and Eichengreen and Sachs (1985) to Cloyne et al. (2025). Using a local-projection design similar to ours and a similar country sample, Cloyne et al. (2025), for example, find that output is more insulated under floats than under pegs after surprise Bundesbank tightenings. At first glance, this seems at odds with our results. The current section argues to the contrary. It observes that a key difference is that those studies examine periods, or samples, with much lower trade integration than ours. Cloyne et al. (2025), for example, study 1979–1998, a period that covers only part of the late-20th-century rise in global trade integration. In the model, greater trade integration reduces the insulation provided by floating exchange rates. Since trade integration is markedly higher in our sample than in the periods underlying the earlier evidence, the difference in findings has a coherent structural interpretation.

For each level of trade openness on the x-axis, Figure 7 reports the model-implied average two-year output response to a foreign monetary shock. Peg responses are shown by the blue solid line, float responses by the red dashed line. Specifically, we simulate the heterogeneous-household model using the calibration from Section 4.2, varying only α and α^* , adjusting them jointly to match the desired openness while keeping Home’s net

foreign liability position at the level targeted in Section 4.2. The vertical dotted line marks our baseline calibration: trade openness of about 0.8, that is, imports plus exports equal to 80 percent of GDP, roughly the GDP-weighted average for the neighboring countries in our sample. At this level, a foreign monetary shock makes output fall by about the same amount under pegs and floats. Less open economies lie to the left, more open ones to the right. For less open economies, flexible exchange rates do provide insulation. Indeed, in the sample of 11 countries studied by Cloyne et al. (2025), for example, GDP-weighted average trade openness was 53.5 percent, a level at which Figure 7 predicts substantial insulation. Moving to the right, spillovers instead become monotonically stronger with openness under a float but weaker under a peg. For sufficiently open economies, a float as implemented here may even provide less insulation than a peg. Appendix G.7 provides a decomposition of the channels behind this finding and shows that heterogeneity remains central to how openness shapes insulation: In the RANK analog, a float provides more insulation than a peg at any degree of openness.

5 Conclusion

In this paper, we show empirically that spillovers from EA monetary policy shocks to neighboring countries are large and do not differ between pegs and floats—flexible exchange rates provide no insulation. This result challenges received wisdom and standard theory alike. We therefore revisit the effects of external shocks in a state-of-the-art HANK model and show that the lack of insulation under flexible exchange rates can be rationalized by the way household heterogeneity alters the international transmission mechanism.

From a policy perspective, the lack of insulation under flexible exchange rates should not be taken as evidence that monetary policy autonomy is irrelevant. While transmission through income and financial channels may constrain the central bank’s response to foreign shocks and limit effective insulation, domestic policy remains effective in stabilizing the economy along other dimensions and in response to domestic shocks. Moreover, our results are silent on welfare, which, despite a lack of output insulation, may still differ across pegs and floats due to differential responses of other variables. We leave a systematic analysis of optimal policy and welfare for future research.

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Online Appendices to Exchange Rate Insulation Revisited

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A Data sources

Our sample spans the period from 1999:M01 to 2025:M04 and includes data for the euro area (EA), its neighboring countries, and the U.S. We use data at multiple frequencies, including monthly, quarterly, annual, and high-frequency observations. Details on the data sources follow.

A.1 High-frequency data

The source for the minute data on exchange rates, government bond yields and stock price indices used in Section 2 and Appendix C is LSEG DataScope. We construct time series of changes in exchange rates, government bond yields and stock prices around ECB monetary event windows. These windows cover both the ECB press release and the subsequent press conference, consistent with the approach used by Jarociński and Karadi (2020) to compute their monetary policy surprises.

Table A.1: High-frequency dataset - exchange rates and bond yields

	Exchange rate		2 year yield		10 year yield	
	RIC	#	RIC	#	RIC	#
United States	USDEUR=R	307				
Germany			DE2YT=RR	301	DE10YT=RR	308
Czechia	EURCZK=R	308	CZ2YT=RR	51	CZ10YT=RR	75
Denmark	EURDKK=R	308	DK2YT=RR	296	DK10YT=RR	303
Estonia	EUREEK=R	177				
Hungary	EURHUF=R	308				
Norway	EURNOK=R	308				
Poland	EURPLN=R	308				
Slovakia			SK2YT=RR	128	SK10YT=RR	94
Slovenia			SI2YT=RR	76	SI10YT=RR	102
Sweden	EURSEK=R	308	SE2YT=RR	203	SE10YT=RR	186
Switzerland	EURCHF=R	308	CH2YT=RR	81	CH10YT=RR	89
United Kingdom	EURGBP=R	308	GB2YT=RR	289	GB10YT=RR	290

Between January 1999 and June 2022, the ECB released the Governing Council’s monetary policy decisions at 13:45 CET, and the press conference started at 14:30 CET.²⁸ Since July 2022, the ECB announces the monetary policy decisions at 14:15 CET, and the press conference starts at 14:45 CET. Following Altavilla et al. (2019), we calculate the changes in exchange rates, government bond yields and stock prices as follows

- Calculate the median for 13:25-13:35 (13:55-14:05).
- Calculate the median for 15:40-15:50 (15:55-16:05).

²⁸Following Jarociński (2022), we drop three observations for days when the ECB and the Fed made coordinated announcements.

- Compute the difference between the two medians. For exchange rates we express the change in percent, for bond yields in basis points.

Tables A.1 and A.2 report the countries in our minute data sample, the Reuters Identification Code (RIC) and the number of observations for each variable.

Table A.2: High-frequency dataset – stock prices

Country	Index	RIC	#
Germany	DAX 40	.GDAXI	308
Czechia	PX	.PX	181
Hungary	BUX	.BUX	297
Norway	OBX	.OBX	248
Poland	WIG20	.WIG20	306
Sweden	OMX Stockholm 30	.OMXS30	195
Switzerland	SMI	.SSMI	306
United Kingdom	FTSE 100	.FTSE	308

A.2 Monthly time-series data

For monthly data, we rely on Eurostat as our source, unless otherwise noted.

Industrial production: manufacturing (series: `sts_inpr_m`), Index (2021 = 100), seasonally adjusted. First observation: 2000:M01, except for euro area, Croatia, Lithuania, Slovenia, and Norway (all 1999:M01), Switzerland (2010:M10). For Iceland and the United Kingdom no data from Eurostat, use OECD (series: `PRMNT001`) instead, with data for Iceland available only up to 2018:M02. For Ireland, Eurostat data are not available between 2010:M01 and 2014:M12; for this period we use OECD data. To construct an aggregate series for EA11 we use the 2015 weights reported by Eurostat for the construction of the EA19 series and reweigh series accordingly. In some instances we use OECD data for 1999 as Eurostat data not available for that year. We rebase Eurostat series to 2015 = 100 in order to merge it with OECD data (2015 = 100). We take logs and remove a linear trend from the series prior to the estimation.

Unemployment rate: harmonized unemployment rate according to ILO definition (series: `ei_lmhr_m`), seasonally adjusted. First observation is 1999:M01, except for Bulgaria (2000:M01), Estonia (2000:M02), Croatia (2000:M01), Cyprus (2000:M01), Malta (2000:M01), Iceland (2003:M01), Switzerland (2010:M01). For the United Kingdom, data are taken from the OECD, short-term economic statistics. To construct an aggregate times series for EA11 we use the 2015 weights reported by Eurostat for the construction of the EA19 series and reweigh series accordingly.

Interest rates: short-term interest rates provided by OECD, Monthly Monetary and Financial Statistics (MEI), annualized and in percent. First observation: 1999:M01, except for Bulgaria (2004:M02), Croatia (2002:M09), Slovenia (2002:M01), Switzerland (1999:M07). OECD data for Bulgaria and Romania are no longer available; for these countries we therefore rely on an older data vintage (data extracted on 18.04.2023), with observations only available up to 2023:M03. No OECD data for Malta and Cyprus. In this case we use the EA short rate from 2008:M01 onward. For the period before we use the T-Bill rate for Malta (source: IMF) and the overnight interest rate for Cyprus (source: Central bank of Cyprus). In our analysis we also use the interest rate on German government bonds with one year maturity from the Bundesbank (Term structure of interest rates on listed Federal securities (method by Svensson)/residual maturity of 1.0 year/monthly data).

Inflation: 100 times yoy log change of all-items HICP (series: `prc_hicp_midx`). First observation: 1999:M01, except for Switzerland (2005:M12). For the UK, we use the CPI all-items index from the Office for National Statistics (2015 = 100). To construct the series for EA11 we use the 2015 weights reported by Eurostat for the construction of the EA19 series and reweigh series accordingly.

Euro-exchange rates: for neighbor countries national currency per euro (monthly average). For countries that adopt euro in sample we use historical series available up to 2015:M12 (series: `ert_h_eur_m`), afterwards euro exchange rate is irrevocably fixed. For other countries we use the series `ert_bil_eur_m`. For the euro area we use the USD/EUR exchange rate from the ECB (series `EXR.M.USD.EUR.SP00.A`).

U.S. data. In our local projections we also use U.S. time series as controls. Consumer Price Index (total), from FRED (series: `CPALTT01USM661S`), seasonally adjusted, index (2015 = 100). Industrial production, total index, from FRED (series: `INDPRO`, seasonally adjusted, index (2017 = 100). For both series, we take logs and remove a linear trend prior to estimation. US monetary policy shocks are taken from Jarociński and Karadi (2020) (series `MP_median`) and Bauer and Swanson (2023) and obtained from Marek Jarociński's and Michael Bauer's webpage.

African and Asian data: Exchange rates measured as national currency per euro (monthly average). For Asia, we use ECB data for Japan, Korea, and Singapore (series: `EXR.M.JPY.EUR.SP00.A`, `EXR.M.KRW.EUR.SP00.A`, and `EXR.M.SGD.EUR.SP00.A`) and IMF data for Taiwan (series: `TWN.EUR_XDC.PA_RT.M`). For Africa, we use IMF data for the CFA franc zone, Comoros, and Cabo Verde (series: `TCD.XDC_EUR.PA_RT.M`, `COM.XDC_EUR.PA_RT.M`, and `CPV.XDC_EUR.PA_RT.M`). Industrial production series are taken from the IMF, in-

dex (2010 = 100). For Asia, we use Japan (JPN.IND.SA_IX.M, 1999:M01–2023:M11), Korea (KOR.IND.SA_IX.M, 1999:M01–2023:M11), Taiwan (TWN.IND.SA_IX.M, 2010:M01–2019:M02), and Singapore (manufacturing) (SGP.C.IX.M, 1999:M01–2016:M03). For Africa, we use Côte d’Ivoire (CIV.IND.IX.M, 2004:M11–2025:M03) and Senegal (SEN.IND.IX.M, 2008:M01–2025:M04). Japan, Korea, and Taiwan are already seasonally adjusted; all remaining industrial production series are seasonally adjusted using X-13ARIMA.

Global Commodity Price Index : To measure the price of commodities, we use the “Global Price Index of All Commodities” as constructed by the IMF and provided by the FRED database (series: PALLFNFINDEXM)

A.3 Quarterly time-series data

Real gross domestic product at market prices. Here we rely again on Eurostat. Chain-linked volumes (2010), million euro. Seasonally adjusted and calendar adjusted. For Iceland: only seasonally adjusted. For the United Kingdom, the series is available only up to 2020:Q3.

Exports and imports of goods and services. chain-linked volume series obtained from Eurostat national accounts (dataset namq_10_gdp), indicators P6 and P7 respectively, seasonally and calendar adjusted. The implicit price deflator in national currency (PD15_NAC) is used to construct the corresponding price indices. For the United Kingdom, Eurostat data are not available beyond 2020:Q1; we therefore use chain-linked volume series from the OECD Quarterly National Accounts (expenditure approach, national currency), with the corresponding current price series used to construct the implicit price deflator. We use the same data sources to measure the (nominal) export and import shares and construct the trade balance to GDP ratio.

Net foreign asset position. To construct the average net liability position to GDP position for our sample of countries, we, whenever available, use Eurostat data (dataset tipsii40). We use IMF World Economic Outlook data for UK, Switzerland, Norway, and Iceland. Data covers 1999-2025. Whenever series are missing, we adjust the GDP weights accordingly. Quarterly GDP weights were constructed based on IMF World Economic Outlook data, which measures GDP in US dollars. Whenever data wasn’t available for one country, we adjusted GDP weights accordingly.

A.4 Annual time-series data

The numbers reported in Panel A of Table 2 are based on annual data, also from Eurostat (unless noted otherwise). Gross domestic product is measured as GDP at market prices (series: nama_10_gdp), annual data in current prices (million euro), 1999–2024. Goods

Trade openness vis-a-vis the euro area is based on goods annual exports and imports to and from the euro area (series `ext_lt_mainez`), measured in million of ECU/EURO, 2002–2024; data are not available for Croatia, Cyprus, Estonia, Greece, Latvia, Lithuania, Malta, Slovakia, and Slovenia. Terms of trade (series: `ext_lt_intertrd`), annual data for 2002–2024; data are not available for Iceland, Norway, Switzerland, and the United Kingdom. Capital-account openness is measured using the Chinn–Ito Index (Chinn and Ito, 2006), available annually for 1999–2023. For the trade openness, we use World Bank Data for all countries (series `NE.TRD.GNFS.ZS`) from 1999–2025. To construct annual GDP weights for our measures of GDP-weighted trade openness, we use the corresponding World Bank data series `NY.GDP.MKTP.KD`, which measures GDP in constant (2015) US dollars.

B Exchange rate policies in neighbor countries

Here we provide a brief overview of the exchange rate policies of the EA neighbor countries. Figure A.1 displays for each country in our sample the time series of the fine exchange-rate regime classification of IRR, measured against the left axis (1-14, since there are no instances of 15 in our sample), and the month-on-month change of the bilateral euro exchange rate, measured against the right axis (in percent). The shaded area indicates country-month observations that qualify as floats in our baseline (IRR category 9 or above). Table 1 in the main text summarizes this information in a compact way. In what follows we look at each country in more detail and provide details on the classification of IRR. When appropriate, we also provide information from the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), the convergence reports by the European Commission, or the websites of the central banks.

Bulgaria: Currency board in place since 1997 under which the Bulgarian Lev (BGN) is pegged to Deutsche Mark and to the Euro afterwards. IRR classification: 2 (“Pre announced peg or currency board arrangement”). Bulgaria introduced in the euro in January 2026, that is, after the end of our sample period.

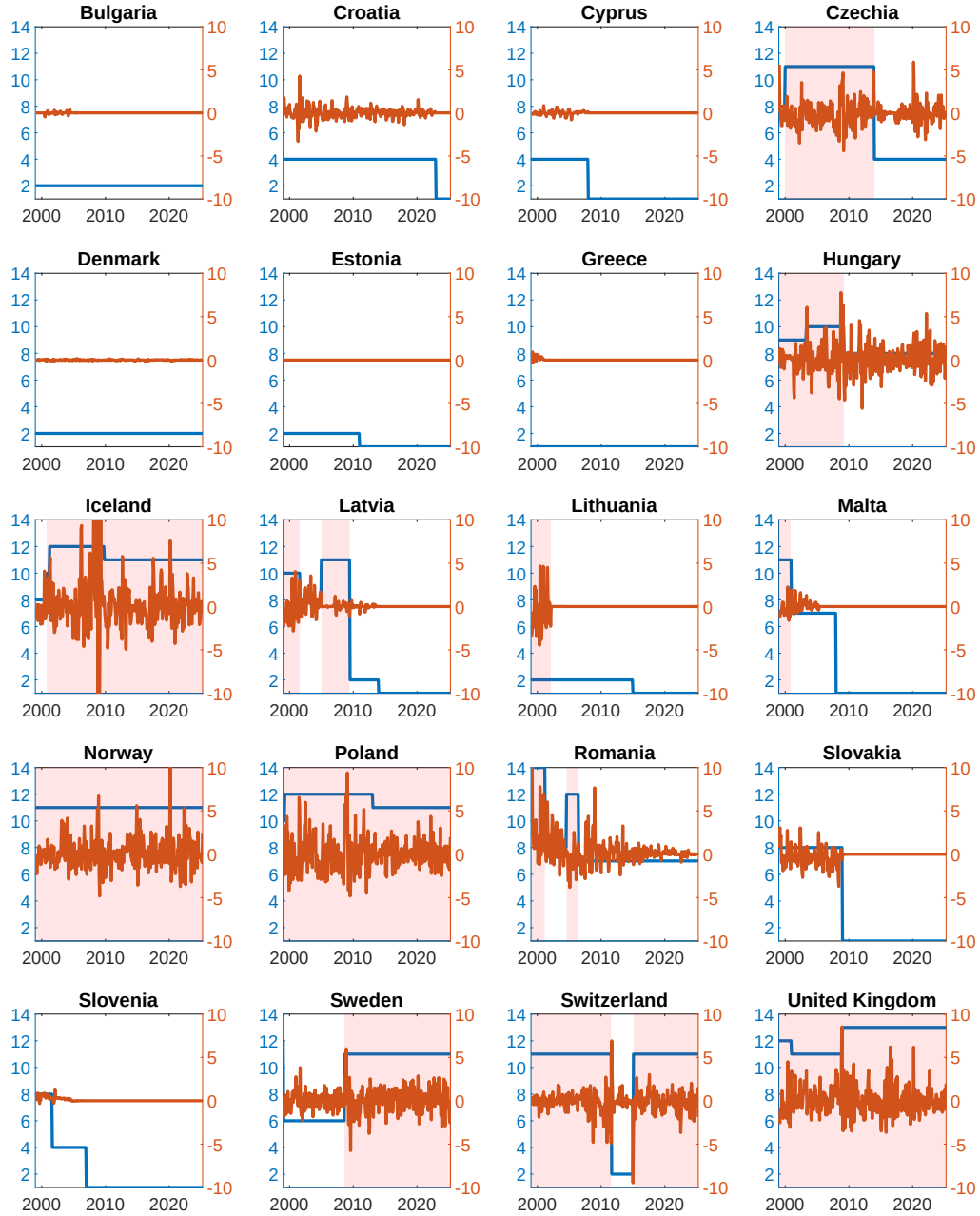
Croatia: According to the central bank the “monetary policy framework is based on maintaining the stability of the nominal exchange rate of the kuna against the euro.” IRR classification: 4 (“De facto peg”). Croatia adopted the euro in January 2023.

Cyprus: Adoption of the euro on January 1, 2008. IRR classification: 1 (“No separate legal tender or currency union”) since then. On May 2, 2005 Cyprus joined the ERM2, but the exchange rate fluctuations were much narrower than the $\pm 15\%$ margin permitted under ERM2. IRR classification from 1999-2008: 4 (“De facto peg”); see also Central Bank of Cyprus website.

Czechia: CPI-Inflation targeting since 1998. From November 2013 to April 2017, exchange rate target as an additional monetary policy instrument, to avoid koruna to strengthen below 27 CZK/EUR (see Convergence programme of the Czech Republic, April 2017). IRR classification: 4 (“De facto peg”). IRR classification throughout 1999: 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”), since 2000:M01: 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”).

Denmark: Denmark is a member of the ERM2 for the whole sample period, but it pegs the Danish krone (DKK) against the euro allowing for a fluctuation band of only $\pm 2.25\%$ (see website of the Danish central bank). IRR classification: 2 (“Pre announced peg or currency board arrangement”).

Figure A.1: Exchange-rate regimes and fluctuations



Notes: blue line measures exchange-rate regime classification of IRR against the left axis, red line is month-on-month change of the bilateral euro exchange rate against the right axis (in percent). The shaded area indicates country-month observations that qualify as a float in our baseline (IRR category 9 or higher).

Estonia: In the early part of our sample the Eesti kroon is pegged to the euro via a currency board arrangement. In 2004, Estonia joined the ERM2, in January 2011 the euro. IRR classification: 2 (“Pre announced peg or currency board arrangement”) and 1 (“No separate legal tender or currency union”), before and after, respectively.

Greece: Adoption of the euro following a currency peg on January 1, 2002. Greece was member of the ERM2 until the end of 2001. IRR classification: 4 (“De facto peg”) and 1 (“No separate legal tender or currency union”), before and after, respectively.

Hungary: Since 2001 inflation target (see website of the Hungarian central bank) and freely floating exchange rate since February 2008 (see website of the Hungarian central bank). Prior to October 2001, the currency followed a crawling peg to a currency basket of composed of the euro (70%) and the USD (30%), allowing for horizontal bands of $\pm 2.25\%$. In May 2001, the size of the bands was increased to $\pm 15\%$. Furthermore, the reference currency was changed to the euro in 2001. This regime was upheld until 2008. IRR classification: 9 (“Pre announced crawling band that is wider than or equal to $\pm 2\%$ ”) up to 2003:M04, 10 (“De facto crawling band that is narrower than or equal to $\pm 5\%$ ”) up to 2009:M03 and 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”) since then.

Iceland: In 1999 and 2000 the Icelandic króna (ISK) was pegged to a basket of nine currencies (the Canadian dollar, the Danish krone, the euro, the Japanese yen, the Norwegian krone, the pound sterling, the Swedish krona, the Swiss franc, and the U.S. dollar) allowing for horizontal bands of $\pm 9\%$. IRR classification: 8 (“Pre announced crawling band that is wider than or equal to $\pm 2\%$ ”). In March 2001 this peg was dropped in favor of an inflation target. However, a subordinate goal of exchange rate stabilisation was formulated, which gives the central bank a mandate to intervene on the foreign exchange markets (see website of the central bank of Iceland). According to the AREAER, disruptions on the international financial markets from 2008 onward led the central bank to intervene on the foreign exchange markets to stabilise the currency. IRR classification 1999–2008: 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”), up 2011:M09: 12 (“De facto moving band $\pm 5\%$, Managed floating), 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”) since then.

Latvia: Up to 2004:M12 peg to IMF special drawing rights. Switch from peg to euro peg on January 1, 2005 with $\pm 1\%$ bands. Joined ERM2 in May 2005 (see website of the central bank of Latvia). Since June 2009 de facto peg to euro, joined euro in January 2014. IRR classification from 1999:M01–2001:M07: 10 (“De facto crawling band that is narrower than or equal to $\pm 5\%$ ”), up to 2004:M12: 8 (“De facto crawling band that is

narrower than or equal to $\pm 2\%$ ”), up to 2009:M06: 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”), up to 2013:M12: 2 (“Pre announced peg or currency board arrangement”), and 1 (“No separate legal tender or currency union”) since then.

Lithuania: Up to 2002 the Lithuanian litas (LTL) was pegged to the US dollar by means of a currency board arrangement. On February 2, 2002 this peg was transformed into a euro-peg. In 2004 Lithuania joined the ERM2 without changing its effective exchange-rate regime (AREAER). Adoption of the euro on January 1, 2015. IRR classification up to 2014:M12: 2 (“Pre announced peg or currency board arrangement”) and 1 (“No separate legal tender or currency union”) since then.

Malta: In the early part of the sample the Maltese lira was pegged to a currency basket, with weight of euro increased in August 2002. Peg to euro only started in January 2005, and adoption of the euro on January 1, 2008 (AREAER). IRR classification: 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”) up to 2000:M12, 7 (“De facto crawling peg”) up to 2007:M12; 1 (“No separate legal tender or currency union”) afterwards.

Norway: Floating exchange rate. Since March 2001 CPI inflation target. IRR classification: 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”).

Poland: Up to March 2001 Polish zloty (PLN) was pegged to a currency basket consisting of the euro (55%) and the US dollar (45%). The peg followed a crawling and pre-announced central exchange rate to its reference basket. On March 24, 1999 the fluctuation band of the exchange rate around this central rate was increased from $\pm 12.5\%$ to $\pm 15\%$. Floating exchange rate since April 2000 (AREAER). IRR classification up to 1999:M03: 10 (“De facto crawling band that is narrower than or equal to $\pm 5\%$ ”) and 12 (“De facto moving band $\pm 5\%$, Managed floating”) afterwards.

Romania: Central bank maintains “managed float, in line with using inflation targets as a nominal anchor for monetary policy and allowing for a flexible policy response to unpredicted shocks likely to affect the economy” (see central bank website). With the exception of the period from 2002 to 2004, the IMF has also classified the exchange-rate regime of Romania as a managed float (AREAER). In August 2005, the central bank adopted an inflation target (see central bank website). Romania has set 2024 as its target year to adopt the euro, but has not joined the ERM2 yet (see European Commission website). IRR classification up to 2001:M01: 14 (“Freely falling”), up to 2004:M07: 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”), up to 2006:M06: 12 (“De facto moving band $\pm 5\%$, Managed floating”), up to 2011:M11: 7 (“De facto crawling peg”), and 4 (“De facto peg”) since then.

Slovakia: Adoption of the euro following a managed float on January 1, 2009 (AREAER). Joined ERM2 in 2005. IRR classification up to 2008:M12: 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”), and 1 afterwards (“No separate legal tender or currency union”).

Slovenia: Adoption of the euro following a managed float on January 1, 2007. Joined ERM II in June 2004. IRR classification up to 2001:M08: 8 (“De facto crawling band that is narrower than or equal to $\pm 2\%$ ”), up to 2006:M12: 4 (“de facto peg”) and 1 afterwards (“No separate legal tender or currency union”) .

Sweden: Inflation targeting since 1993; floating exchange rate. IRR classification up to 1999:M01: 12 (De facto moving band $\pm 5\%$, Managed floating), up to 2008:M08: 6 (“De facto crawling peg”) and 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”) since then.

Switzerland: Free float before September 6, 2011 and after January 15, 2015. Exchange rate floor equivalent to a de facto peg in the period in between. IRR classification up to 2011:M8: 11 (“Moving band that is narrower than or equal to $\pm 2\%$ ”) , up to 2014:M12: 2 (“Pre announced peg or currency board arrangement”), and 11 since then.

United Kingdom: CPI inflation target since 1992. Flexible exchange rate. IRR: classification up to 2000:M12: 12, up to 2008:M12: 11, and 13 since then.

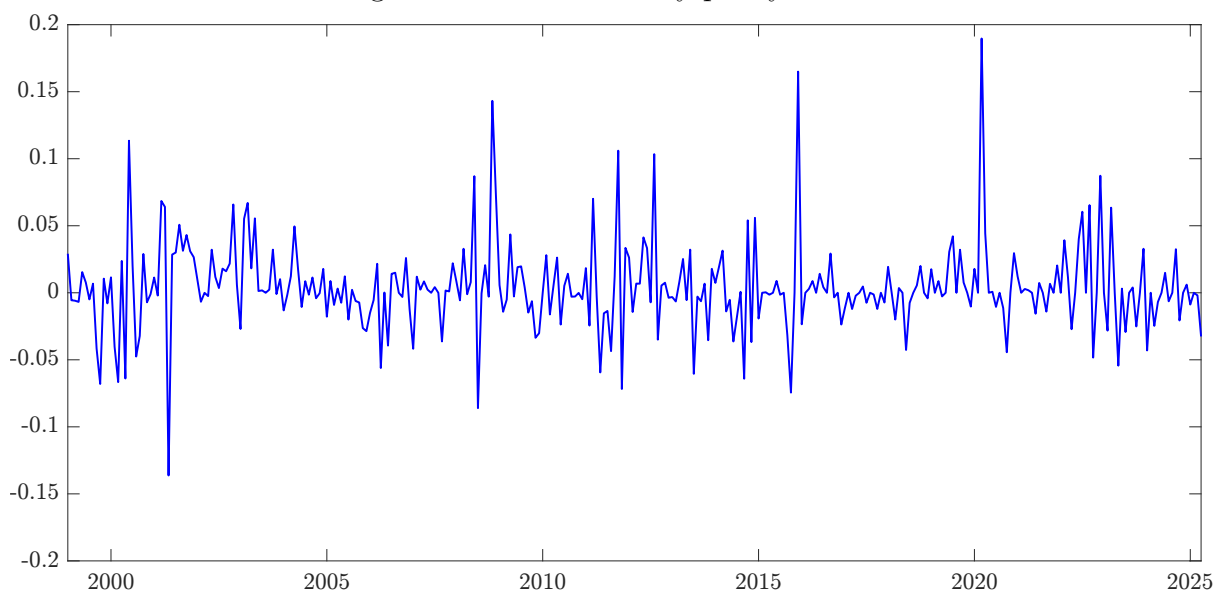
C Event study regressions

Table C.1: Event study regressions

	Exchange rate			2 year yield			10 year yield		
	EA	Peg	Float	EA	Peg	Float	EA	Peg	Float
Coeff.	0.06	0.01	0.03	0.95	0.75	0.35	0.38	0.53	0.22
SE	0.007	0.002	0.002	0.070	0.062	0.033	0.054	0.048	0.037
R ²	0.16	0.05	0.12	0.38	0.20	0.18	0.13	0.16	0.06
#	307	837	1804	301	592	532	308	614	548

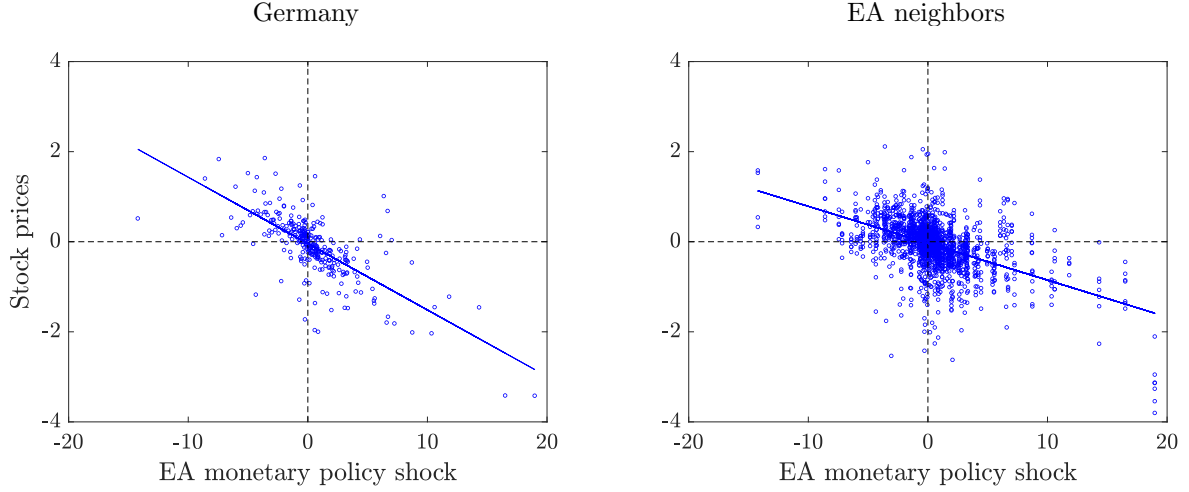
Notes: Linear regressions on EA monetary policy shocks. Sample 1999M1-2025M4. The EA exchange rate refers to the USD/EUR exchange rate. German government bond yields are used as a proxy for EA government bond yields.

Figure C.2: EA monetary policy shocks



Notes: monetary policy shocks due to Jarociński and Karadi (2020); specifically, we use the shock series *MP_median*, obtained with the median rotation that implements the sign restrictions, updated to 2025:M04, and downloaded from Marek Jarocinski's webpage.

Figure C.1: Stock prices around monetary policy events



Notes: Horizontal axis measures EA monetary policy shocks (measured in basis points) due to Jarociński and Karadi (2020); vertical axis measures associated changes in stock price indices (in percent) around monetary event window, see Appendix A.1 for details. The panel for neighbors (right), does not distinguish between pegs/float, as most observations pertain to floats. See Appendix A.1 for country coverage. Solid lines are regression lines fitted to the data shown in the scatter plots.

Table C.2: Event study regressions – stock prices

	Germany	EA neighbors
Coeff.	-0.15	-0.08
SE	0.008	0.003
R ²	0.50	0.24
#	308	1841

Notes: Linear regressions on EA monetary policy shocks. Sample 1999M1-2025M4.

D Response of additional variables

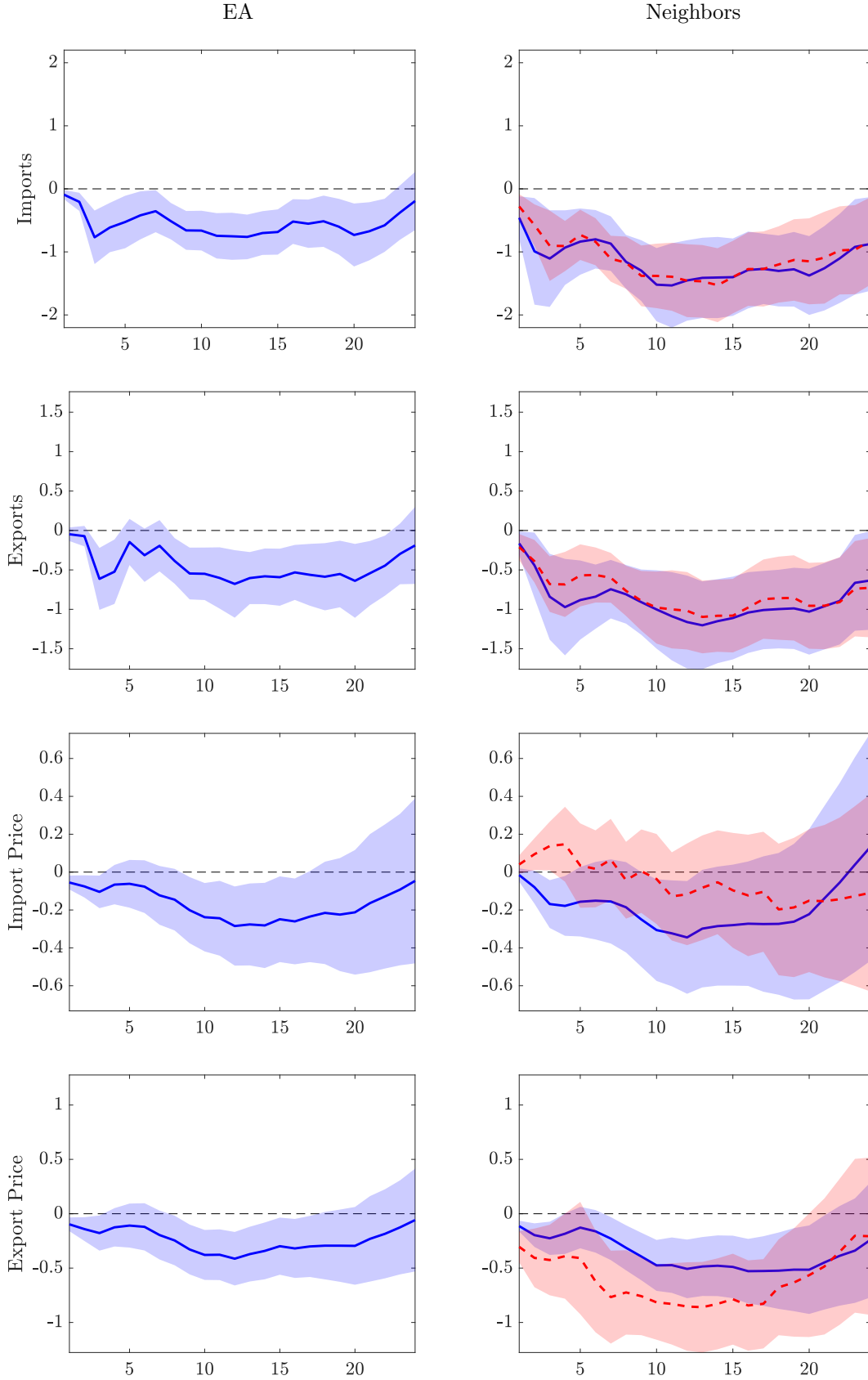
D.1 Response of trade prices and quantities

We estimate the response of the export and import prices and quantities to EA monetary policy shocks based on the specification outlined in Equation (2) in the main text. To this end, we interpolate quarterly data from (see Appendix A.3) to a monthly frequency using the Chow and Lin (1971) procedure.²⁹

The results are shown in Figure D.1. Two observations stand out. First: Euro Area imports and exports fall in tandem, despite decreasing prices. This implies that on the euro area side, expenditure switching is limited at best, and there is no deterioration of net-trade which could cushion the spillovers to the neighbouring countries. If anything, euro area imports decline by more than exports, suggesting that the net export position of the euro area slightly improves. Second, the dynamics of export and import prices of neighboring countries are strikingly different across pegs and floats. For floats, export prices (expressed in euros) fall by more, and import prices (expressed in local currency) even increase, in line with theoretical predictions under (partial) exchange rate pass-through. But this does not translate into large differences in quantities, as exports and imports fall in tandem for both pegs and floats, implying, if anything, a very limited role of expenditure switching and hardly any change in the trade-balance. This is in line with the predictions of our model as shown in Figure G.6.

²⁹We aim for a parsimonious interpolation, only using the a priori most informative predictors for each series. In particular, we interpolate all variables using a constant and a trend as predictors. Furthermore, for real exports (imports) of neighbouring countries, we include monthly observations of the exchange rate and euro area (domestic) industrial production as predictors to proxy for changes in demand and relative prices. For the corresponding price indices, we include the domestic currency exchange rate vis-à-vis the euro, the domestic inflation rate, and the dollar-euro exchange rate to proxy for the relevant relative prices. We proceed analogously for euro area variables. For later reference, we also interpolate the (nominal) import and export to GDP ratio, which we then use to build a measure of the trade-balance to GDP ratio. To do so, we proceed analogously but include both the euro-dollar and euro-domestic currency exchange rate as well as domestic and euro area industrial production and inflation to account for shifts in prices and quantities. To make sure that our results are not driven by outliers, we exclude observations where the growth rate is more than 10 deviations away from the median growth rate. This, for instance, includes Brexit for UK imports.

Figure D.1: Adjustment of trade prices and quantities to EA monetary policy shock

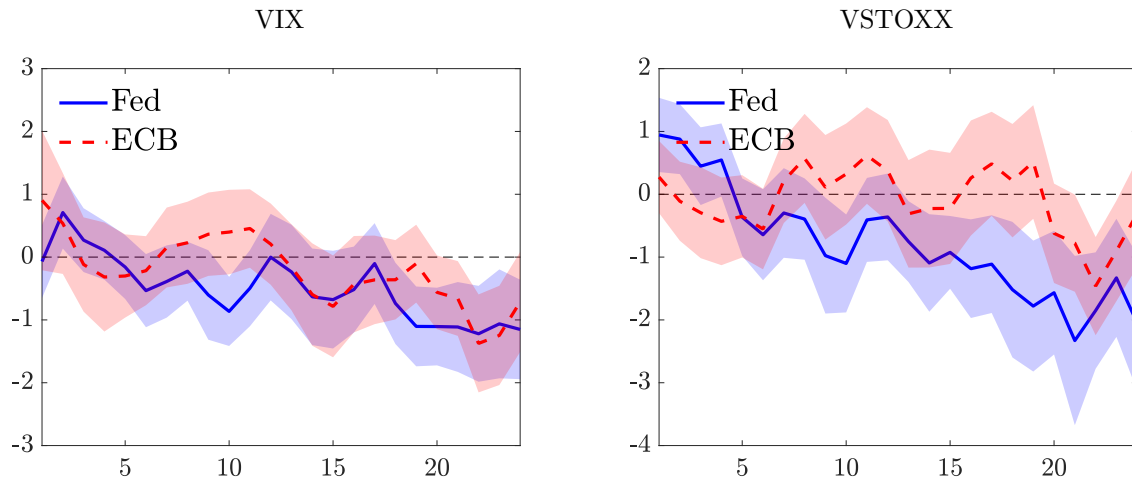


Notes: one-standard-deviation shock identified by Jarociński and Karadi (2020); lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Right column: solid (blue) line is the estimate for peg, dashed (red) line is the estimate for float. Given the prominent role of commodities in European imports, we include 2 lags of the commodity price index as an additional control to improve the precision of the estimates, as suggested by Montiel Olea et al. (2025). Export (import) prices are expressed in euros (national currency).

D.2 Response of VIX and VSTOXX

We estimate the response of the VIX and VSTOXX to EA monetary policy shocks based on specification (2) in the main text.

Figure D.2: Adjustment to EA monetary policy shock



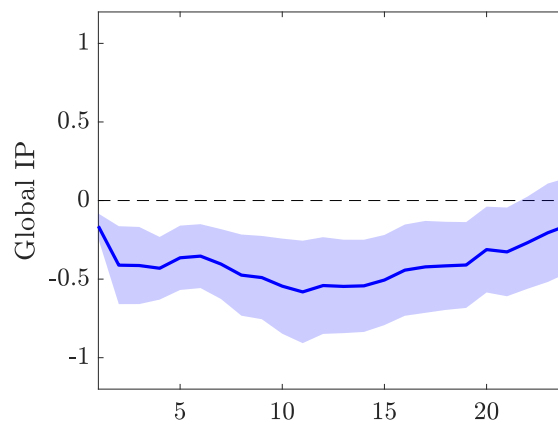
Notes: Response of VIX (left) and VSTOXX (right) to ECB (solid blue line) and Fed policy (dashed red line) shocks; controls as in baseline, but with EA shocks replacing the US shocks in case of response to Fed shock; lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively.

Figure D.2 shows the results, contrasting the response of the VIX (left) and the VSTOXX (right) to EA monetary policy shocks to the response to Fed shocks (also due to Jarociński and Karadi (2020)). And indeed, we observe that only Fed shocks raise the VIX, consistent with earlier work (Miranda-Agrippino and Rey, 2020; Rey, 2013). A similar pattern obtains for the VSTOXX. In this case, the difference across shocks is however, less sharp. This is to be expected given that the Fed presumably is relatively less important for Europe.

D.3 Response of world industrial production

We estimate the response of world industrial production as constructed by Baumeister and Hamilton (2019) to a euro area monetary policy shock. The effects are comparable in sign to the domestic effects and the effects of the neighbors. This suggests that using only trade-openness vis-a-vis the euro area as a calibration target would heavily understate the spillover effects on the neighboring countries. For instance, from the point of view of neighbouring countries, the fall in foreign demand after a euro area tightening is much larger than just the effect of induced contraction in the euro area (multiplied with the corresponding trade-share).

Figure D.3: Adjustment of world industrial production to EA monetary policy shock



Notes: Response of world industrial production to one-standard deviation shock identified by Jarociński and Karadi (2020); lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998). Data for world industrial production from Baumeister and Hamilton (2019).

E Robustness analysis

The main text documents that euro-area monetary policy shocks spill over to neighboring countries regardless of whether the neighbor pegs or floats. This appendix reports on the robustness of the baseline results. Appendix E.1 controls for potential confounding factors. Appendix E.2 looks into alternative ways of classifying countries as pegs or floats. Appendix E.3 looks at the role of specific countries and the assumption of homogeneity. Appendix E.4 looks at the robustness of the results with respect to the sample period chosen and the lag length implemented. Appendix E.5 looks into different ways of measuring monetary shocks. The main results stand, in all of these cases: floats do not appear to provide more insulation than pegs.

E.1 Confounding factors?

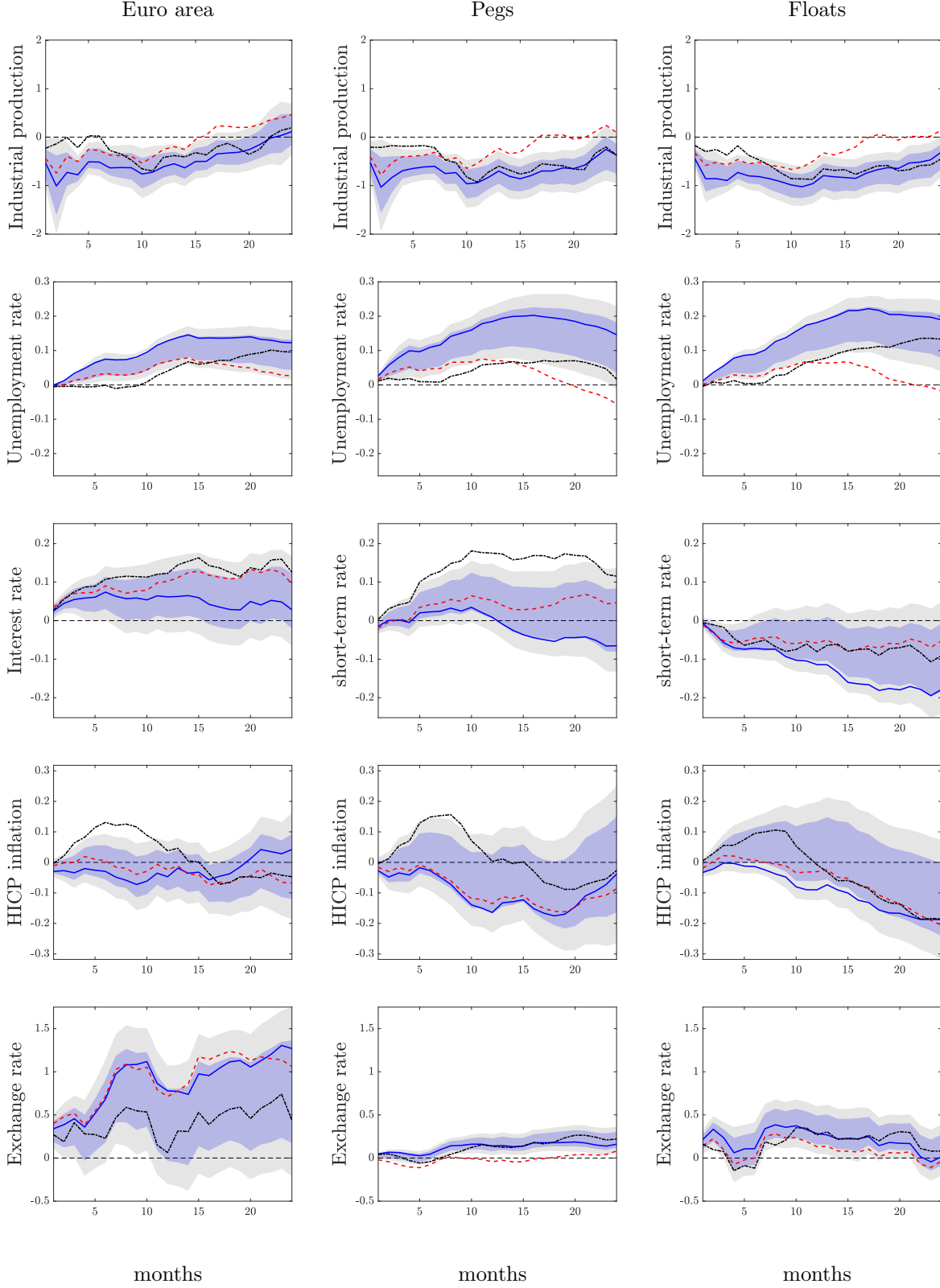
Figure E.1 shows the estimated effects of euro-area monetary shocks when the estimation no longer controls for US monetary policy shocks, but instead accounts and for global financial developments. Doing so, the appendix further guards against the concern that the results in the main text arise from a confounding common global factor that affects global economic activity. In order to provide a visual benchmark against which to assess the robustness of our baseline, all the figures here plot the confidence bounds of the baseline specification against the point estimates that arise under alternative specifications.

The blue solid lines in the figures show results when we exclude as the controls *US* monetary policy shocks. The results are shown as blue solid lines, and are virtually unchanged relative to the baseline. Another candidate global factor would be a global financial cycle that causes us to confound global comovement with cross-border spillovers, see Miranda-Agrippino and Rey (2020) and Rey (2013). We include implied stock market volatility as measured by the VIX and the VSTOXX as additional control variables.³⁰ The responses are shown by the red dashed lines in the figures. For some variables, notably unemployment and industrial production, the measured spillovers are somewhat weaker than in the baseline. Importantly, however, this applies to pegs and floats alike. The output and inflation spillovers to floaters are at least as large as the spillovers to neighbors that peg; and the exchange rate response is mute.

As an additional robustness test, we drop those six large monetary policy shocks from our sample which exceed 10 basis points in absolute value (which includes the observation for March 2020) to verify that our results are not driven by outliers. Results for this specification are shown by the black dash-dotted lines. And while some responses change somewhat relative to baseline, the spillovers to floats remain strong, notably relative to pegs.

³⁰We also consider both indicators in isolation and find very similar results.

Figure E.1: Euro-area monetary policy shock: robustness controls



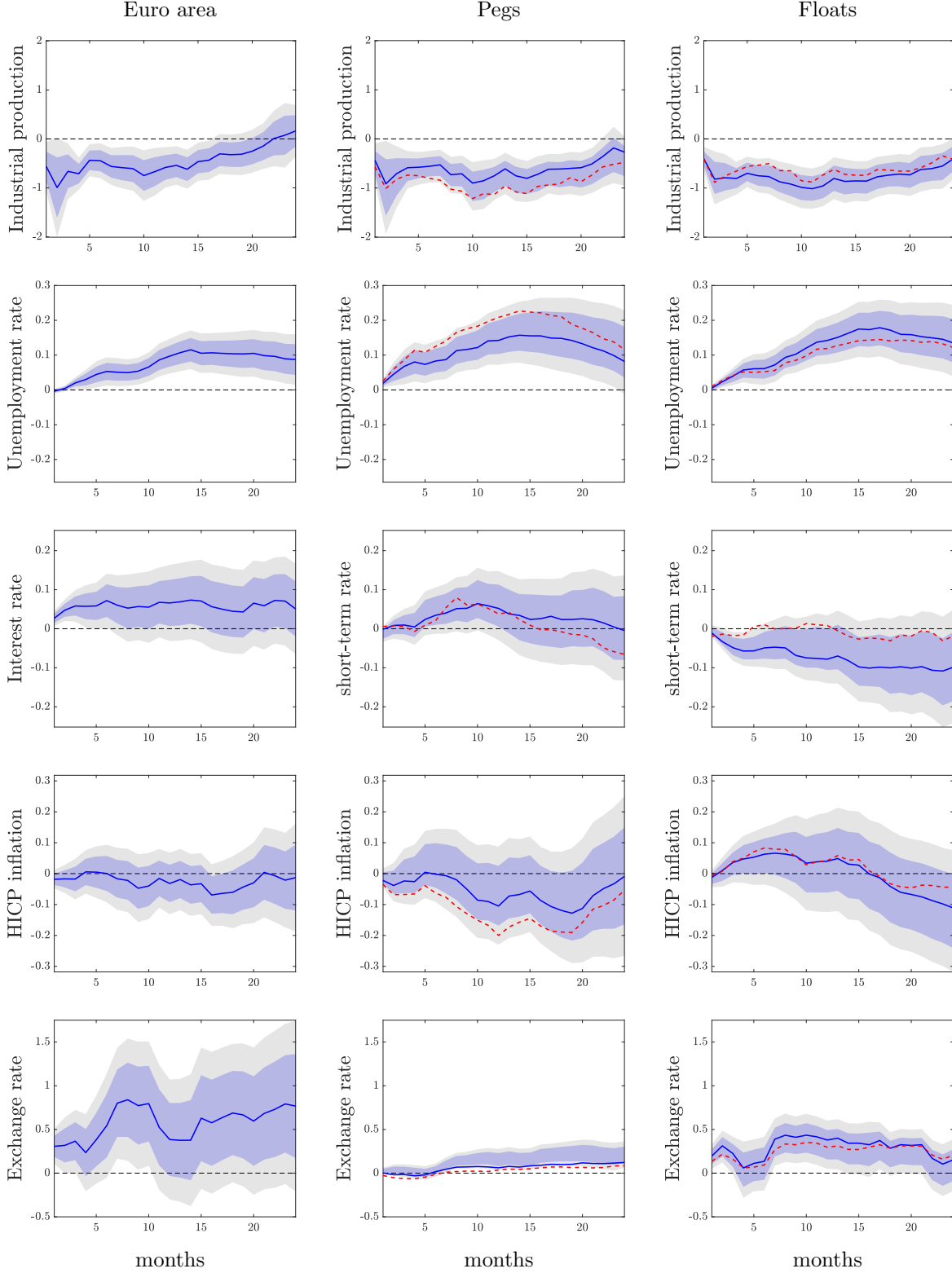
Notes: EA monetary policy shock as in Figure 2.A, but conducting robustness exercises. Shaded areas correspond to 68 and 90 percent confidence bounds of the estimate for the baseline shown in Figure 2.A in the main text. The other lines are the point estimates for alternative specifications: w/o U.S. variables as controls (blue solid line), VIX & VSTOXX as additional control variables (dashed lines in red), and specification without large shocks (black dash-dotted line).

E.2 Robustness: exchange-rate regime classification

The main text documents that euro area monetary policy shocks spill over to neighboring countries regardless of whether the neighbor pegs or floats. This relied on a particular way of classification of pegs and floats. This appendix looks into other ways of classifying the exchange-rate regime. The results differ little from the baseline—as one would expect when the exchange-rate regime has little bearing on the extent of spillovers. The blue solid lines in Figure E.2 show results when we omit the 15% of country-month observations from our sample for which the classification of IRR is between 5 and 9; that is, if we omit intermediate cases.

Next, we provide a classification that does not rely on IRR at all. Namely, the red dashed lines in the figures use ERM2 membership as a criterion: we define as floats all country-month observations for which a country is neither a member of the ERM2 nor a member of the EA. This classifies 64% of observations as floaters, more than in the baseline. Our sample has 743 observations with ERM2 membership, and 1260 observations with EA membership.

Figure E.2: Euro-area monetary policy shock: regime classification



Notes: EA monetary policy shock as in Figure 2.A, but conducting robustness exercises. Shaded areas correspond to 68 and 90 percent confidence bounds of the estimate for the baseline shown in Figure 2.A in the main text. The other lines are the point estimates for alternative specifications (except for EA: baseline): no intermediate regimes, that is, we drop country-month observations with IRR classification between 5 and 9 (blue solid line), float defined as all country-month observations where a country is neither in ERM2 nor on euro (red dashed line).

E.3 Robustness: Homogeneity and set of countries

Figure E.3.1 reports robustness analyses that seek to make sure that certain pertinent groups of countries do not drive or confound our findings. This is important because our baseline specification assumes a certain degree of homogeneity across countries. Namely, the slope parameters in equation (1), β_h , and γ_h^p and γ_h^f , were assumed to be the same across countries. The way in which we probe into the implicit homogeneity assumption is by selecting groups of countries that should be more homogeneous still. The results are barely affected.

First, we select countries that consistently peg or float throughout the entire sample period and estimate a linear model for each country (rather than modelling interaction effects between the shock and the exchange-rate regime). The blue solid lines in the figures here show the average impulse response functions, averaging separately across countries that peg and countries that float; that is, the mean group estimator (Pesaran and Smith, 1995).³¹ Spillovers are large also then.

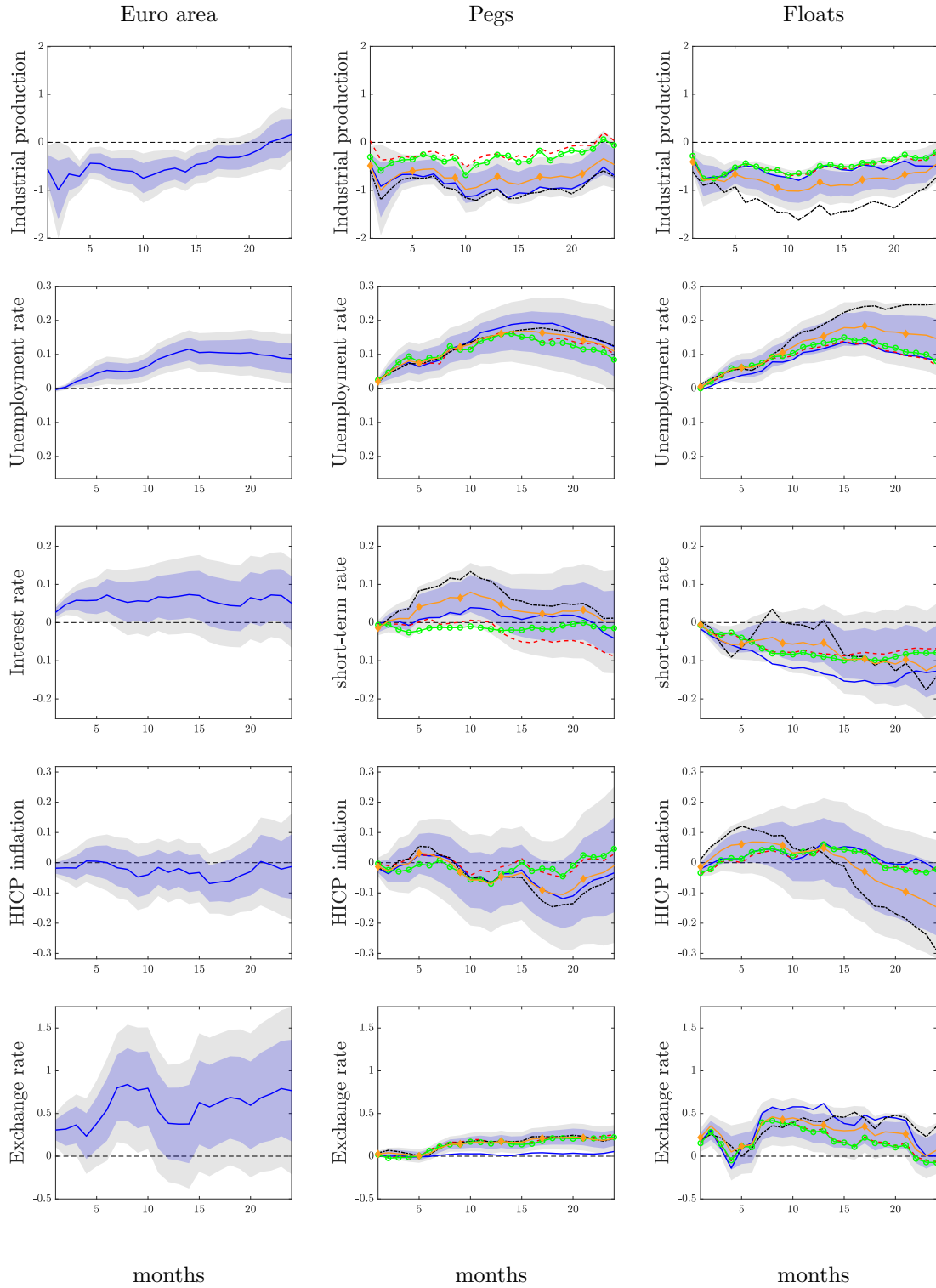
Next, we include/exclude certain groups of countries. For one set of results, for example, we exclude all EMU accession countries (Bulgaria, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia), see the red dashed lines. For another, we run the regressions on a subsample of *only* Central and Eastern European countries (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), black dash-dotted line, and on a subsample which excludes precisely these countries (green line with circles). Results in all these cases are rather similar to the baseline reported in the main text. This provides indirect evidence that the assumption of homogeneity is tenable in the current context.

Finally, as a first step toward assessing whether our results are limited to EA neighboring countries, we extend the sample to include developed Asian countries with floating regimes and African countries that peg to the euro.³² Specifically, we were able to collect data Asian countries with flexible exchange rate against euro: Japan (IRR classification: 13), South Korea (11 up to 2015:M03, 12 afterwards), Singapore (11 up 2016:M03, 4 afterwards, managed float given based of currencies dominated by the dollar), and Taiwan (managed float); and African countries with a peg to the euro (all IRR classification 1): monthly and quarterly observations for industrial production for Côte d’Ivoire and Senegal; for Cameroon only quarterly observations for industrial production.

³¹Neighbors that peg throughout are Bulgaria, Croatia, Cyprus, Denmark, Estonia, Greece, Lithuania, Slovenia and Slovakia. Neighbors that float are Iceland, Norway, Poland, and the United Kingdom. As Figure A.1 above shows, these countries operated a floating exchange rate almost always during our sample period; Iceland early on has a few episodes marked 8 by IRR but afterwards consistently is marked 9 or above.

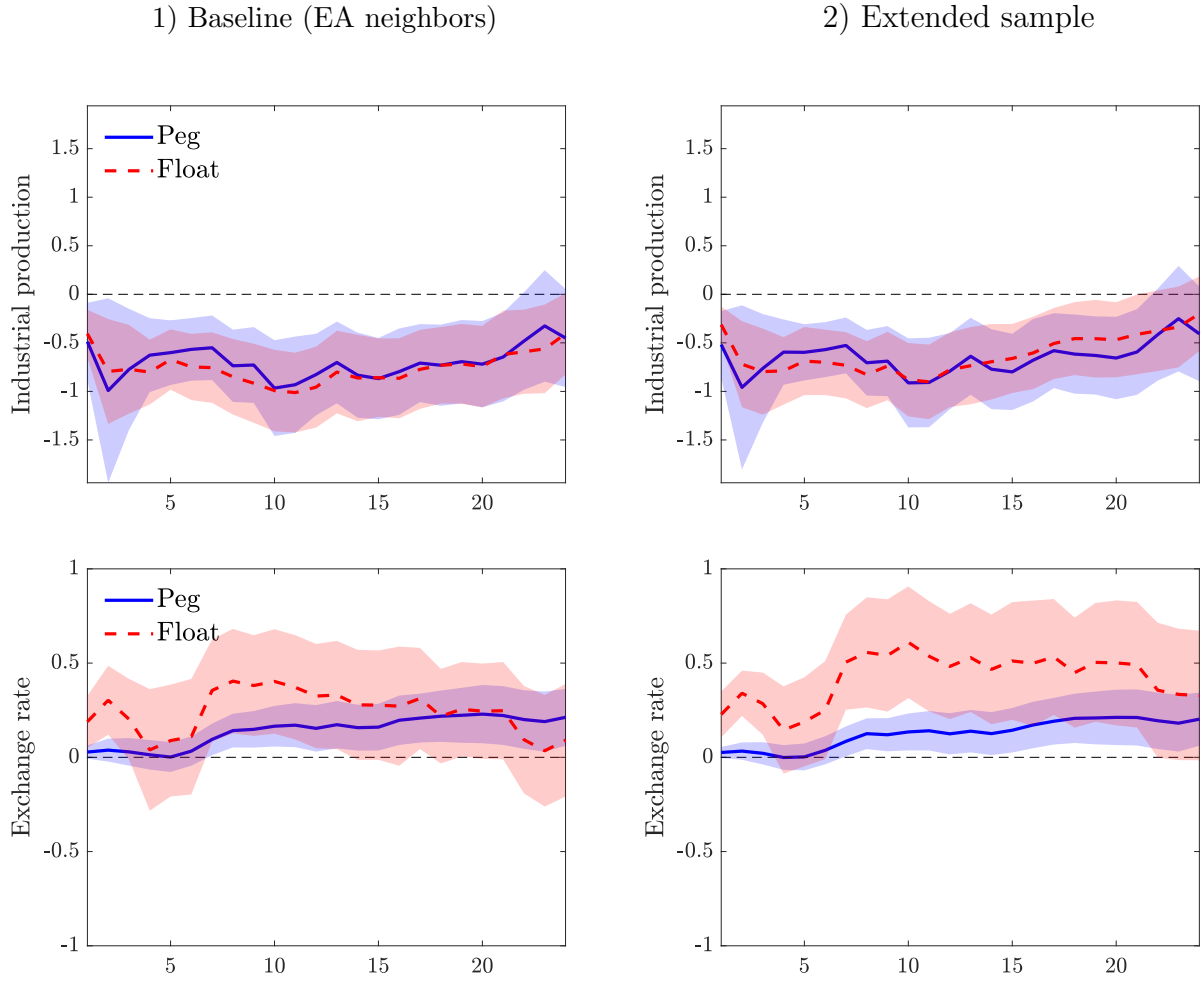
³²We leave a systematic exploration beyond the EA’s neighbors for future work. There are many good reasons: not only is the sample much more limited (three pegs and quarterly data only), it is also hard to argue that the only material difference between these sets of countries is the exchange rate regime.

Figure E.3.1: Euro-area monetary policy shock: robustness countries



Notes: EA monetary policy shock as in Figure 2.A, but conducting robustness exercises. Shaded areas correspond to 68 and 90 percent confidence bounds of the estimate for the baseline shown in Figure 2.A in the main text. The other lines are the point estimates for alternative specifications (except for EA: baseline): mean group estimator for pure pegs and pure floats (blue solid lines), no EMU accession countries in sample, that is, we drop Bulgaria, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia (red dashed line), only Eastern European countries in sample, that is, only Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia (black dash-dotted line), no eastern European countries in sample, that is the complement of the previous selection (green line with circles), excluding Switzerland (orange line with diamonds).

Figure E.3.2: Response to EA MP shock—baseline v extended sample



Notes: For industrial production extended sample includes, in addition to baseline, the following floats: Japan, South Korea (both 1999:M01–2023:M11), Singapore (1999:M01–2016:M03), and Taiwan (2010:M01–2019:M02); and the following pegs: Côte d’Ivoire (2004:M11–2025:M03), Senegal (2008:M01–2025:M04) (peg); for the exchange rate, in addition to baseline, Japan, South Korea, Singapore (1999:M01–2016:M03), Taiwan (float); CFA franc zone, Comoros, Cabo Verde (peg), all for the full sample 1999:M01–2025:M04.

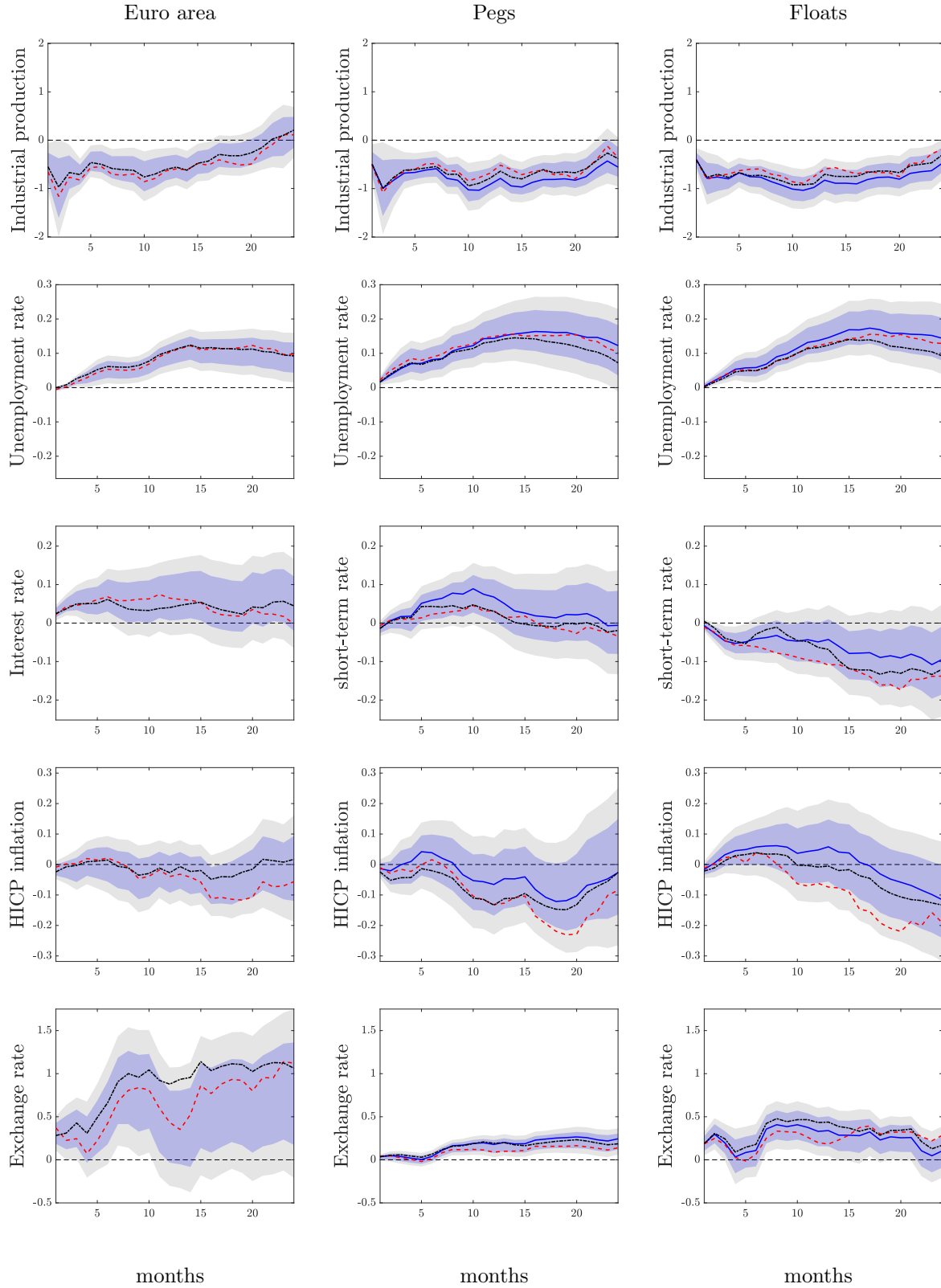
Since data availability is limited, we focus on industrial production and the exchange rate (right panels of Figure E.3.2), which closely match the baseline (reproduced in the left panels).

E.4 Robustness: Sample period, lag length

Figure E.4 reports robustness with respect to the sample period and lag length chosen in the baseline estimates. In one specification, we drop Cyprus and Greece from the sample (blue solid line). The rationale is that one may be concerned that during the European sovereign debt crisis these countries themselves may have been an important factor in EA monetary policy, which would violate the exogeneity assumption for the identified EA monetary policy shocks and render the measured spillovers spurious. The exclusion of Greece and Cyprus is inconsequential. In another specification, we drop observations for the years 2008–09, that is, for the period which is arguably dominated by the global financial crisis (GFC). When we drop the GFC period the response in the EA is notably weaker, but the response of pegs and floats continues to track the EA’s response (red dashed line).³³ For completeness, the figures also show that the lag length that we choose for the controls is inconsequential: the black dash-dotted lines show an alternative specification which features six rather than twelve lags each of the shock and the dependent variable in the vector of controls.

³³Results are also robust to excluding the pandemic period from our sample: the results in the working paper version of this paper are based on data which runs only up to 2018:M12 (Corsetti et al., 2021). They are basically the same as those based on the sample in the current version (which runs up to 2021:M12).

Figure E.4: EA monetary policy shock: different sample composition or lag structure



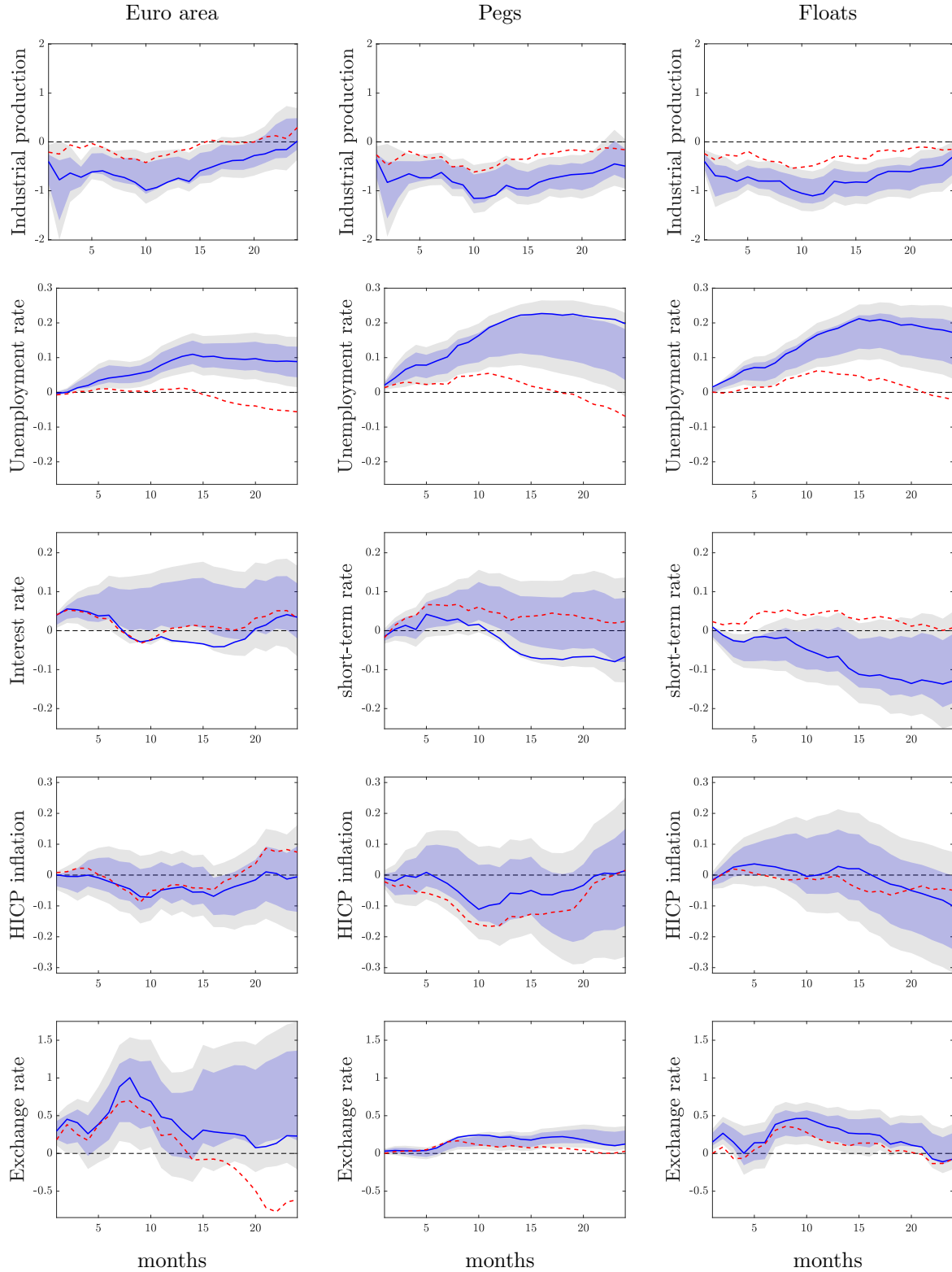
Notes: EA monetary policy shock as in Figure 2.A, but conducting robustness exercises. Shaded areas correspond to 68 and 90 percent confidence bounds of the estimate for the baseline shown in Figure 2.A in the main text. The other lines are the point estimates for alternative specifications: Cyprus and Greece not in sample (blue solid line), drop observations for financial crisis 2008–09 (red dashed line), 6 (rather than 12) lags of shock and dependent variable as controls (black dash-dotted line).

E.5 Different series for monetary shocks

Figure E.5.1 reports responses to monetary shocks, when using other ways of measuring the shocks. One such alternative follows what Jarociński and Karadi (2020) label the “poor man’s sign restriction” (blue solid lines). Rather than restricting the impulse responses of an estimated VAR model as when they construct the baseline shock series, under the poor man’s approach the authors classify all those monetary surprises as monetary policy shocks for which the interest-rate forward and the stock-market move in opposite directions. As another alternative, we have used the measure of monetary policy shocks compiled by Altavilla et al. (2019) (dashed red lines). This measure is also based on high-frequency monetary surprises but does not restrict the sign of the stock market response. For both of the alternative measures, results hardly change relative to what the main text presents.

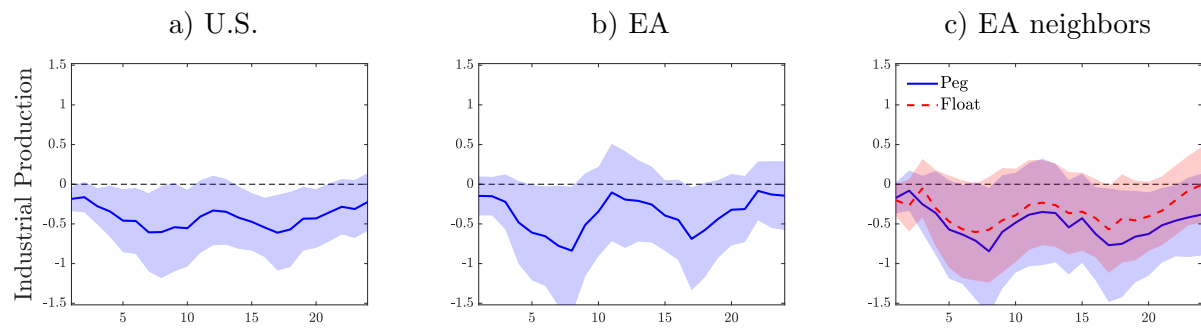
Next we take up the question of whether EA monetary policy shocks are special. We therefore simply estimate the response of pegs and floats to US monetary policy shocks, relying on the shock measure recently put forward by Bauer and Swanson (2023). We show results in Figure E.5.2. Again there is strong co-movement in industrial production across the U.S., the EA, and EA neighbors—regardless of whether they peg to the euro or not. As, vis-a-vis the dollar, both country groups float, we view this as an additional confirmation of our homogeneity assumption.

Figure E.5.1: Euro-area monetary policy shock—different shock measures



Notes: EA monetary policy shock as in Figure 2.A, but conducting robustness exercises. Shaded areas correspond to 68 and 90 percent confidence bounds of the estimate for the baseline shown in Figure 2.A in the main text. The other lines are point estimates for alternative specifications: monetary policy shocks identified using poor man's condition (blue solid line), monetary policy shocks measured as monetary surprises in Altavilla et al., 2019 (red dashed line).

Figure E.5.2: Response of industrial production to U.S. MP shocks



Notes: Results based on data for 1999:M01–2023:M12; Specification includes a dummy for 2020:M03, otherwise as baseline but with EA MP shocks instead of US shocks as controls.

F Constructing the Main Euro Area Shocks

F.1 Euro Area SVAR specification

To recover the EA Main Business Cycle Shock and the EA main Exchange Rate Shock, we first specify a standard SVAR model for the euro area. In particular, we estimate a Bayesian structural VAR model along the lines of Rubio-Ramirez et al. (2010):

$$\mathbf{y}_t' \mathbf{A}_0 = \sum_{\ell=1}^L \mathbf{y}_{t-\ell}' \mathbf{A}_\ell + \mu + \epsilon_t',$$

where $\mathbf{y}_t$ is an $n \times 1$ vector of endogenous variables, ϵ_t an $n \times 1$ vector of (normally distributed) structural shocks and $\mathbf{A}_0$ captures the contemporaneous relationships between the variables.

We estimate based on data for the euro area from January 1999 to April 2025. In particular, we use data for the five variables shown in the main part of the analysis: the unemployment rate, Industrial production, year-on-year HICP inflation, the short-term interest rate, and the Euro-Dollar exchange rate. We take the logarithm of the exchange rate and industrial production. We also include the high-frequency monetary policy shock series as an additional control variable. When constructing the main euro area exchange rate shock, we replace the Euro-Dollar exchange rate with the Broad Nominal Effective Exchange Rate of the Euro to model a shock that indeed implies an appreciation of the euro vis-à-vis the neighboring countries. We estimate the model using the Bayesian algorithm of Arias et al. (2021). We specify flat priors and include 12 lags of the endogenous variables.

F.2 Identification

It is well known that without further assumptions, the matrix $\mathbf{A}_0$ in Equation (F.1) as well as its inverse $\mathbf{A}_0^{-1}$, which captures the contemporaneous effect of structural shocks on the endogenous variables are not uniquely identified. As shown for instance in Arias et al. (2021), this identification problem can be restated by decomposing the impact matrix as $\mathbf{A}_0^{-1'} = \mathbf{S}\mathbf{Q}$ where $\mathbf{S}$ is well well-identified lower-triangular matrix, which orthogonalizes the reduced form residuals and $\mathbf{Q}$ represents an unidentified, orthonormal matrix, where each column is linked to a specific structural shock. Given stationarity of the SVAR system, it allows for an SVMA representation of the form

$$\mathbf{y}_t = \boldsymbol{\Theta}(\mathbf{L})\epsilon = \mathbf{C}(\mathbf{L})\mathbf{Q}\epsilon_t, \quad (23)$$

with $\boldsymbol{\Theta}(\mathbf{L})$ as an infinite polynomial capturing the structural impulse responses to the (unidentified) structural shocks, while $\mathbf{C}(\mathbf{L})$ captures the (identified) impulse responses

under the triangularized system defined by the matrix $\mathbf{S}$. Given this decomposition, each column $\mathbf{q}$ of the matrix $\mathbf{Q}$ can be related to a specific structural shock and, as shown by Angeletos et al. (2020), the contribution of this shock to the spectral density of the variable d over the frequency band $[\underline{\omega}, \bar{\omega}]$ can be written as

$$\Gamma(q; d, \underline{\omega}, \bar{\omega}) = q' \Phi(d, \underline{\omega}, \bar{\omega}) q = q' \int_{\underline{\omega}}^{\bar{\omega}} \overline{\mathbf{C}^d(e^{-i\omega})} \mathbf{C}^d(e^{-i\omega}) d\omega q, \quad (24)$$

with $\mathbf{C}^d$ as the impulse responses of the triangularized system that correspond to the variable of interest d . $\bar{x}$ indicates the complex conjugate transpose of x .³⁴ Lastly, the matrix $\Phi(d, \underline{\omega}, \bar{\omega})$ expresses the entire volatility of the variable d in terms of the shocks in the triangularized system as described by the matrix $\mathbf{S}$ and can be recovered from the data without any identifying assumptions. The EA Main Business Cycle shock (Main Exchange Rate shock) is then identified by solving for the unit length vector $\mathbf{q}$ that maximizes the contribution of the corresponding shock to the volatility of EA industrial production (EA Broad Nominal Effective Exchange Rate) over the business cycle as defined in Equation (24). This boils down to computing the matrix $\Phi(d, \underline{\omega}, \bar{\omega})$ for EA industrial production (EA broad effective exchange rate) and defining the column vector q that represents the main business cycle (main exchange rate shock) as the eigenvector associated with the largest eigenvalue of $\Phi(d, \underline{\omega}, \bar{\omega})$. Given the rotation vector q , we recover the corresponding structural shock using standard formulas (Kilian and Lütkepohl (2017)).³⁵

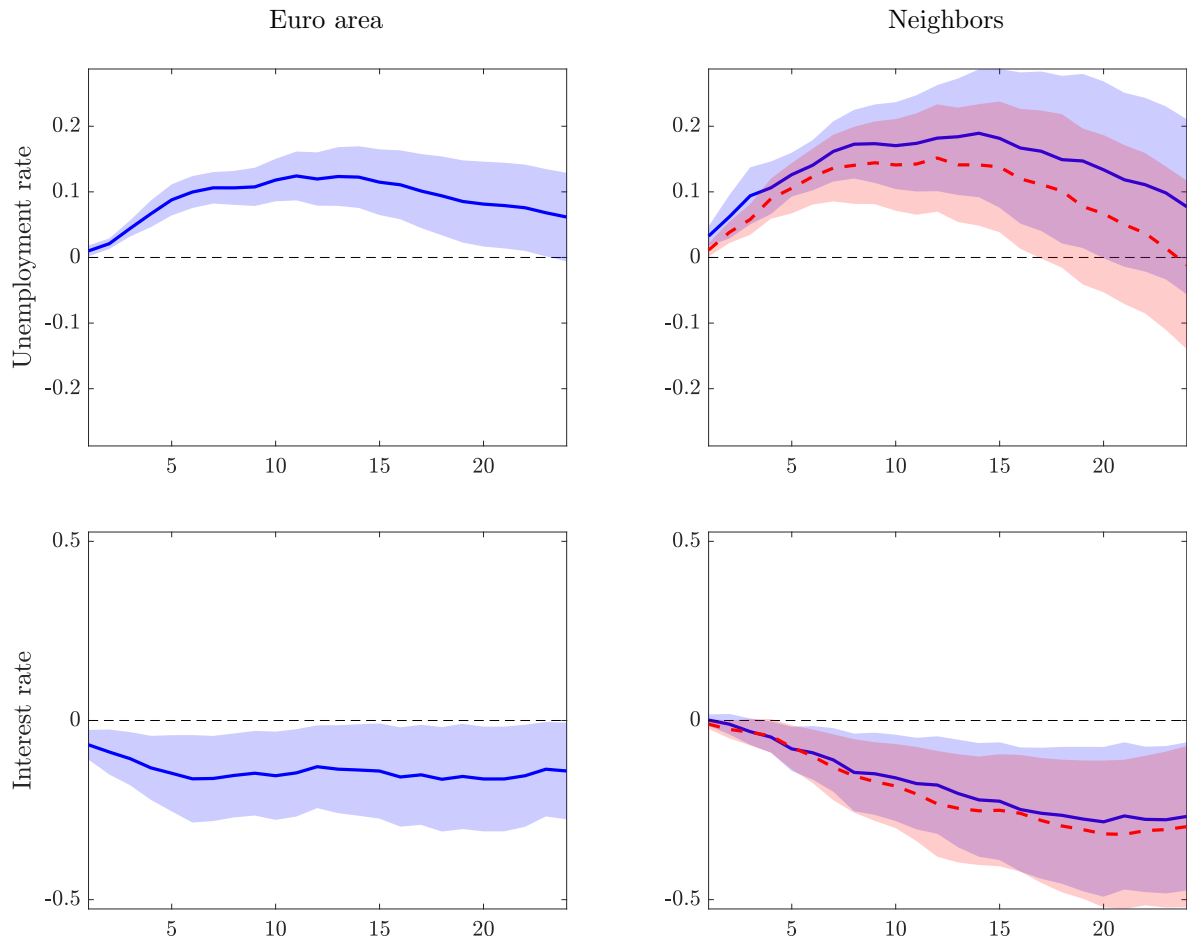
We take 3000 draws from the posterior distribution and compute the corresponding structural shock for each draw. In line with standard practices (Rubio-Ramirez et al. (2010)), we compute the point-wise median as our point-estimate for the structural shock, which we then use in our local projection. We verify that the impulse responses for the euro area from the local projection and the SVAR are indeed very similar, implying that the assumption of invertibility of the SVAR is not too restrictive.

³⁴We choose $\underline{\omega}$ and $\bar{\omega}$ in our monthly SVAR such that, at quarterly frequency, the frequency band is given by $[\underline{\omega}, \bar{\omega}] = [\frac{2\pi}{6}, \frac{2\pi}{32}]$ which is the frequency band typically associated with the business cycle (Stock and Watson (1999), Angeletos et al. (2020)).

³⁵Note that Angeletos et al. (2020) show that the frequency domain identification is similar to a time-domain condition that states that the forecast error variance of the shock peaks after about 12 months. For the Main Exchange Rate shock, we use this result because it delivers slightly sharper inference, with point estimates being very close across both methods.

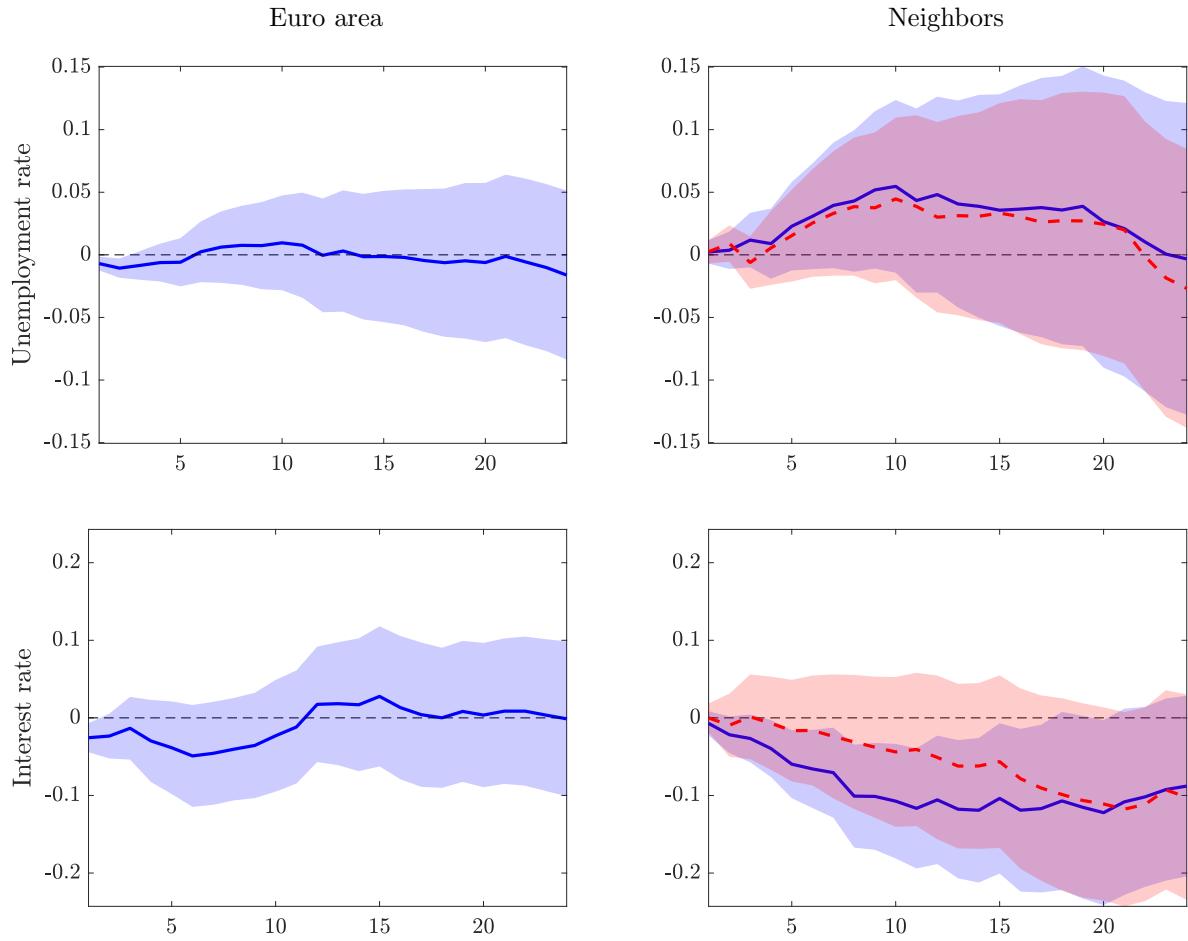
F.3 Additional results

Figure F.1: Adjustment to euro-area main business cycle shock



Notes: MBS shock. lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Horizontal axis is time in months, vertical axis measures deviation in percent/percentage points. Right column: solid (blue) line is estimate for peg, dashed (red) line is estimate for float. Bottom panel shows response of interest rates (annualized pp.); left: one-year bund rate; right: short-term interest rate.

Figure F.2: Adjustment to euro-area main exchange rate shock

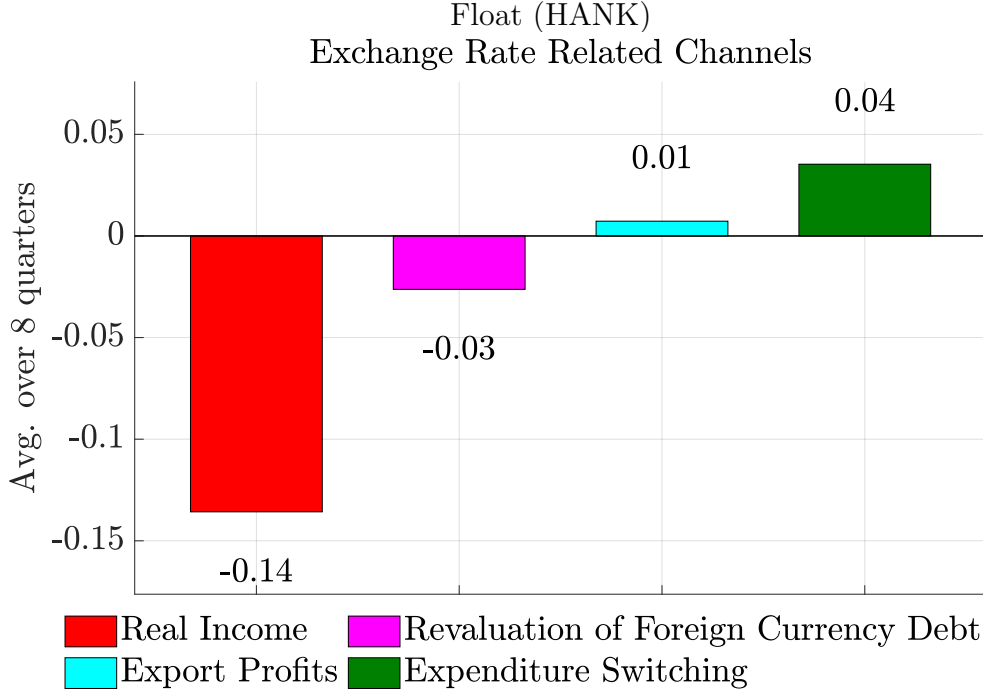


Notes: lines and shaded areas represent point estimate and 90 percent confidence bounds based on Driscoll and Kraay (1998) robust standard errors, respectively. Horizontal axis is time in months, vertical axis measures deviation in percent/percentage points. Right column: solid (blue) line is estimate for peg, dashed (red) line is estimate for float. Bottom panel shows response of interest rates (annualized pp.); left: one-year bund rate; right: short-term interest rate.

G Additional model results

G.1 Decomposition of the exchange rate related channels

Figure G.1: Decomposition of the exchange rate-related spillovers from a foreign monetary policy shock



Notes: Decomposition of the exchange rate related channels of a monetary foreign monetary tightening. Uses equation (23) in Proposition 1. Average over the first 8 quarters after the shock. The response of output and the size of the shock are scaled the same way as in Figure 5.

G.2 Unconditional lack of insulation through the lens of the model

In this section, we assess whether the model also rationalizes the unconditional lack of insulation. In particular, we assume that each economy features three shocks: A government spending shock – a textbook demand-type shock that moves output and prices in the same direction–, a shock to the mark-ups of firms – a textbook supply-side shock that moves output and prices in the opposite direction –, and a monetary policy shock. We also assume that there exists a UIP shock in the spirit of Itskhoki and Mukhin (2021). All shocks follow an AR(1) process and are assumed to be uncorrelated across countries. Furthermore, to allow for some fluctuation in the real exchange rate that is not due to monetary shocks or UIP shocks, we assume that the central banks in floating

Table G.1: Empirical and model-implied second moments

Moment	EA Data	EA Model	Float Data	Float Model	Peg Data	Peg Model
$\sigma(\mathbf{Y}_t)$	2.11	2.36	4.30	4.50	4.81	4.20
$\sigma(\mathbf{i}_t)$	1.28	1.24	1.92	1.56	1.85	2.09
$\sigma(\pi_t)$	0.48	0.55	0.87	1.04	0.85	0.66
$\sigma(\Delta\mathcal{E}_t)$	-	-	3.61	3.48	0.96	0.78
Co-movement with EA counterpart						
$\rho(Y_t^*, Y_t)$	-	-	0.63	0.31	0.54	0.35
$\rho(i_t^*, i_t)$	-	-	0.72	0.23	0.57	0.53
$\rho(\pi_t^*, \pi_t)$	-	-	0.43	0.17	0.63	0.14
Co-movement with EA GDP						
$\rho(Y_t^*, Y_t)$	-	-	0.63	0.31	0.54	0.35
$\rho(Y_t^*, i_t)$	-	-	0.28	0.23	0.15	0.31
$\rho(Y_t^*, \pi_t)$	-	-	0.25	0.11	0.28	0.21
$\rho(Y_t^*, \Delta\mathcal{E}_t)$	-	-	-0.01	-0.03	-0.03	-0.08

Notes: Empirical and model implied unconditional moments. σ represents the standard deviation and ρ the correlation coefficient. Bold letters and symbols indicate that this moment was targeted in the calibration. In particular, we calibrate the parameters by numerically optimizing over the root mean square error, where we take into account the different scales of the targets by rescaling the deviations from the target in terms of percentages from the corresponding targeted value. See notes to Table 2 for a discussion on the computation of the empirical moments. The second moments are computed using the analytical formulas of Auclert et al. (2021a). Table G.2 reports the underlying parameters of the shock processes.

countries follow a Taylor rule that aims to stabilize domestic producer price inflation as specified in Equation (25) and discussed in section G.3 in the Appendix.

We estimate the coefficient of autocorrelation and the variances of the shocks in each country by minimizing the root mean square error relative to the empirical standard deviations of the change in nominal exchange, GDP, inflation, and the interest rate in the EA and the neighboring countries documented in Panel B of Table 2.³⁶ While we assume the variances and autocorrelations of the shock process to be the same for the pegs and the floats, we follow Itskhoki and Mukhin (2025) and assume that under a peg, there is no UIP shock as markets for noise traders don't exist.³⁷ As shown in Table G.1, the model indeed also implies an unconditional lack of insulation. This arises because the same offsetting channels that we described for the spillovers from a monetary shock above are also present for the spillovers from other foreign shocks, as well as the UIP shock. As such, in line with the empirical evidence, a floating exchange rate does not yield material amounts of insulation regardless of the initial shock, which implies that, also unconditionally, the business cycles in the floating and pegging countries will be

³⁶We give more weight to the volatility of the exchange rate under a float in the estimation procedure, as this is the key target. Results are largely robust to equal weighting.

³⁷We verify this by allowing the variance of the UIP shock to differ between pegs and floats. Our estimation procedure indeed drives the variance of the UIP shock under a peg towards zero.

similar. As we deviate from Itskhoki and Mukhin, 2021 and assume that shocks are uncorrelated across countries, the model implies slightly too little co-movement with the euro area. Table G.2 shows the underlying standard deviations and autocorrelations of the shock processes.³⁸

Table G.2: Estimated shock processes

Description	Shock	Std. Dev.	Autocorrelation
H MP Shock	ϵ_t^m	2.01	0.75
H Supply Shock	$\epsilon_t^{\mu_P}$	60.09	0.05
H Demand Shock	ϵ_t^G	650.01	0.46
UIP Shock	ϵ_t^Q	100.10	0.68
F MP Shock	$\epsilon_t^{m^*}$	4.53	0.42
F Supply Shock	$\epsilon_t^{\mu_P^*}$	39.98	0.96
F Demand Shock	$\epsilon_t^{G^*}$	149.99	0.62

Notes: Estimated shock processes. See notes to Table G.1

³⁸Note that, all else equal, the implied first-order autocorrelation of the interest rate following a monetary shock is given by $Cov(i_t, i_{t-1}) = \frac{\rho^i + \rho^m}{1 + \rho^i \rho^m}$, which, given our calibration of the interest rate smoothing under a Taylor-Rule ($\rho^i = 0.75$) and the estimated value of the persistence of the monetary shock ($\rho^m = 0.42$), is close very close to the value of 0.9, which we use in the main text under a real rate rule.

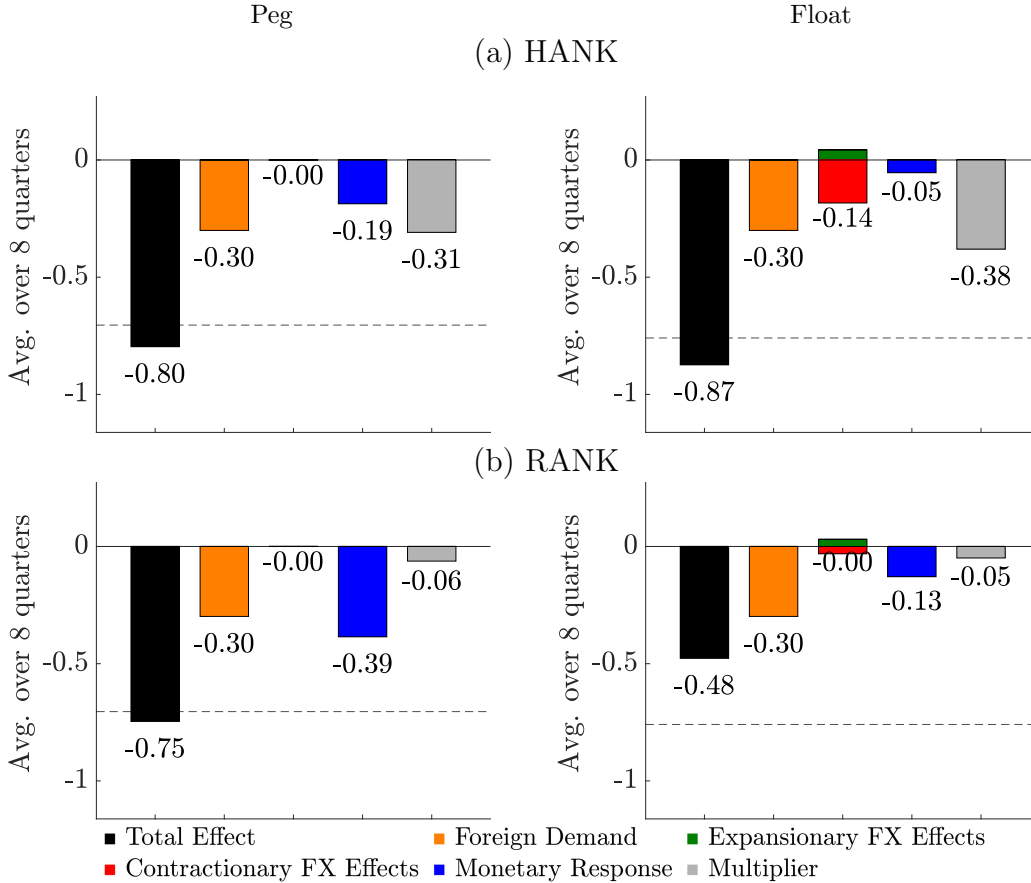
G.3 Results with a conventional Taylor rule

In this section, we document that our main results are robust to using a conventional Taylor rule that focuses on stabilizing domestic producer prices instead of a real rate rule. In particular, we specify the rule as

$$i_t = (1 - \rho^i)(\bar{r} + \phi_{\pi_H}\pi_{H,t}) + \rho^i i_{t-1} + \varepsilon_t^m. \quad (25)$$

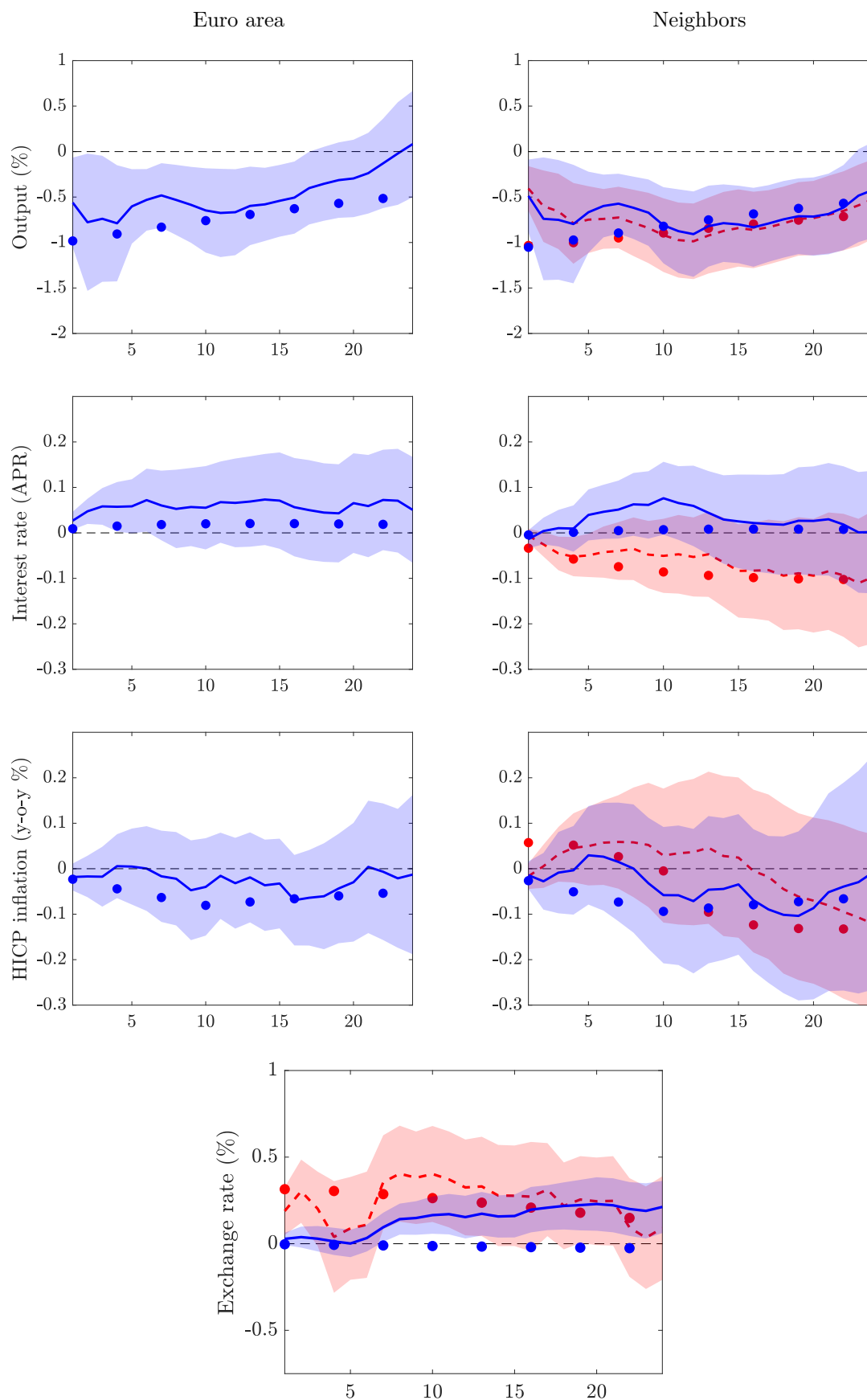
and set $\phi_{\pi_H} = 1$ and $\rho^i = 0.75$, implying that the central bank aims to stabilize domestic producer prices, as advocated for by Galí and Monacelli (2005). Stabilizing domestic consumer prices would produce a counterfactual spike in the interest rate of the floating country due to imported inflation. Results are robust, as shown below.

Figure G.2: Decomposition of the spillovers from a foreign MP shock under a **conventional Taylor Rule**



Notes: See notes to Figure 6. Because under a Taylor rule, the home real interest rate moves, implying that we have to slightly rescale the shock, to engineer the same real depreciation.

Figure G.3: Impulse responses to a monetary shock in the model (under a **conventional Taylor rule**) and the data

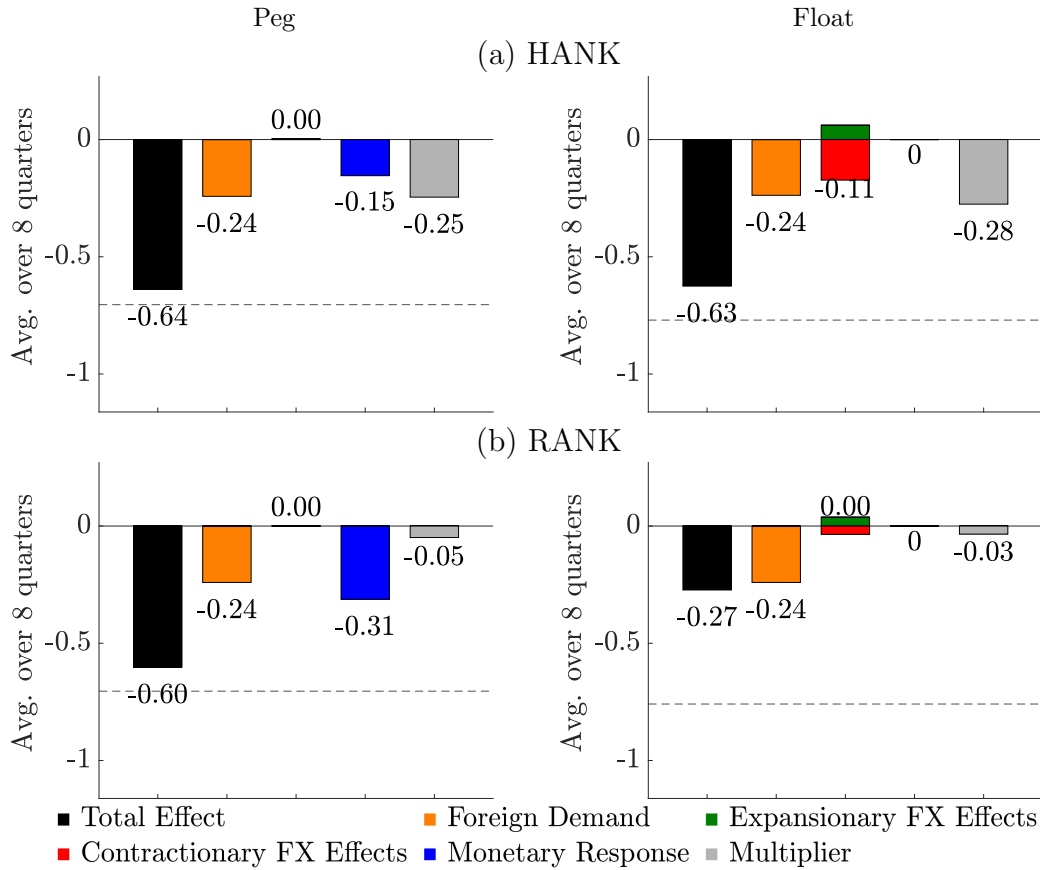


Notes: See notes to Figure 5.

G.4 Results with DCP

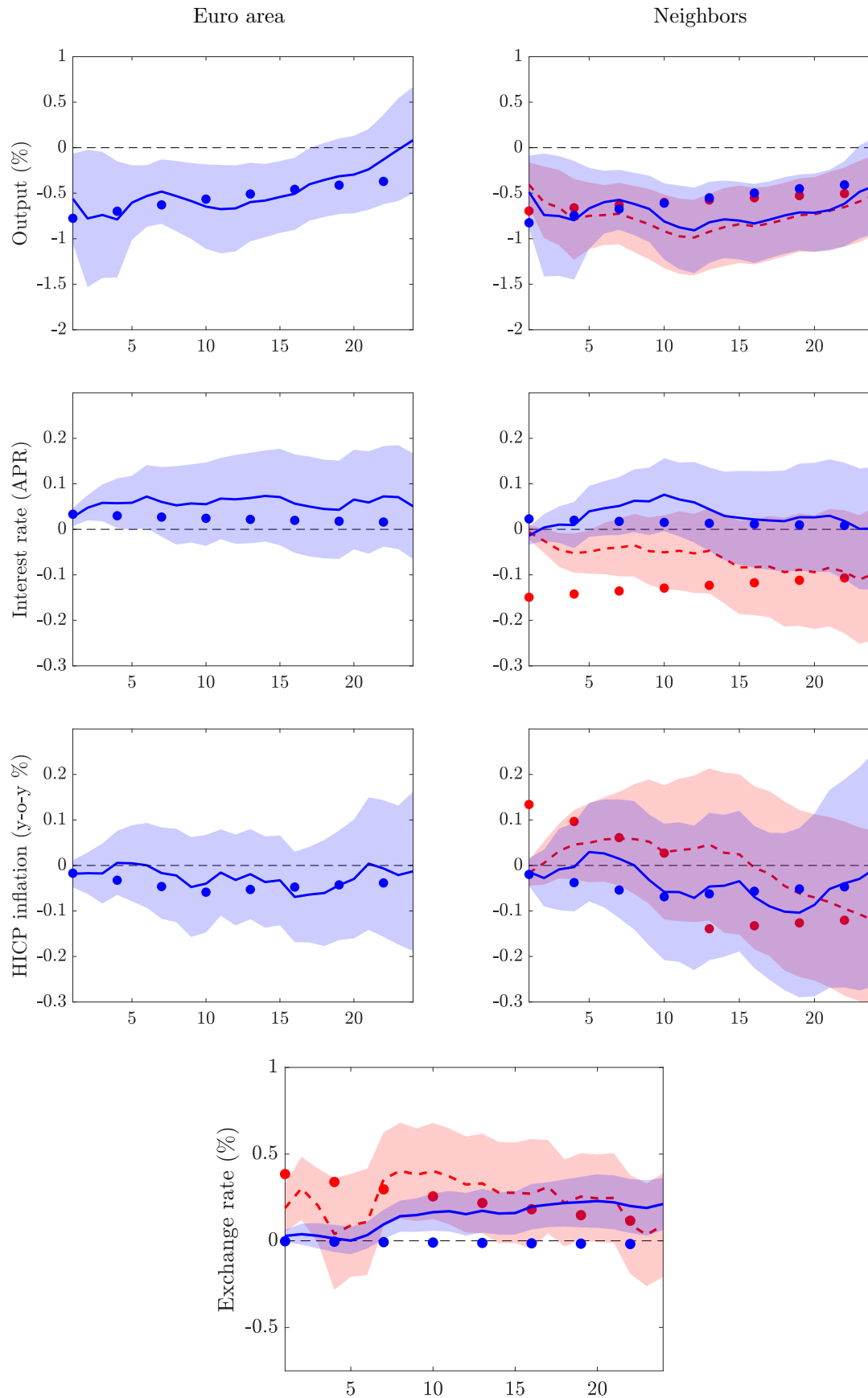
In this section, we document that the core results are robust to assuming bilateral dominant currency pricing (DCP) instead of LCP. In particular, we allow for differences in the degree of price stickiness of export prices in the home and foreign economy and assume that import prices are fully flexible ($\theta_F = 0$), whereas export prices are fairly sticky in the foreign currency ($\theta_H^* = 0.6$). As shown in Figure G.5, the model also predicts a lack of insulation under DCP and the contribution of the different channels remains roughly similar, with the real income channel being relatively stronger, but this is offset by an increasing importance of the sticky export price channel. One also observes in Figure G.5 that the empirical fit deteriorates due to excessive exchange rate pass-through into import prices, causing CPI inflation to spike on impact and then, from period 1 onwards, go into strongly negative territory, prompting the nominal rate to fall strongly on impact.

Figure G.4: Decomposition of the spillovers from a foreign MP shock under **DCP**



Notes: See notes to Figure 6.

Figure G.5: Impulse responses to a monetary shock in the model (under **DCP**) and the data

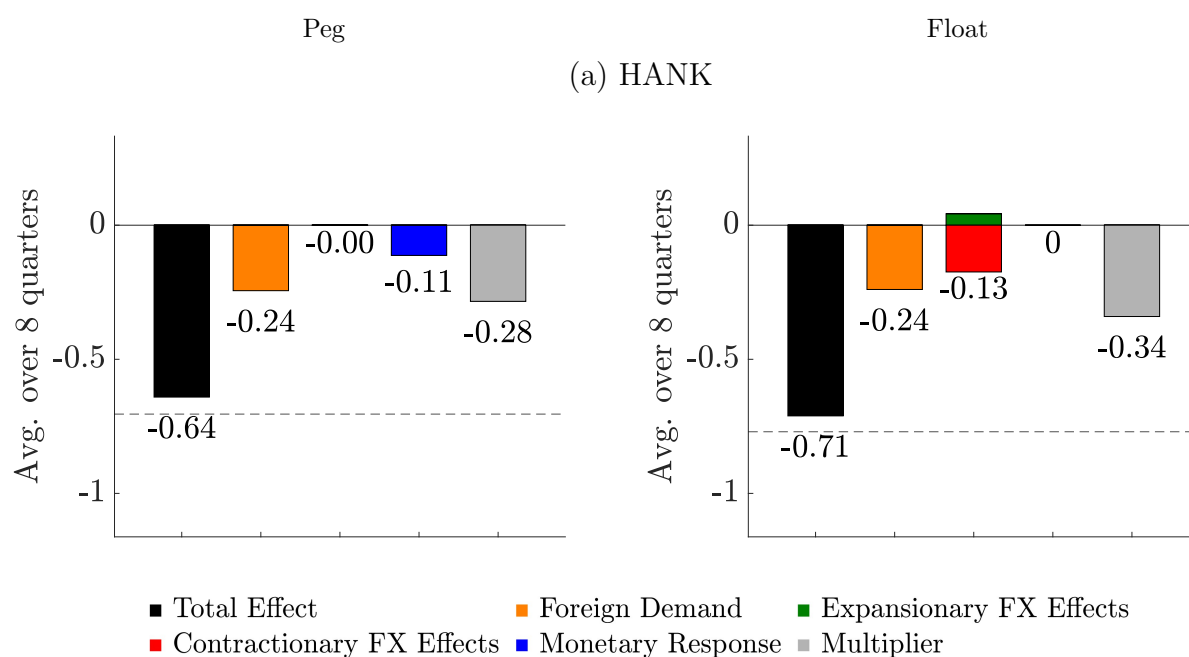


Notes: See notes to Figure 5.

G.5 Results with the income process of Kaplan et al. (2018)

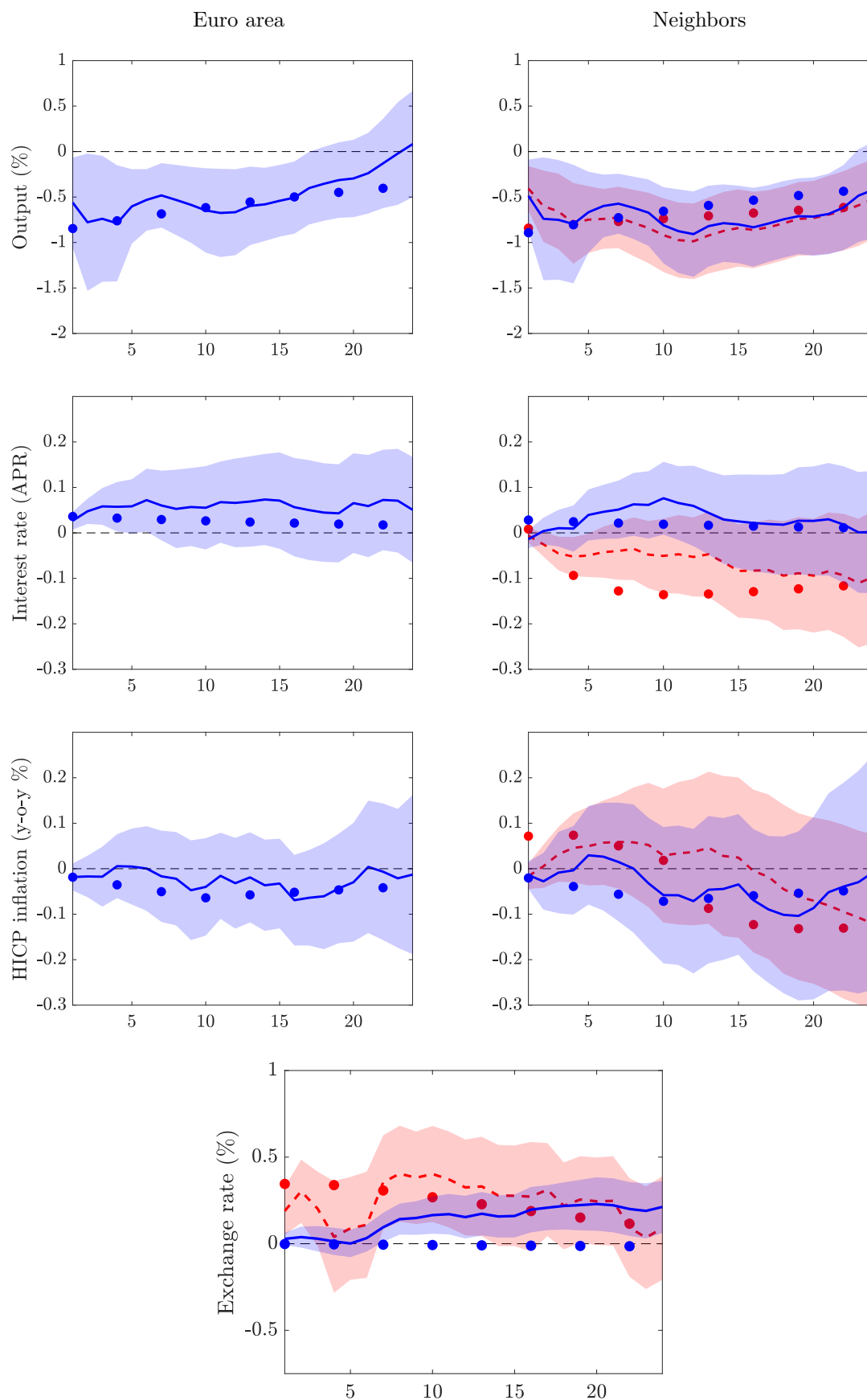
In the main text of the paper, we follow the calibration of Auclert et al. (2021b), who calibrate the AR(1) process for (log) idiosyncratic productivity based on empirical moments for Mexico and Peru, both emerging market economies. But many of the neighboring countries in our sample may, in fact, be closer to a fully advanced economy. In this section, we show that our key results are robust to this concern. In particular, we follow Auclert et al. (2025) and use the (discretized) income process of Kaplan et al. (2018) (henceforth KMV), which is estimated based on data from the US Social Security Administration on male earnings from Guvenen et al. (2021). As in Auclert et al. (2025), the continuous time process Kaplan et al. (2018) is approximated with a 33-state grid. The results from this exercise are shown in Figures G.6 and G.7.

Figure G.6: Decomposition of the spillovers from a foreign monetary policy shock with the **income process of KMV**



Notes: See notes to Figure 6.

Figure G.7: Impulse responses to a monetary shock in the model (with **KMV income process**) and in the data

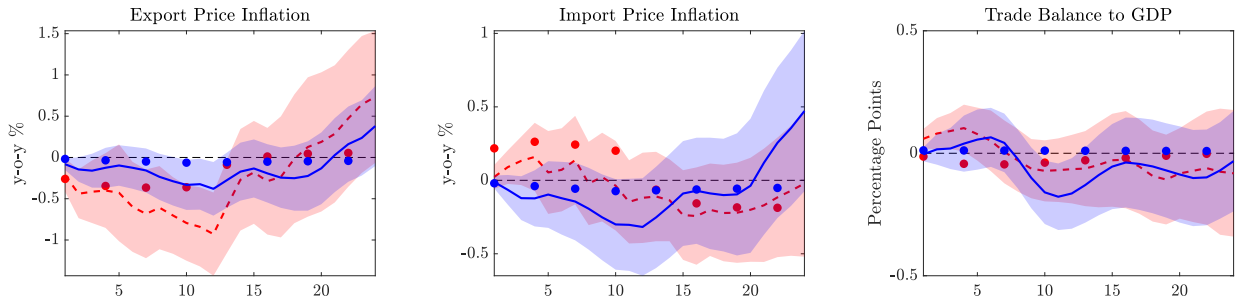


Notes: See notes to Figure 5.

G.6 Empirical fit for import and export prices of pegs and floats

The calibrated model implies only partial exchange rate pass-through and very limited expenditure switching. In this section, we show that the model is able to closely replicate the empirical dynamics of trade prices and the trade balance following a euro area monetary policy shock. To do so, we construct year-on-year inflation rates of export prices (expressed in euros) and import prices (expressed in national currency) from the data on export and import price indices discussed in Appendix D.1. We use data for the export and import share to construct the trade-balance-to-GDP-ratio, and then estimate our baseline local projection specification analogously to Appendix D.1. We then compare the results to the model counterparts, where we define the trade-balance-to-GDP-ratio as the difference of nominal exports and imports relative to nominal GDP, analogously to the data. As shown in Figure G.6, the model implied dynamics closely align with the empirical counterpart, indicating that limited exchange-rate passthrough and lack of expenditure switching are a feature of the data, at least in the short run.

Figure G.8: Empirical fit for trade variables

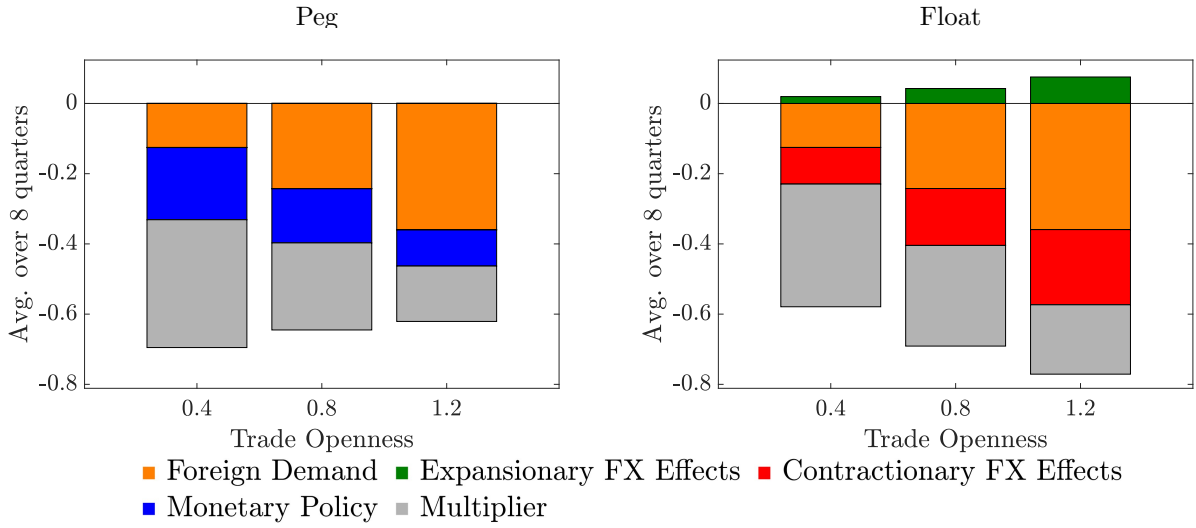


Notes: Empirical and model-based impulse responses for export and import price inflation. Import (export) prices expressed in national currency (euros). For a discussion on estimation of the empirical impulse responses and construction of the data, see Appendix D.1. See notes to Figure 5 for scaling of the variables and the shock. We convert the empirical response of the trade-balance-to-GDP-ratio to quarterly frequency by taking the average of the three monthly responses within each quarter. This follows the logic of time aggregation for flow-based objects, as emphasized by Born and Pfeifer (2014), and provides a first-order approximation to the quarterly response of the ratio.

G.7 Additional material for the relationship between Exchange Rate Insulation and Openness

This appendix supplements the analysis in Section 4.4. That section argues that, in the model, greater trade openness increases monetary spillovers under a float and reduces them under a peg. Figure G.9 decomposes the channels behind this result. Figure G.10 shows how insulation varies with trade openness in the RANK counterpart.

Figure G.9: Openness and changing insulation – decomposing the channels



Notes: Decomposition of two-year-average response of domestic output to a foreign monetary tightening as in Figure 7 of the main text, for select values of trade openness.

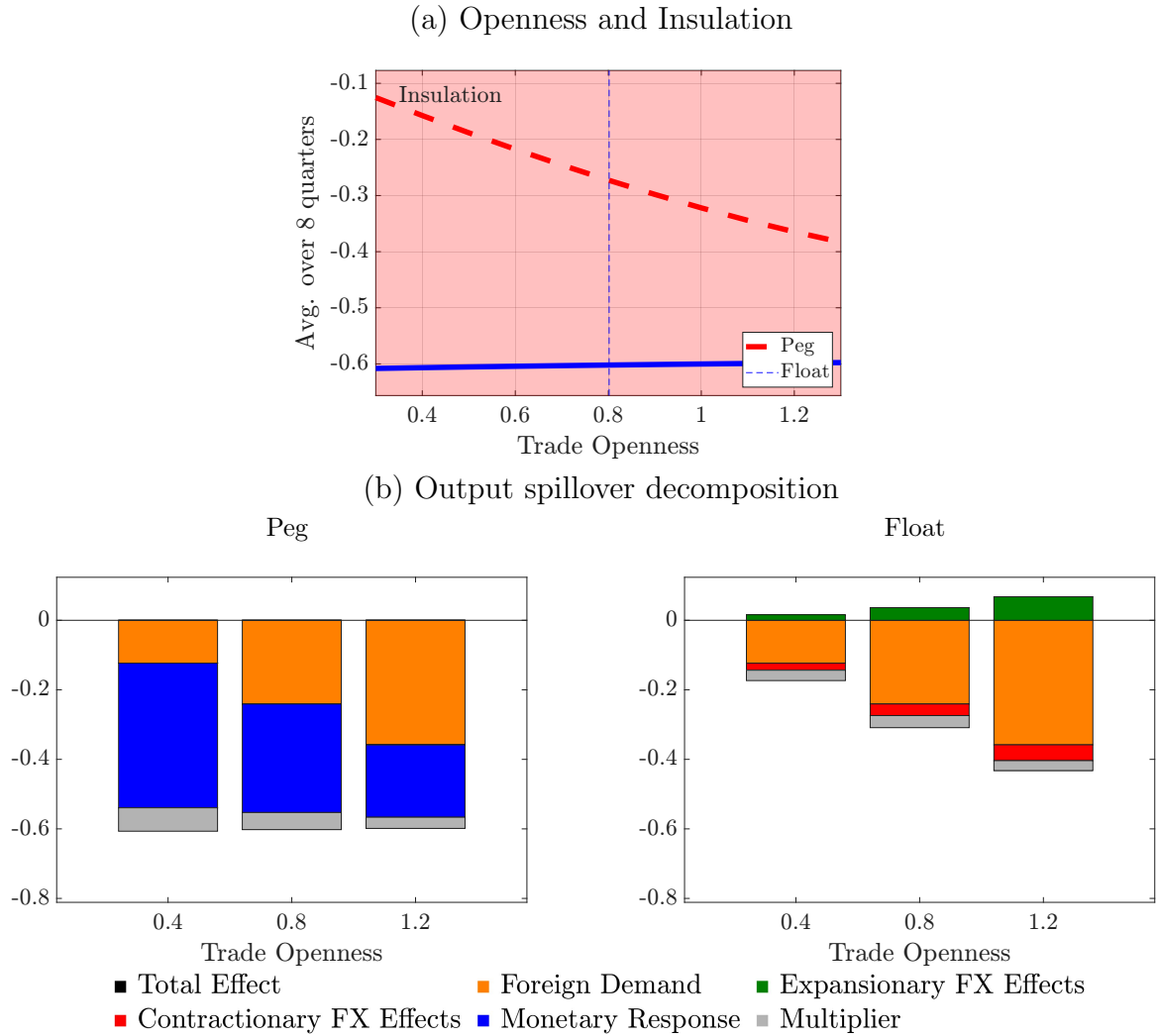
Figure G.9 decomposes the domestic output response to a foreign monetary shock in the HANK economy. Each bar corresponds to a different level of trade openness: 40, 80, and 120 percent. The overall two-year average output response is the net of the positive contributions above zero and the negative contributions below.

The left panel shows the decomposition under a peg. Greater openness mechanically raises the importance of foreign relative to domestic developments. A more open economy has a larger export share, α^* , and hence a stronger foreign-demand channel (orange, top). At the same time, the share of domestic consumption in demand, $1 - \alpha$, falls, reducing the importance of monetary policy (blue, middle) and multiplier effects (gray, bottom). Intuitively, a larger share of the contractionary effects of the tightening needed to stabilize the exchange rate is shifted abroad. As a result, under a peg, output falls by less the more open the economy is.

The right panel shows the decomposition under a float. As noted above, pegs and floats share the foreign-demand channel, which strengthens with openness. Similarly, under a float the general-equilibrium multiplier also weakens. At the same time, the channels tied to international prices and the exchange rate—that is, the channels specific

to a float—become more important in a more open economy. Part of this is mechanical, reflecting the larger weights of imports and exports.³⁹ More subtly, the nominal exchange rate responds more strongly as openness rises. Namely, under the real-rate rule underlying the analysis here and in the main text, the response of the real exchange rate, Q_t , does not change with openness. A larger import share raises the weight of imports in the consumer price index, however. A more open economy therefore requires a larger nominal depreciation. This further amplifies the exchange rate-related channels. Thus, as trade integration rises, a small open economy can stabilize output ever better under a peg, but not under a float.

Figure G.10: Openness and Exchange Rate Insulation with a **RANK** model



Notes: Same as the exercises in Figure 7 and Figure G.9 in the main text, but for the representative-agent counterpart.

Figure G.10 shows link the between openness and spillovers for the RANK version of

³⁹To see the mechanical effect, note that $d\mathbf{P} - d\mathbf{P}_H = \frac{\alpha}{1-\alpha}[d\mathbf{P}_F - d\mathbf{P}_t]$, implying that the real income channel in Proposition 1 scales with α .

the model, spillovers under a peg are independent of openness, and under a float they are small to begin with.

H Deriving the goods market clearing condition

Our aim is to express all equilibrium conditions in *Home per capita* units. Throughout, Home has population mass n and Foreign has mass $1 - n$. We index households by $i \in [0, 1]$ within each country and firms/varieties by $j \in [0, 1]$. We define per capita Home output as

$$Y_t \equiv \int_0^1 Y_t(j) dj. \quad (26)$$

Likewise, we define per capita bundle demands by Home and Foreign households as

$$C_{H,t} \equiv \int_0^1 c_{H,t}(i) di, \quad C_{H,t}^* \equiv \int_0^1 c_{H,t}^*(i) di, \quad (27)$$

where $c_{H,t}(i)$ is Home household i 's demand for the Home bundle and $c_{H,t}^*(i)$ is Foreign household i 's demand for the Home bundle.

World-total market clearing (starting point). In *world totals*, total production of Home goods equals world demand for Home goods:

$$n \int_0^1 Y_t(j) dj = n \int_0^1 \int_0^1 C_{H,t}(j, i) dj di + (1 - n) \int_0^1 \int_0^1 C_{H,t}^*(j, i) dj di. \quad (28)$$

The only purpose of (28) is to provide a correct accounting identity in levels; we now convert it into Home per capita form.

Domestic demand. Variety demand by Home household i is given by the CES demand system

$$C_{H,t}(j, i) = \left(\frac{P_{H,t}(j)}{P_{H,t}} \right)^{-\varepsilon} c_{H,t}(i). \quad (29)$$

Substituting into the double integral and separating the j - and i -integrals yields

$$n \int_0^1 \int_0^1 C_{H,t}(j, i) dj di = n \left[\int_0^1 \left(\frac{P_{H,t}(j)}{P_{H,t}} \right)^{-\varepsilon} dj \right] \left[\int_0^1 c_{H,t}(i) di \right]. \quad (30)$$

Since domestic prices are flexible, $P_{H,t}(j) = P_{H,t}$ for all j , implying

$$\int_0^1 \left(\frac{P_{H,t}(j)}{P_{H,t}} \right)^{-\varepsilon} dj = 1. \quad (31)$$

Using the definition $C_{H,t} \equiv \int_0^1 c_{H,t}(i) di$, the domestic term becomes

$$n \int_0^1 \int_0^1 C_{H,t}(j, i) dj di = n C_{H,t}. \quad (32)$$

Export demand Analogously, demand by Foreign household i is

$$C_{H,t}^*(j, i) = \left(\frac{P_{H,t}^*(j)}{P_{H,t}^*} \right)^{-\varepsilon} c_{H,t}^*(i). \quad (33)$$

Proceeding as above gives

$$(1-n) \int_0^1 \int_0^1 C_{H,t}^*(j, i) dj di = (1-n) \left[\int_0^1 \left(\frac{P_{H,t}^*(j)}{P_{H,t}^*} \right)^{-\varepsilon} dj \right] \left[\int_0^1 c_{H,t}^*(i) di \right]. \quad (34)$$

Define the export price dispersion term

$$\delta_{H,t}^* \equiv \int_0^1 \left(\frac{P_{H,t}^*(j)}{P_{H,t}^*} \right)^{-\varepsilon} dj, \quad (35)$$

and use $C_{H,t}^* \equiv \int_0^1 c_{H,t}^*(i) di$ to obtain

$$(1-n) \int_0^1 \int_0^1 C_{H,t}^*(j, i) dj di = (1-n) \delta_{H,t}^* C_{H,t}^*. \quad (36)$$

Market clearing in Home per capita form. Substituting (32) and (36) into (28) and using $Y_t \equiv \int_0^1 Y_t(j) dj$ yields

$$nY_t = nC_{H,t} + (1-n) \delta_{H,t}^* C_{H,t}^*. \quad (37)$$

Dividing by n gives the Home per capita market clearing condition

$$Y_t = C_{H,t} + \delta_{H,t}^* \frac{1-n}{n} C_{H,t}^*. \quad (38)$$

Using the aggregate import demand functions Standard CES demand implies that

$$C_{H,t} = (1-\alpha) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} C_t, \quad C_{H,t}^* = \alpha^* \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\eta^*} C_t^*, \quad (39)$$

therefore, we can rewrite (38) as

$$Y_t = (1-\alpha) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} C_t + \delta_{H,t}^* \frac{1-n}{n} \alpha^* \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\eta^*} C_t^*. \quad (40)$$

Defining $\mathbf{a}^\star = \frac{1-n}{n} \alpha^\star$ as in the main text delivers the goods market-clearing condition.

I Proof proposition 1

In this section, we derive our generalized version of the international Keynesian cross of Auclert et al. (2021b). Our notation and approach closely align with their derivations, but we allow for sticky export and import prices while also incorporating a role for foreign currency debt as well as monetary policy and foreign demand.

As is standard in heterogeneous-agent models along the lines of Auclert et al. (2025), aggregate consumption depends on the sequence of domestic interest rates r_s , as well as on capital and real labour income. Given the mutual fund structure in the main text, real returns equalize ex ante and correspond to the real rate, except in period 0. Therefore, the aggregate consumption function is given by

$$C_t = \mathcal{C}_t\left(\left\{r_s, r_{a,0}, (1 - \tau_s) \frac{W_s}{P_s} N_s\right\}\right). \quad (41)$$

Given that government spending is exogenous in our calibration, we have $\bar{G}_{H,t} = \bar{G}_{H,t}^\star = 0$. Thus, the goods-market clearing condition reads

$$\begin{aligned} Y_t &= (1 - \alpha) \left(\frac{P_{H,t}}{P_t}\right)^{-\eta} \mathcal{C}_t\left(\left\{r_s, r_{a,0}, (1 - \tau_s) \frac{W_s}{P_s} N_s\right\}\right) + \frac{1-n}{n} \alpha^\star \left(\frac{P_{H,t}^\star}{P_t^\star}\right)^{-\eta^\star} C_t^\star \\ &= (1 - \alpha) \left(\frac{P_{H,t}}{P_t}\right)^{-\eta} \mathcal{C}_t\left(\left\{r_s, r_{a,0}, (1 - \tau_s) \frac{W_s}{P_s} N_s\right\}\right) + \alpha^\star \left(\frac{P_{H,t}^\star}{P_t^\star}\right)^{-\eta^\star} C_t^\star. \end{aligned} \quad (42)$$

We drop the price dispersion term $\Delta_{H,t}^\star$ for notational convenience, as it is constant up to first order. Moreover, because we study the small-open-economy limit $n \rightarrow 0$, $C_t^\star$ is exogenous from the point of view of the home economy.

For ease of exposition, define the auxiliary relative prices

$$\underline{Q}_t = \frac{P_t}{P_{H,t}}, \quad (43)$$

and

$$\bar{Q}_t = \frac{P_{H,t}^\star}{P_t^\star}. \quad (44)$$

Then market clearing becomes

$$Y_t = (1 - \alpha) \left(\frac{1}{\underline{Q}_t}\right)^{-\eta} \mathcal{C}_t\left(\left\{r_s, r_{a,0}, (1 - \tau_s) \frac{W_s}{P_s} N_s\right\}\right) + \alpha^\star \left(\bar{Q}_t\right)^{-\eta^\star} C_t^\star. \quad (45)$$

Using the production technology and markup pricing rule, we get

$$(1 - \tau_t) \frac{W_t}{P_t} N_t = (1 - \tau_t) \frac{W_t}{P_t} Y_t = (1 - \tau_t) \frac{P_{H,t}}{\mu P_t} Y_t = (1 - \tau_t) \frac{1}{\mu} \frac{1}{\underline{Q}_t} Y_t. \quad (46)$$

Hence

$$Y_t = (1 - \alpha) \left(\frac{1}{\underline{Q}_t} \right)^{-\eta} \mathcal{C}_t \left(\left\{ r_s, r_{a,0}, (1 - \tau_s) \frac{1}{\mu} \frac{1}{\underline{Q}_s} Y_s \right\} \right) + \alpha^* \left(\bar{Q}_t \right)^{-\eta^*} C_t^*. \quad (47)$$

We now follow the sequence-space approach of Auclert et al. (2021a) and linearize around a steady state with

$$\bar{Y} = \bar{C}^* = \bar{\bar{Q}} = \bar{Q} = 1,$$

and with $\bar{C} \approx 1$. We also assume that the government does not hold debt, nor spends or raises taxes in steady state, implying that, conditional on a monetary shock, all government terms drop out. As in the main text, we work with sequences of deviations from steady state, using log deviations for prices and quantities and level deviations for interest rates, inflation, and taxes. This yields

$$\begin{aligned} d\mathbf{Y} = & \underbrace{(1 - \alpha)\eta d\underline{\mathbf{Q}}}_{\text{Import price block}} + \underbrace{(1 - \alpha) \left(\mathbf{C}_r d\mathbf{r} + \mathbf{C}_v dr_{a,0} + \mathbf{C}_Y \frac{1}{\mu} [d\mathbf{Y} - d\underline{\mathbf{Q}}] \right)}_{\text{Domestic consumption block}} \\ & - \underbrace{\alpha^* \eta^* d\bar{\mathbf{Q}}}_{\text{Export price block}} + \underbrace{\alpha^* d\mathbf{C}^*}_{\text{Foreign demand block}}. \end{aligned} \quad (48)$$

Here $\mathbf{C}_Y$ is the Jacobian of aggregate consumption with respect to the path of labour income, $\mathbf{C}_r$ is the Jacobian with respect to the path of real interest rates, and $\mathbf{C}_v$ is the column vector capturing the response of consumption to a change in the period-zero return $r_{a,0}$.

It will turn out to be convenient to define the relative import price as

$$d\tilde{\mathbf{Q}} = d\mathbf{P}_F - d\mathbf{P}. \quad (49)$$

Using the CES price index,

$$d\tilde{\mathbf{Q}} = d\mathbf{P}_F - d\mathbf{P} = \frac{1 - \alpha}{\alpha} d\underline{\mathbf{Q}} = \frac{1 - \alpha}{\alpha} (d\mathbf{P} - d\mathbf{P}_H), \quad \Rightarrow \quad d\underline{\mathbf{Q}} = \frac{\alpha}{1 - \alpha} d\tilde{\mathbf{Q}}. \quad (50)$$

Substituting this into (48) gives

$$\begin{aligned}
d\mathbf{Y} = & \underbrace{\alpha\eta d\tilde{\mathbf{Q}}}_{\text{Import price block}} + (1-\alpha) \underbrace{\left(\mathbf{C}_r d\mathbf{r} + \mathbf{C}_v dr_{a,0} + \mathbf{C}_Y \frac{1}{\mu} \left[d\mathbf{Y} - \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}} \right] \right)}_{\text{Domestic consumption block}} \\
& - \underbrace{\alpha^*\eta^* d\bar{\mathbf{Q}}}_{\text{Export price block}} + \underbrace{\alpha^* d\mathbf{C}^*}_{\text{Foreign demand block}}. \tag{51}
\end{aligned}$$

What remains is to characterize $dr_{a,0}$, the surprise valuation term.

Step 1: period-zero return of the mutual fund. From the mutual-fund block in the main text, the realized return in period 0 satisfies

$$(1 + r_{a,0})A_{-1} = div_0 + j_0 s_{-1} + \frac{1 + i_{-1}}{1 + \pi_0} B_{-1} - \left[\frac{1 + i_{-1}^* + \varepsilon_0^Q}{1 + \pi_0^*} \frac{Q_0}{Q_{-1}} \right] Q_{-1} D_{-1}. \tag{52}$$

Using $s_{-1} = 1$, evaluating around the steady state, and denoting by $r_{a,0}$ the period-zero return on household claims to the mutual fund, we obtain

$$1 + r_{a,0} = \frac{div_0 + j_0}{\bar{A}} + \frac{1 + \bar{i}}{1 + \pi_0} \frac{\bar{B}}{\bar{A}} - \left(\frac{1 + \bar{i}^*}{1 + \pi_0^*} \frac{Q_0}{\bar{Q}} \right) \frac{\bar{Q}\bar{D}}{\bar{A}}. \tag{53}$$

In our calibration, the government does not maintain debt in equilibrium, so $\bar{B} = 0$. Hence

$$1 + r_{a,0} = (div_0 + j_0) \underbrace{\frac{1}{\bar{A}}}_{\omega_A} - Q_0 \underbrace{\left(\frac{1 + \bar{i}^*}{1 + \pi_0^*} \right) \frac{\bar{D}}{\bar{A}}}_{\omega_D}. \tag{54}$$

Therefore, up to first order,

$$dr_{a,0} = \omega_A (ddiv_0 + dj_0) - \omega_D dQ_0. \tag{55}$$

Step 2: dividends. Starting from the dividend equation in the main text, and setting government demand to zero,

$$Div_t = P_{H,t} C_{H,t} + \frac{1-n}{n} \mathcal{E}_t P_{H,t}^* C_{H,t}^* - W_t N_t. \tag{56}$$

Add and subtract $\frac{1-n}{n}P_{H,t}C_{H,t}^*$:

$$\begin{aligned} Div_t &= P_{H,t}C_{H,t} + \frac{1-n}{n}\mathcal{E}_tP_{H,t}^*C_{H,t}^* - W_tN_t + \frac{1-n}{n}P_{H,t}C_{H,t}^* - \frac{1-n}{n}P_{H,t}C_{H,t}^* \\ &= \underbrace{P_{H,t}\left(C_{H,t} + \frac{1-n}{n}C_{H,t}^*\right)}_{\text{Operating profits}} - W_tN_t + \underbrace{\frac{1-n}{n}(\mathcal{E}_tP_{H,t}^* - P_{H,t})C_{H,t}^*}_{\text{Sticky export price wedge}}. \end{aligned} \quad (57)$$

Using goods-market clearing,

$$Y_t = C_{H,t} + \frac{1-n}{n}C_{H,t}^*,$$

we obtain

$$Div_t = P_{H,t}Y_t - W_tN_t + \frac{1-n}{n}(\mathcal{E}_tP_{H,t}^* - P_{H,t})C_{H,t}^*. \quad (58)$$

Using $N_t = Y_t$ and $W_t = P_{H,t}/\mu$,

$$Div_t = \left(1 - \frac{1}{\mu}\right)P_{H,t}Y_t + \frac{1-n}{n}(\mathcal{E}_tP_{H,t}^* - P_{H,t})C_{H,t}^*. \quad (59)$$

Dividing by P_t and using that taxes are zero up to first order in this derivation,

$$div_t = \left(1 - \frac{1}{\mu}\right)\frac{P_{H,t}}{P_t}Y_t + \frac{1-n}{n}\frac{\mathcal{E}_tP_{H,t}^* - P_{H,t}}{P_t}C_{H,t}^*. \quad (60)$$

Now factor out $\frac{P_{H,t}}{P_t}$:

$$div_t = \left(1 - \frac{1}{\mu}\right)\frac{P_{H,t}}{P_t}Y_t + \frac{1-n}{n}\left(\frac{\mathcal{E}_tP_{H,t}^*}{P_{H,t}} - 1\right)\frac{P_{H,t}}{P_t}C_{H,t}^*. \quad (61)$$

Using

$$Q_t = \frac{\mathcal{E}_tP_t^*}{P_t}, \quad \underline{Q}_t = \frac{P_t}{P_{H,t}}, \quad \overline{Q}_t = \frac{P_{H,t}^*}{P_t^*},$$

the export law-of-one-price wedge can be written as

$$\frac{\mathcal{E}_tP_{H,t}^*}{P_{H,t}} = \frac{\mathcal{E}_tP_t^*}{P_t} \frac{P_{H,t}^*}{P_t^*} \frac{P_t}{P_{H,t}} = Q_t \overline{Q}_t \underline{Q}_t. \quad (62)$$

Hence

$$div_t = \left(1 - \frac{1}{\mu}\right)\frac{1}{\underline{Q}_t}Y_t + \left(Q_t \overline{Q}_t - \frac{1}{\underline{Q}_t}\right)\frac{1-n}{n}C_{H,t}^*. \quad (63)$$

Using

$$C_{H,t}^* = \alpha^* (\overline{Q}_t)^{-\eta^*} C_t^*,$$

and defining $\alpha^\star = \frac{1-n}{n}\alpha^\star$ and noting that steady-state dividends are

$$div = 1 - \frac{1}{\mu}.$$

linearizing (63) then gives

$$d\mathbf{div} = \left(1 - \frac{1}{\mu}\right) (d\mathbf{Y} - d\underline{\mathbf{Q}}) + \alpha^\star (d\mathbf{Q} + d\overline{\mathbf{Q}} + d\underline{\mathbf{Q}}). \quad (64)$$

Substituting $d\underline{\mathbf{Q}} = \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}$,

$$d\mathbf{div} = \left(1 - \frac{1}{\mu}\right) \left(d\mathbf{Y} - \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right) + \alpha^\star \left(d\mathbf{Q} + d\overline{\mathbf{Q}} + \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right). \quad (65)$$

Thus, at time 0,

$$ddiv_0 = \left(1 - \frac{1}{\mu}\right) \left(dY_0 - \frac{\alpha}{1-\alpha}d\tilde{Q}_0\right) + \alpha^\star \left(dQ_0 + d\overline{Q}_0 + \frac{\alpha}{1-\alpha}d\tilde{Q}_0\right). \quad (66)$$

Step 3: the asset price j_0 . The time-zero asset price is the present discounted value of future dividends:

$$j_0 = \frac{div_1 + j_1}{1 + r_0} = PDV(\{r_s\}, \{div_s\}). \quad (67)$$

Using (63), this can be written as

$$j_0 = PDV\left(\{r_s\}, \left\{\left(1 - \frac{1}{\mu}\right) \frac{1}{\underline{Q}_s} Y_s + \left(Q_s \overline{Q}_s - \frac{1}{\underline{Q}_s}\right) \frac{1-n}{n} C_{H,s}^\star\right\}\right). \quad (68)$$

Linearizing the PDV operator yields

$$dj_0 = \mathbf{J}_{j,r} d\mathbf{r} + \left(1 - \frac{1}{\mu}\right) \mathbf{J}_{j,d} \left(d\mathbf{Y} - \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right) + \mathbf{J}_{j,d} \alpha^\star \left(d\mathbf{Q} + d\overline{\mathbf{Q}} + \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right). \quad (69)$$

Step 4: $dr_{a,0}$. Combining (55), (66), and (69),

$$\begin{aligned} dr_{a,0} &= \omega_A(ddiv_0 + dj_0) - \omega_D dQ_0 \\ &= \omega_A \left[\left(1 - \frac{1}{\mu}\right) \left(dY_0 - \frac{\alpha}{1-\alpha}d\tilde{Q}_0\right) + \alpha^\star \left(dQ_0 + d\overline{Q}_0 + \frac{\alpha}{1-\alpha}d\tilde{Q}_0\right) \right] \\ &\quad + \omega_A \left[\mathbf{J}_{j,r} d\mathbf{r} + \left(1 - \frac{1}{\mu}\right) \mathbf{J}_{j,d} \left(d\mathbf{Y} - \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right) + \mathbf{J}_{j,d} \alpha^\star \left(d\mathbf{Q} + d\overline{\mathbf{Q}} + \frac{\alpha}{1-\alpha}d\tilde{\mathbf{Q}}\right) \right] \\ &\quad - \omega_D dQ_0. \end{aligned} \quad (70)$$

Let e'_0 be the selection vector that picks out the time-zero element of a sequence, so that

$$ddiv_0 = e'_0 d\mathbf{div}.$$

Since the first row of $\mathbf{J}_{j,d}$ is zero, define

$$\mathcal{J}_{j,d} = e'_0 + \mathbf{J}_{j,d}, \quad \Omega^D = [\omega_D, \mathbf{0}].$$

Then

$$\begin{aligned} dr_{a,0} = & \omega_A \mathbf{J}_{j,r} d\mathbf{r} + \omega_A \left(1 - \frac{1}{\mu}\right) \mathcal{J}_{j,d} \left(d\mathbf{Y} - \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}}\right) \\ & + \omega_A \mathcal{J}_{j,d} \boldsymbol{\alpha}^* \left(d\mathbf{Q} + d\bar{\mathbf{Q}} + \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}}\right) - \Omega^D d\mathbf{Q}. \end{aligned} \quad (71)$$

Step 5: plug back into market clearing. Substituting (71) into (51) and rearranging,

$$\begin{aligned} d\mathbf{Y} = & \underbrace{\alpha\eta d\tilde{\mathbf{Q}} - \boldsymbol{\alpha}^*\eta^* d\bar{\mathbf{Q}}}_{\text{expenditure switching}} - \underbrace{\alpha\mathcal{M}^Y d\tilde{\mathbf{Q}}}_{\text{real income}} \\ & + \underbrace{(1-\alpha)\mathcal{M}^{div} \boldsymbol{\alpha}^* \left(d\mathbf{Q} + d\bar{\mathbf{Q}} + \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}}\right)}_{\text{export profits, law-of-one-price-gap}} - \underbrace{(1-\alpha)\mathcal{M}^D d\mathbf{Q}}_{\text{revaluation of FX debt}} \\ & + \underbrace{(1-\alpha)\mathcal{M}^r d\mathbf{r}}_{\text{monetary response}} + \underbrace{\boldsymbol{\alpha}^* d\mathbf{C}^*}_{\text{Foreign demand}} + \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{multiplier}}, \end{aligned} \quad (72)$$

where we define

$$\mathcal{M}^{div} \equiv \mathbf{C}_v \omega_A \mathcal{J}_{j,d}, \quad (73)$$

$$\mathcal{M}^Y \equiv \frac{1}{\mu} \mathbf{C}_Y + \mathbf{C}_v \omega_A \left(1 - \frac{1}{\mu}\right) \mathcal{J}_{j,d} = \frac{1}{\mu} \mathbf{C}_Y + \left(1 - \frac{1}{\mu}\right) \mathcal{M}^{div}, \quad (74)$$

$$\mathcal{M}^r \equiv \mathbf{C}_r + \mathbf{C}_v \omega_A \mathbf{J}_{j,r}, \quad (75)$$

$$\mathcal{M}^D \equiv \mathbf{C}_v \Omega^D. \quad (76)$$

Finally, substituting back the primitive-price definitions of the auxiliary objects,

$$d\tilde{\mathbf{Q}} = d\mathbf{P}_F - d\mathbf{P}, \quad (77)$$

$$d\bar{\mathbf{Q}} = d\mathbf{P}_H^* - d\mathbf{P}^*, \quad (78)$$

$$d\mathbf{Q} + d\bar{\mathbf{Q}} + \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}} = d\mathcal{E} + d\mathbf{P}_H^* - d\mathbf{P}_H, \quad (79)$$

$$\frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}} = d\mathbf{P} - d\mathbf{P}_H, \quad (80)$$

and rearranging terms, we obtain

$$\begin{aligned}
d\mathbf{Y} = & \underbrace{\alpha^* \cdot d\mathbf{C}^*}_{\text{foreign demand}} + \underbrace{\alpha \cdot \eta \cdot [d\mathbf{P}_F - d\mathbf{P}] - \alpha^* \cdot \eta^* \cdot [d\mathbf{P}_H^* - d\mathbf{P}^*]}_{\text{expenditure switching}} \\
& + (1 - \alpha) \cdot \left(\underbrace{\mathcal{M}^{div} \cdot \alpha^* \cdot [d\mathcal{E} + d\mathbf{P}_H^* - d\mathbf{P}_H]}_{\text{export profits, law-of-one-price gap}} \right. \\
& \quad \left. - \underbrace{\mathcal{M}^D \cdot d\mathbf{Q}}_{\text{revaluation of FX debt}} - \underbrace{\mathcal{M}^Y \cdot [d\mathbf{P} - d\mathbf{P}_H]}_{\text{real income}} \right) \\
& + (1 - \alpha) \cdot \left(\underbrace{\mathcal{M}^r \cdot d\mathbf{r}}_{\text{monetary response}} + \underbrace{\mathcal{M}^Y \cdot d\mathbf{Y}}_{\text{multiplier}} \right).
\end{aligned}$$

This is the expression stated in Proposition 1.

J Recovering the international Keynesian Cross of Auclert et al. (2021b)

In this section, we show how the generalized international Keynesian cross maps into the international Keynesian cross of Auclert et al. (2021b). In particular, under the assumptions that the law of one price holds, the home economy has a zero steady state zero net foreign asset position, and the monetary authority follows a real rate rule, the international Keynesian cross is nested in our notation.

To do so, we first characterize the dynamics of the relative prices under their assumption of the law of one price, which in our set-up is equivalent to assuming flexible trade prices.

J.1 Characterizing the dynamics of $d\tilde{\mathbf{Q}}$ under the Law of One Price (flexible import prices)

Step 1: CES CPI aggregator. Let the CPI price index be

$$P_t = \left[(1 - \alpha) P_{H,t}^{1-\eta} + \alpha P_{F,t}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \quad \alpha \in (0, 1), \eta > 0. \quad (81)$$

Step 2: Impose LOP for imports. Assume law of one price for the import price index,

$$P_{F,t} = \mathcal{E}_t P_t^*, \quad (82)$$

and define the real exchange rate

$$Q_t \equiv \frac{\mathcal{E}_t P_t^*}{P_t}. \quad (83)$$

Combining (82)–(83) gives the identity

$$\frac{P_{F,t}}{P_t} = Q_t. \quad (84)$$

Step 3: Use the CES aggregator to relate $P_t/P_{H,t}$ to $P_{F,t}/P_t$. Raise (81) to the power $1 - \eta$ and divide by $P_t^{1-\eta}$:

$$1 = (1 - \alpha) \left(\frac{P_{H,t}}{P_t} \right)^{1-\eta} + \alpha \left(\frac{P_{F,t}}{P_t} \right)^{1-\eta}. \quad (85)$$

Linearize (85) around a symmetric steady state with $\bar{P}_H = \bar{P}_F = \bar{P}$ so that $\frac{\bar{P}_H}{\bar{P}} = \frac{\bar{P}_F}{\bar{P}} = 1$. Using $x^{1-\eta} \approx 1 + (1 - \eta) d \log x$ at $x = 1$, (85) implies

$$(1 - \alpha) d \left(\frac{P_{H,t}}{P_t} \right) + \alpha d \left(\frac{P_{F,t}}{P_t} \right) = 0, \quad (86)$$

where the d in front of the variables implies that we are expressing everything in deviation from the steady state with relative prices equal to one. Since $d(P_{H,t}/P_t) = -d(P_t/P_{H,t})$, rewrite (86) as

$$d \left(\frac{P_t}{P_{H,t}} \right) = \frac{\alpha}{1 - \alpha} d \left(\frac{P_{F,t}}{P_t} \right). \quad (87)$$

Step 4: Apply the definition of $\tilde{Q}_t$ and conclude. Define

$$\tilde{Q}_t \equiv \frac{1 - \alpha}{\alpha} \left(\frac{P_t}{P_{H,t}} \right), \quad (88)$$

so that

$$d\tilde{Q}_t = \frac{1 - \alpha}{\alpha} d \left(\frac{P_t}{P_{H,t}} \right). \quad (89)$$

Substitute (87) into (89):

$$d\tilde{Q}_t = d \left(\frac{P_{F,t}}{P_t} \right). \quad (90)$$

Finally, using (84),

$$d \left(\frac{P_{F,t}}{P_t} \right) = dQ_t. \quad (91)$$

Therefore,

$$d\tilde{Q}_t = dQ_t \quad \text{for all } t, \quad (92)$$

and we get

$$\boxed{d\tilde{\mathbf{Q}} = d\mathbf{Q}} \quad (93)$$

i.e. the sequence $\{d\tilde{Q}_t\}$ coincides with the sequence of real exchange rate log-deviations under LOP for imports.

J.2 Characterizing the dynamics of $d\bar{\mathbf{Q}}$ under Law of One Price (flexible export prices)

Recall the definition of $\bar{Q}_t$

$$\bar{Q}_t = \frac{P_{H,t}^*}{P_t^*} \quad (94)$$

Under the Law of One Price for exports, we have

$$P_{H,t}^* = \frac{P_{H,t}}{\mathcal{E}_t} \quad (95)$$

Thus we get

$$\bar{Q}_t = \frac{P_{H,t}}{\mathcal{E}_t P_t^*} = \frac{P_{H,t}}{\mathcal{E}_t P_t^*} \frac{P_t}{P_t} = \frac{P_{H,t}}{P_t} \frac{P_t}{\mathcal{E}_t P_t^*} = \frac{P_{H,t}}{P_t} \frac{1}{Q_t} = \frac{1}{\underline{Q}_t} \frac{1}{Q_t} \quad (96)$$

Linearizing and writing in Sequence Space Notation

$$d\bar{\mathbf{Q}} = -(d\mathbf{Q} + d\underline{\mathbf{Q}}) \quad (97)$$

Plugging in our definition for $\tilde{Q}$ we get

$$d\bar{\mathbf{Q}} = -(d\mathbf{Q} + \frac{\alpha}{1-\alpha} d\tilde{\mathbf{Q}}) \quad (98)$$

Combining with Equation 93 we get

$$\boxed{d\bar{\mathbf{Q}} = -\left(1 + \frac{\alpha}{(1-\alpha)}\right) d\mathbf{Q}} \quad (99)$$

J.3 From the generalized international Keynesian cross to the version in Auclert et al. (2021b)

Plugging in the expressions for the relative export prices $d\bar{\mathbf{Q}}$ and relative import price $d\tilde{\mathbf{Q}}$ into Equation (72) we get

$$d\mathbf{Y} = \underbrace{\left(\alpha\eta d\mathbf{Q}\right)}_{\text{expenditure switching}} + \underbrace{\left(\alpha^*\eta^*\left(1 + \frac{\alpha}{(1-\alpha)}\right) d\mathbf{Q}\right)}_{\text{expenditure switching}} \quad (100)$$

$$+ \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{multiplier}} + \underbrace{(1-\alpha)\mathcal{M}^r d\mathbf{r}}_{\text{monetary response}} - \underbrace{\alpha\mathcal{M}^Y d\mathbf{Q}}_{\text{real income}} \quad (101)$$

$$+ \underbrace{(1-\alpha)\mathcal{M}^{div}\alpha^*\left(d\mathbf{Q} - \left(1 + \frac{\alpha}{(1-\alpha)}\right) d\mathbf{Q} + \frac{\alpha}{1-\alpha} d\mathbf{Q}\right)}_{\text{export profits, law of one price gap}} \quad (102)$$

$$- \underbrace{(1-\alpha)\mathcal{M}^D d\mathbf{Q}}_{\text{revaluation of foreign currency debt}} + \underbrace{\alpha^* d\mathbf{C}^*}_{\text{foreign demand}} . \quad (103)$$

The export price profits term drops out

$$d\mathbf{Y} = \underbrace{\left(\alpha\eta d\mathbf{Q}\right) + \left(\boldsymbol{\alpha}^*\eta^* \left(1 + \frac{\alpha}{(1-\alpha)}\right) d\mathbf{Q}\right)}_{\text{expenditure switching}} \quad (104)$$

$$+ \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{multiplier}} + \underbrace{(1-\alpha)\mathcal{M}^r d\mathbf{r}}_{\text{monetary Policy}} - \underbrace{\alpha\mathcal{M}^Y d\mathbf{Q}}_{\text{real Income}} \quad (105)$$

$$- \underbrace{(1-\alpha)\mathcal{M}^D d\mathbf{Q}}_{\text{revaluation of foreign currency debt}} + \underbrace{\boldsymbol{\alpha}^* d\mathbf{C}^*}_{\text{foreign demand}}. \quad (106)$$

If we further set the steady state net foreign asset position ω_D to zero, this implies balanced trade and hence $\boldsymbol{\alpha}^* = \alpha$ and $\mathcal{M}^D = \mathbf{0}$

$$d\mathbf{Y} = \underbrace{\left(\alpha\eta d\mathbf{Q}\right) + \left(\alpha\eta^* \left(1 + \frac{\alpha}{(1-\alpha)}\right) d\mathbf{Q}\right)}_{\text{Expenditure Switching}} \quad (107)$$

$$+ \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{Multiplier}} + \underbrace{(1-\alpha)\mathcal{M}^r d\mathbf{r}}_{\text{Monetary Policy}} - \underbrace{\alpha\mathcal{M}^Y d\mathbf{Q}}_{\text{Real Income}} + \underbrace{\alpha d\mathbf{C}^*}_{\text{Foreign demand}} \quad (108)$$

Simplifying the expenditure switching term

$$\alpha\left(1 + \frac{\alpha}{1-\alpha}\right) = \frac{\alpha}{1-\alpha} \quad (109)$$

and defining the trade elasticity as $\chi = \eta(1-\alpha) + \eta^*$ we get

$$d\mathbf{Y} = \underbrace{\left(\frac{\alpha}{1-\alpha}\chi\right) d\mathbf{Q}}_{\text{expenditure switching}} + \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{Multiplier}} + \underbrace{(1-\alpha)\mathcal{M}^r d\mathbf{r}}_{\text{Monetary Policy}} \quad (110)$$

$$- \underbrace{\alpha\mathcal{M}^Y d\mathbf{Q}}_{\text{Real Income}} + \underbrace{\alpha d\mathbf{C}^*}_{\text{Foreign demand}} \quad (111)$$

Now, if we follow Auclert et al. (2021b) and assume a real rate rule ($d\mathbf{r} = \mathbf{0}$) as well as no change in foreign demand induced by the shock ($d\mathbf{C}^* = \mathbf{0}$), we recover their version of the international Keynesian cross

$$d\mathbf{Y} = \underbrace{\left(\frac{\alpha}{1-\alpha}\chi\right) d\mathbf{Q}}_{\text{expenditure switching}} + \underbrace{(1-\alpha)\mathcal{M}^Y d\mathbf{Y}}_{\text{Multiplier}} \quad (112)$$

J.4 Notation

The tables below collect the paper's notation. Country labels H and F , the foreign-country superscript $*$, and agent indices such as i and k are treated as modifiers of the underlying notation rather than as separate symbols. When a foreign-country counterpart is written explicitly in the model section or calibration section, it is listed explicitly below.

Table J.2: Notation used for variables

Variable	Description
a_t	real value of individual home household's claims on the domestic mutual fund.
A_t	real aggregate value of all home households' claims on domestic mutual fund.
B_t	real value of one-period nominal domestic-currency government bonds held by the home mutual fund.
c_t	individual home household's consumption of consumption basket.
$c_{F,t}$	individual home household's consumption of foreign (imported) goods.
$c_{H,t}$	individual home household's consumption of home goods.
C_t	aggregate consumption, per home household.
$C_{F,t}$	aggregate demand for foreign (imported) goods by the home economy, per home household.
$C_{H,t}$	aggregate demand for home goods by the home economy, per home household.
C_t^*	aggregate foreign consumption, per foreign household.
$C_{H,t}^*$	foreign demand for the home good, per foreign household.
D_t	real value of the domestic mutual fund's foreign-currency debt position, measured in units of the foreign consumption basket, per home household.
D_t^*	foreign mutual funds' position in cross-country foreign-currency debt, measured in units of the foreign consumption basket, per foreign household.
div_t	after-tax real dividends of domestic firms, per home household.
e_t	idiosyncratic labor productivity of a household (the household index is suppressed).
$\mathcal{E}_t$	nominal exchange rate.

Variable (c'td)	Description (c'td)
G_t	home government's aggregate government spending, per home household.
$G_{F,t}$	home government's spending on foreign (imported) goods, per home household.
$G_{H,t}$	home government's spending on home goods, per home household.
$G_{H,t}^*$	foreign government's spending on home goods, per foreign household.
i_t	nominal interest rate on home one-period bonds / home policy rate.
i_t^*	nominal interest rate on foreign one-period bonds.
j_t	real ex-dividend price per share of domestic firms' profits.
N_t	labor hours supplied (individual and aggregate per-household).
$n_{k,t}$	labor input employed by wholesaler k .
P_t	consumer price index in home; home-currency price of the home consumption basket.
$P_{F,t}$	home-currency price of the good that home imports.
$P_{H,t}$	home-currency price of the domestic good sold in home.
P_t^*	foreign consumer price index; foreign-currency price of the foreign consumption basket.
$P_{H,t}^*$	export-price index; foreign-currency price of the home good sold in the foreign market.
Q_t	real exchange rate, $Q_t = \frac{P_t^* \mathcal{E}_t}{P_t}$.
r_t	realized return on home government bonds.
$r_{a,t}$	realized return on home households' asset holdings/claims on the domestic mutual fund.
s_t	Number of shares in domestic firms held by the domestic mutual fund.
$V_t(a_{t-1}, e_t)$	Home household's value function.
W_t	nominal wage in home country.
$y_{k,t}$	output of wholesaler k .
Y_t	aggregate per-capita production / output of final goods in home.
$\Delta_{H,t}^*$	price-dispersion term associated with home output sold abroad.
ε_t^m	monetary policy shock in home.

Variable (c'td)	Description (c'td)
ε_t^μ	markup shock in home.
ε_t^Q	exogenous international portfolio shifter affecting home's return on foreign-currency debt.
π_t	home consumer-price inflation rate (net).
π_t^*	foreign consumer-price inflation rate (net).
$\pi_{H,t}$	net inflation of home goods sold in the home market, in home currency.
$\pi_{H,t}^*$	net export-price inflation of home goods sold abroad, in foreign currency.
$\pi_{W,t}$	nominal wage inflation in home (net).
τ_t	income tax rate on wages and dividends in home.

Table J.2: Notation used for parameters

Parameter	Description
α	home economy's import share in consumption.
α^*	foreign economy's import share in consumption.
α^*	effective weight of foreign demand in home output, defined as $\alpha^* = \frac{1-n}{n}\alpha^*$.
β	household time-discount factor.
γ	coefficient of relative risk aversion.
χ	convolute trade elasticity defined as $\chi = (1 - \alpha)\eta + (1 - \alpha^*)\eta^*$.
η	elasticity of substitution between domestic and foreign goods in the home consumption bundle.
η^*	elasticity of substitution between domestic and foreign goods in the foreign consumption bundle.
κ_F	slope of the foreign export-price Phillips curve.
κ_W	slope of the wage Phillips curve in home.
κ_H^*	slope of the export-price Phillips curve for home goods sold abroad.
μ_W	average gross wage markup charged by labor unions.
μ_H	average markup charged by domestic wholesalers in the home and foreign market.
μ_F	average markup charged by foreign wholesalers in the home and foreign market.

Parameter (c'td)	Description (c'td)
φ	curvature parameter on labor disutility (inverse Frisch elasticity of labor supply).
ψ	weight on labor disutility in household utility.
ρ^m	persistence of monetary shock.
ρ_e	autocorrelation of idiosyncratic labor productivity.
σ_e	cross-sectional standard deviation of idiosyncratic labor productivity.
θ_F	Calvo non-update probability for foreign export prices.
θ_W	Calvo non-update probability for wages.
θ_H^*	Calvo non-update probability for home export prices.
n	mass (share) of households residing in the home country.

Table J.2: Notation used for steady state of variables

Steady-state notation	Description
$\bar{r}$	steady-state real net return on domestic bonds in home.