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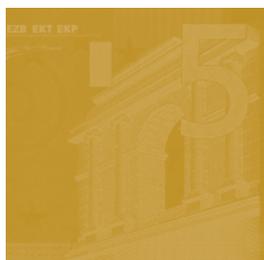
**WHAT DRIVES BUSINESS  
CYCLES AND  
INTERNATIONAL  
TRADE IN EMERGING  
MARKET ECONOMIES?**

by **Marcelo Sánchez**



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# WHAT DRIVES BUSINESS CYCLES AND INTERNATIONAL TRADE IN EMERGING MARKET ECONOMIES? <sup>1</sup>

by Marcelo Sánchez <sup>2</sup>



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## Abstract

This paper investigates the role of domestic and external factors in explaining business cycle and international trade developments in fifteen emerging market economies. Results from sign-restricted VARs show that developments in real output, inflation, real exchange rates and international trade variables are dominated by domestic shocks. External shocks on average explain a fraction of no more than 10% of the variation in the endogenous variables considered. Moreover, real imports fail to display a cross-regional pattern, while technology shocks appear to be the disturbances playing a somewhat more important role in explaining consumer prices developments. Consumer prices and – depending on the disturbance considered – real imports are the variables showing larger impulse responses to unit shocks.

**Keywords:** Business cycles; International trade; Emerging Markets; Structural shocks

**JEL Codes:** C32, E32, F41

## Non-technical summary

Emerging Market Economies (EMEs) have experienced rapid growth in economic activity and international trade over the last fifteen years, outperforming the rest of the world in these two areas. This has been the case in many countries in East Asia, Latin America and EU New Member States (NMS). Against this background, the present paper investigates what are the determinants of EME's business cycles and international trade. This is an important matter regarding conjunctural analysis, with two key questions in this area being: First, how much of the macroeconomic developments in EMEs is driven by external factors (capturing developments in advanced economies as well as global commodity prices) in comparison with the autonomous strength of domestic developments. Second, how is the impact of domestic factors split among the main exogenous sources of uncertainty. Answering these two questions is crucial for assessing: a) the sustainability of the expansion of EMEs in the case of a marked slowdown of the global economy; and b) the extent to which domestic demand and monetary policy could help buffer regional exports from global developments.

Our main results are obtained from the analysis of impulse responses and variance decompositions. Identification is achieved by means of sign restrictions. To motivate the latter, a standard dynamic stochastic general equilibrium (DSGE) model with small open economy features is laid out and its predictions are compared with the related literature. The empirical results show that, quantitatively, impulse responses to unit shocks are found to be rather muted. Consumer prices and – depending on the shock – real imports are the most affected endogenous variables. Consumer prices are mostly driven by technology and risk premium shocks. At the country level, Latin America (owing to Brazil and Argentina) and Poland show above-average consumer price responses both in the baseline approach and in the model including the real exchange rate.

Other impulse response results are worth discussing. In the model with real exports, the largest effects on endogenous variables tend to stem from monetary shocks, although the impact is still rather limited. Unpredictable monetary policy is found to induce modest changes in consumer prices and real output (as well as on real exports), as well as a larger effect on real imports which carries over to the trade balance. In the model including the real exchange rate, monetary shocks no longer count among those eliciting real imports' largest responses. However, in light of the still muted reaction of consumer prices and real output to monetary disturbances, the above-average values for the responses of real exchange rates to these shocks may still point to undesirable side effects of unanticipated monetary policy. Finally, a model including both the real exchange rate and nominal interest rate is applied to Chile, in light of the country's reasonably long history of a relatively unchanged monetary regime (namely, inflation targeting). It is found that Chilean macroeconomic developments have become more resilient to risk premium disturbances in the post-inflation-targeting period. Indeed, the decline in real output is no longer detectable, while the increase in consumer prices and the weakening of the currency are no longer significant. Accompanying these outcomes, a stronger (but still short-lived) interest rate hike appears to be needed in comparison with the results obtained over a longer sample period going back to the late 1970s.

Turning to variance decomposition analysis, the most robust result is that emerging markets countries appear to be relatively little affected by foreign shocks. These external disturbances appear on average to explain no more than 10% of the variation in real output, consumer prices, real exchange rates, real exports and real imports among this class of countries. The latter result is on the low side of the spectrum of estimates. It is worth stressing that this finding does not by itself imply that external forces have a small influence on emerging economies. As long as an important component of world economic developments is predictable, the estimates from this paper are still consistent with the conventional wisdom that small open economies are quite responsive to global factors. Taking this into consideration, the results reported here are broadly consistent with other studies pointing to a modest contribution of external determinants in emerging economies' fluctuations. This finding may, however, be regarded as standing in contrast to many studies in the literature that conclude that foreign variables play a dominant role in explaining domestic macroeconomic developments in small open economies.

Looking at the specific role of each of domestic disturbance, variance decomposition results found for the model including the real exchange rate do not seem to be much in line with those of the baseline model. Two relatively robust results in this area are the following. First, real imports fail to display a cross-regional pattern, with a different shock playing the key role in each regional grouping. The associations between regions and shocks driving real imports are however found to be model-specific. Second, technology shocks play a larger-than-fair role in explaining consumer price developments. This notwithstanding, the only regional grouping for which this is true under both model specifications are NMS, as emerging Asia is in a comparable situation only for the baseline model while Turkey only falls in this category under the alternative model including the real exchange rate.

## 1 Introduction

Emerging Market Economies (EMEs) have experienced rapid growth in economic activity and international trade over the last fifteen years, having normally outperformed the rest of the world in these two areas. Among emerging Asian countries, this has been largely the result of an outward-oriented strategy sustained on a very strong expansion of trade within and outside the region. The fast pace of economic growth exhibited by the region since the 1980s came suddenly to a halt at the time of the Asian financial crisis of 1997–1998. At that time, the strong intra-regional trade linkages transmitted negative shocks experienced in one country throughout the area. However, the economic slowdown in Emerging Asia proved temporary, and the expansion eventually resumed strongly. Latin American economies emerged from the lost decade of the 1980s, benefiting from the implementation of sounder macroeconomic policies and structural reforms. The impact of financial crises in Mexico (1994), Brazil (1999) and Argentina (2002), coupled with some contagion from the Russian and Asian crises, neither proved long-lasting nor seems to have prevented the region from posting a very robust output and export performance. Along the way, there has been an increase in Latin American countries' integration with the rest of the world, partly as a result of both multilateral trade liberalisation measures and regional integration initiatives (such as NAFTA and Mercosur). New EU Member States (NMS) have over the same period experienced a considerable transformation of their economies, going through the transition from socialist regimes to market economies increasingly integrated with the world economy. A defining feature of this process has been the accession process towards participation in the EU. In order to join the EU in 2004, ten NMS were asked to comply – among other things – with a functioning market economy and the capacity to cope with competitive pressures. These countries have succeeded in maintaining rapid economic growth during the accession process and beyond, opening up to the rest of the world in the areas of both international trade and foreign direct investment.

Against this background, the present paper investigates what are the determinants of EME's business cycles and international trade. This is an important matter regarding conjunctural analysis, with two key questions in this area being: First, how much of the strong growth momentum currently evidenced by EA countries is driven by external factors as opposed to the autonomous strength of domestic developments. Second, how is the impact of domestic factors split among the main exogenous sources of fluctuations arising from within each economy. Answering the previous two questions is crucial for assessing: a) the sustainability of the expansion of EMEs in the case of a

marked slowdown of the global economy; and b) the extent to which domestic demand and monetary policy could help buffer regional exports from global developments. In any case, it is worth stressing that EMEs' autonomous national impetus is likely to be limited by several factors. The latter include, for instance, the still relatively small size of these economies compared to the world economy, and the different regions' dependence on global demand for some products – such as US demand for IT goods from emerging Asia,<sup>1</sup> global demand for primary and industrial commodities from Latin America, and EU demand for NMS' manufacturing products.

The related empirical literature for EMEs tends to focus much more on the analysis of business cycles than it does on that of international trade. One of the few exceptions is Hoffmaister and Roldós (1997), who include the trade balance alongside other more common domestic endogenous variables such as real output and consumer prices. The authors report that overall a single domestic shock (namely, the supply shock) dominates the macroeconomic behaviour of both Asia and Latin America, with the latter region also being the more affected by external shocks. Moreover, they find that the trade balance is driven by domestic factors – and especially demand (fiscal) shocks – even if that domestic endogenous variable is the most affected by foreign variables such as terms of trade disturbances.<sup>2</sup> Among EME country studies that do not tackle international trade, Genberg (2003) uses a semi-structural vector autoregressive (VAR) to analyse macroeconomic behaviour in Hong Kong. He finds that external factors account for around half of macroeconomic fluctuations in the short-run and become dominant in the medium to long run. In addition, Moon and Jian (1995), in their cointegrated VAR study of South Korea, analyse the behaviour of a series of domestic macroeconomic variables controlling for external variables such as foreign interest rates, prices and output. Both domestic and external factors are found to impact the Korean economy, with the authors stressing that world interest rates play a significantly larger role than domestic rates.

The analysis pursued here also relates to studies that separate out the influence of domestic and external factors on a country's economy. Taking the existing literature as a whole, findings about the role of domestic and external variables in driving macroeconomic developments in EMEs tend to vary. Many studies have found evidence that external factors are of considerable, or even dominant,

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<sup>1</sup> US purchases of IT software and equipment is particularly important for countries such as South Korea, Taiwan, Singapore and Malaysia. Zebregs (2004) calculates that the electronics sector has accounted for around half of overall emerging Asia's export growth in the period 1998–2001.

<sup>2</sup> For advanced economies, the literature tackling both business cycles and international trade aspects includes Cushman and Zha (1997) for Canada, Dungey and Pagan (2000) for Australia, and Buckle *et al.* (2003) for New Zealand.

importance. For instance, Genberg (2003) finds that they are responsible for over 75% of business cycles in Hong Kong, and Canova (2005) estimates the corresponding average share for Latin American countries at almost 90% – with 50% being US-driven. Canova's study attributes most of the foreign impact to a financial transmission channel, with a large contribution of US monetary shocks, while US demand and supply shocks do not appear to have a significant impact. Even for larger open economies results have tended to attach a large share to external factors, as is the case in Cushman and Zha's (1997) study on Canada, for which the US is estimated to contribute with over 70% of business cycle dynamics. Results for small industrial economies tend to be consistent with that for Canada (see Dungey and Pagan, 2000, for Australia, and Buckle *et al.*, 2003, for New Zealand). Using sign-restricted VAR models for individual countries, Ruffer *et al.* (2007) investigate the role of domestic as well as intra- and extra-regional factors in explaining developments in various macroeconomic variables in emerging East Asian countries. The authors find that external developments tend to play a large role in driving domestic macroeconomic fluctuations. In contrast to the above-mentioned literature, Hoffmaister and Roldós (1997) find that external factors account for limited fraction of macroeconomic fluctuations in Asia and Latin America (20% and 30% at the very maximum, respectively).<sup>3</sup> Similarly, Kose *et al.*'s (2003) dynamic factor analysis indicates that macroeconomic fluctuations in both Asia and Latin America are largely explained by domestic factors, while extra-regional and especially intra-regional developments play a considerably more modest role.

This paper extends the existing literature by identifying the role played in EMEs' business cycles and international trade by external factors as opposed to impulses originating at the domestic level. VAR models are estimated for fifteen EME countries and theoretical sign restrictions used to identify supply, real demand, monetary and risk premium shocks.<sup>4</sup> The identification restrictions used are consistent with a large number of macroeconomic models. The approach employed here draws from previous work using sign identification restrictions by Faust (1998), Canova and De Nicolò (2002) and

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<sup>3</sup> One possible interpretation is that the authors' use of long-run identification restrictions à la Blanchard and Quah (1989) could be biasing upwards the estimate of the share of (domestic) supply factors, as suggested by Faust and Leeper's (1997) findings.

<sup>4</sup> Our analysis incorporates four domestic macroeconomic variables and control for a set of external variables including measures of advanced economies' economic activity, world interest rates and consumer prices, as well as oil and non-oil commodity prices.

Uhlig (2005) for advanced economies.<sup>5</sup> In particular, sign restrictions are allowed to hold for cross-products of impulse responses. Variance decomposition analysis is used to decompose macroeconomic developments in each EME between different types of domestic shocks, on the one hand, and a set of global disturbances, on the other.

The remainder of the paper is organised as follows. Section 2 develops a standard dynamic stochastic general equilibrium (DSGE) model with small open economy features in order to help motivate the discussion about the sign restrictions on impulse responses that are to be used for identification purposes. Section 3 presents the econometric methodology used, examining the VAR setup and the identification restrictions employed in the empirical part. Section 4 briefly describes the data. Section 5 discusses the results of the paper, including the reaction of business cycles and international trade to a number of macroeconomic shocks as well as variance decomposition analysis. Finally, section 6 contains some concluding remarks.

## **2. The theoretical restrictions**

This section describes the type of sign restrictions used in the econometric work undertaken here. In order to facilitate the derivation of these restrictions, I formulate a specific model for which I study the reaction of key macroeconomic and trade variables to standard structural disturbances. The empirical approach used in this paper is not meant to be a direct estimation of the model developed here. Given the lack of previous small open economy studies exploring in some detail the impulse responses in question, I proceed to investigate the robustness of identification properties to changes in parameter values over their relevant range. I then turn to the issue of robustness of the results with respect to related theoretical models available for small open economies. On the basis of these two sensitivity analyses, I finally propose the sign restrictions used in my econometric exercise.

### **2.1 A reference model**

The small open economy model used here is similar to those developed by Kollmann (2001), Bergin (2003), Ambler *et al.* (2003), and Bouakez and Rebei (2005). It can also be regarded as an extension

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<sup>5</sup> Related approaches also include Canova and De Nicolò (2003), Peersman (2005) and Peersman and Straub (2004). Canova (2005) uses an approach similar to the one employed here to identify US structural shocks by means of sign-restricted VARs, then follows a Bayesian VAR approach to estimate the impact of these shocks on Latin American economies.

of the small open economy model developed by McCallum and Nelson (1999 and 2000) because of its characterisation of imports as only comprising intermediate inputs. McCallum and Nelson convincingly argue that this assumption improves the fit of the model to the data. Among the other features of the model, I let the risk premium depend on the level of net foreign assets, in order to ensure that there is a unique steady-state in the context of an incomplete markets setup (see Schmitt-Grohé and Uribe, 2003). I allow wages and domestic prices to be sticky, with deviations from the law of one price in particular being modelled by introducing stickiness in the determination of tradable prices.

The domestic economy is populated by six types of agents: households (indexed by  $i \in (0, 1)$ ), firms producing final goods that can be consumed at home and abroad, firms producing intermediate goods (indexed by  $j \in (0, 1)$ ), firms importing intermediate goods (indexed by  $l \in (0, 1)$ ), a fiscal and a monetary authority. The economy is small in the sense that it reacts to exogenous developments in the rest of the world (the "foreign economy"), without in turn affecting the latter. I am interested in solving for the symmetric equilibrium, in which each type of private sector agents (households or firms) makes identical decisions.

Any given household  $i$  supplies labour  $N_t(i)$  of type  $i$ , and makes decisions about consumption, investment and the hourly nominal wage,  $W_t(i)$ . Households also own the firms and maximise the following expected discounted sum of instantaneous utilities derived from consuming a homogenous good ( $C_t$ ), holding real money balances ( $M_t/P_t$ ) and enjoying leisure:

$$E_t \sum_{s=0}^{\infty} \beta^s g_{t+s} \left[ \frac{C_{t+s}(i)^{1-1/\sigma}}{1 - \frac{1}{\sigma}} + \frac{1}{1 - \xi} \left[ \frac{M_{t+s}(i)}{P_t} \right]^{1-\xi} - \frac{N_{t+s}(i)^{1+\gamma}}{1 + \gamma} \right] \quad (2)$$

where  $\beta \in (0, 1)$  is the discount factor,  $\sigma > 0$  is the inverse of the elasticity of intertemporal substitution,  $\xi > 1$  is the elasticity of money holdings,  $\gamma > 0$  is the inverse of the elasticity of labour supply with respect to real wages, and  $g_t$  is a preference shock that does not affect the marginal utility of consumption.

Household  $i$ 's budget constraint is given by

$$\begin{aligned} & M_{t-1}(i) + B_{t-1}(i) + S_t B_{t-1}^*(i) - T_t(i) + W_t(i)N_t(i) + D_t(i) - AC_t^K(i) - AC_t^w(i) \\ \geq & P_t [C_t(i) + I_t(i)] + M_t(i) + \frac{B_t(i)}{R_t} + \frac{S_t B_t^*(i)}{\kappa_t R_t^*} \end{aligned} \quad (3)$$

where  $I_t$  denotes investment spending,  $D_t$  are dividends from domestic firms producing and importing intermediate goods (that is,  $D_t \equiv D_t^h + D_t^m$ ), and  $T_t$  are nominal lump-sum taxes



paid to the government.  $S_t$  is the nominal exchange rate (an increase being associated with a depreciation).  $B_t$  and  $B_t^*$  denote (net) holdings of domestic and foreign uncontingent bonds that pay one unit of money at  $t + 1$ . Their associated price is the inverse of the respective gross nominal interest rates,  $R_t$  and  $\kappa_t R_t^*$ , where  $\kappa_t$  is a risk premium term. This term is assumed to depend on the level of net foreign assets relative to output:

$$\ln \kappa_t = -\omega \left[ \exp \left( \frac{Q_t B_t^*}{Y_t} \right) - 1 \right] + \varepsilon_{\kappa t} \quad (4)$$

where  $Q_t \equiv S_t P_t^* / P_t$  is the real exchange rate and  $\varepsilon_{\kappa t}$  is the risk premium shock.

In (3), households face two types of adjustment costs, namely, capital adjustment costs,  $AC_t^K(i)$ , and wage adjustment costs,  $AC_t^w(i)$ . These adjustments costs are assumed to be quadratic:

$$\begin{aligned} AC_t^K(i) &= \frac{\psi_K}{2} \left( \frac{I_t(i)}{K_t(i)} - \delta \right)^2 P_t K_t(i) \\ AC_t^w(i) &= \frac{\psi_w}{2} \left( \frac{W_t(i)}{W_{t-1}(i)} - \pi \right)^2 W_t(i) \end{aligned} \quad (5)$$

where  $\pi$  is the steady-state inflation rate,  $\delta$  is the capital depreciation rate and  $K_t$  is the capital stock. The latter evolves according to  $K_{t+1}(i) = I_t(i) - (1 - \delta)K_t(i)$ , with  $I_t$  standing for investment.

Households' optimisation yields:

$$\lambda_t(i) = g_t C_t(i)^{-1/\sigma} \quad (6)$$

$$\lambda_t(i) = \beta R_t E_t \left[ \frac{\lambda_{t+1}(i)}{\pi_{t+1}} \right] \quad (7)$$

$$\lambda_t(i) = \beta \kappa_t R_t^* E_t \left[ \frac{(S_{t+1}/S_t) \lambda_{t+1}(i)}{\pi_{t+1}} \right] \quad (8)$$

$$\lambda_t(i) = \frac{\beta E_t \left[ \lambda_{t+1}(i) \left\{ 1 + g_{t+1} - \delta - \frac{\psi_K}{2} \left( \frac{I_{t+1}(i)}{K_{t+1}(i)} - \delta \right)^2 + \psi_K \left( \frac{I_t(i)}{K_t(i)} - \delta \right) \frac{K_{t+2}(i)}{K_{t+1}(i)} \right\} \right]}{1 + \psi_K \left( \frac{I_t(i)}{K_t(i)} - \delta \right)} \quad (9)$$

$$\begin{aligned} -\theta_w \frac{g_t N_t(i)^\gamma}{\lambda_t(i)} \frac{P_t}{W_t(i)} &= (\theta_w - 1) + \frac{\psi_w}{N_t(i)} \left[ \frac{1}{2} \left( \frac{W_t(i)}{W_{t-1}(i)} - \pi \right)^2 + \left( \frac{W_t(i)}{W_{t-1}(i)} - \pi \right) \frac{W_t(i)}{W_{t-1}(i)} \right] \\ &\quad - \frac{\psi_w}{N_t(i)} \beta E_t \left[ \frac{\lambda_{t+1}(i)}{\lambda_t(i)} \left( \frac{W_{t+1}(i)}{W_t(i)} - \pi \right) \left( \frac{W_{t+1}(i)}{W_t(i)} \right)^2 \right] \end{aligned} \quad (10)$$

where  $\lambda_t$  is the Lagrange multiplier associated with the household's problem,  $\pi_t \equiv P_t/P_{t+1}$  is the overall gross inflation rate, and  $q_t \equiv P_t^K/P_t$  is the real rental price of capital.  $MRS_t(i) \equiv C_t(i)^{-1/\sigma}/N_t(i)^\gamma = [\theta_w/(\theta_w - 1)] W_t(i)/P_t$  is defined to be the marginal rate of substitution between consumption and leisure, which turns out to be equal to a mark-up over the real wage.

The final good is produced by firms operating under perfect competition. These firms use domestic and imported intermediate goods with a CES technology described by

$$Y_t = \left[ \varphi^{1/\nu} (Y_t^d)^{(\nu-1)/\nu} + (1-\varphi)^{1/\nu} (Y_t^m)^{(\nu-1)/\nu} \right]^{\nu/(\nu-1)} \quad (11)$$

where  $\varphi \in (0, 1)$  and  $\nu > 0$ . In turn,  $Y_t^d = \left( \int_0^1 Y_t^d(j)^{(\theta-1)/\theta} dj \right)^{\theta/(\theta-1)}$  and  $Y_t^m = \left( \int_0^1 Y_t^m(l)^{(\eta-1)/\eta} dl \right)^{\eta/(\eta-1)}$  are composite domestic and imported intermediate goods, respectively, where  $\theta > 1$  and  $\eta > 1$  are the corresponding elasticities of substitution between goods in each class. The prices for these two composite goods are given by  $P_t^d = \left( \int_0^1 P_t^d(j)^{1-\theta} dj \right)^{1/(1-\theta)}$  and  $P_t^m = \left( \int_0^1 P_t^m(l)^{1-\eta} dl \right)^{1/(1-\eta)}$ . Furthermore, the demand functions for each type of domestic and imported intermediate goods are:

$$Y_t^d(j) = \left( \frac{P_t^d(j)}{P_t^d} \right)^{-\theta} Y_t^d \quad (12)$$

$$Y_t^m(j) = \left( \frac{P_t^m(l)}{P_t^m} \right)^{-\eta} Y_t^m \quad (13)$$

The zero-profit condition for final goods implies that their price equals:

$$P_t = \left[ \varphi (P_t^d)^{1-\nu} + (1-\varphi) (P_t^m)^{1-\nu} \right]^{1/(1-\nu)} \quad (14)$$

Domestic intermediate goods firms (indexed by  $j$ ) produce according to:

$$\begin{aligned} H_t(j) &\equiv Y_t^d(j) + Y_t^x(j) \\ &= z_t K_t(j)^\alpha \left[ \left( \int_0^1 N_t(j)^{(\theta_w-1)/\theta_w} dj \right)^{\theta_w/(\theta_w-1)} \right]^{1-\alpha} \end{aligned} \quad (15)$$

where  $z_t$  is a stochastic technology factor, which is common to the whole economy.  $\theta_w > 1$  is the elasticity of substitution between different types of labour, and  $\alpha \in (0, 1)$  is the capital share of output.

Domestic intermediate producers maximise

$$E_t \sum_{s=0}^{\infty} \beta^s \left( \frac{\lambda_{t+s}}{\lambda_t} \right) \frac{D_{t+s}^h(j)}{P_{t+s}} \quad (16)$$

with  $D_t^h(j) \equiv P_t^d(j)Y_t^d(j) + S_t P_t^x(j)Y_t^x(j) - W_t N_t(j) - P_t^K(j)K_t(j) - AC_t^d(i) - AC_t^x(i)$ , where  $AC_t^d(j)$  and  $AC_t^x(j)$  are quadratic adjustment costs à la Rotemberg (1982) entailed by changing prices of domestic intermediate goods charged to local and foreign buyers, respectively:

$$\begin{aligned} AC_t^d(i) &= \frac{\psi_d}{2} \left( \frac{P_t^d(j)}{\pi P_{t-1}^d(j)} - 1 \right)^2 P_t^d(j)Y_t^d(j) \\ AC_t^x(i) &= \frac{\psi_x}{2} \left( \frac{P_t^x(j)}{\pi^x P_{t-1}^x(j)} - 1 \right)^2 S_t P_t^x(j)Y_t^x(j) \end{aligned} \quad (17)$$

Firm  $j$ 's optimisation problem is constrained by the following demand functions (12) and (18):

$$Y_t^x(j) = \left( \frac{P_t^x(j)}{P_t^x} \right)^{-\theta} Y_t^x \quad (18)$$

The first-order conditions are

$$w_t = (1 - \alpha) \zeta_t(j) \frac{z_t(j)}{N_t(j)} \quad (19)$$

$$q_t = \alpha \zeta_t(j) \frac{z_t(j)}{K_t(j)} \quad (20)$$

$$\begin{aligned} -\theta \frac{\zeta_t(j)}{P_t^d(j)} &= (1 - \theta) \left[ 1 - \frac{\psi_d}{2} \left( \frac{P_t^d(j)}{\pi P_{t-1}^d(j)} - 1 \right)^2 \right] - \psi_d \frac{P_t^d(j)}{\pi P_{t-1}^d(j)} \left( \frac{P_t^d(j)}{\pi P_{t-1}^d(j)} - 1 \right) \\ &+ \psi_d \beta E_t \left[ \frac{\lambda_{t+1}}{\lambda_t} \frac{[P_{t+1}^d(j)/P_t^d(j)]^2}{\pi_{t+1} \pi} \left( \frac{P_{t+1}^d(j)}{\pi P_t^d(j)} - 1 \right) \frac{Y_{t+1}^d(j)}{Y_t^d(j)} \right] \end{aligned} \quad (21)$$

$$\begin{aligned} -\theta \frac{\zeta_t(j)}{P_t^x(j)} \frac{1}{Q_t} &= (1 - \theta) \left[ 1 - \frac{\psi_x}{2} \left( \frac{P_t^x(j)}{\pi^x P_{t-1}^x(j)} - 1 \right)^2 \right] - \psi_x \frac{P_t^x(j)}{\pi^x P_{t-1}^x(j)} \left( \frac{P_t^x(j)}{\pi^x P_{t-1}^x(j)} - 1 \right) \\ &+ \psi_x \beta E_t \left[ \frac{\lambda_{t+1}}{\lambda_t} \frac{Q_{t+1}}{Q_t} \frac{[P_{t+1}^x(j)/P_t^x(j)]^2}{\pi^x \pi_{t+1}^*} \left( \frac{P_{t+1}^x(j)}{\pi^x P_t^x(j)} - 1 \right) \frac{Y_{t+1}^x(j)}{Y_t^x(j)} \right] \end{aligned} \quad (22)$$

where  $\alpha$  is the capital share,  $\zeta_t$  is the real marginal cost,  $w_t \equiv W_t/P_t$  is the real wage rate,  $\pi^x$  is the steady-state inflation for exported intermediate goods (in foreign currency),  $\pi_t^* \equiv P_t^*/P_{t+1}^*$  is the foreign gross inflation rate, and  $p_t^d \equiv P_t^d/P_t$  and  $p_t^x \equiv P_t^x/P_t$  are the relative prices of domestic intermediate goods sold at home and abroad, respectively.

The aggregate demand for exports is assumed to equal:

$$Y_t^x = \phi \left( \frac{P_t^x}{P_t^*} \right)^{-\varsigma} Y_t^* \quad (23)$$

where  $\phi > 0$  and  $\varsigma > 0$ , whereas  $Y_t^*$  is foreign real output.

The importing firms maximise

$$E_t \sum_{s=0}^{\infty} \beta^s \left( \frac{\lambda_{t+s}}{\lambda_t} \right) \frac{D_{t+s}^m(l)}{P_{t+s}} \quad (24)$$

with  $D_t^m(l) \equiv [P_t^m(l) - S_t P_t^*] Y_t^m(l) - AC_t^m(l)$ , where  $AC_t^m(l)$ , the adjustment cost relating to changing the price of imported intermediate goods, is given by

$$AC_t^m(l) = \frac{\psi_m}{2} \left( \frac{P_t^m(l)}{\pi P_{t-1}^m(l)} - 1 \right)^2 P_t^m(l) Y_t^m(l) \quad (25)$$

The first-order condition is

$$\frac{Q_t}{p_t^m(l)} = (1 - \eta) \left[ 1 - \frac{\psi_m}{2} \left( \frac{P_t^m(j)}{\pi P_{t-1}^m(j)} - 1 \right)^2 \right] - \psi_x \frac{P_t^m(j)}{\pi P_{t-1}^m(j)} \left( \frac{P_t^m(j)}{\pi P_{t-1}^m(j)} - 1 \right) \quad (26)$$

$$+ \psi_m \beta E_t \left[ \frac{\lambda_{t+1}}{\lambda_t} \frac{[P_{t+1}^m(j)/P_t^m(j)]^2}{\pi_{t+1} \pi} \left( \frac{P_{t+1}^m(j)}{\pi P_t^m(j)} - 1 \right) \frac{Y_{t+1}^m(j)}{Y_t^m(j)} \right] \quad (27)$$

The government cannot run deficits or surpluses, so its budget constraint is

$$P_t G_t - \int_0^1 T(i) di = M_t - M_{t-1} \quad (28)$$

where  $G_t$  is real government spending.

The central bank follows a Taylor (1993) rule:

$$\ln \left( \frac{R_t}{R} \right) = \rho_R \ln \left( \frac{R_{t-1}}{R} \right) + (1 - \rho_R) \gamma_\pi \ln \left( \frac{\pi_t}{\pi} \right) + (1 - \rho_R) \gamma_y \ln \left( \frac{Y_t}{Y} \right) + \varepsilon_{Rt} \quad (29)$$

where  $R$  is the steady-state nominal interest rate,  $Y$  is steady-state output, and  $\rho_R$  is the interest rate smoothing coefficient. According to this rule, the central bank (gradually) raises or lowers the short-term nominal interest rate in response to deviations from their steady-state levels of inflation and output.

In the symmetric equilibrium, the economy's resource constraint can be written as  $Y_t = C_t + G_t + I_t - AC_t^K - AC_t^w - AC_t^d - AC_t^x - AC_t^m$ , while the balance of payments identity is given by:

$$\frac{b_t^*}{\kappa_t R_t^*} - \frac{b_{t-1}^*}{\pi_t^*} = p_t^x Y_t^x - Y_t^m \quad (30)$$

where  $b_t^* \equiv B_t^* / P_t^*$ .

Three of the shocks in the model (namely,  $z_t$ ,  $g_t$  and  $\varepsilon_{\kappa t}$ ) are assumed to display a first-order autocorrelation pattern, with the associated coefficients labelled as  $\rho_z$ ,  $\rho_g$  and  $\rho_\kappa$ , respectively. The monetary shock  $\varepsilon_{Rt}$  is instead assumed to follow a white-noise process. I abstract here from specifying the exogenous processes for foreign variables  $\pi_t^*$  and  $Y_t^*$ . However, in my empirical analysis I shall control for the impact of foreign variables, including foreign price and real output levels, together with other variables possibly influencing the latter two as well as more generally having a potential impact on the small open economy under study.

To solve the model, its equilibrium conditions are log-linearised around steady-state values. In particular, this gives rise to a dynamic system that includes standard equations such as the uncovered interest parity condition as well as price- and wage-setting equations (the so-called New Keynesian Phillips curves), among others.

## 2.2 Sign restrictions

I do not *a priori* assume that the sign restrictions resulting from the above model hold generally, given that approaches with different modelling features may deliver different signs for the joint dynamics of macroeconomic and international trade variables in response to shocks. For this reason, this subsection focuses on the robustness of the previous model's results to different parameter values as well as with respect to other modelling strategies found in the related literature.

Figures 1A-1B report impulse responses produced by the four shocks to the model when the parameters are allowed to vary within the ranges presented in Table 1. More precisely, each box presents 68% of the 1,000 paths generated randomly drawing the parameter set independently from a uniform distribution covering the range shown in Table 1. The first column in Figures 1A-1B represents responses to technology shocks, the second responses to preference shocks, the third responses to monetary shocks and the fourth responses to risk premium shocks. Figure 1A only plots the responses of the variables used in the baseline VAR model, namely, real output, inflation, real exports and real imports. Figure 1B reports the responses of the variables used in alternative VAR specifications, that is, the real exchange rate and nominal interest rate.

As in Canova *et al.* (2006) and Pappa (2005), I decompose the parameter vector in two components. First, two parameters are held fixed to a particular value: i) the discount factor, set so that the annual real interest rate equals 4%, and ii) the relevant steady-state “debt ratio”, namely,  $QB^*/Y$ , which is set so that the foreign debt amounts to 20% of real GDP. The remaining parameters are allowed to vary. Their ranges are centred around standard values and the intervals are selected to

contain existing estimates and values set in calibration exercises, or else chosen to fulfil theoretical conditions. For instance, the interval for wage and price adjustment costs starts from a very low value but is allowed to reach high levels as well, in line with estimates in Dib (2003) and Ambler *et al.* (2003). Capital adjustment costs are also allowed to adopt a high value and are bounded from below at 4. The coefficients of the interest rate rule hover around standard figures, also being consistent with equilibrium determinacy. The ranges for the capital share in production and the capital depreciation rate also include normal values. In addition, I allow for variation in the shares of consumption and investment, while accommodating for a reasonable role for government expenditure.

The sign restrictions contained in Figure 1A appear not to be robust to the time horizon. On impact (interpreted to mean at the end of the first quarter), the confidence bands indicate that all responses adopt a particular sign, with the exception of the reaction of real output to the risk premium shock. Figure 1B points to determinate signs for the immediate reaction of the real exchange rate and nominal interest rate to the disturbances. Beyond the first quarter, many responses in Figures 1A-1B fail to exhibit a clear-cut sign. This suggests that the empirical analysis concentrate on sign conditions for the first quarter only. For the latter quarter, and with a focus on the baseline set of variables, a technology disturbance drives on impact real output and the trade variables upwards, while it pushes inflation down. A preference shock yields on impact a rise in inflation, real output and real imports, as well as a decrease in real exports resulting from a real exchange rate appreciation. A monetary shock initially induces all four variables to fall.

The risk premium shock deserves special discussion. It generates on impact an increase in inflation and real exports, a fall in real imports and an indeterminate (even if largely positive) impact on real output. The decline in real imports induced by the shock can be interpreted as resulting from a substitution effect that is not fully offset by a possible favourable income effect (or even compounded by the fall in real output under some parameter values). This is a standard prediction in the related literature. The ambiguous sign for the real output response mirrors the debate in the literature concerning the expansionary or contractionary effect of a depreciation. The empirical literature for EMEs suggests that a weakening in the exchange rate as arising, for instance, from a rise in risk premia tends to be contractionary, even after including a number of different controls.<sup>1</sup> In the present setup,

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<sup>1</sup> See *e.g.* Ahmed (2003) and the references cited therein, regarding the related empirical literature. Eichengreen (2005) and Sánchez (2006 and 2007) analyse how differently an economy displaying contractionary depreciations responds to financial and real shocks.

this "contractionary depreciation" result (as induced by the higher debt burden given by the domestic economy's initial net borrower position) is not to be taken for granted. Indeed, the depreciation induced by the shock also yields an increase in real exports that may more than offset the adverse forces set in motion. This favourable effect appears to be strong enough for the calibration used by Céspedes *et al.* (2003 and 2004), despite the considerable attention these authors pay to the balance sheet effects arising from liability dollarisation. In my empirical investigation, I will leave the sign of the real output response to the risk premium shock unrestricted, thereby allowing the data to determine the relevant overall effect in place in each economy.

The contemporaneous signs found in Figures 1A-1B are broadly in line with other findings in the literature. For example, Ambler *et al.* (2003) obtain comparable signs on impact for impulse responses of all six variables considered here to a wide variety of disturbances, including technology and monetary shocks.<sup>2</sup> McCallum and Nelson (2000) study the impact of monetary and risk premium shocks, obtaining exactly the same sign for contemporaneous responses of all four baseline variables analysed here. Specifically, McCallum and Nelson (1999) report responses of variables including real output and inflation to monetary and risk premium shocks. In only one out of the four results involved, the contemporaneous response is not strictly the same as the one reported here, namely, the response of inflation to risk premium shocks. McCallum and Nelson (1999) report a contemporaneous lack of response of inflation to a risk premium shock, in light of their assumption that prices are fully predetermined. In practice, however, this difference plays no role in the empirical work conducted here given that the probability that responses be exactly zero is negligible.<sup>3</sup> Finally, Galí and Monacelli (2005) examine, under four different setups, the impact of a technology shock on several macroeconomic variables, including the ones studied here. The results are entirely consistent with mine, with the exception of consumer prices in one of the four scenarios studied by the authors, namely, that of a pegged exchange rate. In the latter case, consumer prices are predicted by the authors to fall following a favourable technology shock. While many countries in our sample have adopted bilateral exchange rate pegs (at least for some time), the case studied by Galí and Monacelli

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<sup>2</sup> Ambler *et al.* (2003) also report responses to a government spending shock that are comparable to those associated with a preference disturbance here. Moreover, they find reactions to a foreign interest rate shock that are in line with the consequences of a risk premium disturbance in the present paper.

<sup>3</sup> Moreover, the related theoretical literature and the evidence found for both advanced and emerging economies point to prices being contemporaneously influenced by factors such as forward-lookingness and marginal costs. See *e.g.* the evidence for advanced economies in Ireland (2005), Rabanal and Rubio-Ramírez (2005a and 2005b), and Smets and Wouters (2005). Regarding EMEs, see Agénor and Bayraktar (2003), Céspedes *et al.* (2005), and Genberg and Pauwels (2005).

corresponds to one of effective exchange rate peg which is rather unusual in practice. Even the case of Singapore - which officially targets its nominal effective exchange rate - the target has not been fixed over time, the weights (which are not disclosed to the public) are deemed not to be constant and a band is considered around the target. I thus decide to also include among my sign restrictions a negative response of consumer prices to the technology shock, which is also in line with other related studies.

In sum, the sign restrictions assumed here to hold on impact (that is, at the end of the third quarter) are determinate in all cases but the reaction of real output to risk premium disturbances:

	Y	P	Y <sup>x</sup>	Y <sup>m</sup>	Q	R
Technology shock	+	-	+	+	+	-
Preference shock	+	+	-	+	-	+
Monetary shock	-	-	-	-	-	+
Risk premium shock	?	+	+	-	+	+

As mentioned in the previous subsection, the small open economy is not assumed to be driven purely by domestic disturbances, being instead also influenced by external factors. The shocks included in the Table above should thus be considered to be domestic or country-specific. Different types of shocks hit the rest of the world and therefore indirectly affect the domestic economy. These shocks, which I label “foreign” shocks, will however not be differentiated by type (technology, preference, etc.) but instead be bundled together in one single grouping.

### 3 Methodology

This section consists of two parts. The first part describes the identification strategy employed in the paper. The second part outlines the vector autoregressive model and describes the way variance decompositions are computed. Appendix A describes in more detail the approach to identification, examining the algorithm used to achieve decompositions of the relationship between reduced form and structural form errors.

#### 3.1 Choice of variables and sign restrictions

I model each EME using four macroeconomic variables: real output, consumer prices, real exports and real imports. This choice allows me to characterise business cycle and international trade characteristics of the economy by means of a relatively small set of variables. In addition, I also

consider models involving either the real exchange rate or both the latter and the nominal interest rate. I characterise the dynamics of the economy in terms of responses to global shocks as well as three domestic structural disturbances: a technology shock, a preference shock, a monetary policy shock and a risk premium shock.

I set up sign restrictions for cross-products of responses in endogenous variables to candidate identified shocks. In doing so, I build from previous work by Faust (1998), Canova and De Nicolò (2002) and Uhlig (2005) for advanced economies. Identification is based on the contemporaneous theoretical sign restrictions described in section 2.

The present use of sign restrictions pins down expected reactions on all domestic variables to all postulated domestic disturbances. In particular, no variable is allowed to move freely on impact in either direction following any of the changes in the four specified shocks (with the exception of the response of real output to a risk premium shock). Moreover, I attempt to leave no single disturbance unidentified. The success of the strategy pursued here would consist of finding meaningful estimated reactions of endogenous variables to shocks, and doing so by using identification schemes that impose only a minimal set of plausible economic assumptions on the way the economy behaves.

### **3.2 Vector autoregressive model setup**

The empirical estimation strategy proceeds in two steps. First, I set up a vector autoregressive (VAR) model on quarterly series for fifteen individual EME countries. In addition to a set of domestic macroeconomic variables used as endogenous variables, I control for the impact of exogenous variables characterising global developments. Second, I use sign restrictions derived from a theoretical model in order to identify structural shocks. More concretely, I identify technology, preference, monetary and risk premium shocks. To do so, I impose sign restrictions on the cross-products of impulse responses, rather than on the pairwise cross-correlation functions as in Canova and De Nicolò (2002). Third, I use the identified structural errors for two purposes: 1) impulse responses of endogenous variables to a number of different shocks; and 2) variance decomposition analysis, with a focus on computing the contribution of each domestic shock as well as external factors to macroeconomic fluctuations. The entire set of results is reported in section 5.

The first step for estimating the model consists in setting up a VAR model for each of the EMEs in our sample. A set of domestic macroeconomic variables is used as endogenous variables, while I also

control for the impact of exogenous variables characterising global developments. The latter are assumed to follow first-order autoregressive processes that are entirely independent from the workings of each and every EME. The error term from these processes is denoted by  $x_t$ . The reduced form model can be written as follows :

$$A(L)y_t = G(L)x_t + \varepsilon_t \text{ with } \varepsilon_t \stackrel{D}{\sim} WN(0, \Sigma) \quad (31)$$

where  $y_t$  is a  $n \times 1$  vector of domestic variables,  $x_t$  is a  $k \times 1$  vector of exogenous global shocks,  $\varepsilon_t$  is a vector of white noise errors, and  $A(L)$  and  $G(L)$  are polynomials of orders  $p$  and  $q$ , respectively. In my setup,  $n = 4$ . Model (18) can be estimated by OLS equation by equation.

The VAR model in (31) can be rewritten in the Wold form :

$$y_t = H(L)x_t + B(L)\varepsilon_t$$

where  $H(L) = A(L)^{-1}G(L)$  and  $B(L) = A(L)^{-1}$ . I am interested in recovering the structural form of the system in order to express endogenous variables in terms of exogenous variables and economically interpretable disturbances. The latter can be represented by a vector  $\omega_t$  of structural shocks that satisfies :

$$\omega_t \stackrel{D}{\sim} WN(0, I_n) \text{ and } \varepsilon_t = C\omega_t \quad (32)$$

This implies that  $CC' = \Sigma$ . The Wold representation for the structural form allowing for exogenous variables becomes :

$$y_t = H(L)x_t + B(L)C\omega_t \quad (33)$$

This paper employs impulse responses for identification purposes. The orthogonalised impulse response of the  $i$ -th variable to one unit deviation of the  $j$ -th shock after  $s$  periods can be expressed as :

$$\frac{\partial y_{t+s|t}}{\partial \omega_{jt}} = B_s c_j \quad (34)$$

where  $B_s = \partial y_{t+s|t} / \partial \varepsilon_t'$  can be obtained from  $B(L)$ , and  $c_j$  is the  $j$ -th column of  $C$ .

I use variance decomposition to separate the part of the mean square error (MSE) of forecasts of each endogenous variable due to domestic shocks to the VAR from that determined by the set of

exogenous external variables. I can make use of an adding up property since identified shocks are orthogonal to each other, and also orthogonal to exogenous variables. From (33), the contribution of the  $j$ -th structural domestic shock  $\omega_j$  to the MSE of the  $s$ -period-ahead forecast of  $y_{it}$  is:<sup>4</sup>

$$D_{ij} = B_s^i c_j c_j' B_s^i$$

where  $B_s^i$  is the  $i$ -th row of  $B_s$ .

The corresponding expression that obtains for the whole set of exogenous variables (each one indexed by  $l$ ) is:

$$F_i = \sum_{l=1}^k F_{il} = H_s^i H_s^i$$

where  $H_s^i$  is the  $i$ -th row of  $H_s$ , and  $H_s = \partial y_{t+s|t} / \partial x_t'$  can be obtained from  $H(L)$ .

## 4 Data description

The database consists of monthly series for fifteen EME countries over the period 1990:1–2005:5. Appendix B provides the reader with a description of the data sources. The Emerging Asian countries under study are China, Hong Kong, South Korea (henceforth Korea), Malaysia, Singapore, Taiwan and Thailand. Latin American EME countries are Argentina, Brazil, Chile and Mexico. The remaining four economies are the three largest NMS (namely, the Czech Republic, Hungary and Poland), and Turkey. Due to data availability constraints, two countries (China and the Czech Republic) have slightly shorter sample periods (see Appendix C). In the case of China, moreover, some of the data (for industrial production and CPI) is provided on a year-on-year rates of change basis, which implies that the VAR model used is expressed on this same basis.

As mentioned in section 2, I use the following endogenous variables for each EME country: industrial production as a measure of economic activity, CPI as a measure of domestic prices, and two international trade variables: real exports and real imports (defined, for cross-country comparability, as their respective value in US dollars deflated by US CPI). The exogenous variables used here to

<sup>4</sup> The fraction of the MSE of the forecast of any endogenous variable due to the *entire* set of external variables, and therefore the remaining fraction explained by the *entire* set of shocks, are independent of the chosen decomposition  $C$ . Instead, the properties of  $C$  are crucial for decomposing the MSE among *each* individual domestic shock.

capture global effects outside the EME regions include indicators of world economic activity, consumer prices and interest rates, as well as crude oil prices and an index for non-oil commodity prices. For global economic activity and interest rates, I construct G7 industrial production and CPI indices as well as a measure of G7 short-term interest rate levels (see Appendix B). I follow Canova and De Nicolò (2002) in: a) linearly detrending and seasonally adjusting all series using a simple linear regression on seasonal dummies; and b) checking by visual inspection whether the transformed data shows signs of non-stationarity. The results from item b) indicate that there is no compelling evidence of stochastic non-stationarity in the series employed.<sup>5</sup> I do not model long-run relationships explicitly, even if they should be present in the data. I follow instead the now common practice of estimating the model in its level specification, while allowing – as mentioned earlier – for a sufficiently large number of lags. This can be justified on the ground that the alternative approaches of transforming the model to stationary form by differencing or imposing long-run relationships may be unnecessary or even inappropriate (see *e.g.* Sims *et al.*, 1990).

## 5 Empirical results

This section reports all the empirical results of the paper. Subsection 5.1 presents the baseline model results, while subsection 5.1 discusses alternative results for models involving either the real exchange rate or both the latter and the nominal interest rate.

For all specifications considered, the analysis starts by estimating the reduced form of the VAR model in (18) for each EME economy. I then identify structural shocks using the approach outlined in section 3. In order to assess the relative importance of external and domestic shocks for the evolution of the various variables, I assess the reaction of business cycles and international trade to a number of domestic macroeconomic shocks. In addition, I gain some insights by performing a variance decomposition analysis.

Joint selection of the lags of endogenous variables and exogenous disturbances ( $p$  and  $q$ , respectively), together with the set of dummies (if any) entering the VAR model, is based on Akaike information criteria.<sup>6</sup> I constrain the largest values of  $p$  and  $q$  to be equal to 24. The lag selection tests normally suggest optimal values of  $p$  no larger than 12 and  $q$  equal to 0. That is, I use lags of the

<sup>5</sup> The usefulness of more formal tests for non-stationarity is constrained by the relatively short number of years in the present samples.

<sup>6</sup> In practice, the decisions reached are unchanged if the Schwartz information criterion is used instead.

endogenous variables not going beyond one year back in time, while only the contemporaneous level of the exogenous shocks enters the model significantly. For each emerging Asian economy, I try consecutive monthly impulse dummies from 1997:7 through 1998:12. I limit the number of dummies to a maximum of 2, choosing the ones – if any – that are most significant. In practice, allowing for extra dummies does not appear to yield a substantial gain in the goodness of fit. In the cases of Argentina and Brazil, estimation starts in 1990:4 to avoid the first quarter of that year, in which both countries experienced extreme nominal volatility, with inflation rates above all other realisations among the samples used here.<sup>7</sup>

In reporting results, Tables 2 through 4 show the mean and (if different) the median of all impulse responses and variance decompositions obtained. Comparison between these two statistics allows us to get a sense of the asymmetry around the mean of the respective distributions. For more detail, Figures 2 and 3 present median impulse responses, as well as the 16<sup>th</sup> and 84<sup>th</sup> percentile confidence intervals, for the baseline model and the specification including the exchange rate, respectively.

## 5.1 Baseline model results

### 5.1.1 Impulse responses

Tables 2A through 2D present the results obtained for impulse responses of each endogenous variable of interest to all four disturbances using the baseline model. In these Tables, impulse responses are reported for the first quarter, the fourth quarter (*i.e.* the final quarter of the first year after a given shock) and the eighth quarter (*i.e.* the final quarter of the second year). Figures 2A through 2E report the corresponding median responses, as well as the 16<sup>th</sup> and 84<sup>th</sup> error bands for every month over a three-year horizon. In line with the theoretical results in section 2, identification focuses on sign restrictions for the first quarter.<sup>8</sup> The response of real output to a risk premium shock at the end of the first quarter is not *a priori* constrained to conform to any sign restriction, and neither are any responses beyond the first quarter. In addition to the means for each country, I report the medians, so as to convey an idea of the asymmetry of the distribution of fully identified impulse responses around the mean. The averages for regions and all emerging countries are also reported.

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<sup>7</sup> Tables A1 and A3 report the main aspects of all reduced-VAR specifications used for the baseline approach and the model including the exchange rate, respectively. Table C1 describes the sample periods used for all countries.

<sup>8</sup> For more details on the identification approach used here, see Appendix A.

First of all, I find that full identification (*i.e.* identification of the four shocks) is achieved in all countries. The results also indicate that, although this is not assumed *a priori*, signs of impulse responses tend not to deviate over time from those imposed at around the end of the first quarter. Along the way, in many cases responses appear to die out by the end of the second year, with responses to technology shocks however being exceptional in that the reactions often remain stable or even increase within the two-year horizon.

Quantitatively, the reaction of endogenous variables to unit disturbances is normally found to be rather muted.<sup>9</sup> The stronger reactions are those of consumer prices (in line with this being the only nominal variable in the model) and – depending of the shock – real imports. With regard to the reaction of consumer prices, the shocks that induce the largest responses are the technology and risk premium shocks, which also happen to generate relatively protracted effects. At the country level, the response of consumer prices is particularly strong in two Latin American economies (Argentina and Brazil) and, less so, Poland. Responses of real imports are highest following technology and monetary shocks. Real imports also tend to react more strongly in Latin American countries (and especially Argentina), China and, less so, Turkey.

Responses of real output and real exports tend to be of a relatively smaller magnitude. The reaction of real output to the risk premium shock, which is left unrestricted on impact, appears to be positive in some emerging Asian countries (significantly so in Hong Kong and – over the second year – Korea, and not significantly in China, Malaysia and Taiwan as well as Korea over the first year). Risk premium disturbances instead reduce real output in Argentina (by a small but significant magnitude) and Poland (not significantly though). Concerning real exports, the largest effects tend to stem from monetary shocks, although the impact is still rather limited. Nevertheless, taking also into account the often muted influence of monetary shocks on inflation and real output as well as the larger impact of these shocks on real imports, one could conclude that unpredictable monetary policy – while possibly allowing for some stabilisation in the former two variables - would likely imply more pronounced fluctuations in EME countries' international trade (and, in particular, their trade balance).

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<sup>9</sup> The combination of muted responses and limited accuracy typical for EME estimates implies that, except for the very short-run, statistical significance is not so often found.

## 5.1.2 Variance decomposition results

Here I describe variance decomposition results for each country. These results, which appear in Tables 3A through 3D, report the shares of the variability in endogenous variables in each country or region that are accounted for by each of the five sources of uncertainty, namely, the four domestic shocks and foreign disturbances.

The results show that EMEs are mostly driven by domestic shocks. In contrast, external disturbances, which capture unexpected developments in advanced economies as well as global commodity prices, represent no more than 10% of the variation in real output, consumer prices, real exports and real imports for EME countries. It is worth stressing that, due to large cross-country diversity, no very clear patterns seem to emerge concerning the role of shocks in driving endogenous variables under study. Still, in the rest of the subsection I focus on cases in which there is evidence of apparent deviations from the benchmark case in which each of the four domestic shocks considered account for a larger-than-fair share of the fraction of total variability that is not explained by foreign disturbances.

With regard to real output's variance, each domestic shock accounts for a considerable share of this variable's variance at the EME average level. Monetary shocks explain a larger-than-fair fraction of real output fluctuations as a result of the contributions from emerging Asia (mostly owing to Hong Kong, Malaysia and Thailand) and Latin America (due to Argentina and Brazil). It is also worth saying that technology disturbances make a relatively large contribution to NMS' real output variability (especially in the Czech Republic), whereas preference shocks stand out in the case of Turkey.

In the case of consumer price variability, while each domestic shock explains a considerable share at the EME average level, technology shocks exceed by some margin the contribution of the remaining disturbances. This especially results from the role played by technology shocks in driving consumer prices in emerging Asia (due to Hong Kong, Malaysia and Thailand) and NMS (owing to Czech Republic and Hungary). Concerning other patterns worthy of mention, preference shocks explain the largest share of Latin-American consumer price variability among all individual shocks (largely due to Brazil), while preference shocks play a small role in this regard in the case of Turkey.

For real exports, again, each domestic disturbance explains a considerable fraction of the EME average variability. Risk premium disturbances account for a relatively large share of real exports movements owing to emerging Asia (mostly owing to Hong Kong, Malaysia and Taiwan) and NMS

(Czech Republic and Hungary). Technology shocks exhibit a rather large contribution to Latin-American real exports' variance, while monetary disturbances occupy a comparable position in the Turkish case.

Regarding real import variability, each domestic shock plays a considerable role at the EME average level. The shares in real imports' variance are rather similar across domestic disturbances in the case of emerging Asia. In Latin America, technology shocks also display the largest single contribution to real import fluctuations (owing to Brazil and Mexico), while a comparable role is played by risk premium shocks in NMS (due to Czech Republic and Hungary) and preference shocks in Turkey.

In sum, the most robust result is that EMEs appear to be mostly dominated by domestic factors. In addition, despite large variation in results at the country and regional levels, some patterns can be detected concerning the variance decomposition results. Each domestic shock accounts for a considerable fraction of the business cycle and international trade fluctuations that are not explained by foreign shocks. Among domestic disturbances displaying larger-than-fair contributions to the variance of endogenous variables, monetary shocks stand out with regard to driving real output, while a similar role is played by technology and risk premium shocks vis-à-vis consumer prices and real exports, respectively.

## **5.2 Alternative specifications**

### **5.2.1 Model including the real exchange rate**

#### **5.2.1.1 Impulse responses**

In Tables 4A through 4D, I report the results obtained for impulse responses to unit shocks for the model that includes the real exchange rate. As in subsection 5.1.1, responses are shown for the first quarter as well as for the end of the first and second years.

In line with the baseline model, identification of all four shocks is achieved in all countries. Among other robust results, signs of impulse responses are normally found not to deviate over time from the restrictions set around the end of the first quarter, while the reaction of endogenous variables to unit shocks appear to be rather small. While impulse responses still tend to die out by the end of the second

year, technology shocks no longer seem to be induce particularly protracted or even increasing reactions within the two-year horizon.

The quantitatively bigger responses are those of consumer prices and – depending of the shock – real imports. Both results are in line with those found under the baseline model specification. As with the latter, the reaction of consumer prices is larger in the cases of technology and risk premium shocks. These disturbances also induce persistent and increasing inflationary effects, respectively. Once more, the response of consumer prices is especially strong in the same two Latin American countries (namely, Argentina and Brazil) and, less so, Poland. In addition, Turkey also ranks high among the countries whose consumer prices are influenced by unexpected developments, with the exception of preference shocks. Real imports continue to react most strongly to technology and monetary shocks, with Chinese real imports being particularly affected. Otherwise, the effect on real imports appears to be more spread out than under the baseline model, although real imports from Argentina and Turkey still react relatively strongly to risk premium shocks.

Among the reactions of a relatively smaller magnitude, broadly in line with my findings for the baseline model, the reaction of real output to the risk premium shock continues to be positive in a number of emerging Asian countries (being negative only at the end of the first quarter in Singapore). The response of real output to the risk premium shock for the Czech Republic is also positive on impact, while the corresponding ones for Brazil and Turkey are negative instead. In any case, these results for output responses appear to be smaller in magnitude than those reported for the baseline specification. With regard to the real exchange rate, the largest impact is registered for China (under monetary and risk premium shocks), Argentina (under preference and risk premium shocks), Brazil (under preference shocks) and Turkey (under risk premium shocks).

One final set of results concerns the degree of exchange rate pass-through to consumer prices. The degree of pass-through (in response to any of the four domestic shocks) can be computed as

$$\frac{\hat{P}_t}{\hat{S}_t} = \frac{\hat{P}_t}{\hat{Q}_t + \hat{P}_t}$$

where hats denote deviations from the no-shock path.

The pass-through results for the present model specification are reported in Table 4E. One caveat to these estimates refers to the fact that, while they can be interpreted economically in terms of each structural shock, both the magnitudes and – in the absence of identification assumptions - signs of the

implied impulse responses can produce some largely unexpected values. With this in mind, I constrain my analysis to a comparison with the recent recursive SVAR study by Ca' Zorzi *et al.* (2003). The latter reports pass-through estimates for an identification scheme in which the exchange rate appears as the most exogenous macroeconomic variable, being allowed to react to the rest of the system only with a (quarterly) lag. Under such identification strategy, the unexpected exchange rate component does not depend on the state of macroeconomic variables in the very short run, which could thus be interpreted as resulting from the exchange rate being driven by exogenous factors relating to “noise trading” or imperfect information considerations. In this regard, it makes sense to compare Ca' Zorzi *et al.*'s estimates with those reported in Table 4E under the column of the risk premium shock. One point in common between the two set of results is that, among the group of EMEs, Latin American countries (with the exception of Chile) and - to some extent - Turkey exhibit a relatively large degree of pass-through in the range of 50% to 100% at business cycle frequencies.

Summarising section 5 thus far, a number of results are robust across the two model specifications considered. Among them, identification of the four shocks is achieved in all countries, while signs of impulse responses tend not to deviate over time from those imposed on impact. Moreover, responses normally die out by the end of the second year. Quantitatively, impulse responses to unit shocks are often found to be rather muted. Other robust findings for impulse responses across model specifications include the following. First, consumer prices and – depending on the shock – real imports are the most affected endogenous variables. Second, consumer prices are mostly driven by technology and risk premium shocks. Third, at the country level, Latin America (owing to Brazil and Argentina) and Poland show above-average consumer price responses both in the baseline approach and in the model including the real exchange rate.

### **5.2.1.2 Variance decomposition results**

Variance decompositions for each EME country, obtained using the model that includes real exchange rates (in the place of real exports), are reported in Tables 5A through 5D. As with the baseline model, business cycle and international trade fluctuations appear to be mostly dominated by domestic shocks. Foreign shocks still account on average for no more than 10% of the variation in the endogenous variables (real output, consumer prices, real exchange rate and real imports).

As was found for the baseline model, each domestic disturbance explains a considerable fraction of the variability in the endogenous variables under study. With regard to larger-than-fair contributions, I find the following under the model that includes the real exchange rate.

For real output, the technology disturbance exceeds by some margin the contributions of the other shocks, as a result of results for Latin America (owing to Brazil, Chile and Mexico) and, less so, emerging Asia (due to Thailand and especially Korea). Instead, NMS's real output display an above-average contribution from monetary shocks (driven by Poland), whereas this place is occupied by preference shocks in the case of Turkey.

With regard to consumer prices, the most noticeable relatively larger contribution is that of technology shocks in NMS (due to Czech Republic and Hungary) and Turkey. In the latter country an above-average fraction of consumer price variability can also be attributed to preference disturbances.

In the case of real imports, it is not possible to detect shocks that have a widespread role across regional groupings. Above-average single contributions can be detected for risk premium shocks in Latin America, monetary shocks in NMS and technology shocks in Turkey.

Concerning the real exchange rate – the new variable – monetary shocks exhibit the biggest single contribution in the cases of emerging Asia (due to Hong Kong, Malaysia and Taiwan) and Latin America (owing to Argentina and Brazil). Instead, in Turkey technology disturbances play a larger-than-fair role in driving the real exchange rate.

By way of summary, the most robust finding across model specifications is that EMEs are dominated by domestic shocks. Concerning the specific role of each of the latter disturbances, the variance decomposition results found for the model including the real exchange rate do not seem to be much in line with those of the baseline model. Two relatively robust results across model specifications are the following. First, technology shocks play a role in explaining consumer price developments. This notwithstanding, the only regional grouping for which this is true under both model specifications are NMS, as emerging Asia only features in the baseline case while Turkey only falls in this category under the alternative model considered in this subsection. Second, real imports fail to display a cross-regional pattern, with a different shock playing the most important role in each regional grouping. It must be borne in mind that the associations between regions and shocks driving real imports are however found to be model-specific.

## 5.2.2 Model including both the real exchange rate and nominal interest rate

The model including both the real exchange rate and nominal interest rate is best applied to economies in which interest rates play an important role in the monetary policy regime. Among the countries in our sample, Chile arguably constitutes the most relevant case study. In particular, Chile took steps in the direction of inflation targeting already in 1991. It is worth noting that the country is normally considered to have become “full-fledged” inflation targeting regime only in 1999, when the country let the exchange rate float (see *e.g.* Aguirre and Schmidt-Hebbel, 2006, and Schmidt-Hebbel and Tapia, 2002).

In connection with the above, I estimate VARs for two (monthly) samples, namely, a “full sample” since 1979:1 and a “short sample” starting in 1991:1. Results are generally robust between the latter sample period and the roughly comparable one used in the previous two model specifications (see under 5.1 and 5.2.1). The idea here is to focus on a comparison of Chilean macroeconomic responses to shocks between the “full sample” and the post-inflation-targeting “short sample” periods just defined. In doing this, I concentrate on the reaction of this economy to financial disturbances as captured in the risk premium shock.

Figures 3A and 3B report the set of impulse responses (including confidence intervals) for the “full sample” and the “short sample” periods, respectively. The reduced form features of the present model are the same as those reported for the previous two specifications used in this paper. Regarding the structural form, the angle grid used here is 5, while sign restrictions are imposed over the monthly periods (1,3) – that is, over every month in the first quarter. For the full sample period, 2,100 draws on VAR parameters were used to obtain 3,537 identification matrices; for the short sample period, 4,000 draws on VAR parameters were needed to derive 1,201 identification matrices.

The estimates reported in Figures 3A and 3B must be interpreted carefully, given the degree of uncertainty surrounding them. Concentrating on a comparison of responses to the risk premium disturbance, it is possible to interpret these Figures by saying that the Chilean macroeconomy has become more resilient to the shock in the post-inflation-targeting period. Indeed, the decline in real output is no longer visible, whereas the inflationary impact and the real exchange rate depreciation are no longer significant. It is worth noting that, in terms of the interest rate reaction accompanying these outcomes, it appears that a stronger (but still temporary) hike is needed in comparison with the full sample results.

## 6 Concluding remarks

The present paper investigates what are the sources of business cycles and international trade in emerging market economies. The analysis shows that business cycles and international trade tend to adopt different features in different countries, at different horizons, and in response to different shocks. At the same time, some patterns can be identified. In summarising these results, the focus is on those that are found to be robust across the two main model specifications considered, namely, one including real exports and another one using real exchange rates instead. Both models also include real output, consumer prices and real imports.

First of all, full identification (*i.e.* identification of all four shocks considered) is achieved in all countries, while signs of impulse responses tend not to deviate over time from those imposed on impact. Moreover, responses normally die out by the end of the second year. Quantitatively, impulse responses to unit shocks are often found to be rather muted. Other robust findings for impulse responses include the following. First, consumer prices and – depending on the shock – real imports are the most affected endogenous variables. Second, consumer prices are mostly driven by technology and risk premium shocks. Third, at the country level, Latin America (owing to Brazil and Argentina) and Poland show above-average consumer price responses both in the baseline approach and in the model including the real exchange rate.

Other impulse response results are worth discussing. In the model with real exports, the largest effects tend to stem from monetary shocks, although the impact is still rather limited. Unpredictable monetary policy is found to generate modest changes in consumer prices and real output (as well as on real exports), as well as a larger effect on real imports which carries over to the trade balance. In the model including the real exchange rate, monetary shocks no longer count among those eliciting real imports' largest responses. However, in light of the still muted reaction of consumer prices and real output to monetary disturbances, the above-average values for the responses of real exchange rates to these shocks may still point to undesirable side effects of unanticipated monetary policy. Finally, a model including both the real exchange rate and nominal interest rate is applied to Chile, in light of the country's reasonably long history of a relatively unchanged monetary regime (namely, inflation targeting). Focusing on responses to the risk premium shock, it is found that Chilean macroeconomic developments have become more resilient to the disturbance in the post-inflation-targeting period. Indeed, the decline in real output is no longer detectable, while the increase in consumer prices and the

weakening of the currency are no longer significant. Accompanying these outcomes, a stronger (but still short-lived) interest rate hike appears to be needed in comparison with the results obtained over a longer sample period going back to the late 1970s.

Turning to variance decomposition analysis, the most robust result is that emerging markets countries appear to be relatively little affected by foreign shocks, with the latter capturing developments in advanced economies as well as global commodity prices. These external disturbances on average explain no more than 10% of the variation in real output, consumer prices, real exchange rates, real exports and real imports among emerging market economies. The latter result is on the low side of the spectrum of estimates. It is worth stressing that this finding does not by itself imply that external forces have a small influence on emerging economies. As long as an important component of world economic developments is predictable, the estimates from this paper are still consistent with the conventional wisdom that small open economies are quite responsive to global factors. Taking this into consideration, the results reported here are broadly consistent with other studies pointing to a modest contribution of external determinants in emerging economies' fluctuations (see *e.g.* Hoffmaister and Roldós, 1997, and Kose *et al.*, 2003). This finding may, however, be regarded as standing in contrast to many studies in the literature that conclude that foreign variables play a dominant role in explaining domestic macroeconomic developments in small open economies.

Looking at the specific role of each of domestic disturbance indicates, variance decomposition results found for the model including the real exchange rate do not seem to be much in line with those of the baseline model. Two relatively robust results across model specifications are the following. First, real imports fail to display a cross-regional pattern, with a different shock playing the key role in each regional grouping. It must be borne in mind that the associations between regions and shocks driving real imports are however found to be model-specific. Second, technology shocks play a larger-than-fair role in explaining consumer price developments. This notwithstanding, the only regional grouping for which this is true under both model specifications are NMS, as emerging Asia is in a comparable situation only for the baseline model while Turkey only falls in this category under the alternative model including the real exchange rate.

## Appendix A. Identification algorithm and statistical inference

One common way to identify model (18) is by choosing  $C$  to be lower triangular. The resulting decomposition is unique and is called Choleski decomposition. This imposes  $n(n-1)/2$  zero restrictions on  $C$ , such that  $y_j$  has no contemporaneous impact on  $y_i$  as long as  $j > i$ . Other popular decompositions employ other types of short-run restrictions on  $C$ , or a set of long run restrictions on the system, or a combination of both. Existing dynamic macroeconomic theory provides a wealth of restrictions that can be used to identify shocks. Rarely, however, do these restrictions take the form of zero constraints either on the impact or the long run multipliers. Theoretical models (including the DSGE model outlined in section 2) involve conditional restrictions on the sign of the responses of certain variables to shocks. This motivates the identification algorithm used in this paper, which combines Uhlig's (2005) Bayesian approach for estimation and inference (for a related application, see Peersman, 2005) with Canova and De Nicolò's (2002) use of discrete grid search over decompositions. I describe my approach in the rest of this Appendix.

I explore the space of all possible decompositions  $C$  of  $\Sigma$  in (2). Let  $C_{start}$  be a particular decomposition of  $\Sigma$ , then any other possible decomposition  $C$  verifies:

$$CC' = \Sigma = C_{start} (C_{start})'$$

Let  $J$  be an orthogonal matrix such that  $C = C_{start} J$ . This turns the exploration of all possible decompositions into an exploration of the space of orthogonal matrices (see Press, 1997). Let  $P$  be a matrix of eigenvectors of  $\Sigma$  and  $D$  a diagonal matrix of eigenvalues. One can then write  $PDP' = \Sigma$ . Given that  $\Sigma$  is real symmetric positive definite, there exist a unique  $P$  and a unique matrix  $D$  with positive entries along the principal diagonal.  $D$  defines a unique diagonalisation of  $\Sigma$  into an orthonormal base of eigenvectors. Thus,  $PD^{1/2} D^{1/2} P' = PD^{1/2} (D^{1/2})' P' = PD^{1/2} (PD^{1/2})' = \Sigma$  obtains, where decomposition  $C_{eigen} = PD^{1/2}$  yields uncorrelated shocks without imposing any zero restrictions. I take this decomposition as our starting decomposition, that is,  $C_{start} = C_{eigen}$ .

The algorithm used here explores all matrices of the form  $C_{eigen} J$ , where  $J = \prod_{a,b} J_{ab}(\theta)$ , with  $J_{ab}(\theta)$  being the six bivariate rotation matrices obtained by rotating the pair of rows and columns  $(a,b)$ , and  $\theta = \theta_1, \dots, \theta_6$  being a set of angles that adopt values over the range  $(0, \pi]$ . Given that - following Canova and De Nicolò (2002) - I will conduct a grid search over this range, one important aspect is the coarseness of the angle grid used as the latter may affect the number of identification matrices obtained.

More specifically, the procedure used here requires the prior estimation of a reduced-form VAR model (for details of the concrete specifications used, see Tables A1 and A3). The structural analysis starts by

producing decompositions by i) drawing from the Normal-Wishart posterior for the reduced-form VAR parameters (see Sims and Zha, 1999),<sup>10</sup> and ii) conducting a grid search over the rotation matrices

Table A1. Reduced form specifications for baseline model

Countries	Lags of endogenous variables	Asian crisis dummies	
<i>Asia</i>			
China	4	1997:7	1997:11
Hong Kong	7	1998:6	1998:11
Korea	8	1997:8	1998:2
Malaysia	8	1997:7	1997:12
Singapore	9	1997:11	1997:12
Taiwan	8	1998:8	1998:10
Thailand	12	1997:11	1998:8
<i>Latin America</i>			
Argentina	6		
Brazil	7		
Chile	8		
Mexico	8		
<i>NMS and Turkey</i>			
Czech Republic	4		
Hungary	8		
Poland	11		
Turkey	7		

Table A2. Structural form specifications for baseline model

Countries	Angle grid	Monte Carlo draws	Sign restrictions on quarters	Number of identifying rotations
<i>Asia</i>				
China	5	1000	1 through 5	1533
Hong Kong	5	2000	3	1710
Korea	8	1000	2 through 4	1090
Malaysia	4	2000	2 through 3	1970
Singapore	8	1500	2 through 3	2552
Taiwan	5	8000	2 through 3	1206
Thailand	5	1000	2 through 4	1015
<i>Latin America</i>				
Argentina	4	1000	2 through 3	1980
Brazil	4	5000	1 through 3	1446
Chile	5	350	3	1027
Mexico	3	700	3	2793
<i>NMS and Turkey</i>				
Czech Republic	5	500	2 through 3	1301
Hungary	5	1000	2 through 4	2200
Poland	6	1200	2 through 3	1255
Turkey	3	1000	1 through 4	1509

<sup>10</sup> In the case of China, it was necessary to adjust the variance-covariance matrix due to the use of data in annual growth terms.

<sup>14</sup> Fry and Pagan (2005) discuss an alternative approach in this regard.

$J_{ab}(\theta)$  described in the previous paragraph. The use of a grid search, as opposed to randomly drawing from a uniform distribution (see Peersman, 2005), is justified below in terms of enhancing the economic interpretation of the procedure.<sup>14</sup>

The second step in my procedure consists of choosing among all candidate decompositions that are computed. Among the latter, I only keep decompositions whose associated impulse response functions satisfy the sign restrictions on the cross products. In all cases, I have managed to fully identify the VAR system, that is, decompositions can be found with economically interpretable technology, monetary, preference and risk premium shocks. In this context, it is deemed useful to enhance the economic interpretability of the results. This is done by choosing the fineness of the angle search grid and the monthly periods over which the sign restrictions hold such that a given candidate rotation matrix is consistent with unique (full) identification.<sup>15</sup> Once this is achieved, the number of draws on the VAR parameters is increased until the total number of identification matrices satisfying the sign restrictions exceeds 1,000.<sup>16</sup> The concrete choices made can be found in Tables A2 and A4. Finally, based on the relevant decomposition matrices, I calculate statistics of interest. I report mean and - when

Table A3. Reduced form specifications for model with exchange rates

Countries	Lags of endogenous variables	Asian crisis dummies	
<i>Asia</i>			
China	4	1997:7	1997:11
Hong Kong	8	1997:11	1998:10
Korea	8	1997:8	1998:9
Malaysia	12	1997:10	1998:6
Singapore	10	1997:11	1998:4
Taiwan	8	1997:11	1998:10
Thailand	10	1997:9	1997:11
<i>Latin America</i>			
Argentina	6		
Brazil	7		
Chile	8		
Mexico	8		
<i>NMS and Turkey</i>			
Czech Republic	4		
Hungary	8		
Poland	11		
Turkey	7		

<sup>15</sup> The search grid was applied for a number of 3 to 10 angles. In choosing the months over which sign restrictions on accumulated impulse responses hold, I started with month number 3 only (that is, end of the first quarter). If too many rotations could be accepted, I then tried pairs of two months, starting with the pair (2,3) and then considering (3,4). The preference for three-month choices was (1-3), (2-4) and (3-5), in that order. Up to five-month periods were considered, in all cases excluding month number 6 as this would have implied making an assumption about the state of the economy at the end of the second quarter (which is not necessarily supported by the theoretical analysis of section 2).

<sup>16</sup> Attempts at producing statistics with a number of draws substantially larger than 1,000 yielded broadly similar results to the ones reported here.

different - median values for impulse responses and variance decompositions in Tables 2 through 4. Median impulse responses, as well as the 16<sup>th</sup> and 84<sup>th</sup> percentile error bands, are shown in Figures 2 and 3.

Table A4. Structural form specifications for model with exchange rates

Countries	Angle grid	Monte Carlo draws	Sign restrictions on quarters	Number of identifying rotations
<i>Asia</i>				
China	7	1100	2 through 4	1267
Hong Kong	3	1000	2 through 3	1011
Korea	3	1200	1 through 5	1114
Malaysia	3	2000	2 through 4	1796
Singapore	8	1000	2 through 3	1009
Taiwan	3	1000	3 through 4	2452
Thailand	4	1000	1 through 4	1606
<i>Latin America</i>				
Argentina	4	1000	1 through 3	1189
Brazil	3	2000	2 through 3	1248
Chile	3	2000	1 through 3	1987
Mexico	3	1000	1 through 3	1040
<i>NMS and Turkey</i>				
Czech Republic	4	1000	3	2581
Hungary	5	1000	2 through 4	1182
Poland	4	1000	3 through 4	1088
Turkey	3	1000	1 through 3	2004

## Appendix B. Data sources

Economic activity in emerging market countries is measured by using industrial production data, which is available for all of them and obtained from the International Monetary Fund's *International Financial Statistics* (henceforth IFS) except for China, Hong Kong and Taiwan (national statistics). CPI is from IFS except for China, Hong Kong and Taiwan (national statistics). Export and import data is from IFS, with the exception of Poland (national statistics). Concerning global variables, world economic activity is measured in terms of G7 countries' industrial production indicators (from IFS), weighted according to an average over the entire sample of their quarterly national accounts (from the OECD database) expressed in US dollars. The same weights are used to: a) construct a G7 CPI index from individual countries' respective indices (data from IFS); and b) build a measure of G7 interest rate levels from short-term interest rates (from IFS). Brent oil prices in US dollars are from IFS. Non-oil commodity prices in US dollars are from the Hamburg Institute of International Economics (HWWA), and are computed using OECD countries' weights.

## Appendix C. Samples used for different countries

Not all countries offer the same data availability over the period 1990:1–2005:5. More concretely, I work with a slightly shorter sample size for two countries, namely China and the Czech Republic (see Table C1).

Table C1. Sample periods for EME countries

Country	Sample period
China	1991:12-2005:5
Hong Kong	1990:1-2005:5
Korea	1999:1-2005:5
Malaysia	1990:1-2005:5
Singapore	1990:1-2005:5
Taiwan	1990:1-2005:5
Thailand	1990:1-2005:5
Argentina	1990:4-2005:5
Brazil	1990:4-2005:5
Chile	1990:1-2005:5
Mexico	1990:1-2005:5
Czech Republic	1991:1-2005:5
Hungary	1990:1-2005:5
Poland	1990:1-2005:5
Turkey	1990:1-2005:5

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Table 1. Parameter values or ranges

Parameter	Description	Value or range
$\beta$	subjective discount factor	0.99
$QB^*/Y$	steady-state foreign debt to output ratio	-0.2
$\gamma$	inverse labour supply elasticity	[0.167,2]
$\omega$	risk premium elasticity	[-0.013,-0.039]
$\delta$	capital depreciation rate	[0.065,0.020]
$I/Y$	steady-state investment to output ratio	[0.15,0.30]
$C/Y$	steady-state consumption to output ratio	[0.50,0.65]
$Y^d/H$	steady-state share of domestic demand in domestic intermediate production	[0.62,0.80]
$\phi$	weight of domestic intermediate production in final demand	[0.62,0.80]
$\nu$	elasticity of substitution between domestic and imported intermediate goods	[0.2,1.2]
$\zeta$	price elasticity of world demand for the domestic intermediate good	[0.2,1.2]
$\alpha$	capital share	[0.2,0.4]
$\gamma_R$	interest rate smoothing, Taylor rule	[0.1,0.9]
$\gamma_\pi$	response on inflation, Taylor rule	[1.3,2.5]
$\gamma_Y$	response on output, Taylor rule	[0.1,1.2]
$\psi_k$	investment adjustment cost coefficient	[4,20]
$\psi_w$	wage adjustment cost coefficient	[0.5,25.0]
$\psi_d$	price adjustment cost coefficient for domestic demand for domestic intermediate goods	[0.1,8.0]
$\psi_x$	price adjustment cost coefficient for foreign demand for domestic intermediate goods	[0.1,8.0]
$\psi_m$	price adjustment cost coefficient for imported intermediate goods	[0.1,8.0]
$\theta$	elasticity of substitution between types of domestic intermediate goods	[6,8]
$\eta$	elasticity of substitution between types of imported intermediate goods	[6,8]
$\theta_w$	elasticity of substitution between types of labour	[3,8]
$\rho_z$	autoregressive coefficient of the technology shock	[0.10,0.95]
$\rho_g$	autoregressive coefficient of the preference shock	[0.1,0.9]
$\rho_\kappa$	autoregressive coefficient of the risk premium shock	[0.1,0.9]
$\sigma$	inverse elasticity of intertemporal substitution	[0.5,2.0]

Table 2A  
Baseline model: Impulse responses of real output to unit shocks

		A) Responses to a technology shock														
		Asia				Latin America				EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
	EMEs <sup>1</sup>	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1 quarter		0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01
4 quarters		0.02	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.00
8 quarters		0.02	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.00
		[0.01]					[0.01]		[0.00]							
		B) Responses to a monetary shock														
		Asia				Latin America				EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
	EMEs <sup>1</sup>	-0.01	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	-0.02
1 quarter		-0.01	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	-0.02
4 quarters		-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01
8 quarters		-0.02	-0.01	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		[-0.01]			[0.00]		[0.00]									
		C) Responses to a preference shock														
		Asia				Latin America				EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
	EMEs <sup>1</sup>	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1 quarter		0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01
4 quarters		0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
8 quarters		0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
		[0.01]														
		D) Responses to a risk premium shock														
		Asia				Latin America				EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
	EMEs <sup>1</sup>	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02	0.00	0.00
1 quarter		0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02	0.00	0.00
4 quarters		0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02	0.00	0.00
8 quarters		0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02	0.00	0.00
					[0.03]											
					[0.02]											

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
1) Values for this grouping are arithmetic averages over all individual countries included.

Table 2B  
Baseline model: Impulse responses of consumer prices to unit shocks

		A) Responses to a technology shock																		
		Asia						Latin America						EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey				
	EMEs <sup>1</sup>	-0.01	0.00	0.00	0.00	0.00	0.00	-0.12	-0.10	-0.01	-0.02	-0.01	-0.01	-0.06	-0.03					
1 quarter		-0.02	0.00	0.00	0.00	0.00	0.00	[-0.14]	-0.10	-0.01	-0.02	-0.01	-0.01	-0.06	-0.03					
4 quarters		-0.03	0.00	0.00	0.00	0.00	0.00	[-0.20]	-0.19	-0.01	-0.02	-0.01	-0.01	-0.08	-0.03					
8 quarters		-0.05	0.00	0.00	0.00	0.00	0.00	[-0.24]	-0.31	-0.02	-0.03	-0.02	-0.02	-0.09	-0.04					
															[-0.08]					
		B) Responses to a monetary shock																		
		Asia						Latin America						EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey				
	EMEs <sup>1</sup>	-0.01	0.00	0.00	0.00	0.00	0.00	-0.07	-0.06	-0.01	-0.01	0.00	0.00	-0.02	-0.01					
1 quarter		-0.01	0.00	0.00	0.00	0.00	0.00	[-0.10]	-0.06	[0.00]	-0.01	0.00	0.00	-0.02	-0.01					
4 quarters		-0.02	-0.01	0.00	0.00	0.00	0.00	[-0.10]	-0.08	0.00	-0.01	0.00	0.00	-0.02	-0.03					
8 quarters		-0.01	-0.01	0.00	0.00	0.00	0.00	[-0.10]	-0.05	0.00	-0.01	0.00	0.00	-0.02	-0.03					
															[-0.04]					
		C) Responses to a preference shock																		
		Asia						Latin America						EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey				
	EMEs <sup>1</sup>	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.01	0.01	0.00	0.00	0.02	0.01					
1 quarter		0.01	0.00	0.00	0.00	0.00	0.00	[0.03]	[0.04]	0.01	0.01	0.00	0.00	0.02	0.01					
4 quarters		0.02	0.00	0.00	0.00	0.00	0.00	0.12	0.07	0.01	0.02	0.00	0.00	0.04	0.00					
8 quarters		0.02	0.00	0.00	0.00	0.00	0.00	[0.11]	[0.06]	0.01	0.03	0.00	0.00	0.03	0.00					
															[0.06]					
		D) Responses to a risk premium shock																		
		Asia						Latin America						EU NMS						
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey				
	EMEs <sup>1</sup>	0.02	0.01	0.00	0.00	0.00	0.00	0.08	0.08	0.01	0.02	0.00	0.00	0.05	0.00					
1 quarter		0.02	0.01	0.00	0.00	0.00	0.00	[0.04]	[0.09]	0.01	0.02	0.00	0.00	[0.03]	0.00					
4 quarters		0.03	0.01	0.00	0.00	0.00	0.00	0.17	0.18	0.02	0.05	0.00	0.00	0.05	0.00					
8 quarters		0.04	0.01	0.00	0.00	0.00	0.00	[0.12]	0.22	0.02	0.06	0.00	0.00	0.06	0.00					
															[0.27]					

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
<sup>1)</sup> Values for this grouping are arithmetic averages over all individual countries included.

Table 2C  
Baseline model: Impulse responses of exports to unit shocks

		A) Responses to a technology shock															
		Asia						Latin America				EU NMS					
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
	EMEs <sup>1</sup>	0.01															
1 quarter		0.03 [0.02]	0.01	0.01	0.00 [0.01]	0.02 [0.01]	0.02	0.01	0.01	0.01	0.01	0.01	0.04 [0.03]	0.01	0.01	0.01	
4 quarters		0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.01	
8 quarters		0.02 [0.01]	0.01 [0.02]	0.01 [0.00]	0.01	-0.01 [0.02]	0.02	0.01	0.01	0.01	0.00	0.00	0.01 [0.01]	0.01	0.02	0.01	
		B) Responses to a monetary shock															
	EMEs <sup>1</sup>	-0.02															
1 quarter		-0.04	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02	
4 quarters		-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	0.00	
8 quarters		-0.02 [-0.01]	-0.01	-0.01	-0.02	-0.02	-0.02	-0.07 [-0.06]	-0.01	-0.01	-0.02	-0.01	0.00	-0.01	0.00	0.00	
		C) Responses to a preference shock															
	EMEs <sup>1</sup>	-0.01															
1 quarter		-0.05	0.00	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.04	-0.02	0.00	-0.01	-0.01	-0.01	-0.03	
4 quarters		0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	0.01	-0.01	-0.01	-0.01	
8 quarters		0.01	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00	0.01	-0.01	-0.01	-0.01	
		D) Responses to a risk premium shock															
	EMEs <sup>1</sup>	0.01															
1 quarter		0.02	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	
4 quarters		0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	-0.01	-0.01	
8 quarters		0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	-0.01	-0.01	-0.01	

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
1) Values for this grouping are arithmetic averages over all individual countries included.

Table 2D  
Baseline model: Impulse responses of imports to unit shocks

	EMEs <sup>1</sup>	A) Responses to a technology shock																
		Asia							Latin America							EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	0.02	0.03	0.01	0.02	0.01	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.03	0.01	0.04			
4 quarters	0.02	0.05	0.02	0.00	0.01	0.02	0.03	[0.04]	0.03	0.04	0.02	0.00	0.01	0.02	[0.03]			
8 quarters	0.01	0.02	0.01	0.00	-0.01	0.01	0.02	[0.06]	0.02	0.02	0.00	0.00	0.00	0.01	0.01			
							[0.03]							[0.00]				

	EMEs <sup>1</sup>	B) Responses to a monetary shock																
		Asia							Latin America							EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	-0.03	-0.04	-0.02	-0.02	-0.03	-0.03	-0.02	-0.03	-0.03	-0.02	-0.02	-0.04	0.00	-0.02	-0.04			
4 quarters	-0.02	-0.03	-0.02	[-0.03]	-0.03	-0.02	-0.03	[-0.02]	-0.03	-0.02	-0.02	-0.02	0.00	0.00	[-0.05]			
8 quarters	-0.01	-0.01	-0.01	[-0.04]	-0.02	-0.01	-0.03	[-0.04]	-0.02	-0.02	-0.02	-0.01	0.00	0.00	-0.02			
		[0.00]					[-0.02]								[0.00]			

	EMEs <sup>1</sup>	C) Responses to a preference shock																
		Asia							Latin America							EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	0.01	0.03	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.02	0.00	0.01	0.02	0.01			
4 quarters	0.00	0.01	0.01	-0.01	-0.01	0.00	0.00	0.01	0.00	-0.02	0.00	0.00	0.01	0.00	0.00			
8 quarters	0.00	0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.02	0.00	0.00	0.01	0.01	-0.01			
		[0.02]				[0.00]								[0.01]				

	EMEs <sup>1</sup>	D) Responses to a risk premium shock																
		Asia							Latin America							EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	-0.02	-0.06	0.00	0.00	0.00	-0.01	-0.01	-0.04	-0.02	-0.01	-0.02	-0.01	-0.01	-0.02	-0.02			
4 quarters	-0.01	0.01	0.00	0.00	0.00	0.00	-0.01	-0.05	-0.01	-0.01	-0.02	-0.01	0.00	-0.03	-0.01			
8 quarters	0.00	0.01	0.00	0.00	0.00	0.00	0.00	[-0.04]	0.00	0.00	-0.02	-0.01	0.00	-0.01	0.00			
															[0.01]			

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
<sup>1)</sup> Values for this grouping are arithmetic averages over all individual countries included.

Table 3A  
Variance decomposition of real output at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	22.0	16.4	35.9	19.4	6.3	100.0
<i>Asia</i> <sup>2</sup>	15.4	11.2	43.6	22.1	7.7	100.0
China	25.8	23.2	20.6	21.7	8.7	100.0
	[21.4]	[18.1]	[15.6]	[16.6]	[8.3]	
Hong Kong	4.2	10.4	66.5	11.2	7.7	100.0
	[2.2]	[7.6]	[7.5]	[7.5]		
Korea	35.8	16.2	21.0	16.8	10.2	100.0
	[34.9]	[16.5]				
Malaysia	14.3	2.3	71.9	4.6	6.9	100.0
	[17.2]	[2.7]	[72.5]	[0.0]		
Singapore	19.2	5.4	32.3	33.1	10.0	100.0
	[14.1]	[1.3]	[27.5]	[27.4]	[8.3]	
Taiwan	1.0	2.1	47.4	46.1	3.4	100.0
Thailand	7.7	19.1	45.2	21.3	6.7	100.0
	[1.6]	[2.6]	[61.2]	[24.9]		
<i>Latin America</i> <sup>2</sup>	25.9	14.9	44.3	11.9	3.1	100.0
Argentina	10.3	16.7	53.6	18.5	0.9	100.0
	[2.4]	[15.1]	[47.6]	[17.3]		
Brazil	1.2	2.1	91.0	2.9	2.8	100.0
	[1.0]	[0.2]	[94.0]	[1.8]		
Chile	32.8	26.9	18.3	17.6	4.4	100.0
	[22.0]	[17.7]	[0.6]	[8.9]	[4.3]	
Mexico	59.2	13.9	14.2	8.5	4.3	100.0
	[69.0]	[11.8]	[4.0]	[5.6]	[4.2]	
<i>EU NMS</i> <sup>2</sup>	35.8	16.9	17.0	22.9	7.5	100.0
Czech Republic	53.4	16.6	13.2	7.9	8.9	100.0
	[62.8]	[11.6]	[3.7]	[0.6]	[8.8]	
Hungary	23.2	12.5	19.3	41.6	3.4	100.0
	[23.8]	[9.7]	[9.0]	[45.0]		
Poland	30.7	21.5	18.5	19.2	10.1	100.0
	[31.9]	[17.0]	[15.2]	[13.2]	[8.6]	
Turkey	10.6	57.2	6.1	19.9	6.2	100.0
	[7.0]	[64.3]	[6.2]	[15.4]	[6.0]	

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 3B

Variance decomposition of consumer prices at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	34.0	16.6	20.1	22.1	7.1	100.0
<i>Asia</i> <sup>2</sup>	37.4	17.5	15.7	21.7	7.7	100.0
China	24.7 [20.2]	24.1 [19.4]	21.3 [16.1]	22.0 [16.7]	7.9 [7.4]	100.0
Hong Kong	60.4 [67.9]	17.5 [15.8]	9.7 [7.4]	4.6 [1.5]	7.8 [7.7]	100.0
Korea	12.1 [10.5]	16.1 [17.3]	29.3	36.2	6.3	100.0
Malaysia	55.4 [58.8]	6.1 [4.2]	5.8 [1.8]	25.4 [26.0]	7.3 [6.6]	100.0
Singapore	29.2 [28.3]	9.2 [4.7]	28.9 [27.0]	22.5 [18.9]	10.2 [9.6]	100.0
Taiwan	37.5	38.1	7.7	13.2	3.5	100.0
Thailand	42.6 [42.8]	11.7 [1.6]	7.2 [3.0]	27.8 [38.8]	10.7 [10.4]	100.0
<i>Latin America</i> <sup>2</sup>	21.4	18.9	30.9	24.2	4.7	100.0
Argentina	25.0 [23.4]	15.0 [3.7]	28.0 [25.1]	30.1 [45.9]	1.9	100.0
Brazil	18.7 [17.0]	23.2 [25.2]	46.8 [47.7]	2.5 [0.0]	8.8	100.0
Chile	40.6 [36.7]	21.9 [5.9]	17.7 [6.1]	14.6 [2.9]	5.2 [5.0]	100.0
Mexico	1.2 [0.7]	15.5 [16.6]	30.9 [29.6]	49.6 [50.5]	2.8	100.0
<i>EU NMS</i> <sup>2</sup>	46.2	15.6	15.2	14.6	8.4	100.0
Czech Republic	49.8 [57.8]	16.3 [6.5]	13.8 [8.3]	13.6 [5.6]	6.5 [6.4]	100.0
Hungary	63.6 [63.3]	4.5 [0.9]	19.3 [17.7]	10.0 [9.6]	2.6 [2.5]	100.0
Poland	25.3 [3.8]	25.9 [6.2]	12.4 [2.8]	20.3 [7.4]	16.1 [16.3]	100.0
Turkey	24.2 [24.1]	4.5 [1.6]	23.3 [23.5]	39.0 [40.9]	9.0 [8.7]	100.0

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 3C  
Variance decomposition of exports at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	18.8	18.0	24.8	30.2	8.2	100.0
<i>Asia</i> <sup>2</sup>	12.1	16.1	29.3	36.2	6.3	100.0
China	23.8	23.4	22.1	23.2	7.5	100.0
	[19.7]	[18.8]	[17.0]	[18.1]	[6.8]	
Hong Kong	10.8	2.8	25.7	56.2	4.5	100.0
	[6.1]	[1.8]	[28.8]	[58.3]	[4.4]	
Korea	21.5	22.4	22.5	25.9	7.7	100.0
	[24.9]	[25.4]		[19.8]		
Malaysia	8.4	15.7	6.1	65.9	3.9	100.0
	[4.8]	[1.4]	[2.9]	[86.7]	[3.7]	
Singapore	11.4	12.8	44.8	22.7	8.3	100.0
	[5.1]	[7.7]	[49.1]	[7.1]	[7.4]	
Taiwan	2.1	14.9	39.4	38.9	4.7	100.0
Thailand	6.5	20.7	44.3	20.7	7.8	100.0
	[0.0]	[13.8]	[55.2]	[22.0]		
<i>Latin America</i> <sup>2</sup>	33.8	17.8	23.3	22.2	3.0	100.0
Argentina	13.5	17.4	27.6	39.2	2.2	99.9
	[9.8]	[1.5]	[28.0]	[58.6]		
Brazil	64.9	20.9	3.4	7.2	3.6	100.0
	[69.9]	[20.0]	[1.9]	[4.5]	[3.5]	
Chile	12.7	30.6	25.6	28.6	2.5	100.0
	[5.6]	[33.6]	[21.2]	[22.7]		
Mexico	43.9	2.4	36.5	13.7	3.5	100.0
	[49.7]	[0.6]	[45.5]	[2.2]	[3.6]	
<i>EU NMS</i> <sup>2</sup>	14.8	14.0	17.9	33.3	20.1	100.0
Czech Republic	10.6	14.1	11.7	38.4	25.2	100.0
	[4.7]	[13.4]	[3.7]	[44.3]	[25.7]	
Hungary	14.9	8.8	27.7	45.7	2.9	100.0
	[8.9]	[5.6]	[21.6]	[51.1]		
Poland	18.8	19.1	14.2	15.8	32.1	100.0
	[8.8]	[16.0]	[11.9]	[11.2]	[32.9]	
Turkey	18.9	43.4	20.2	11.2	6.3	100.0
	[15.1]	[45.8]	[19.7]	[6.8]		

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 3D  
Variance decomposition of imports at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	22.8	23.1	21.6	23.5	8.9	100.0
<i>Asia</i> <sup>2</sup>	21.5	22.4	22.5	25.9	7.7	100.0
China	23.8	22.7	22.7	23.5	7.3	100.0
	[20.0]	[18.7]	[18.3]	[19.7]	[6.7]	
Hong Kong	6.4	8.6	46.3	32.9	5.8	100.0
	[2.6]	[7.2]	[52.3]	[32.2]		
Korea	49.2	24.7	0.7	10.4	15.0	100.0
	[50.7]	[23.2]				
Malaysia	29.3	6.1	4.0	57.2	3.4	100.0
	[15.6]	[1.8]	[1.3]	[75.6]		
Singapore	18.2	12.4	35.4	24.2	9.8	100.0
	[12.3]	[4.8]	[32.9]	[15.8]	[8.7]	
Taiwan	14.9	62.3	9.1	9.2	4.5	100.0
Thailand	8.5	20.2	39.1	24.0	8.2	100.0
	[1.0]	[10.2]	[48.7]	[30.0]		
<i>Latin America</i> <sup>2</sup>	37.3	15.8	26.2	16.8	3.8	100.0
Argentina	9.3	12.4	40.8	35.8	1.7	100.0
	[9.9]	[0.6]	[46.3]	[43.5]		
Brazil	50.0	3.0	34.2	3.0	9.8	100.0
	[49.6]	[3.1]	[34.5]	[2.8]		
Chile	17.5	34.5	20.4	24.6	3.0	100.0
	[15.7]	[40.1]	[20.3]	[21.1]		
Mexico	72.5	13.4	9.5	3.9	0.7	100.0
	[80.0]	[13.2]	[1.7]	[3.5]		
<i>EU NMS</i> <sup>2</sup>	13.0	16.7	17.8	32.6	20.0	100.0
Czech Republic	7.0	15.6	14.8	39.0	23.6	100.0
	[1.2]	[16.6]	[12.4]	[44.5]	[23.7]	
Hungary	19.6	13.0	26.2	38.3	2.9	100.0
	[11.8]	[8.1]	[16.0]	[42.3]		
Poland	12.3	21.5	12.3	20.5	33.4	100.0
	[8.9]	[21.8]	[8.5]	[16.1]	[33.6]	
Turkey	3.5	76.7	9.1	6.4	4.3	100.0
	[2.0]	[80.2]	[8.8]	[2.5]		

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 4A  
Model with exchange rates: Impulse responses of real output to unit shocks

EMEs <sup>1</sup>		A) Responses to a technology shock													
		Asia						Latin America				EU NMS			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland
1 quarter	0.01	0.01	0.00	0.01	0.00	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.00
4 quarters	0.02	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00
8 quarters	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00
		[0.01]			[0.01]										
EMEs <sup>1</sup>		B) Responses to a monetary shock													
		Asia						Latin America				EU NMS			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland
1 quarter	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00
4 quarters	-0.01	-0.01	0.00	[-0.02]	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	[0.01]	0.00	0.00
8 quarters	-0.02	-0.01	-0.01	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EMEs <sup>1</sup>		C) Responses to a preference shock													
		Asia						Latin America				EU NMS			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland
1 quarter	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
4 quarters	0.02	0.00	0.01	0.01	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 quarters	0.02	0.00	0.01	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EMEs <sup>1</sup>		D) Responses to a risk premium shock													
		Asia						Latin America				EU NMS			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland
1 quarter	0.01	0.01	0.00	0.03	-0.01	0.00	0.01	0.00	-0.01	-0.01	0.00	0.01	0.00	0.00	-0.01
4 quarters	0.01	0.00	0.00	[0.02]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
8 quarters	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
<sup>1)</sup> Values for this grouping are arithmetic averages over all individual countries included.

Table 4B

Model with exchange rates: Impulse responses of consumer prices to unit shocks

		A) Responses to a technology shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
	EMEs <sup>1</sup>	0.00	0.00	0.00	0.00	0.00	0.00	-0.09	-0.12	-0.01	-0.02	-0.01	-0.01	-0.05	-0.03		
1 quarter		0.00	0.00	0.00	0.00	0.00	0.00	-0.08	-0.22	-0.02	-0.03	-0.01	-0.01	-0.03	-0.03		
4 quarters		0.01	0.00	0.00	0.00	0.00	0.00	-0.07	-0.31	-0.02	-0.03	-0.01	-0.01	-0.02	-0.04		
8 quarters		0.02	0.00	0.00	0.00	0.00	0.00	[-0.55]	[-0.04]								
		B) Responses to a monetary shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
		-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.09	-0.04	0.00	0.00	0.00	0.00	-0.02	-0.01	
1 quarter		[-0.02]	[-0.11]	[-0.03]										[-0.03]			
4 quarters		-0.02	-0.01	0.00	0.00	0.00	0.00	-0.14	-0.06	0.00	-0.01	0.00	0.00	-0.02	-0.02		
8 quarters		-0.02	-0.01	0.00	0.00	0.00	0.00	[-0.19]	-0.06	0.00	-0.01	0.00	0.00	-0.02	-0.04		
		C) Responses to a preference shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.01	0.02	0.00	0.00	0.03	0.00	
1 quarter								[0.01]						[0.04]			
4 quarters		0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.01	0.03	0.00	0.00	0.03	0.01		
8 quarters		0.02	0.00	0.00	0.00	0.00	0.00	[0.00]	[0.13]	0.01	0.03	0.00	0.00	0.02	0.00		
		D) Responses to a risk premium shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.04	0.00	0.02	0.00	0.00	0.01	0.01	
1 quarter								[0.07]						[0.00]			
4 quarters		0.01	0.00	0.00	0.00	0.00	0.00	0.21	0.08	0.01	0.05	0.00	0.00	0.01	0.02		
8 quarters		0.01	0.00	0.00	0.00	0.00	0.00	[0.19]	[0.07]	0.01	0.07	-0.01	0.00	0.01	0.04		
		E) Responses to a risk premium shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.15	0.01	0.07	0.01	0.00	0.01	0.04	
1 quarter								[0.30]	[0.11]		[0.06]						
4 quarters		0.03	0.00	0.00	0.00	0.00	0.00										
8 quarters		0.04	0.00	0.00	0.00	0.00	0.00										

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.

1) Values for this grouping are arithmetic averages over all individual countries included.

Table 4C  
Model with exchange rates: Impulse responses of real exchange rates to unit shocks

		A) Responses to a technology shock																
		Asia					Latin America					EU NMS						
	EMEs <sup>1</sup>	China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.01		
4 quarters	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	[0.03]	0.01	0.01	[0.00]	0.01	0.00	-0.01	0.01		
8 quarters	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[0.04]	0.00	0.02	0.01	0.00	0.00	0.01	0.00		
									[0.01]									
		B) Responses to a monetary shock																
		Asia					Latin America					EU NMS						
	EMEs <sup>1</sup>	China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	-0.01	-0.06	-0.01	0.00	-0.01	0.00	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.00	-0.02		
4 quarters	0.00	[-0.07]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[-0.02]	-0.01	[-0.01]	-0.01	-0.01		
8 quarters	0.00	-0.02	0.00	0.00	[-0.01]	0.00	0.00	0.00	0.00	[-0.01]	0.00	-0.01	0.00	[-0.01]	0.00	-0.01		
		[-0.01]					[-0.01]											
		C) Responses to a preference shock																
		Asia					Latin America					EU NMS						
	EMEs <sup>1</sup>	China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	-0.02	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	-0.02	-0.04	-0.03	-0.01	-0.02	-0.02	-0.01	-0.01	-0.03		
4 quarters	-0.01	[-0.02]	-0.01	0.00	-0.01	0.00	-0.01	0.00	[-0.05]	[-0.04]	-0.01	[-0.03]	0.00	-0.01	0.00	-0.01		
8 quarters	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	-0.01	0.01	-0.01		
							[-0.01]				[0.00]							
		D) Responses to a risk premium shock																
		Asia					Latin America					EU NMS						
	EMEs <sup>1</sup>	China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey		
1 quarter	0.02	0.06	0.00	0.03	0.01	0.00	0.00	0.01	0.03	0.02	0.00	0.01	0.02	0.00	0.01	0.03		
4 quarters	0.01	[0.05]	0.00	0.02	0.01	0.00	0.00	0.01	[0.02]	0.01	0.01	0.02	0.02	0.00	0.00	0.02		
8 quarters	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01		
								[0.00]										

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
<sup>1)</sup> Values for this grouping are arithmetic averages over all individual countries included.

Table 4D  
Model with exchange rates: Impulse responses of imports to unit shocks

		A) Responses to a technology shock															
		Asia				Latin America				EU NMS				Turkey			
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey	
	EMEs <sup>1</sup>	0.02	0.01	0.02	0.01	0.00	0.01	0.03	0.01	0.03	0.01	0.02	0.02	0.01	0.01		
1 quarter		0.02	0.01	0.02	0.01	0.00	0.02	0.03	0.01	0.03	0.01	0.02	0.02	0.01	0.01		
4 quarters		0.03	0.01	0.02	0.01	0.00	0.03	0.04	0.01	0.03	0.01	0.00	0.00	0.02	0.00		
8 quarters		0.02	0.01	0.01	0.01	0.00	0.03	0.01	0.01	0.01	-0.01	0.00	0.00	0.00	0.00		
		[0.01]			[0.00]		[0.00]			[0.02]				[0.02]	[0.01]		
		B) Responses to a monetary shock															
	EMEs <sup>1</sup>	-0.02	-0.01	-0.01	-0.02	-0.02	-0.03	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	-0.03		
1 quarter		-0.03	-0.01	-0.01	-0.02	-0.02	-0.03	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	-0.03		
4 quarters		[-0.04]	[0.00]	[-0.01]	[-0.02]	[-0.01]	[-0.03]	[0.00]	[0.00]	[-0.02]	[-0.01]	[-0.01]	[-0.01]	[-0.01]	[-0.01]		
8 quarters		-0.02	-0.01	-0.02	-0.02	-0.01	-0.03	-0.01	[0.00]	-0.01	0.00	0.00	0.00	0.00	0.00		
		[0.04]	[0.00]	[0.00]	[0.03]	[0.00]	[0.05]	[0.00]	[0.00]	[-0.02]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]		
		C) Responses to a preference shock															
	EMEs <sup>1</sup>	0.01	0.00	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.02		
1 quarter		0.01	0.00	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.02		
4 quarters		0.01	0.00	0.02	0.01	0.01	0.01	-0.02	0.02	0.00	0.01	0.00	0.01	0.00	0.00		
8 quarters		0.01	-0.01	0.01	0.00	0.00	-0.01	-0.02	0.01	-0.01	0.01	0.00	0.01	0.01	-0.01		
		[0.02]			[0.00]		[0.01]	[-0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]		
		D) Responses to a risk premium shock															
	EMEs <sup>1</sup>	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.05	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04		
1 quarter		-0.06	-0.01	-0.01	-0.01	-0.01	-0.01	-0.05	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04		
4 quarters		[-0.05]	0.00	-0.01	-0.01	0.00	-0.01	-0.06	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.02		
8 quarters		-0.01	0.00	0.00	-0.01	0.01	0.00	-0.04	-0.01	-0.01	-0.02	-0.02	-0.02	0.00	-0.01		
		[0.01]			[0.00]		[0.00]	[-0.07]	[-0.04]	[-0.01]	[-0.04]	[-0.04]	[-0.04]	[0.00]	[-0.01]		
					0.00	0.01	0.00	[-0.05]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]		

This Table reports estimated accumulated responses at the end of the corresponding period (in %). Medians are reported in between square brackets when different from the respective means.  
1) Values for this grouping are arithmetic averages over all individual countries included.

Table 4E  
Model with exchange rates: Degree of exchange-rate pass-through to consumer prices

	EMEs <sup>1</sup>	A) Under technology shocks														
		Asia						Latin America						EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
1 quarter	0.54	-0.34 [-1.53]	-0.75 [-8.39]	0.31 [-0.68]	0.42 [0.37]	0.17 [0.32]	0.69 [0.59]	0.27 [0.25]	1.00	0.98 [0.97]	0.43 [0.82]	0.50	1.21 [1.00]	0.97 [1.08]	0.77	
4 quarters	0.15	0.95 [0.86]	-8.44 [-8.39]	-0.85 [-2.57]	0.75 [0.67]	0.06 [0.03]	0.56 [0.57]	0.70 [0.69]	0.93	1.03	0.53	0.53	2.52 [1.70]	0.85 [0.83]	0.83	
8 quarters	0.88	0.84	1.26	2.04 [0.15]	-0.56 [-0.59]	0.33 [0.25]	0.36 [0.53]	-0.05 [-0.08]	0.94	1.00	0.58	0.69	1.82 [1.40]	1.73 [1.47]	0.95	
	EMEs <sup>1</sup>	B) Under monetary shocks														
		Asia						Latin America						EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
1 quarter	0.38	0.17	0.49	0.62 [0.64]	0.04 [0.02]	0.21 [0.17]	-0.06 [0.09]	0.14 [0.13]	0.83 [0.84]	0.80 [0.82]	0.26	0.25 [0.19]	0.63	-0.07 [0.03]	1.10 [0.78]	0.36
4 quarters	0.43	0.49	0.76	0.83 [0.81]	0.19 [0.14]	-3.11 [-1.23]	0.59 [0.93]	4.43 [4.12]	1.00 [0.99]	1.09 [1.10]	0.57	0.53 [0.41]	-2.29	-0.18 [-0.20]	0.80 [0.86]	0.71
8 quarters	0.69	0.61 [0.79]	0.94	0.70	1.68 [0.79]	-0.79 [-0.98]	-0.76 [-1.00]	2.54 [2.68]	1.01 [1.00]	1.08	1.20	0.69 [0.67]	-0.34 [-0.30]	0.69 [0.30]	0.98	0.85
	EMEs <sup>1</sup>	C) Under preference shocks														
		Asia						Latin America						EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
1 quarter	-0.36	-1.10 [-0.38]	-0.06	0.77 [0.49]	-0.11 [-0.12]	-0.29 [-0.27]	-0.45 [-0.48]	-0.03	-1.05 [-0.27]	2.05 [1.88]	-1.23	-4.28 [-2.11]	-0.24	-0.14 [-0.11]	0.84 [0.74]	-0.11
4 quarters	1.39	2.46 [3.80]	-0.12	1.25 [1.02]	-0.03	-0.45	-0.66 [-0.75]	-0.05 [-0.10]	1.64 [-0.38]	1.30 [1.23]	12.93 [12.18]	2.59 [2.21]	0.14	-0.01 [-0.03]	0.93 [0.99]	-1.10
8 quarters	0.60	2.47 [1.80]	-0.08	0.97 [1.09]	-0.56 [-0.62]	-0.17 [-0.13]	-0.76 [-0.83]	1.07 [1.08]	0.96 [0.64]	1.08 [1.04]	1.86 [1.85]	0.67 [1.57]	0.35	0.28 [0.26]	1.49 [22.79]	-0.65
	EMEs <sup>1</sup>	D) Under risk premium shocks														
		Asia						Latin America						EU NMS		
		China	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand	Argentina	Brazil	Chile	Mexico	Czech Rep.	Hungary	Poland	Turkey
1 quarter	0.64	0.18 [0.20]	-0.91	0.07 [0.05]	0.05 [0.06]	0.56 [0.38]	0.53 [0.51]	0.03	0.72 [0.73]	0.68 [0.64]	0.41	0.64 [0.65]	0.00	2.56 [1.12]	3.76 [0.28]	0.27
4 quarters	1.15	2.44 [-0.91]	0.37	0.08 [0.07]	0.05 [0.04]	0.17 [0.48]	-0.60 [-0.62]	0.47 [0.48]	0.91 [0.96]	0.89 [0.88]	0.48	0.76 [0.74]	-0.35	10.20 [-9.57]	0.81 [0.86]	0.53
8 quarters	1.00	5.09 [-0.02]	0.37	-0.04 [-0.09]	-0.16 [-0.18]	0.65 [0.64]	1.79 [1.55]	-0.14 [0.82]	0.96 [0.96]	0.99 [0.98]	0.54	0.87 [0.84]	-0.91	3.13 [2.91]	0.97 [1.13]	0.82

This Table reports estimates of exchange-rate pass-through at the end of the given period. Medians are reported in between square brackets when different from the respective means.

<sup>1)</sup> Values for this grouping are arithmetic averages over all individual countries included.

Table 5A  
Variance decomposition of real output at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	31.5	18.5	22.5	21.0	6.5	100.0
<i>Asia</i> <sup>2</sup>	24.1	22.4	20.8	24.4	8.3	100.0
China	25.2	24.9	21.2	21.1	7.6	100.0
	[20.8]	[18.1]	[13.5]	[14.3]	[6.9]	
Hong Kong	1.7	60.8	3.3	13.0	21.2	100.0
		[61.2]	[3.0]	[12.8]		
Korea	64.6	3.3	22.0	3.1	7.0	100.0
	[87.3]	[1.7]	[1.4]	[2.7]	[6.6]	
Malaysia	20.3	8.2	34.8	33.0	3.7	100.0
	[20.0]	[7.7]	[15.1]	[50.3]		
Singapore	12.0	16.6	27.3	33.2	10.9	100.0
	[6.8]	[6.9]	[12.6]	[25.1]	[9.4]	
Taiwan	12.0	16.8	18.2	48.1	4.9	100.0
	[3.9]	[17.1]	[10.4]	[53.8]		
Thailand	33.1	26.2	18.9	19.0	2.8	100.0
	[33.5]	[2.1]	[17.2]	[16.4]	[2.7]	
<i>Latin America</i> <sup>2</sup>	49.0	12.2	17.6	16.7	4.7	100.0
Argentina	0.4	14.7	40.8	42.6	1.5	100.0
		[0.1]	[43.3]	[43.5]		
Brazil	61.3	10.4	17.1	8.6	2.6	100.0
	[60.3]	[9.3]	[16.1]	[6.7]		
Chile	72.9	2.5	6.9	9.8	7.9	100.0
	[73.5]	[1.1]	[6.7]	[9.5]	[4.3]	
Mexico	61.3	21.0	5.6	5.6	6.7	100.2
	[61.5]	[22.3]	[3.6]	[5.0]	[6.8]	
<i>EU NMS</i> <sup>2</sup>	16.7	21.8	35.1	20.5	6.0	100.0
Czech Republic	33.0	18.6	17.7	18.6	12.1	100.0
	[39.1]	[16.0]	[12.1]	[14.0]	[11.8]	
Hungary	5.3	28.9	32.2	32.1	1.5	100.0
	[2.4]	[27.7]	[29.6]	[27.8]	[1.0]	
Poland	11.7	18.0	55.3	10.7	4.3	100.0
	[1.3]	[14.2]	[76.7]	[4.3]	[3.9]	
Turkey	58.4	6.2	15.9	16.5	2.9	99.9
	[57.9]	[5.7]	[5.7]	[7.7]	[3.0]	

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 5B  
Variance decomposition of consumer prices at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	30.9	23.5	17.0	20.5	8.1	100.0
<i>Asia</i> <sup>2</sup>	28.2	26.9	18.8	19.2	6.9	100.0
China	22.4	25.5	22.3	22.3	7.5	100.0
Hong Kong	[17.5]	[19.7]	[15.7]	[15.0]	[6.9]	100.0
Korea	1.2	78.5	3.0	8.8	8.5	100.0
Malaysia	61.0	4.2	19.8	8.1	6.9	100.0
Singapore	[80.4]	[3.2]	[3.4]	[3.0]	[6.7]	100.0
Taiwan	47.8	3.3	19.6	24.4	4.9	100.0
Thailand	[47.2]	[2.6]	[24.5]	[17.3]	[4.8]	100.0
	23.7	29.5	15.0	20.1	11.7	100.0
	[16.8]	[22.0]	[9.6]	[12.3]	[10.2]	100.0
	24.1	22.8	25.7	24.1	3.3	100.0
	[21.6]	[21.1]	[25.2]	[20.5]	[2.9]	100.0
	17.3	24.5	26.3	26.3	5.6	100.0
	[17.1]	[1.8]	[25.8]	[25.1]	[4.7]	100.0
<i>Latin America</i> <sup>2</sup>	27.8	24.9	19.3	24.3	3.7	100.0
Argentina	0.9	15.6	40.2	41.9	1.4	100.0
Brazil	[0.7]	[1.2]	[47.6]	[47.3]	6.3	99.9
Chile	58.2	0.4	9.3	25.7	2.7	100.0
Mexico	[75.1]	[0.1]	[10.0]	[2.6]	2.0	100.0
	36.2	48.1	11.0	2.0	2.7	100.0
		[48.2]				100.0
	15.7	35.6	16.6	27.6	4.5	100.0
	[15.6]	[37.9]	[14.3]	[28.1]		100.0
<i>EU NMS</i> <sup>2</sup>	40.0	6.2	12.3	24.0	17.5	100.0
Czech Republic	56.4	4.4	13.8	19.4	6.0	100.0
Hungary	[71.8]	[1.7]	[5.7]	[7.9]	[5.0]	100.0
Poland	60.2	9.2	11.2	14.0	5.4	100.0
Turkey	[64.8]	[3.2]	[4.7]	[4.5]	[4.8]	100.0
	3.5	4.9	11.9	38.5	41.2	100.0
	[1.7]	[2.8]	[3.8]	[46.6]	[42.3]	100.0
	35.5	46.6	9.0	3.8	5.1	100.0
	[35.3]	[46.4]	[8.3]	[2.8]		100.0

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

Table 5C

Variance decomposition of real exchange rates at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	16.6	21.6	30.8	20.8	9.6	99.4
<i>Asia</i> <sup>2</sup>	21.5	18.4	33.1	17.1	8.6	98.7
China	29.8	22.9	19.8	19.0	8.5	100.0
	[26.5]	[14.5]	[11.7]	[10.4]	[8.0]	
Hong Kong	7.6	13.8	57.7	8.6	12.3	100.0
Korea	56.6	3.3	20.6	3.7	6.8	91.0
	[89.2]	[1.7]	[1.4]	[1.8]	[6.5]	
Malaysia	7.0	11.1	47.2	31.0	3.7	100.0
	[5.8]	[9.0]	[34.3]	[46.0]		
Singapore	21.7	26.5	25.2	15.1	11.5	100.0
	[15.9]	[20.4]	[20.6]	[7.8]	[10.2]	
Taiwan	8.5	38.1	35.1	12.5	5.8	100.0
	[3.1]	[33.3]	[31.6]	[5.5]	[4.1]	
Thailand	19.3	13.2	26.4	29.5	11.6	100.0
	[18.7]	[12.0]	[27.8]	[33.8]	[11.1]	
<i>Latin America</i> <sup>2</sup>	10.5	25.1	36.2	22.0	6.2	100.0
Argentina	0.4	14.8	40.8	42.5	1.5	100.0
	[0.3]	[0.1]	[43.0]	[42.9]		
Brazil	1.1	9.3	60.4	19.1	10.1	100.0
	[0.5]	[9.1]	[63.6]	[14.9]		
Chile	30.9	44.1	14.8	2.0	8.2	100.0
			[14.1]	[1.6]		
Mexico	9.6	32.1	28.7	24.4	5.2	100.0
	[9.4]	[34.3]	[27.3]	[24.5]		
<i>EU NMS</i> <sup>2</sup>	17.3	19.1	22.5	23.6	17.5	100.0
Czech Republic	26.1	20.5	21.2	23.3	8.9	100.0
	[25.7]	[17.3]	[17.1]	[16.1]	[7.1]	
Hungary	4.3	25.6	28.7	33.9	7.5	100.0
	[1.3]	[18.9]	[21.3]	[27.5]	[7.6]	
Poland	21.4	11.3	17.6	13.6	36.1	100.0
		[3.6]	[15.8]	[9.1]	[39.2]	
Turkey	4.9	38.0	17.5	33.2	6.4	100.0
	[4.4]	[38.1]	[15.1]	[31.3]		

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.

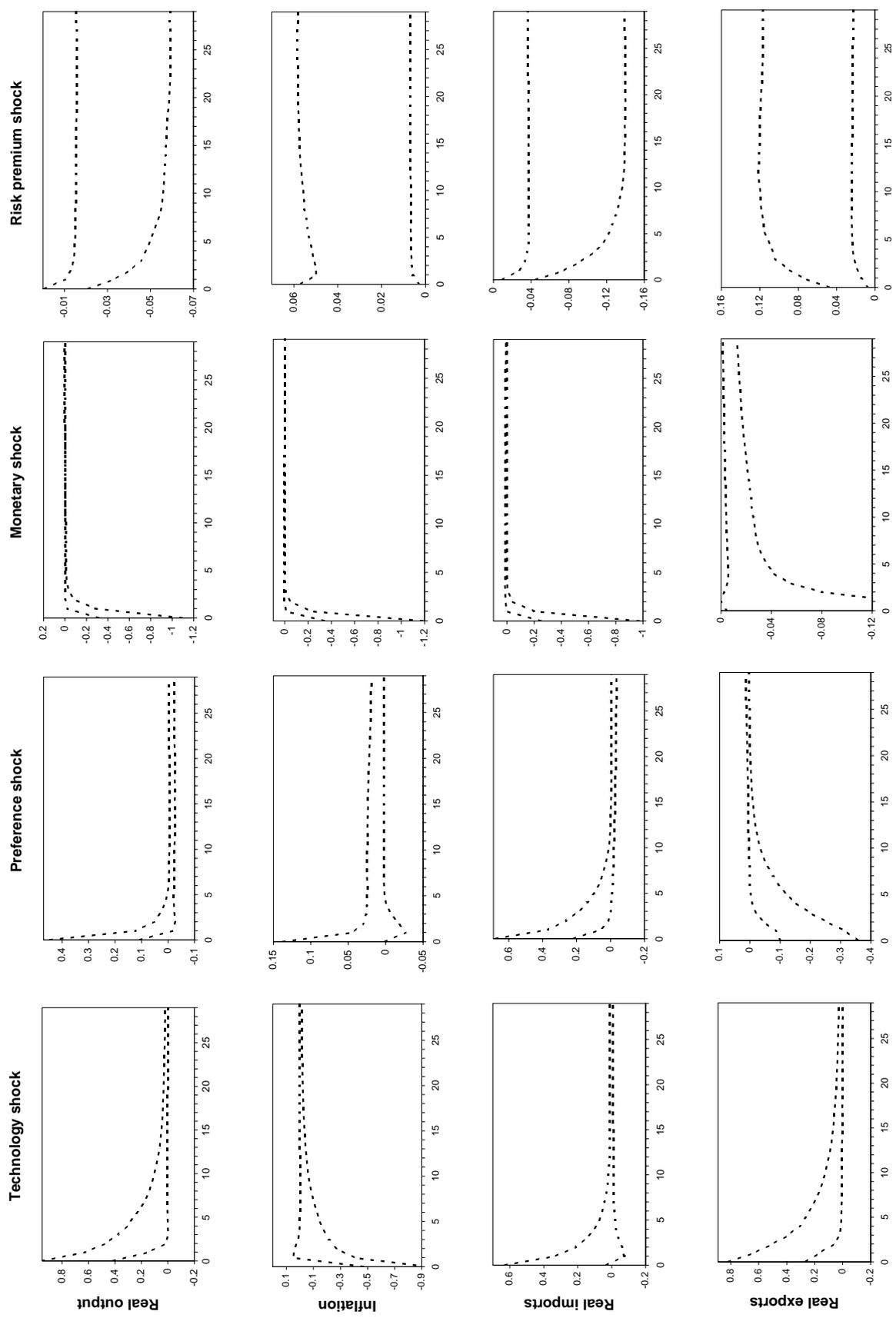
Table 5D  
Variance decomposition of imports at the three-year horizon

	Technology	Preference	Monetary	Risk premium	Foreign	Total
<b>Emerging markets</b> <sup>1,3</sup>	20.1	17.5	24.7	28.9	8.7	100.0
<i>Asia</i> <sup>2</sup>	24.0	24.9	21.4	20.4	9.3	100.0
China	27.7	22.7	21.6	20.0	8.0	100.0
	[23.2]	[15.1]	[14.4]	[12.0]	[7.6]	
Hong Kong	2.2	62.4	1.0	13.0	21.4	100.0
	[2.1]		[0.8]	[12.9]		
Korea	58.4	4.2	26.3	5.3	5.8	100.0
	[80.4]	[3.2]	[13.5]	[4.6]	[5.3]	
Malaysia	11.3	4.3	29.3	49.3	5.8	100.0
		[1.3]	[41.8]	[37.3]		
Singapore	33.7	20.1	17.6	21.5	7.1	100.0
	[20.0]	[7.9]	[5.5]	[14.4]	[5.8]	
Taiwan	6.8	39.4	35.2	14.5	4.1	100.0
	[6.2]	[16.2]	[5.7]	[3.0]	[3.7]	
Thailand	27.9	21.1	18.8	19.3	12.9	100.0
	[30.3]	[6.6]	[10.9]	[13.3]		
<i>Latin America</i> <sup>2</sup>	9.9	10.2	27.1	48.4	4.4	100.0
Argentina	0.6	14.8	40.6	42.5	1.5	100.0
	[0.5]	[0.1]	[43.4]	[43.5]	[1.5]	
Brazil	26.7	24.2	23.9	21.1	4.1	100.0
	[20.5]	[24.8]	[21.9]	[22.0]	[4.0]	
Chile	1.3	1.1	16.8	74.3	6.5	100.0
	[0.8]	[0.8]	[16.9]	[74.5]	[6.3]	
Mexico	11.0	0.6	27.2	55.5	5.7	100.0
	[10.4]		[28.9]	[54.5]		
<i>EU NMS</i> <sup>2</sup>	19.4	11.9	29.4	24.8	14.5	100.0
Czech Republic	20.4	8.7	28.6	26.6	15.7	100.0
	[8.7]	[6.6]	[19.7]	[17.1]	[15.9]	
Hungary	10.3	20.6	27.5	35.8	5.8	100.0
	[7.0]	[8.4]	[18.0]	[29.8]		
Poland	27.5	6.4	32.1	12.0	22.0	100.0
	[25.6]	[2.3]	[34.2]	[7.7]	[23.0]	
Turkey	35.8	12.6	24.6	22.7	4.3	100.0
	[35.3]	[12.7]	[19.9]	[15.6]		

The values reported in this Table are averages over all plausible identifications by type of shock and are in percentage terms. Median values are reported in brackets (only for individual countries) when different from the respective means.

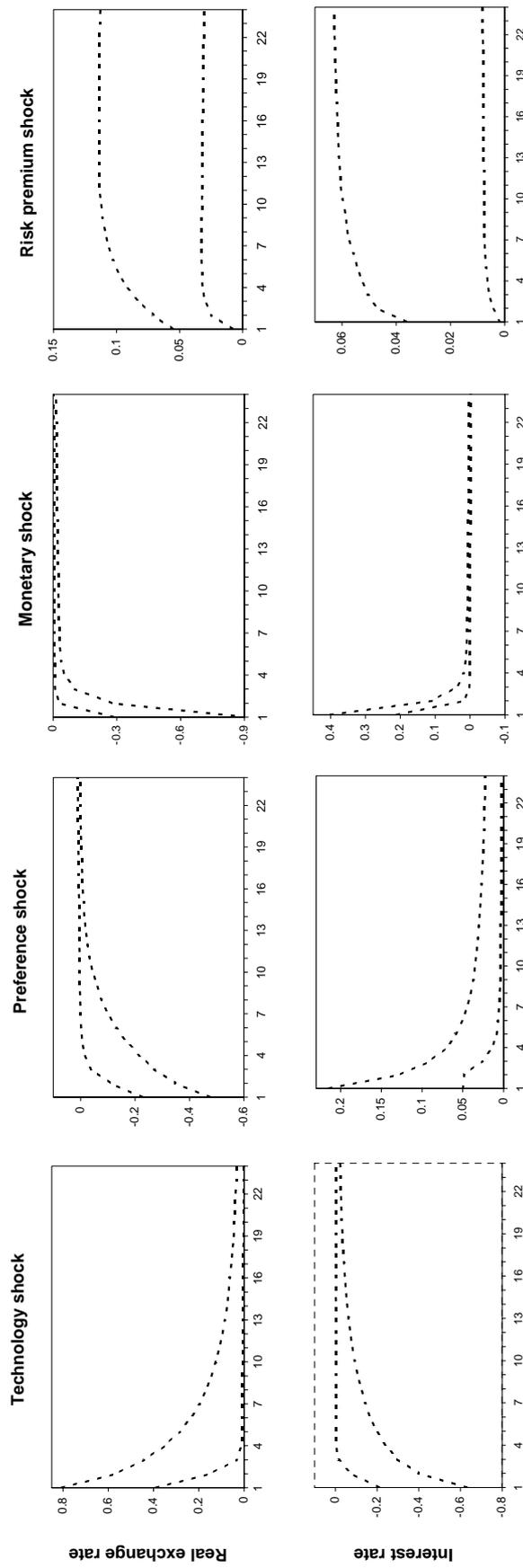
<sup>1)</sup> The values for this grouping are the unweighted average of countries in Asia, Latin America and EU NMS, to which Turkey is added.

<sup>2)</sup> The values for these regions are computed as the simple average of the countries listed under each of them.



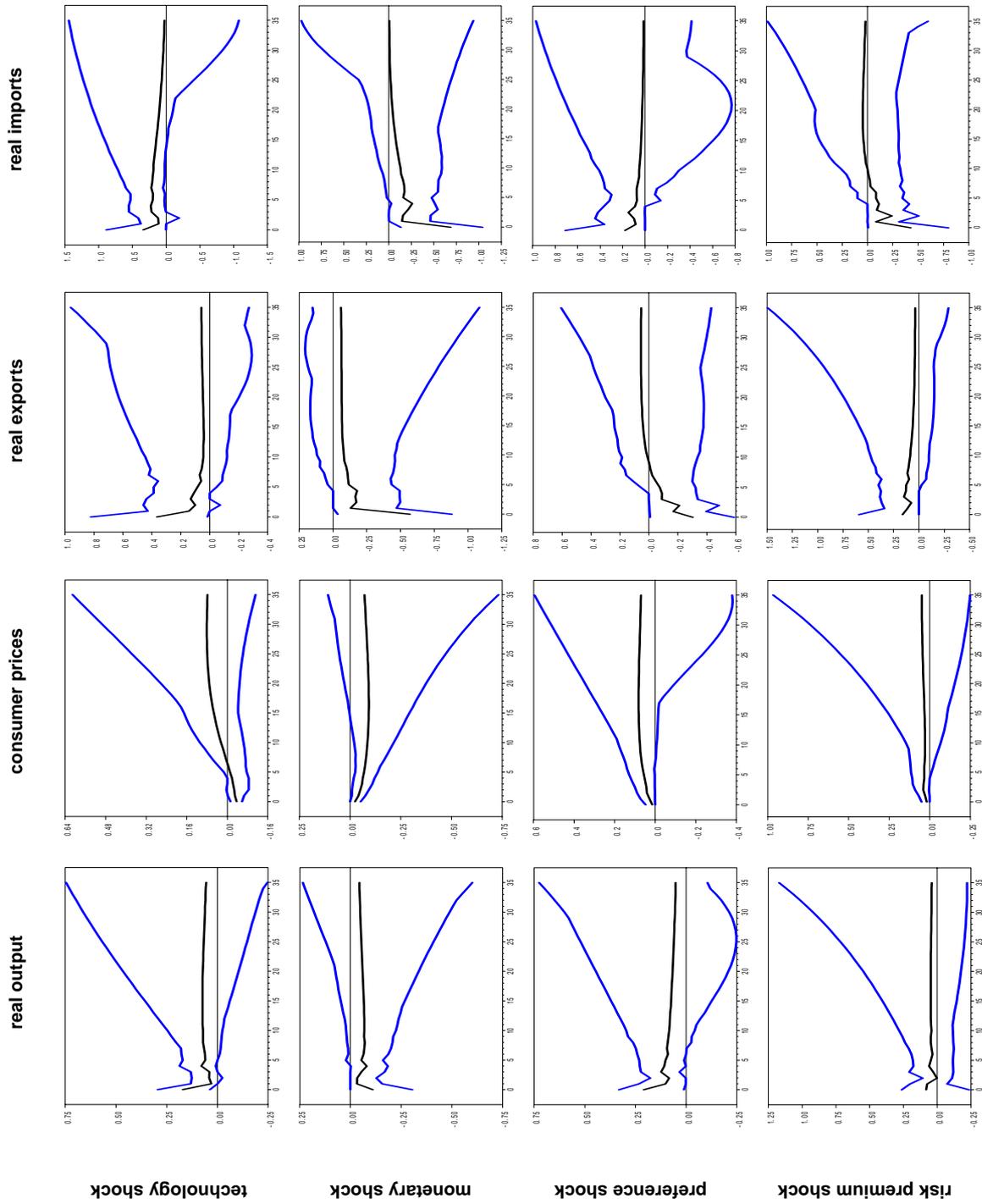
**Figure 1A. Responses to unit shocks**

Note: This Figure shows impulse response of a given variable to unit shocks.



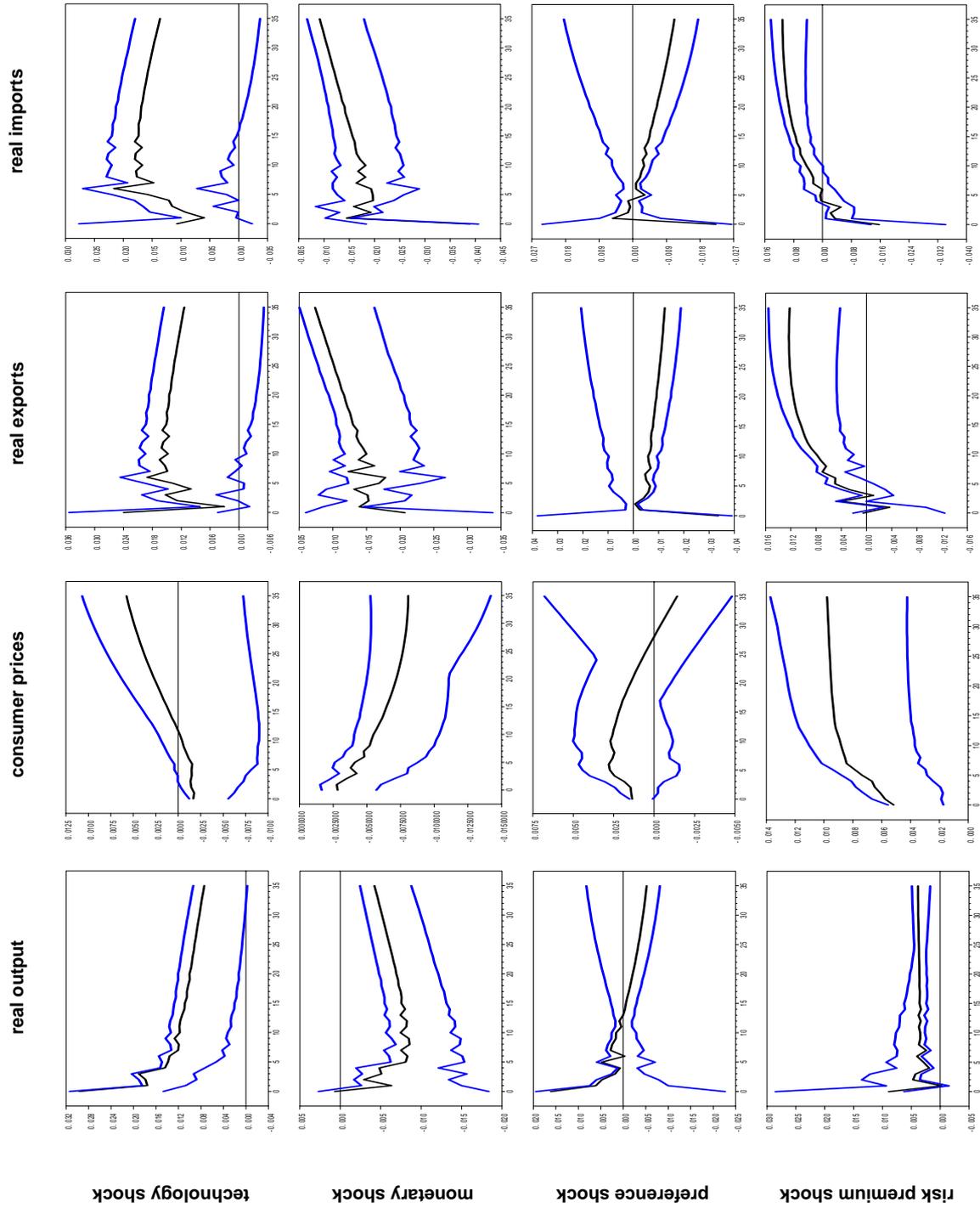
**Figure 1B. Responses to unit shocks: Additional variables**

*Note:* This Figure shows impulse response of a given variable to unit shocks.



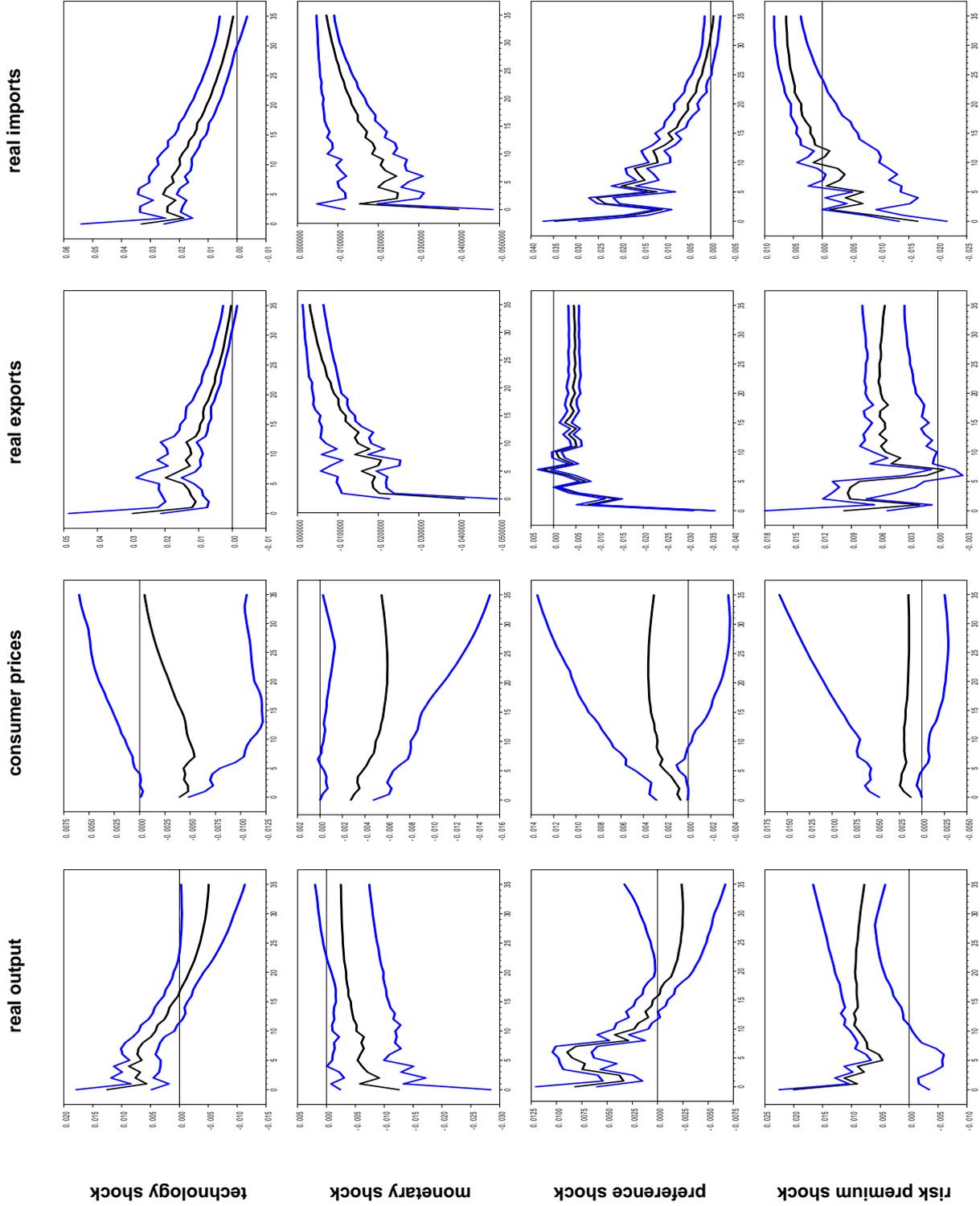
**Figure 2A. China: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



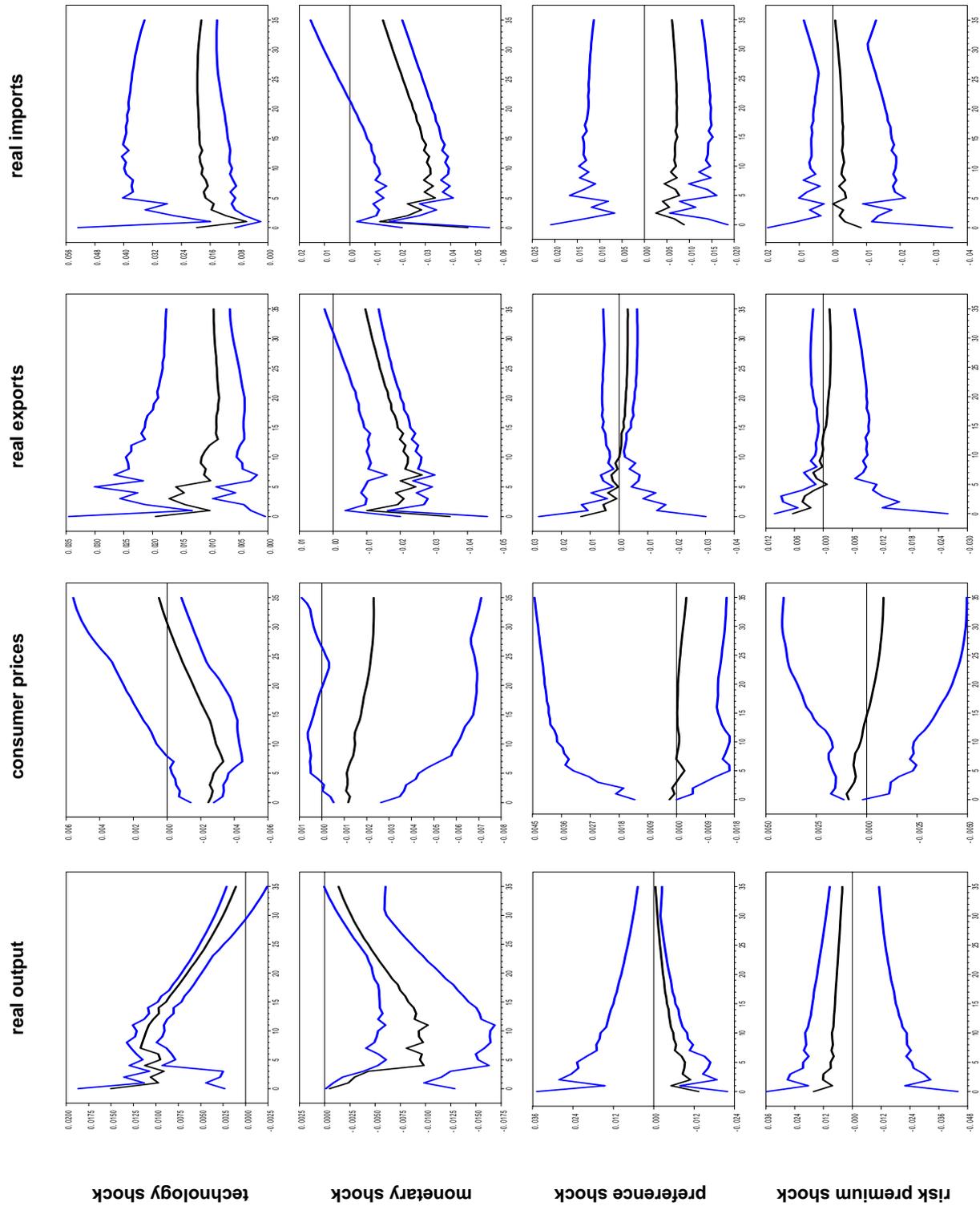
**Figure 2B. Hong Kong: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 2C. Korea: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 2D. Malaysia: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.

real imports

real exports

consumer prices

real output

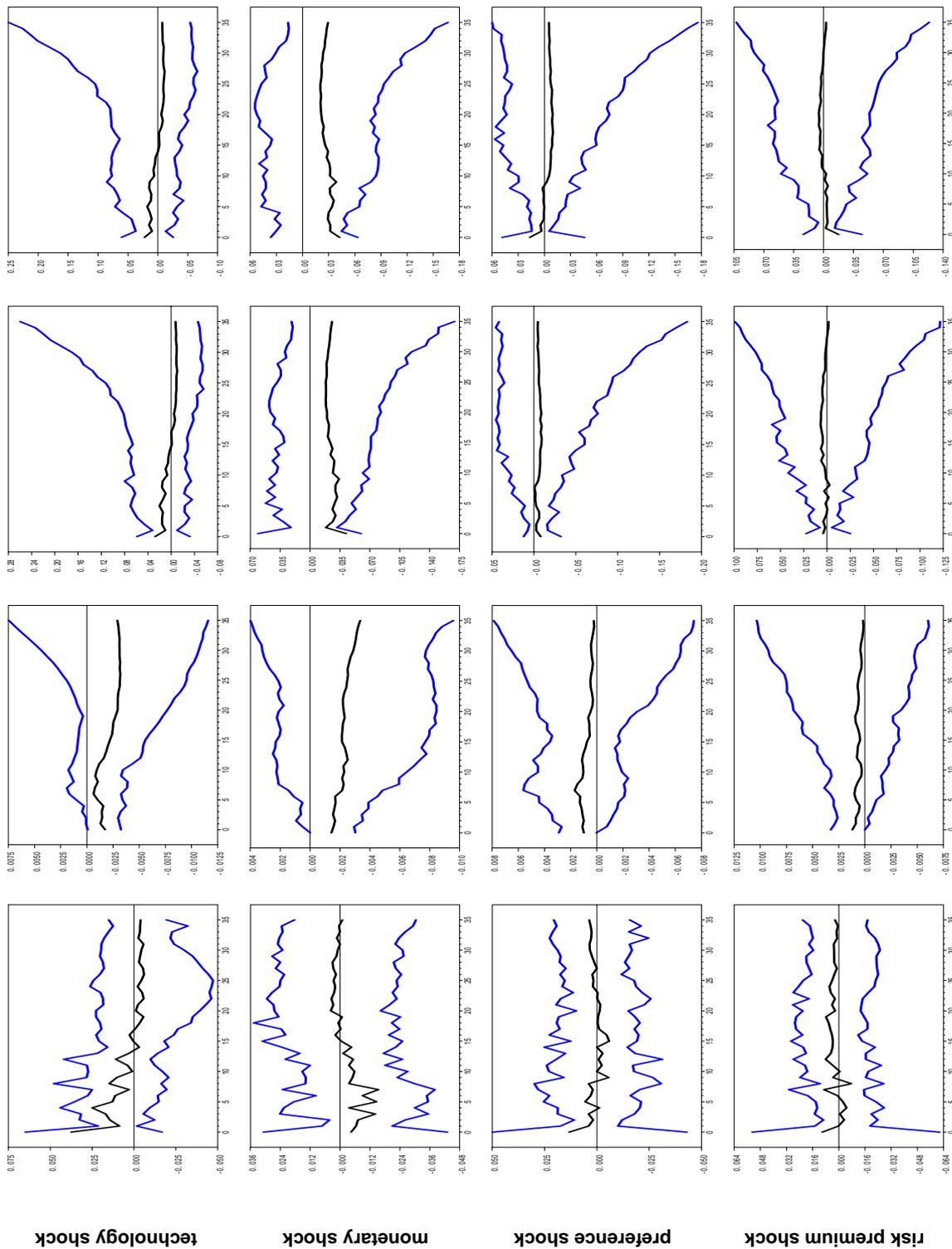
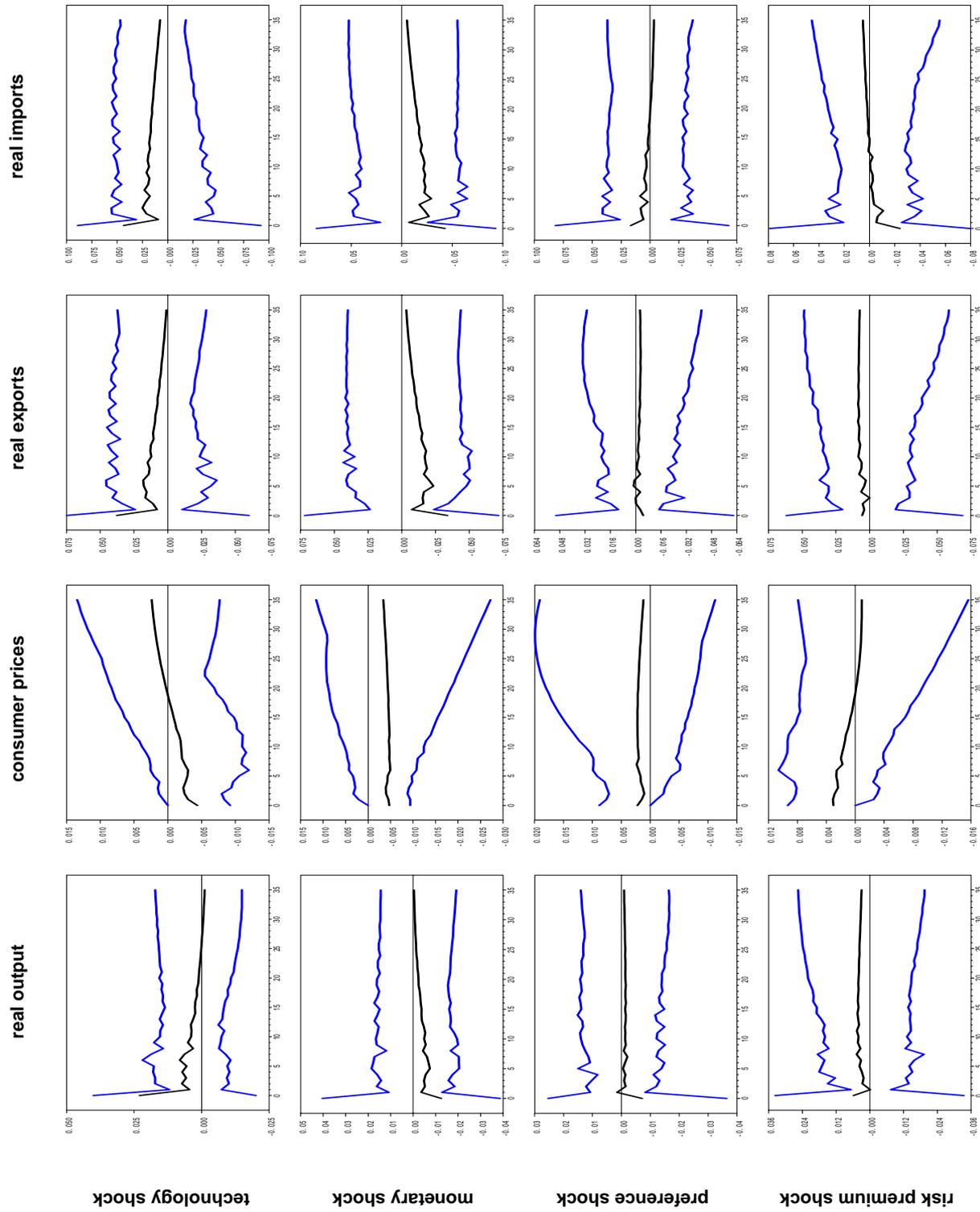


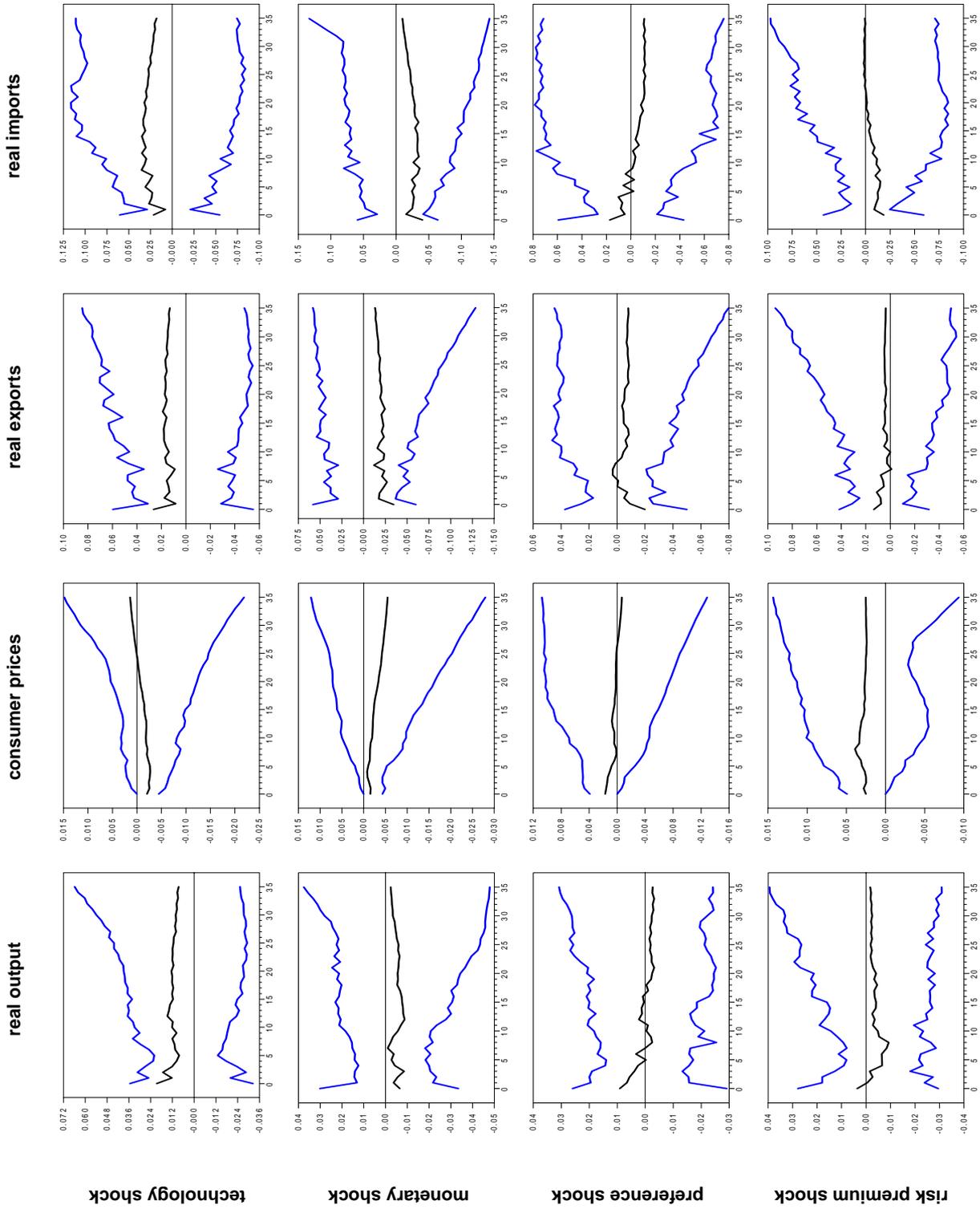
Figure 2E. Singapore: Responses to unit shocks in baseline model

Note: The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



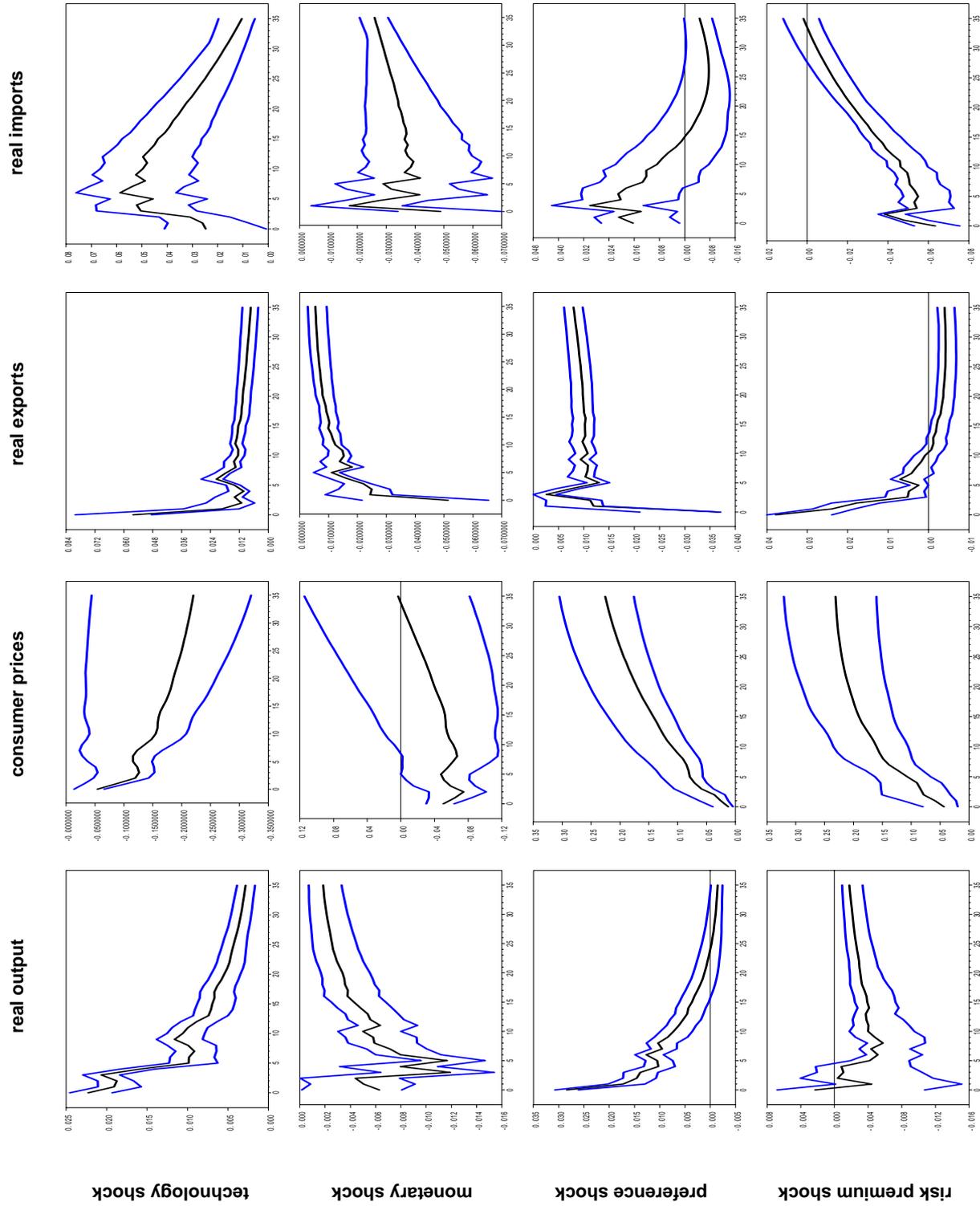
**Figure 2F. Taiwan: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



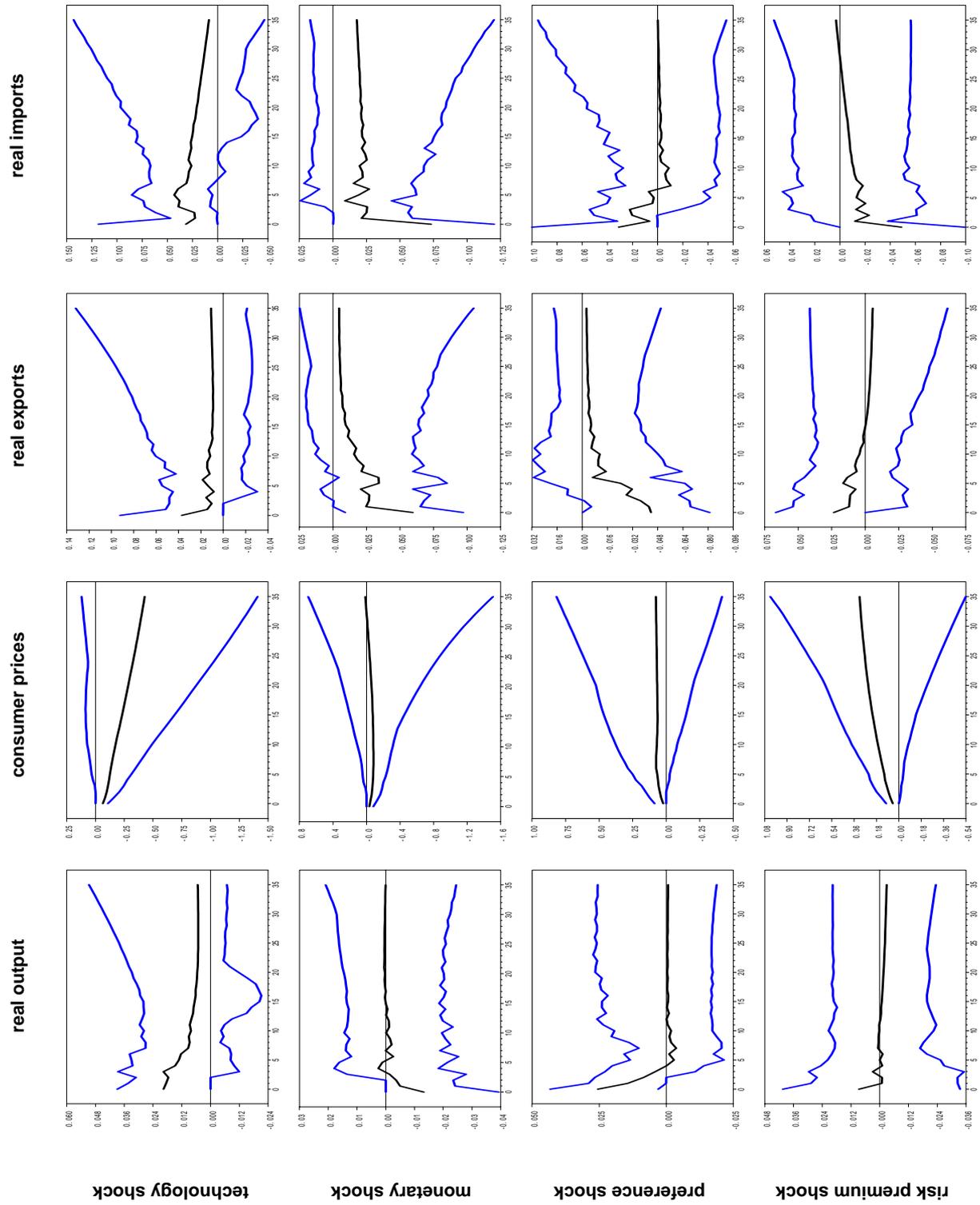
**Figure 2G. Thailand: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



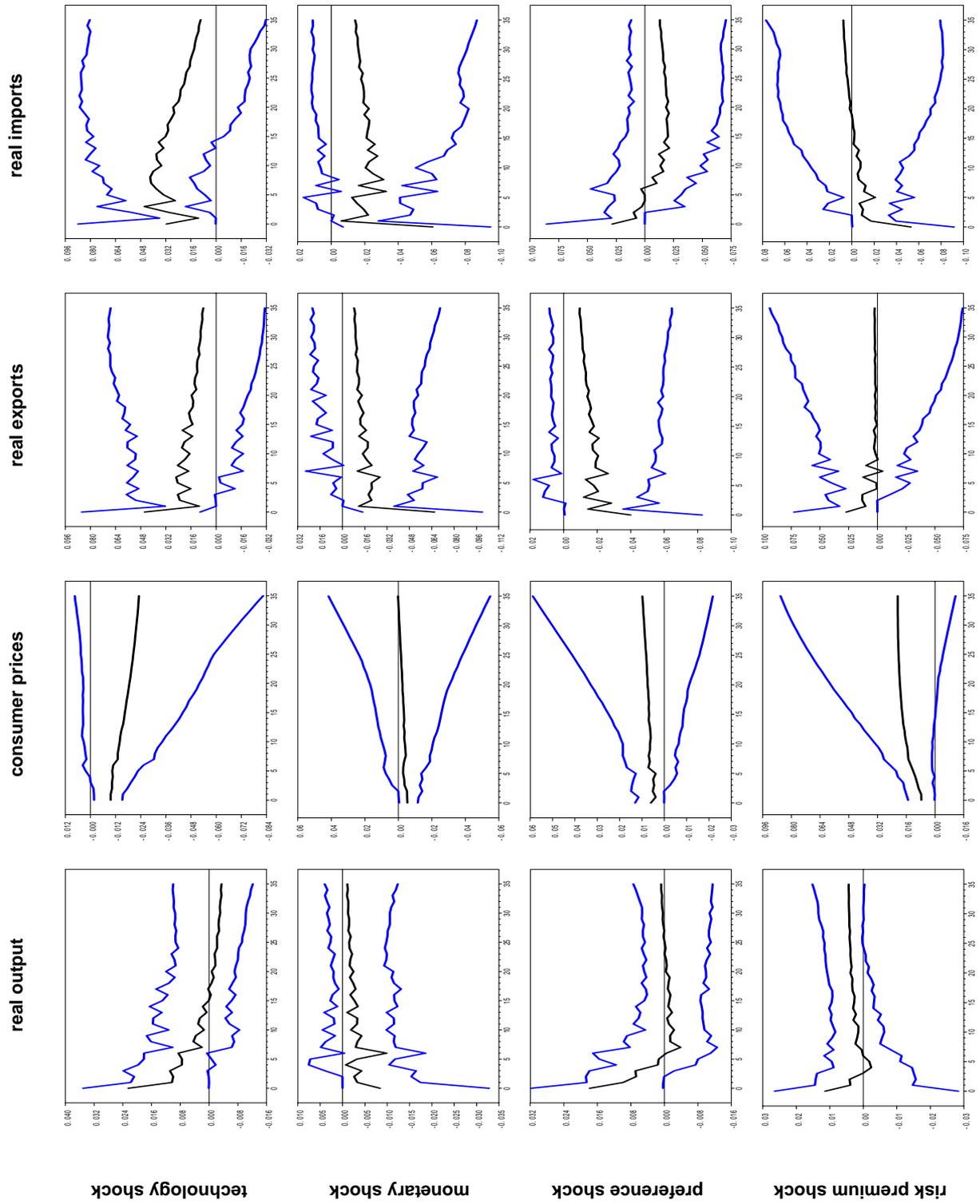
**Figure 2H. Argentina: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



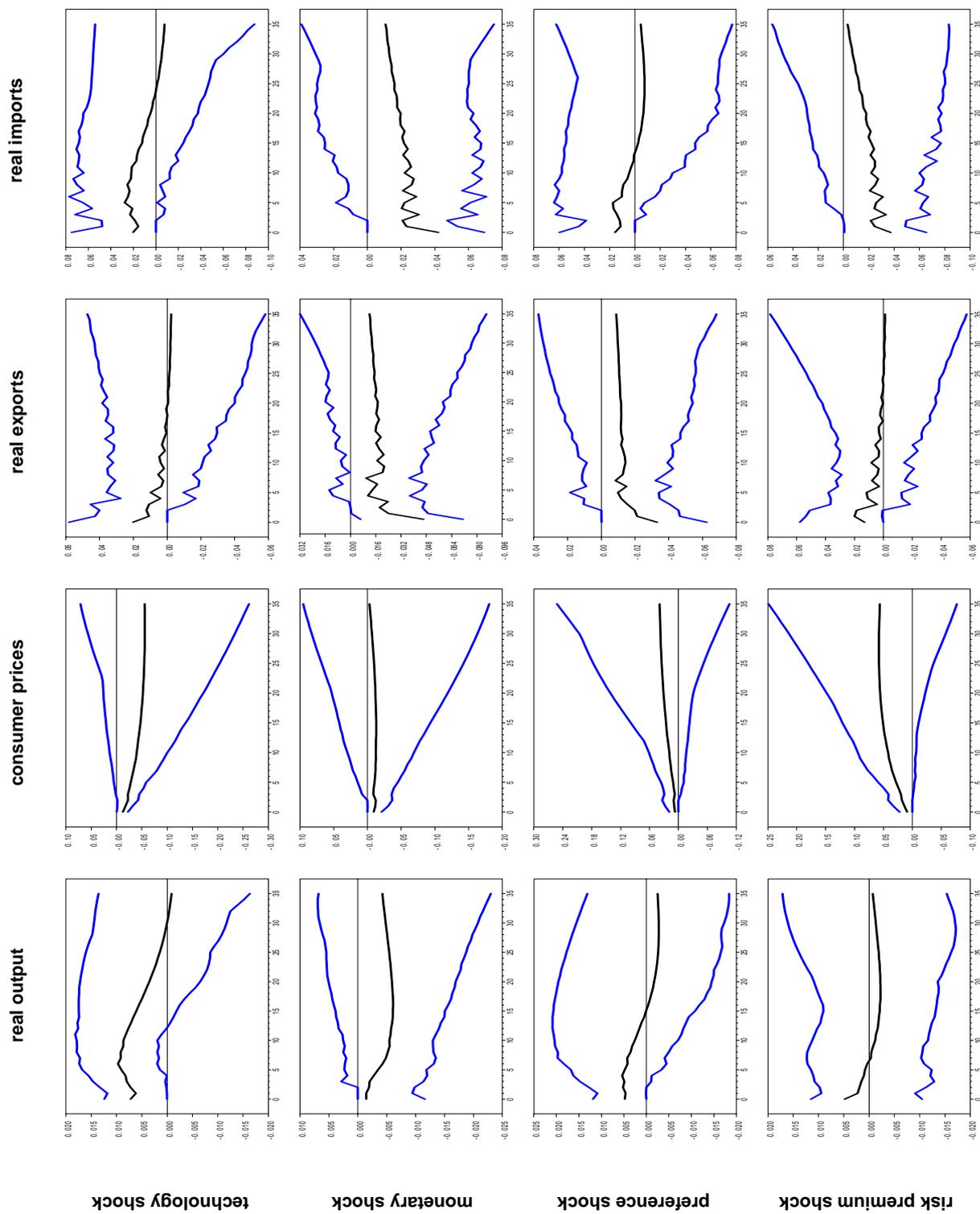
**Figure 2I. Brazil: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



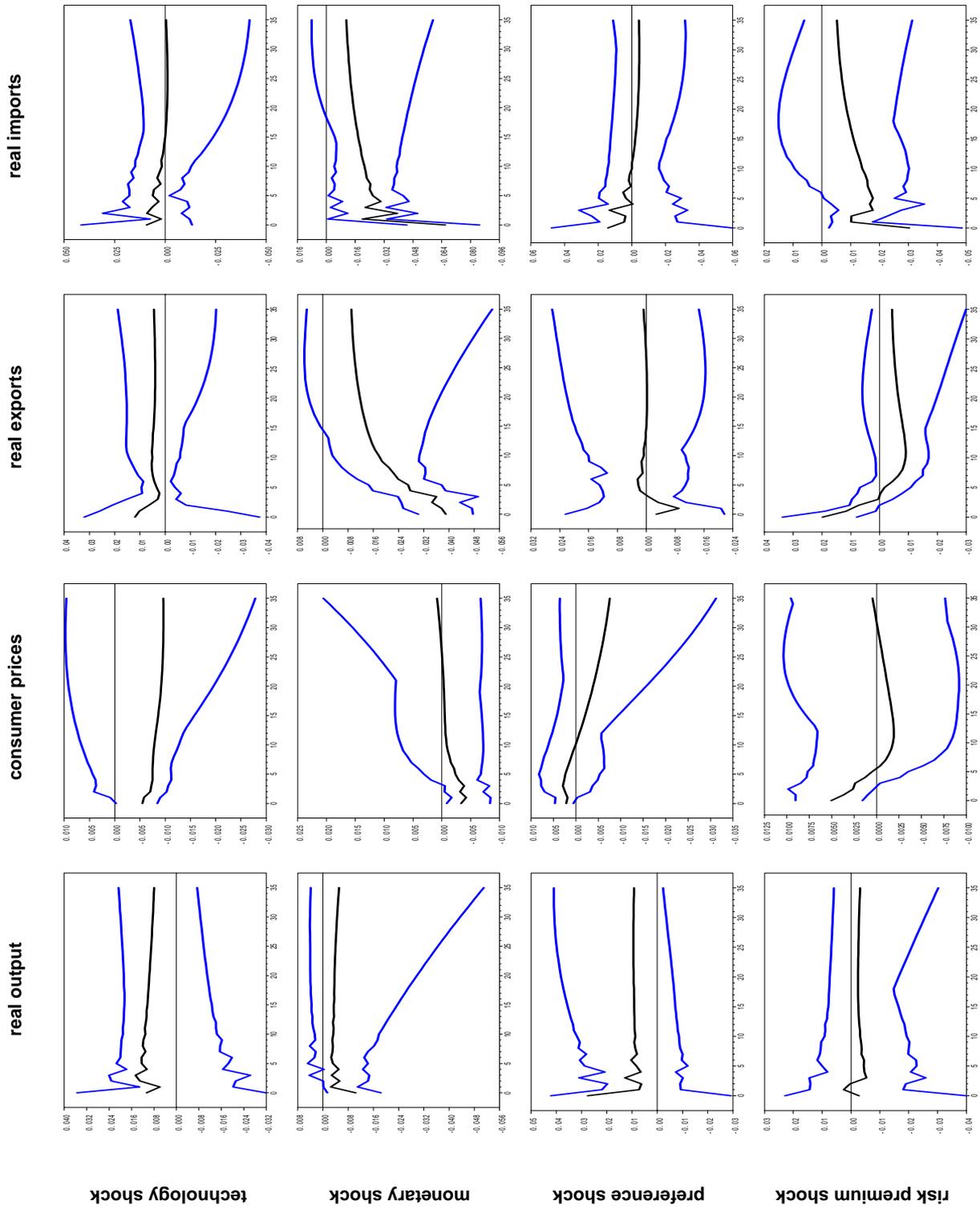
**Figure 2J. Chile: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 2K. Mexico: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 2L. Czech Republic: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.

real imports

real exports

consumer prices

real output

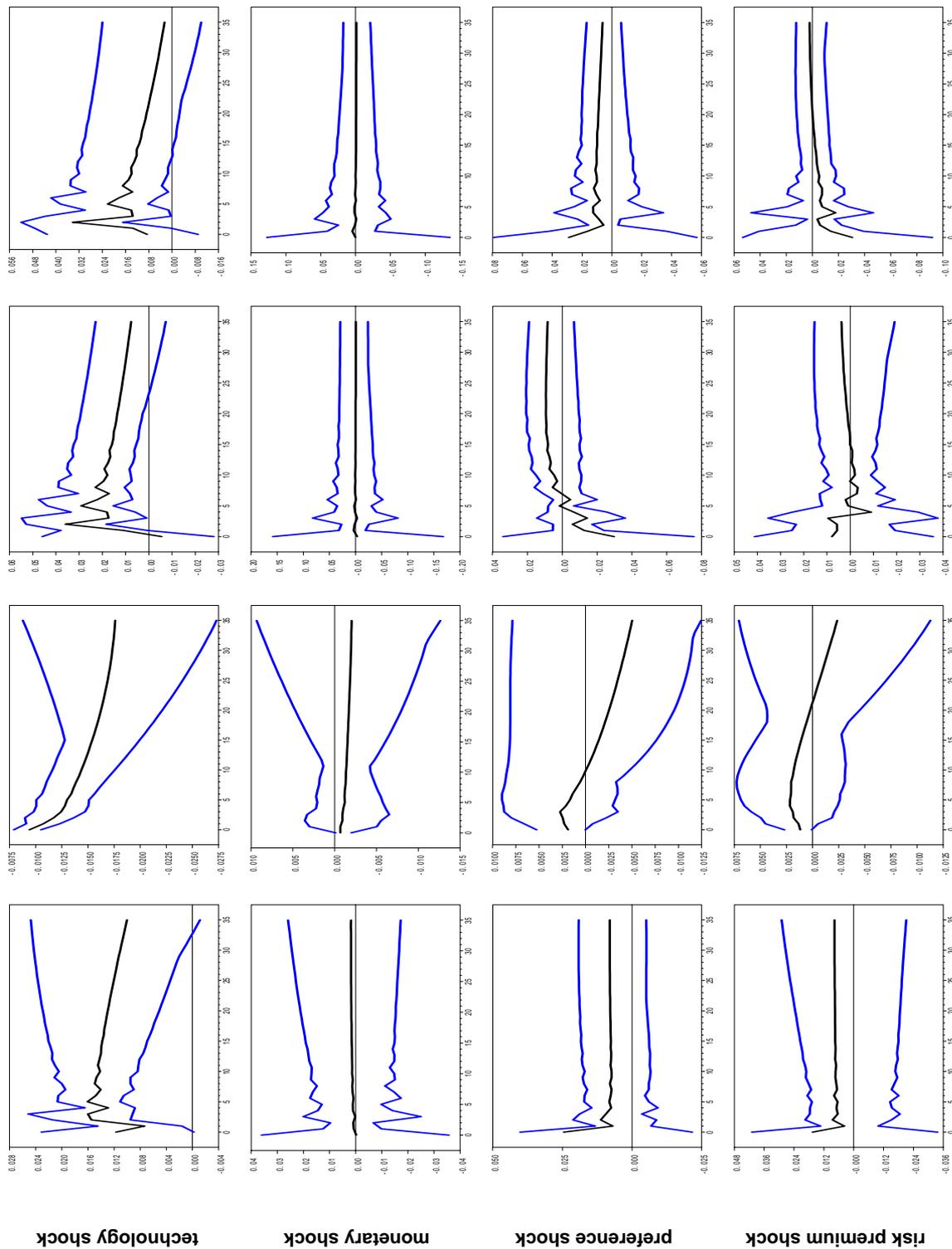
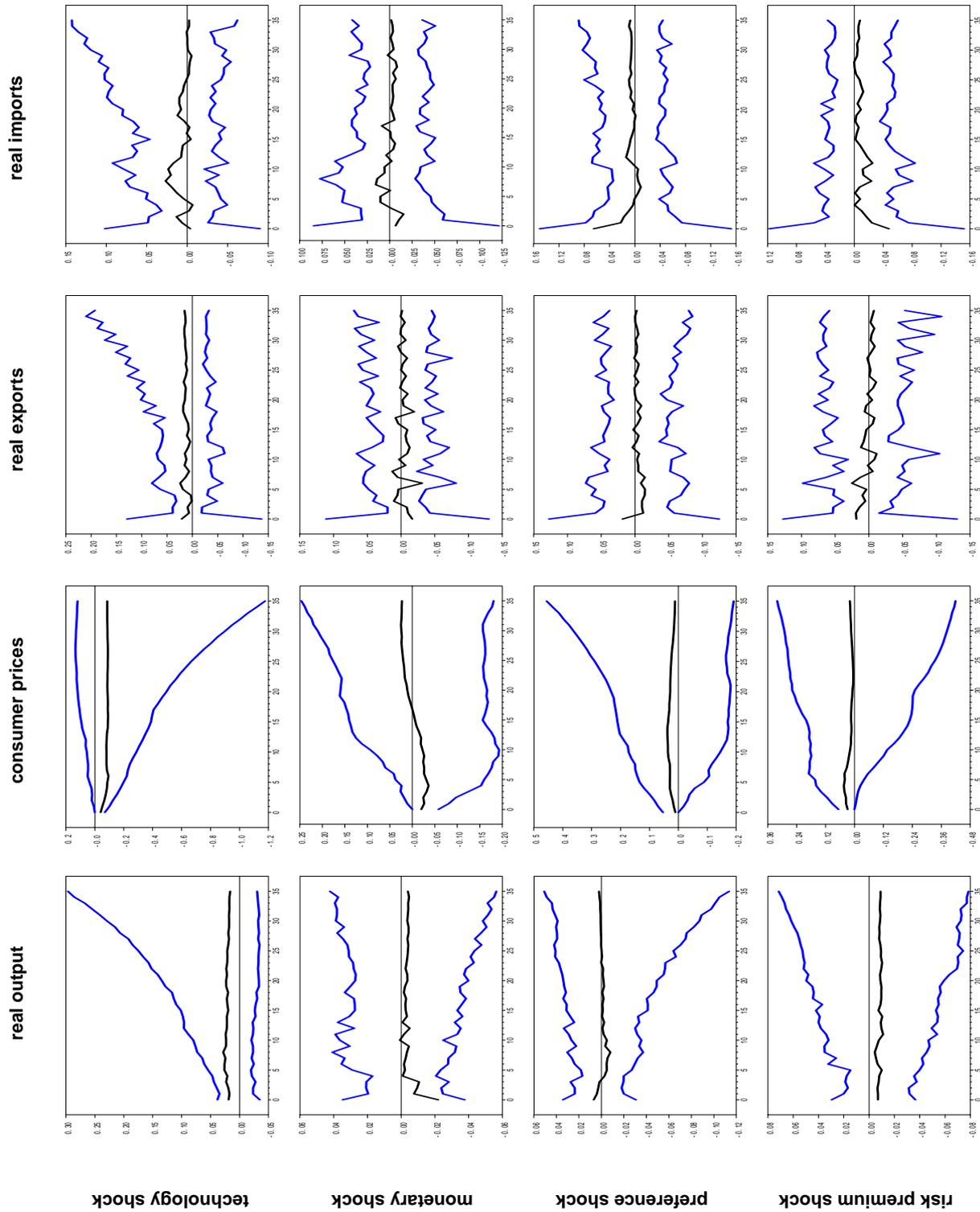


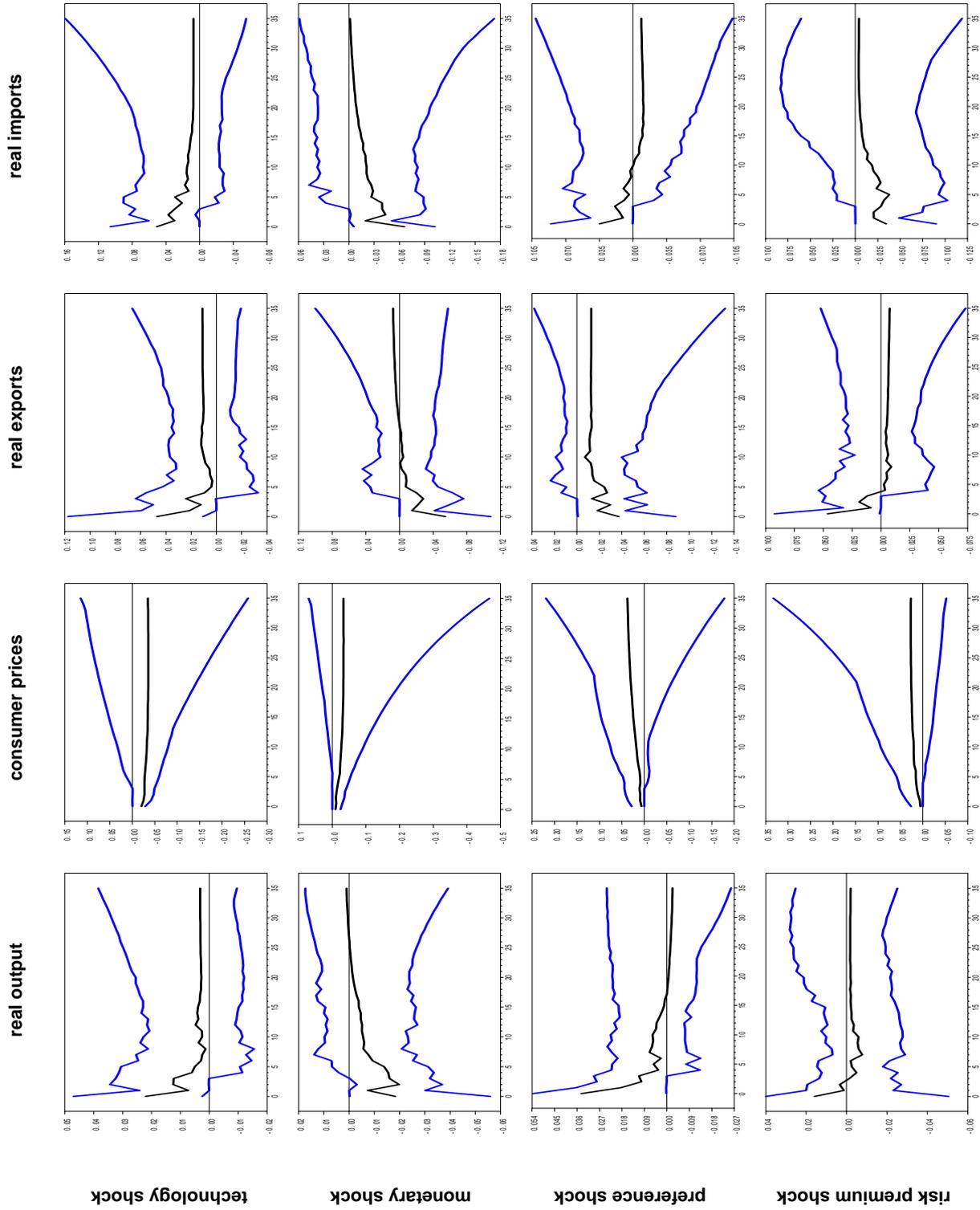
Figure 2M. Hungary: Responses to unit shocks in baseline model

Note: The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



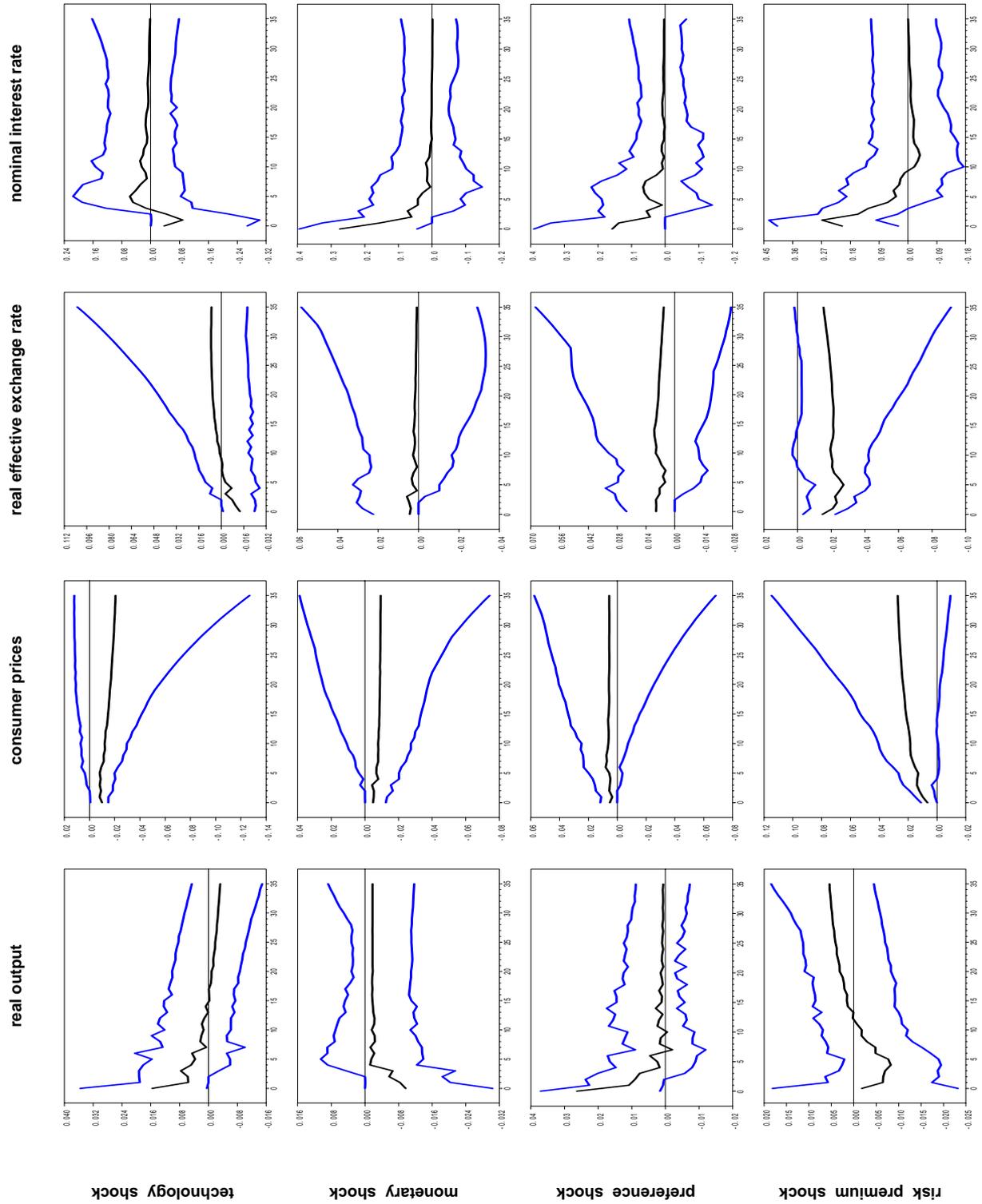
**Figure 2N. Poland: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



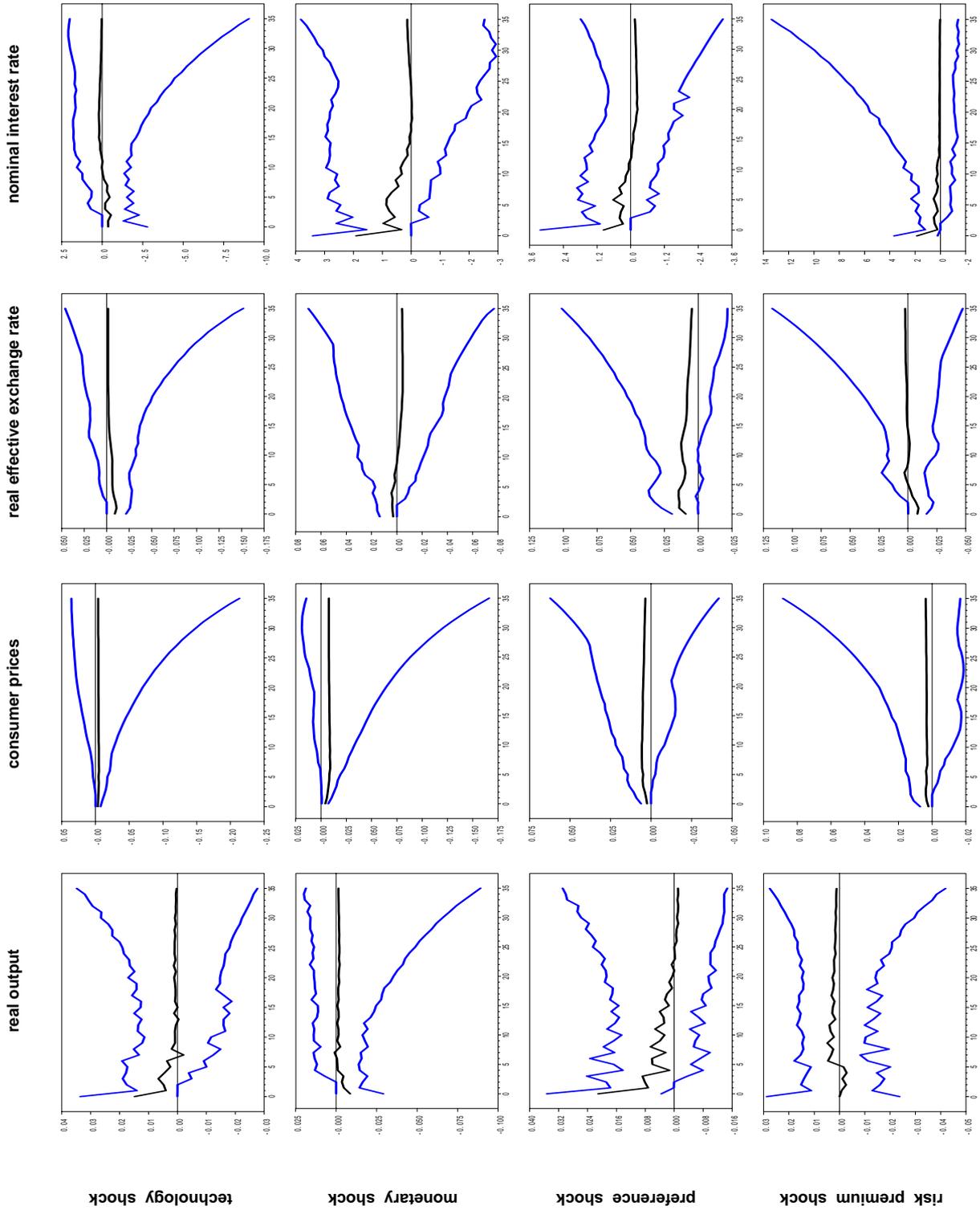
**Figure 2N. Turkey: Responses to unit shocks in baseline model**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 3A. Chile: Responses to unit shocks in model with exchange rates and interest rates (full sample)**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.



**Figure 3B. Chile: Responses to unit shocks in model with exchange rates and interest rates (short sample)**

*Note:* The Figure reports median responses alongside 16th and 84th percentile confidence intervals, expressed in percentage deviations from baseline.

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