Institutional Quality, the Cyclicality of Monetary Policy and Macroeconomic Volatility

Roberto Duncan*
Ohio University†

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Abstract

In contrast to industrialized countries, emerging market economies are characterized by pro- or acyclical monetary policies and high output volatility. This paper argues that those facts can be related to a long-run feature of the economy - namely, its institutional quality (IQL). The paper presents evidence that supports the link between an index of IQL (law and order, government stability, investment profile, etc.), and (i) the cyclicality of monetary policy, and (ii) the volatilities of output and the nominal interest rate. In a DSGE model, foreign investors that choose a portfolio of direct investment and lending to domestic agents, face a probability of partial confiscation which works as a proxy that captures IQL. The economy is hit by external shocks to demand for home goods and productivity shocks while its central bank seeks to stabilize inflation and output. In the long run, a lower IQL tends to discourage external liabilities. If there is a positive external demand shock, we observe an increase in output and real appreciation. The latter operates through two opposite channels. First, it directly increases the opportunity cost of leisure generating incentives to expand labor supply. Second, it reduces the real value of the debt denominated in foreign currency which stimulates consumption but contracts the labor supply. If the IQL is low, the economy attracts fewer loans for domestic consumers and shows a lower debt-to-consumption ratio in the steady state. This implies that the reduction of the real value of the debt caused by the real appreciation is smaller. Given this low wealth effect, the real appreciation leads to an expansion of the labor supply. Wages drop and inflation diminishes. The central bank reacts by cutting its policy rate to stabilize inflation and generates a negative comovement between output and the nominal interest rate (procyclical policy). As a corollary, negative correlations between policy rates and output are not necessarily an indicator of destabilizing polices even in the presence of demand shocks.

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†Department of Economics, Ohio University. Office: 349 Bentley Annex. E-mail: duncanr1@ohio.edu.

1 Introduction

Monetary policies designed to stabilize business-cycle fluctuations are generally regarded as optimal (see, e.g., Woodford, 2001). In contrast to industrialized economies, emerging market economies (EMEs) are characterized by either procyclical or, at most, acyclical monetary policies and higher output volatility. In fact, several studies (see Lane, 2003, also section 2) have confirmed that central banks in the developing world tend to raise (cut) interest rates during recessions (expansions). On the other hand, it is well known that macroeconomic volatility is higher in EMEs (Mendoza, 1991; also section 2). Some works have linked these facts by suggesting that procyclical monetary policies might have contributed to the larger economic fluctuations observed in EMEs (Lane, 2003; Kaminsky, *et al.*, 2004).

This paper highlights the role of institutional quality as a factor behind such empirical regularities. It presents evidence that supports the link between the cyclicality of monetary policy and the quality of institutions. In a sample of 56 developed and developing economies, the correlation between output and the central bank's (nominal) interest rate -a usual measure of the cyclicality of monetary policy- is directly related to an index of institutional quality (e.g., law and order, government stability, investment profile, etc.) widely used in the economic literature. That is, countries with strong institutions tend to show positive output-interest rate correlations (i.e., signals of countercyclical monetary policy), while countries with weak institutionality have negative correlations and follow policies usually characterized as procyclical. This result is robust with respect to a number of sensitivity exercises. On the other hand, there is a statistically significant and negative relationship between measures of the volatility of both output and interest rates and the proxy of institutional quality.

This works extends a standard dynamic stochastic general equilibrium model with price rigidities by introducing foreign investors which choose a portfolio of foreign direct investment (FDI) and lending to domestic agents, and produce an export good. The economy is hit by external demand and productivity shocks and the central bank's objective is to stabilize domestic inflation, output, and variations in the nominal exchange rate. The latter captures the case of managed float regimes frequently found in EMEs. Foreign investors face a probability of incurring an output loss (partial confiscation) which works as a proxy of institutional quality and affects the long-run level and composition of external liabilities and output. In particular, in the steady state, lower institutional quality discourages both FDI and lending in foreign currency to domestic agents, a prediction consistent with recent empirical evidence (Alfaro, *et al.* 2005a,b; Wei, 2006; Bussea and Hefeker, 2007; Faria and Mauro, 2008; Papaioannou 2009).

From a quantitative viewpoint, the model does a satisfactory job of matching the sample variance-covariance matrix of output and the interest rate for both Indonesia and Switzerland, the economies with the lowest and highest levels of institutional quality in our sample.

The model predicts a positive comovement between total output and the nominal interest rate at relatively high levels of institutional quality. The reaction of the central bank is to increase the interest rate when there is a positive external demand shock of home goods because inflation and output increase. In contrast, the central bank reacts by cutting the interest rate when there is a positive productivity shock in the domestically-owned sector. This occurs basically because inflation falls. If demand shocks mainly drive business cycles, a positive output-interest rate comovement arises.

At relatively low levels of institutional quality, the model predicts a negative comovement between total output and the nominal interest rate. The impulse-response analysis shows that the key difference between high and low institutional quality relies on how the central bank reacts to external demand

shocks. If there is a positive external demand shock, we observe an increase in output and a real appreciation (i.e., an increase in the relative price of home goods). The real appreciation operates through two opposite channels. On the one hand, under price stickiness, the necessary nominal appreciation lowers the consumer price level, generating a higher opportunity cost of leisure and, therefore, an incentive to expand labor supply. On the other, it reduces the real value of the debt denominated in foreign currency and thus stimulates both consumption and leisure causing a contraction of labor supply. If institutions are weaker, however, the economy attracts fewer loans for domestic consumers and shows a lower debt-to-consumption ratio in the steady state. This implies that the reduction of the real value of debt in foreign currency caused by the real appreciation is smaller. Given this low wealth effect, the real appreciation leads to an expansion of labor supply. As a result, wages drop and inflation diminishes. The central bank reacts, in this case, by cutting its interest rate to stabilize inflation and generates a procyclical monetary policy. Since the foreign-owned sector has a relatively small size under weak institutionality, productivity shocks from this sector do not play a crucial role. Besides, productivity shocks in the domestically-owned sector contribute by reinforcing the sign of the output-interest co-movement. The net result is a negative link between the interest rate and output or, more generally, a lower correlation between those variables compared to the case of high institutional quality.

Some explanations have been proposed to understand negative output-interest rate correlations in developing economies without either solid theoretical backgrounds or systematic empirical support (see also section 2). The Asian crisis and other financial crises across EMEs triggered a strand of the literature on the optimal response of monetary policy to large external shocks.[1] According to Calvo and Reinhart (2000), developing countries do not adopt countercyclical stabilization policies because when the domestic economy contracts, it experiences capital outflows, and central banks prefer to raise interest rates to compensate for the effect on the exchange rate, instead of leaving the currency value to float freely (*fear of floating)*. In a static model with collateral constraints and currency mismatch, Devereux and Poon (2004) argue that a contraction of the monetary supply can be optimal if the economy is hit by a large external demand shock and the collateral constraint is binding, otherwise a countercyclical monetary policy would be recommendable. Yakhin (2008) contends that the degree of financial integration of the economy with the rest of the world could be a determinant of the optimal stance of monetary policy. In Céspedes, *et al.* (2003), a procyclical monetary policy might be useful if an economy is characterized by balance-sheet effects and financial vulnerability (high indebtedness in foreign currency). The authors, however, contend that unrealistic values for the model parameters would be necessary for an economy to be in that situation.[2]

There are several differences between those works and ours. First, we emphasize the role of institutional quality and how this affects external liabilities, the transmission of shocks, and the response of monetary policy. Second, our framework attempts to provide an argument which rationalizes why a

[1] In the closed economy literature, traditional Keynesian rational expectations models, such as Fischer (1977) and Phelps and Taylor (1977), recommended the use of monetary policy to stabilize output. Ireland (1996) concludes that money velocity shocks (interpreted as demand shocks) do not imply an activist role for the monetary authority, while productivity shocks involve a procyclical monetary policy. Carlstrom and Fuerst (1998) show that these results were not robust to other type of equilibria considered. Nevertheless, external factors are key to understand business cycle fluctuations and the role of monetary policy in EMEs (see also Aghion, *et al.* 2000; Cook, 2004; Christiano, *et al.* 2004; Caballero and Krishnamurthy, 2005).

[2] It is also worth adding that Neumeyer and Perri (2005) also study the link between interest rates and output in EMEs. They analyze, however, country real interest rates (not domestic nominal rates). In addition, they focus on a small group of countries and most of them have followed fixed exchange rates so that world interest rate shocks can be transmitted directly to domestic interest rates. That is, they basically study periods in which central banks did not own monetary independence.

central bank might follow a procyclical monetary policy not only when the economy faces *large* and *negative* (external) shocks (e.g., when a credit constraint is binding), but also during periods of economic normalcy. Third, this paper presents empirical evidence that relates institutional quality to both the procyclicality of monetary policy *and* output and interest rate volatilities, and, in turn, it discards other potential explanations.[3] Finally, this work tackles the task of explaining the linkage between the cyclicality of monetary policy and institutions from a positive perspective. The above mentioned works basically attempt to address the procyclical nature of monetary policy from a normative point of view.

The rest of the paper is organized as follows. Section 2 briefly summarizes the empirical evidence related to the main features and predictions of the model that is formulated in section 3. Section 4 presents the solution and calibration of the model, the main results, and provide a sensitivity analysis. Section 5 concludes.

2 Empirical Motivation

2.1 Procyclicality of Monetary Policies and Weak Institutionality

The empirical evidence tends to support the idea that EMEs' monetary policies are mainly pro- or acyclical. Kaminsky *et al.* (2004) estimate the correlation between a policy-controlled short-term interest rate and a measure of the business cycle for a sample of 104 countries during the 1960-2003 period. They conclude that, in contrast to industrialized countries, monetary policy in EMEs appears to be procyclical (i.e., central bank policy rates are lowered during recessions and raised during expansions). In addition, they also estimate variants of the Taylor rule verifying the previous finding. These results were later confirmed by Calderón, Duncan, and Schmidt-Hebbel (2004a,b) and Yakhin (2008). The latter work uses higher frequency data and restricts the sample to include only countries with floating or managed-floating exchange rate regimes. For the 1974-2004 period, the author finds that the average correlation is positive (0.26) in developed economies and negative (-0.18) in developing countries. Consistent evidence is obtained when the author estimates the slope of output in a Taylor rule for each country.

As in the empirical literature cited above, the measure of monetary policy cyclicality used here is the sample correlation between the Hodrick-Prescott (HP) detrended (log of) real GDP and the HP detrended (log of the gross) nominal central bank discount rate.[4] The source of these series is the IMF's International Financial Statistics database. These series are seasonally adjusted when necessary. As in previous studies, the proxy for institutional quality is the International Country Risk Guide (ICRG) constructed and published monthly by the PRS Group.[5] The ICRG index is the sum of 12 partial measures of institutional quality (law and order, government stability, investment profile, corruption,

[3] In the next section, I present evidence that supports these relationships and also test (and reject) that measures of financial openness and central bank independence can help explain monetary policy procyclicality, even after controlling for potential fear-of-floating issues.

[4] As the instrument of monetary policy, the central bank discount rate is available for most countries. When it is not available, the interbank rate is used.

[5] This index was also used to account for the procyclicality of fiscal policy in developing countries (see Alesina and Tabellini, 2005).

among others) and ranges from 0 -which denotes the lowest level of institutional quality- to 100.[6] (See data appendix for further details.)

The analysis is focused on a set of developed and emerging and developing countries. This set of countries is restricted in two dimensions. First, some countries' central banks lack of independent monetary policy (i.e., periods in which monetary regimes were currency boards, unilateral or multilateral currency unions are dropped from the analysis). We follow the exchange rate regime classification proposed by Ilzetzki, Reinhart, and Rogoff (2008). To minimize the fear-of-floating issue, we control for the periods in which the regime is not typified as either freely floating or managed floating (e.g., certain types of bands or crawling pegs). By using this *de facto* classification, rather than a *de jure* classification, the estimations here consider those periods of monetary independence. Second, the lack of availability of policy measures or other relevant variables is an obvious constraint as well. In particular, we restrict attention to countries with at least 20 consecutive quarters.

Our sample then is composed of 56 economies with varying periods ranging from 1984.1 until 2008.4. Twenty eight countries in our sample are classified as developed per the IMF (World Economic Outlook, October 2009): Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Iceland, Israel, Italy, Japan, Korea, Malta, The Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States. We add the Euro Area to this group for the 1999-2008 period. Twenty seven countries are emerging or developing economies: Argentina, Belarus, Bolivia, Botswana, Brazil, Chile, Colombia, Costa Rica, Croatia, Ecuador, Hungary, Indonesia, Jamaica, Latvia, Lithuania, Malaysia, Mexico, Morocco, Peru, the Philippines, Poland, Romania, the Russian Federation, South Africa, Thailand, Tunisia, and Turkey.

For each of these economies the sample correlation between output and the interest rate is computed[7] and plotted against the average ICRG of the corresponding period. The first graph in figure 1 is the scatter diagram of these two statistics for our sample. The figure also reports least squares estimates and Newey-West HAC corrected standard errors in parentheses.

Table 1 provides some relevant summary statistics. On average, emerging and developing countries exhibit a (slightly) negative output-interest correlation while developed countries exhibit a clearly positive one.

As the figure shows, there is a statistically significant and positive relationship between these two measures in our sample. That is, there is a tendency that whenever an economy presents low average levels of institutionality, the correlation between output and interest rates tends to be low as well. Choosing the Indonesian case as an (extreme) example, we find that Indonesia, labeled as IDN in the graph, is represented by the Cartesian coordinates (51,-0.53), on the south-west extreme of the figure. This economy shows the lowest ICRG index of the sample and, at the same time, the most negative correlation. On the other extreme of the spectrum, we can find Switzerland with the coordinates (90,0.69). This country has clearly followed a countercyclical monetary policy and hence shows the highest institutional level of the sample.

[6] The ICRG components are: Government Stability, Socioeconomic Conditions, Investment Profile, Internal Conflict, External Conflict, Corruption, Military in Politics, Religious Tensions, Law and Order, Ethnic Tensions, Democratic Accountability, and Bureaucracy Quality.

[7] We control for the exchange rate regime by using a suitable dummy variable whenever this is a statistical significant regressor. Following the *de facto* classification mentioned above, the dummy variable takes the value of 1 if the period is not classified as one of freely floating or managed floating and zero otherwise.

To get an idea of the economic magnitudes reported in figure 1, suppose that a developing country such as Bolivia, close to the average output-interest-rate correlation among developing economies, improves its institutional quality index by 2 standard deviations. This change would imply a correlation of 0.28, such as the one shown by Spain during the 1984-1998 period.

Sensitivity analysis

Several robustness checks are performed. Table 2 reports the slopes, standard errors, and p-values of the baseline regression shown in figure 1 (see regression I, column 1) and a number of variants (regression I, columns 2-4). The main finding remains unaltered even after using series obtained by using a quadratic trend filter. Using the Chinn-Ito (2007) index, the possibility that the output-interest-rate correlation is linked to the degree of financial openness (as Yakhin, 2008, suggests; see the discussion in the introduction) is tested. In addition, a similar exercise is performed using an index of central bank independence (column 3) proposed by Cukierman (1992) and updated by Polillo and Guillén (2005). Finally, the table shows a multivariate analysis in which we test the significance of all the regressors previously mentioned (column 4). The conclusion remains unaltered: the index of institutional quality is statistically significant while the other regressors are insignificant or do not show the expected sign.

In order to use the conditional response of interest rates to business cycle fluctuations as a measure of the stance of monetary policy and avoid some potential bias, we estimate the output coefficients of a standard Taylor rule that includes the inflation rate (π) for each country:

$$R_{it} = \beta_{0i} + \beta_{\pi i}\pi_{it} + \beta_{yi}Y_{it} + u_{it},$$

for a given $i = 1, ..., 56$. To control for potential endogeneity, we use GMM and lags of both the dependent variable and regressors as instrumental variables. Next, a vector of estimates (β_{yi}) is regressed on our measure of institutional quality and the other (potential) explanatory variables as in previous exercises. Table 3 reports the results of the cross-section regressions. As can be seen, own main conclusions are verified.

In table 4 we report a similar exercise. We assume now, however, that we can characterize the whole set of countries by using a unique interest rule (as in Calderón, Duncan, and Schmidt-Hebbel (2004)) and include a multiplicative term, $Y_t * ICRG_t$, to try to capture the interaction between the measure of monetary cyclicality and institutional quality. More precisely, we estimate

$$R_{it} = \beta_0 + \beta_\pi \pi_{it} + \beta_y Y_{it} + \beta_{yQ} Y_{it} \times ICRG_{it} + v_{it}$$

using GMM panel data techniques. Under this equation, the degree of cyclicality of monetary policy is determined by $\partial R_{it}/\partial Y_{it} = \beta_y + \beta_{yQ} ICRG_{it}$. That is, the cyclicality of monetary policy is defined to be an increasing function of the institutional quality proxy provided that $\beta_{yQ} > 0$. If in addition β_y is negative then it would be possible to determine a threshold value, say $ICRG^*$, such that monetary policy can be characterized as countercyclical (procyclical) if the observed $ICRG_{it}$ is above (below) $ICRG^*$. Mathematically, such a threshold is directly derived when $\partial R_{it}/\partial Y_{it} = 0$, and thus, $ICRG^* = -\beta_y/\beta_{yQ}$. However, we also need $\beta_y < 0$ to have an economically reasonable threshold value. Table 4 provides LS estimates (column 1) as a reference case to contrast the difference with GMM estimates, which are reported for three different sets of instrumental variables to check robustness (columns 2-4). As can be observed, the J-statistic verifies that the specification cannot be statistically rejected. We obtain statistical significance with expected signs for all of our main coefficients. We also test the

joint hypothesis that β_y and β_{yQ} are nonsignificant. As we can see in table 4 (see F-statistic (2) and p-value) we then reject that null hypothesis at the conventional levels of significance. Additionally, the acyclical-policy value $ICRG^*$ is around 63 points, with a narrow range between 62.1 and 63.6 (columns 2-4). The countries that showed ICRG averages below the highest threshold value (63.6 points) are Belarus, Bolivia, Colombia, Ecuador, Indonesia, Israel, Peru, the Philippines, the Russian Federation, and Turkey (see table 1 for the ICRG averages). Based on these results, we find that countries with low institutional quality –at least lower than our threshold estimate– tend to show procyclical monetary policies, while those with high institutional quality usually go in the opposite direction.

To control for the fear-of-floating issue, we also include the currency depreciation rate in the LS and GMM panel regressions. Columns 1 through 4 in table 4 report parameter estimates as well as standard errors. Here we see that our main conclusion holds again. In general, the estimates associated with the output and the multiplicative term are virtually unchanged or change insignificantly. Furthermore, the currency depreciation rate is insignificant or does not show the expected signs, and, perhaps more importantly, it does not cause a change in the signs of the relevant parameter estimates.

It is worth pointing out that our findings are consistent with previous empirical evidence on the link between the cyclicality of monetary policy and institutional quality. Calderón, Duncan, and Schmidt-Hebbel (2004) obtain a similar pattern as well. Using annual data for a panel of 19 EMEs in the 1990-2003 period, they estimate an extended Taylor rule similar to the one described above. Their estimates show all the expected signs and significance. EMEs with an institutional quality index below 58 points pursue procyclical monetary policies.[8]

2.2 Institutional Quality and the Volatility of Output and the Interest Rate

As above, we also compute the standard deviations of output and interest rates as measures of their corresponding volatilities. Figure 1 shows a scatter of these statistics, denoted by $SD(Y)$ and $SD(R)$, along with our proxy of institutional quality, the ICRG average, for the set of economies used above. Additionally, the figure displays their regression lines. In the graph, the Indonesian economy is shown to be an economy with high variability with both output and interest rates and, at the same time, with the lowest ICRG average. On the other extreme, Switzerland shows the highest ICRG average and low levels of both output and interest rate variability. As we can see, there is a negative relationship between the volatilities of both output and interest rates and institutional quality. The slopes in both regressions are statistically significant at standard levels.

Table 1 reports our estimates of output and interest volatility for each country. On average, output volatility is much higher in emerging and developing countries.[9] Likewise, the volatility of the nominal interest rate in developing economies is several times higher than the one in developed countries.

Table 2 shows the results of some robustness checks. It reports the slopes, standard errors, and p-values for the baseline regressions of volatility (regressions II and III, column 1 in the table). In addition, we test for the possibility that the output and interest-rate volatilities are related to the degree of financial openness and central bank independence in multivariate regressions (regressions II and III, column 4).

[8] The main differences between such an empirical work and ours are that (i) we use data at quarterly frequency, which might be more suitable to study business-cycle fluctuations; and (ii) we test alternative explanations to institutional quality (such as central bank independence and financial openness).

[9] Other studies have shown evidence in this direction (see, e.g., Mendoza 1991; Neumeyer and Perri, 2005).

However, these alternative explanations are, in general, rejected or not robust, while the sign and significance of the institutional quality proxy remain unchanged.

3 Model

3.1 Outline

Consider a small open economy (SOE) composed of three types of agents: households, firms, and a government or consolidated monetary-fiscal authority. Additionally, this economy interacts with the rest of the world (ROW) which is populated by a large number of foreign consumers of the home good, foreign producers of physical capital (supplied to foreign investors as will be described below), and competitive foreign investors whose behavior is explicitly modeled. Diagram 1 shows the flow of goods, services, and assets.

A continuum of monopolistic domestically-owned firms produce the home good which is sold to domestic agents (households and government) and the rest of the world (exports). Thus, they directly face shocks in the external demand for home goods as well as productivity shocks. Besides, they set prices *à la* Calvo (1983).[10]

The monetary-fiscal authority (or, simply, the central bank) sets both monetary and fiscal policies.[11] Aside from purchasing home goods produced by domestically-owned firms and collecting taxes, the central bank sets the domestic interest rate by minimizing a standard loss function that depends on inflation and the output deviations from steady-state equilibrium as well as changes in the nominal exchange rate. The latter gives us a way to capture managed floating regimes that are often adopted in EMEs. This loss function is adopted as a behavioral assumption since our goal is to account for the lack of countercyclicality of monetary policies and the high macroeconomic volatility observed in developing countries.

This economy also interacts with foreign investors which play a key role in investing physical capital, supplying funds denominated in foreign currency as mentioned before, and hiring labor from domestic households. They also face productivity shocks when producing an intermediate good that is completely exported. Foreign investors' portfolio decisions along with institutional quality shape the long-run level and composition of external liabilities and output that the SOE owns. The quality of institutions affects foreign investors' optimal portfolio composition as will be explained below.

3.2 Foreign Investors

Foreign investors (FIs) consume a foreign composite good C_f^* purchased at the exogenous (relative) price p_c^*. Their preferences are represented by

$$E_0 \sum_{t=0}^{\infty} \beta^t U^*(C_{ft}^*)$$

[10] This assumption implies that each domestic firm may reset its price with a constant probability in any given period. This is adopted so that monetary policy has significant non-neutral effects on economic activity.

[11] The latter is basically irrelevant for obtaining the main results of the model. It just facilitates the model parameterization.

with

$$U(C_{ft}^*) = \frac{\left(C_{ft}^*\right)^{1-\chi_f}}{1-\chi_f}$$

FIs choose to invest in a portfolio composed of a risk-free bond B_w that yields a constant (gross) return R_w, and a risky investment portfolio in SOEs, B_f, that provides a (gross) return of R_f. Let Π_f denote the dividends from both direct investment and financial investment (i.e. the return from lending) in the SOE . Then R_f is given by

$$R_{ft+1} \equiv 1 + \frac{\Pi_{ft+1}}{B_{ft}} \tag{3.1}$$

This return can be understood as a weighted average of a direct investment in productive activities (FDI) K_f and a purely financial investment in a bond issued by SOE's households whose quantity is denoted by D_f^f (see below).[12]

FIs' wealth Ω_f is, thus, allocated to consumption and investment in the current period:

$$\Omega_{ft} = p_c^* C_{ft}^* + B_{wt} + B_{ft} \tag{3.2}$$

To induce a stationary equilibrium, portfolio adjustment costs are included in the model. FIs' wealth in the next period will result in:

$$\Omega_{ft+1} = R_w B_{wt} + R_{ft+1} B_{ft} - \Psi_w\left(B_{wt}\right) - \Psi_f\left(B_{ft}\right) \tag{3.3}$$

where $\Psi_w\left(B_{wt}\right) = \frac{\psi_w}{2}\left(B_{wt} - \bar{B}_w\right)^2$ and $\Psi_f\left(B_{ft}\right) = \frac{\psi_f}{2}\left(B_{ft} - \bar{B}_f\right)^2$ are the portfolio adjustment costs with positive parameters ψ_w, ψ_f, $\bar{B}_w$, and $\bar{B}_f$.

Assuming a constant relative price p_c^*, the first-order conditions imply that:

$$\left(C_{ft}^*\right)^{-\chi_f} = \beta E_t \left(C_{ft+1}^*\right)^{-\chi_f} \left[R_w - \psi_w\left(B_{wt} - \bar{B}_w\right)\right] \tag{3.4}$$

$$\left(C_{ft}^*\right)^{-\chi_f} = \beta E_t \left(C_{ft+1}^*\right)^{-\chi_f} \left[R_{ft+1} - \psi_f\left(B_{ft} - \bar{B}_f\right)\right] \tag{3.5}$$

Given the returns R_f and R_w, the last four equations help to determine the optimal choices of C_f^*, Ω_f, B_f and B_w by FIs.

FIs operate in each SOE, invest an amount of physical capital K_f, and hire labor services L_f to produce an intermediate good Y_f. The production of this intermediate good is completely exported because it is assumed here that domestically-owned firms only need labor to produce.

The total portfolio size that the parent company located in the source country assigns to this SOE for physical and financial investment is:

[12] Based on the findings of Faria and Mauro (2008), the model abstracts from portfolio equity inflows because institutional quality affects them and FDI inflows in a similar way.

$$B_{ft} = K_{ft} + D^f_{ft} \tag{3.6}$$

Note that the model assumes that the FIs do not invest in assets denominated in the SOE's domestic currency and issued by domestic households.[13,14]

When doing business in this SOE, FIs face what we will call as *institutional risk*. This sort of risk is thought to capture the SOE's institutional quality in terms of the costs related to poor property rights protection, weak contract enforcement, and corrupted or inefficient judicial systems. Thus, FIs deal with two possible states: one with a high quality of institutions and the other characterized by institutional weakness. Under the high-institutional-quality case, there is an exogenous probability $q \in [0, 1]$ that no loss occurs and then they operate normally. In the low-institutional-quality case, in contrast, a fraction ϕ of output might be lost with probability $1 - q$.[15] In this context, q becomes our candidate to proxy the SOE's level of institutional quality.

Before describing each case in further detail, some definitions are provided. Let δ denote the depreciation rate, I_f be physical investment, and FCF_f denote FIs' financial cash flow in assets denominated in foreign currency. The latter variables can then be defined as:

$$I_{ft} = K_{ft} - (1 - \delta)K_{ft-1}$$
$$FCF_{ft} \equiv D^f_{ft} - (1 + r_d)D^f_{ft-1}$$

In the high-institutional-quality case, FIs' dividends are:

$$\Pi^H_{ft} = Y_{ft} - \frac{w_t}{s_t}L_{ft} - I_{ft} - FCF_{ft}$$

where w denotes the real wage (expressed in terms of the home good) and s is the real exchange rate. The production technology given by

$$Y_{ft} = A_{ft}K^{\alpha_k}_{ft-1}L^{\alpha_l}_{ft}$$

where $0 < \alpha_k + \alpha_l < 1$ and A_f is a productivity term that follows the stochastic process:

$$A_{ft} = (A_{ft-1})^{\rho_{af}}\, e^{\xi_{ft}} \tag{3.7}$$

with $\rho_{af} \in (0, 1)$ and $\xi_{ft} \sim N(0, \sigma^2_{af})$.

[13] Since domestic-currency denominated bonds are not traded internationally in the model, the only source of external funds are bonds in foreign currency issued by domestic households and purchased by FIs. This is an assumption that is consistent with the so-called "original sin". According to Eichengreen *et al.* (2003), there exists a large concentration of debt denominated in just a few major currencies. As an example, they contend that of the nearly \$5.8 trillion in securities placed in international markets in the 1999-2001 period, \$5.6 trillion was issued in five currencies: the US dollar, the euro, the yen, the pound sterling and the Swiss franc. Put differently, most developing countries do not borrow in their own currencies from the rest of the world.

[14] Strictly speaking, assets are denominated in terms of goods. We refer to domestic-currency denominated bonds as those assets expressed in units of the domestic good, while foreign-currency denominated bonds are those assets expressed in units of the intermediate exportable good.

[15] This part of the setup is partially inspired on the expropriation models developed by Eaton and Gersovitz (1984) and Cole and English (1991).

In the low-institutional-quality case, it is assumed that the foreign-owned firm loses a fraction $1-\phi$ of Y_f only. Put differently, the consequence of weak institutions for FIs is the possibility of a partial loss of sales with probability $1-q$. In such a case, dividends are defined as:

$$\Pi_{ft}^{L} = \phi Y_{ft} - \frac{w_t}{s_t} L_{ft} - I_{ft} - FCF_{ft}$$

By using the last three equations, FI's expected dividends expressed in foreign currency take the form:

$$\Pi_{ft} = q\Pi_f^H + (1-q)\Pi_f^L$$
$$\Pi_{ft} = QA_{ft}K_{ft-1}^{\alpha_k}L_{ft}^{\alpha_l} - \frac{w_t}{s_t}L_{ft} - I_{ft} - FCF_{ft}$$

where $Q \equiv q + (1-q)\phi$ and is now referred to as our index of institutional quality. Since FIs' production is exported, they face an infinitely elastic demand for their good at the exogenous price P_f^f. For simplicity, P_f^f and r_d are assumed to be constant for every t and the former is normalized to one.

Let $\Lambda_{ft} \equiv \beta^t U_c^*(C_{ft}^*)$ be the stochastic discount factor, the FIs' problem in a SOE consists of choosing K_f and D_f^f to maximize the present discounted value of expected dividends:

$$E_0 \sum_{t=0}^{\infty} \Lambda_{ft}\Pi_{ft}$$

subject to initial conditions K_{f-1} and D_{f-1}^f, and a suitable transversality condition. Optimality implies that:

$$E_t \frac{\Lambda_{ft+1}}{\Lambda_{ft}} \left[\alpha_k Q A_{ft+1} K_{ft}^{\alpha_k - 1} L_{ft+1}^{\alpha_l} - (r_d + \delta)\right] = 0 \tag{3.8}$$

$$\alpha_l Q A_{ft} K_{ft-1}^{\alpha_k} L_{ft}^{\alpha_l - 1} = \frac{w_t}{s_t} \tag{3.9}$$

The first of these equations dictates that direct investment must be such that the marginal product of capital is equal to its opportunity cost. Note that the former is affected directly by the parameter of institutional quality (Q). The latter equation is the standard equality between the marginal product of labor and its relative cost. Given prices and returns, these two equations, jointly with expression 3.6, determine both the FIs' optimal portfolio, in terms of K_f and D_f^f, and the optimal choice of L_f.

3.3 Domestic Households

Each household has identical preferences represented by

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, L_t)$$

with

$$U(C_t, L_t) = \frac{C_t^{1-\chi_h}}{1-\chi_h} - \nu_0 \frac{L_t^{\nu}}{\nu}$$

where L denotes labor and C is a composite of the consumption of home and foreign goods. This composite is given by

$$C_t = \zeta C_{ht}^{\gamma} C_{ft}^{1-\gamma}$$

where $\zeta \equiv [\gamma^{\gamma}(1-\gamma)^{1-\gamma}]^{-1}$ is a constant, γ represents the relative preference for home goods, and C_h is a basket of the different varieties of goods produced domestically. It is aggregated through

$$C_{ht} = \left[\int_0^1 (C_{ht}(j))^{\frac{\vartheta-1}{\vartheta}} dj \right]^{\frac{\vartheta}{\vartheta-1}}$$

where $\vartheta > 1$ is the elasticity of substitution across varieties. Assuming that the law of one price holds, and that the foreign good price is constant and normalized to one ($P_f^* = 1$), the consumption price index (or minimum cost of one unit of aggregate consumption), P, is defined as

$$P_t = (P_{ht})^{\gamma} (S_t)^{1-\gamma} \tag{3.10}$$

with

$$P_{ht} = \left[\int_0^1 (P_{ht}(j))^{1-\vartheta} dj \right]^{\frac{1}{1-\vartheta}}$$

where S is the nominal exchange rate and P_h is the local price of the home good.

Households smooth out consumption by issuing debt denominated in both domestic currency (D_h^h) and foreign currency (D_h^f).[16] Note that the subscript here refers to the holder's origin (either home or foreign) and the superscript indicates the currency in which the bond is denominated. Given prices and interest rates, households have the following budget constraint:

$$P_t C_t + T_t + (1 + r_{t-1}) D_{ht-1}^h + (1 + r_d) S_t D_{ht-1}^f = W_t L_t + \Pi_{ht} + D_{ht}^h + S_t D_{ht}^f \tag{3.11}$$

In this constraint, T stands for the total taxes paid to the government, $\Pi_h \equiv \int_0^1 \Pi_h(j) dj$ denotes the total dividends from domestically-owned firms owned by the representative household, W denotes the nominal wage, and r is the domestic interest rate.

Households choose consumption and labor (leisure) to maximize expected utility subject to their budget constraint 3.11, initial conditions D_{h-1}^f and D_{h-1}^h, and a suitable transversality condition. Optimality entails that

[16] Bonds denominated in foreign currency are acquired by the FIs, while those denominated in local currency can be purchased only by (other) domestic households.

$$\upsilon_0 C_t^{\chi_h} L_t^{\nu-1} = \frac{W_t}{P_t} \tag{3.12}$$

$$E_t \frac{\Lambda_{ht+1}}{\Lambda_{ht}} \left[(1+r_t) - (1+r_d) \frac{S_{t+1}}{S_t} \right] = 0 \tag{3.13}$$

where $\Lambda_{ht} \equiv \beta^t U_c(C_t, L_t)/P_t$ is the Lagrange multiplier. From the solution to this intratemporal problem, the demands for each good, C_h and C_f, can be obtained. The first order conditions imply:

$$C_{ht} = \gamma \frac{P_t C_t}{P_{ht}} \tag{3.14}$$

$$C_{ft} = (1-\gamma) \frac{P_t C_t}{S_t} \tag{3.15}$$

3.4 Domestically-owned Firms

Domestic production is carried out by a continuum of monopolistic competitors. Firm j, with $j \in [0,1]$, employs the following linear technology

$$Y_{ht}(j) = A_{ht} L_{ht}(j) \tag{3.16}$$

where $Y_h(j)$ stands for home output of variety j and A_h is a productivity term governed by the following stochastic process:

$$A_{ht} = (A_{ht-1})^{\rho_{ah}} e^{\xi_{ht}} \tag{3.17}$$

where $\rho_{ah} \in (0,1)$ and $\xi_{ht} \sim N(0, \sigma_{ah}^2)$.

The domestically-owned firms' dividends are then given by:

$$\Pi_{ht}(j) = P_{ht}(j) Y_{ht}(j) - W_t L_{ht}(j)$$

Let mc_t denote the (real) marginal cost of the firms. Cost minimization implies that:

$$\frac{W_t}{P_{ht}(j)} = mc_t(j) \frac{Y_{ht}(j)}{L_{ht}(j)} \tag{3.18}$$

Following Calvo (1983), firms may reset their prices with probability $1-\theta$ in any given period. This, in turn, implies that in every period t, a fraction $1-\theta$ of domestically-owned firms reset prices and the remaining θ keep them unchanged. A firm that reoptimizes in period t chooses a price $\tilde{P}_{ht}$ that maximizes the nominal market value of profits. Recalling that Λ_t is the stochastic discount factor, the firm then maximizes

$$E_t \sum_{\tau=0}^{\infty} \theta^\tau \left[\frac{\Lambda_{t+\tau}}{\Lambda_t} \left(\tilde{P}_{ht} Y_{h,t+\tau|t} - TC_{t+\tau} \left(Y_{h,t+\tau|t} \right) \right) \right]$$

subject to the demand for its good

$$Y_{h,t+\tau|t} = \left[\frac{\tilde{P}_{ht}}{P_{ht+\tau}}\right]^{-\vartheta} Y^d_{h,t+\tau}$$

where Y^d_h is the demand from domestic and foreign consumers, $TC(.)$ is the cost function, and $Y_{h,t+\tau|t}$ denotes output in period $t+\tau$ for a firm that last reset its price in period t. The first order condition takes the form:

$$E_t \sum_{\tau=0}^{\infty} \theta^\tau \left[\frac{\Lambda_{t+\tau}}{\Lambda_t} Y_{h,t+\tau|t} \left(\tilde{P}_{ht} - \tilde{\vartheta} MC_{t+\tau|t}\right)\right] = 0 \tag{3.19}$$

where $MC_{t+\tau|t}$ denotes the (nominal) marginal cost in period $t+\tau$ for a firm that last reset its price in period t, and $\tilde{\vartheta} \equiv \vartheta/(\vartheta - 1)$ is the frictionless optimal mark-up. As a standard result, note that if $\theta = 0$, then $\tilde{P}_{ht} = \tilde{\vartheta} MC_{t|t}$.

Since P_{ht} is the price index of home goods, the previous assumption on firms' price setting is related to the following index:

$$P_{ht} = \left[\theta \left(P_{ht-1}\right)^{1-\vartheta} + (1-\theta)\left(\tilde{P}_{ht}\right)^{1-\vartheta}\right]^{\frac{1}{1-\vartheta}} \tag{3.20}$$

The latter two expressions are useful in deriving a log-linearized expression for domestic inflation, the so-called aggregate supply curve.

3.5 External Demand for Home Goods

Foreigners' consumption of home goods is unit elastic and defined as:

$$X_{ht} = \frac{S_t X_t}{P_{ht}} \tag{3.21}$$

where X_t follows an exogenous stochastic process:[17]

$$X_t = \left(\overline{X}\right)^{1-\rho_x} \left(X_{t-1}\right)^{\rho_x} e^{\xi_{xt}} \tag{3.22}$$

with a steady-state value $\bar{X} > 0$, $\rho_x \in (0,1)$, and $\xi_{xt} \sim N(0, \sigma_x^2)$.

3.6 Monetary-Fiscal Authority

The monetary-fiscal authority balances its budget:

$$T_t = P_{ht} G_{ht} \tag{3.23}$$

[17] As in Céspedes *et al.*(2003), we suppose exogeneity by interpreting the assumption of a small open economy as a negligible share of domestic goods on foreigners' consumption basket.

Fiscal revenues finance the purchase of the domestic good with a real value of G_h. It is assumed that $G_{ht} = G_h$, for every t.

Monetary policy is specified by controlling the domestic interest rate r which, implicitly, is optimally chosen by minimizing a loss function that depends directly on a measure of inflation and the output gap. The role of the central bank in choosing its optimal policy will be explained in detail below.

3.7 Market Clearing Conditions

Before describing the market clearing conditions and the equilibrium, let us first to recall and then define some relative prices and real values. Let $w_t \equiv W_t/P_{ht}$ be the real wage (expressed in terms of home goods); $s_t \equiv S_t P^*_{ft}/P_{ht} = S_t/P_{ht}$ be the real exchange rate or relative price of foreign goods in terms of domestic goods;[18] and d^f_{ft}, d^f_{ht}, and d^h_{ht} be the real value of FIs' asset holdings and domestic households' foreign- and domestic-currency denominated debt holdings, respectively.

Market clearing then implies that:

$$d^f_{ft} = d^f_{ht} \tag{3.24}$$

$$d^h_{ht} = 0 \tag{3.25}$$

$$Y_{ht} = C_{ht} + G_h + X_{ht} \tag{3.26}$$

$$L_t = \int_0^1 L_{ht}(j)dj + L_{ft} \tag{3.27}$$

3.8 Imperfectly Competitive Equilibrium

Given our initial conditions, international prices $(p^*_c, P^f_f, P^*_f, r_w, r_d)$, fiscal policy $\{T_t, G_h\}^\infty_{t=0}$ and monetary policy $\{r_t\}^\infty_{t=0}$, the symmetric equilibrium is defined as the sequences of prices $\Delta_p \equiv \{r_{ft}, w_t, s_t\}^\infty_{t=0}$ and allocations $\Delta_a \equiv \left\{C_{ht}, C_{ft}, C_t, C^*_{ft}, L_{ht}, L_{ft}, B_{ft}, B_{wt}, \Omega_{ft}, K_{ft}, d^f_{ft}, d^f_{ht}, d^h_{ht}\right\}^\infty_{t=0}$, such that:

- Foreign investors maximize utility and their parent companies (the foreign-owned firms) maximize dividends subject to their budget constraints;
- Domestically-owned firms maximize dividends and set goods prices optimally;
- Households maximize their utility subject to their budget constraints;
- The monetary-fiscal authority balances its budget and sets (optimally) the monetary policy rate; and that
- Assets, goods and labor markets clear.

[18] Since the CPI-based real exchange rate is actually s^γ, without loss of generality, we let s be the real exchange rate. To verify the previous claim, recall that $P^*_{ft} = 1$, $P_{ft} = S_t P^*_{ft}$, and interpret the small-open economy assumption as a zero-share of home goods in foreign consumers' basket $(1-\gamma^* \approx 0)$. Since $P^* = (P^*_f)^{\gamma^*}(P^*_h)^{1-\gamma^*} = P^*_f$, the real exchange rate will be $SP^*/P = SP^*_f/P = (S/P_h)^\gamma$.

In other words, an equilibrium is constructed based on the set of endogenous variables that satisfies equations 3.1-3.27.[19]

3.9 Loglinearizing the Model

The model is loglinearized around its deterministic steady-state equilibrium. The equations that characterize the steady-state equilibrium are presented in appendix 6.2. For any variable in the loglinearized system, "$\hat{x}_t$" denotes the log-deviation of "x_t" from its steady-state value "x". For instance, $\widehat{Y}_{ht} \equiv log(Y_{ht}/Y_h)$. Domestic and CPI inflation rates are expressed in percent changes, e.g. $\pi_{ht} \equiv p_{ht} - p_{ht-1}$. Appendix 6.3 summarizes the loglinearized model.

It is worth recalling that the solution to the model is achieved in terms of the relative prices $\widehat{s}_t \equiv log(s_t/s)$ and $\widehat{w}_t \equiv log(w_t/w)$. At this point, the loglinearized version of the model can be reduced to 14 endogenous variables $\widehat{B}_{wt}$, $\widehat{B}_{ft}$, $\widehat{K}_{ft}$, $\widehat{D}_{ft}$, $\widehat{Y}_{ht}$, π_t, $\widehat{w}_t$, $\widehat{C}_t$, $\widehat{s}_t$, π_{ht}, $\widehat{C}^*_{ft}$, $\widehat{L}_{ft}$, $\widehat{R}_{ft}$, and $\widehat{R}_t$, where π stands for the CPI inflation rate (i.e. equation 3.10 expressed in percent changes). In addition, there are three exogenous stochastic processes for $\widehat{X}_t$, $\widehat{A}_{ft}$, and $\widehat{A}_{ht}$ given by the log-linear versions of equations 3.22, 3.7, and 3.17, respectively. The rest of endogenous variables ($\widehat{\Omega}_{ft}$, $\widehat{\Pi}_{ft}, \widehat{C}_{ht}$, $\widehat{C}_{ft}$, $\widehat{L}_t$, $\widehat{L}_{ht}$, $\widehat{X}_{ht}$, among others) can then be expressed as functions of the initial 14 variables and the exogenous shocks.

Let $\widehat{x}_{1t}$ and $\widehat{x}_{2t}$ denote the vectors of backward- and forward-looking variables, respectively. It is convenient then to rewrite the loglinearized model in its state-space form:

$$H_x \begin{bmatrix} \widehat{x}_{1t+1} \\ E_t\widehat{x}_{2t+1} \end{bmatrix} = A_x \begin{bmatrix} \widehat{x}_{1t} \\ \widehat{x}_{2t} \end{bmatrix} + B_R\widehat{R}_t + \begin{bmatrix} \xi_{t+1} \\ \mathbf{0} \end{bmatrix} \tag{3.28}$$

where $\widehat{x}_{1t} \equiv \left(\widehat{B}_{wt-1}, \widehat{B}_{ft-1}, \widehat{K}_{ft-1}, \widehat{D}_{ft-1}, \widehat{Y}_{ht-1}, \pi_{t-1}, \widehat{w}_{t-1}, \widehat{C}_{t-1}, \widehat{X}_t, \hat{A}_{ft}, \hat{A}_{ht}, \widehat{s}_{t-1}\right)'$,

$\widehat{x}_{2t} \equiv \left(\widehat{s}_t, \pi_{ht}, \widehat{C}^*_{ft}, \widehat{L}_{ft}, \widehat{R}_{ft}\right)'$, ξ_t is a vector that contains zeros and the shocks $\left(\xi_{xt}, \xi_{ft}, \xi_{ht}\right)'$, $\mathbf{0}$ stands for a vector of zeros whose size is the same as vector $\widehat{x}_{2t}$, and H_x, A_x, B_R are matrices whose elements are constant functions of the structural parameters of the model.

3.10 Monetary Policy

The model considers the case of a discretionary monetary policy by which the central bank (CB) minimizes a loss function period by period. That is, it makes an optimal decision each period without committing to any future action. Let Y denote total output (the sum of domestic- and foreign-owned firms' production), the CB's expected loss function is given by:

$$(1/2)E_t \sum_{\tau=0}^{\infty} \beta^\tau \left[\pi^2_{ht+\tau} + \psi_y \widehat{Y}^2_{t+\tau} + \psi_S \left(\Delta S_{t+\tau}\right)^2\right] \tag{3.29}$$

where $\widehat{Y}$ and π_h are expressed as (log-)deviations from steady-state values, $\Delta S \equiv \log(S_t/S_{t-1})$ stands for nominal depreciation rate, and ψ_y and ψ_S represent the (relative) weights of output gap and nominal

[19] To be precise, we should also include an equation for the CB's optimal behavior to pin down the interest rate. This will be given by a feedback rule derived from the problem to be described in the next two subsections.

depreciation rate in the loss function. This can be seen as a standard loss function for the analysis of EMEs (see Céspedes *et al.*, 2002, for a similar functional form in the case of a SOE model).[20] The inclusion of nominal depreciation rate in the loss function captures the fact that central banks in EMEs tend to intervene in the foreign exchange market and follow a dirty or managed float exchange rate. The CB pursues its objective by controlling R subject to the set of equations given by 3.28.

4 Main Results

4.1 The Exercise

In this section we describe briefly the solution and the calibration of the model followed by the main results and the characterization of the steady-state equilibrium. The exercise basically consists of computing three simulated statistics:

(1) the output-interest rate correlation denoted by $\rho_{Y,R}$,

(2) the standard deviation of output σ_Y, and

(3) the standard deviation of the interest rate σ_R,

and analyzing how these depend on the level of institutional quality (Q).

4.2 Solution

The solution of the model is achieved via standard numerical methods for linear quadratic problems. In particular, we follow Söderlind (1999) to find the optimal policy and the rational expectations equilibrium. For simplicity, we assume that partial confiscation does not occur in equilibrium. Since the state of the economy is summarized by the predetermined variables $\widehat{x}_{1t}$, the solution consists of a linear decision rule and non-predetermined variable rules of the form

$$\widehat{R}_t = -F_x \widehat{x}_{1t}$$

and

$$\widehat{x}_{2t} = C_x \widehat{x}_{1t},$$

in which the state variables evolve according to

$$\widehat{x}_{1t+1} = M_x \widehat{x}_{1t} + \xi_{t+1},$$

and F_x, C_x, and M_x are matrices whose elements are constant functions of the deep parameters of the model.

[20] The difference is that in such a work the level –but not the change– of the real exchange rate is included in the loss function. It is also worth adding that Galí and Monacelli (2005) derive a loss function that depends on domestic inflation and output in a SOE.

4.3 Calibration

To solve the model, initially, the values of the structural parameters are assigned. The parameterization is summarized in table 5. Two basic criteria for parameterizing the model are adopted. First, we use some of the standard parameter values given in previous studies for small open economies, in particular, EMEs.[21] Among the developing economies, Indonesia is chosen because it shows the lowest correlation in our sample. Thus, the second criterion is to calibrate some parameters to match certain features of the Indonesia data.

The parameters related to portfolio adjustment costs are set as follows: $\overline{B}_w = 5.85, \overline{B}_f = 0.08, \psi_w = \psi_f = 0.001$. These values are chosen such that the total debt is matched at 98% of GDP, FDI stocks are 8% of GDP, and debt liabilities are 90% of GDP. The steady-state fraction of FIs' portfolio allocated in the SOE is the same as the one allocated in the rest of the world ($\frac{B_f}{\Omega_f} = \frac{B_w}{\Omega_f}$).

Since there is not an obvious functional relationship between our empirical proxy of institutional quality (the ICRG index) and our theoretical proxy of institutional quality ($Q = q + \phi(1-q)$), we set the initial value of Q by simply assuming a one-to-one mapping between Q and the ICRG expressed in percentage points. Since the empirically relevant range of values of the ICRG is above 50 points, we set $\phi = 0.5$ and let q vary between 0 and 1. This produces values of Q in the upper half of the unit interval. Therefore, the first value of Q, slightly above 50 points, is consistent with the average ICRG for Indonesia during the 1997-2004 period.

The other values are obtained from standard estimates or calibrated values in the literature. For example, the capital-share parameter α_k is set equal to 0.35, the labor share α_l is 0.55, the depreciation δ rate is assumed at a value of 0.025 (as in Devereux *et al.*, 2006), and the subjective discount factor β is assumed to be 0.99. The steady-state interest rate is $r = r_d = 1.1\%$ per quarter, slightly above the world interest rate $r_w = 1\%$, which implies a constant risk premium of 0.1%.[22] A similar figure is also used in Devereux *et al.*(2006) in a study on EMEs.

To characterize the stochastic properties of the exogenous shocks, we assume that $\rho_x = \rho_{ah} = \rho_{af} = 0.6$ (close to Tovar (2005) and Galí and Monacelli (2005) estimates), $\sigma_x = 0.037$, and $\sigma_{ah} = \sigma_{af} = 0.005$. The latter values allow us to match the variability of output and interest rates. We set the value of the degree of price stickiness θ at 0.6. As in Galí and Monacelli (2005), the price elasticity $\vartheta = 6$ (which implies a steady-state mark-up of 20%), the coefficient of risk aversion is the same for domestic and foreign agents, $\chi_h = \chi_f = 2$, and the parameter related to labor in the utility function ν is 2 as well.

Following Céspedes *et al.* (2004), and Devereux *et al.*(2006), we set the share of home goods in households' consumption basket at 0.75. On the other hand, the value of G_h at 0.08 implies a government spending share around 8%. Finally, the relative weights of output deviations and nominal depreciations in the central banks' loss function ψ_y and ψ_S are fixed at 0.5 and 0.06 respectively. The first value is also used in Céspedes *et al.* (2002). Even though, the second value is helpful to observe output-interest-rate correlations consistent with the Indonesian data, the lack of estimates in the literature leads us to perform some sensitivity checks to verify the robustness of our main results (see section 4.6).

[21] The parameterization basically draws on values from Céspedes *et al.*(2000), Choi and Cook (2004), Cook (2004), and Devereux *et al.*(2006).

[22] Recall also that the inflation rate is zero in steady-state, so the long-run real and nominal interest rates are the same.

4.4 Model Implied Statistics

From a quantitative perspective, the model shows a reasonable approximation to the sample variance-covariance matrix of both Indonesia and Switzerland, the economies with the lowest and highest output-interest rate correlation, respectively. A simple exercise is performed to see if the model is potentially useful to match the main moments under analysis. The exercise consists of changing (only) Q from the value used to calibrate Indonesian data up to the value that matches the output-interest rate correlation for Switzerland. The model is able to do an adequate job in matching the sample variance-covariance matrix for the Indonesian economy. It also offers an appropriate approximation of the moments for Switzerland by explaining a high portion of the volatility in that country, as shown in table 6.

From a qualitative perspective, the model also predicts the three empirical relationships, that is, that $\rho_{Y,R}$ tends to be higher and positive in economies with stronger institutions, while σ_Y and σ_R tend to be lower in those countries as well. Given the parameter values that allow us to replicate Indonesian statistics, we try to find out whether changes only in Q could help us to obtain the signs of the relationships mentioned before. Thus, Q is raised and the three statistics are plotted for each of the values obtained from the simulation. Figure 2 summarizes this exercise. The results are the following:

Result 1. An increase in Q tends to increase $\rho_{Y,R}$. The first graph in figure 2 plots the simulated correlation between total output and the interest rate for different levels of institutional quality (Q). The statistic is measured on the vertical axis, while Q varies over the horizontal axis. As we can see, with relatively low institutional quality levels, the correlation is negative. When institutions are sufficiently strong, the correlation turns to positive values. The cut-off value obtained is around 0.575. For the sake of exposition, from now on, we define as low (high) institutional quality any value of Q below (above) 0.575.

Result 2. An increase in Q tends to decrease σ_Y. The second graph in figure 2 verifies this result. As Q goes up, the standard deviation of total output tends to fall. There are only small intervals in which the inverse link between the simulated statistic and Q does not fully hold.

Result 3. An increase in Q tends to decrease σ_R. Finally, the third graph in figure 3 displays this result. As Q increases the standard deviation of the nominal interest rate set by the CB shows a tendency to fall.

4.5 Characterization of the Steady-State Equilibrium

Before presenting the model dynamics to obtain additional intuition surrounding these results, we provide a brief characterization of the steady-state equilibrium of some relevant variables for a low and a high level of institutional quality. Figure 3 plots the long-run values of (i) FDI as a percentage of FIs' total portfolio (K_f/B_f), (ii) total FDI liabilities (K_f), (iii) debt liabilities (loans in foreign currency to domestic consumers, D_f^f), (iv) debt liabilities as a percentage of total consumption (D_f^f/C), (v) the real exchange rate (s), and (vi) total output ($Y = sY_f + Y_h$).

First, we can observe that a country with higher institutional quality shows a higher ratio K_f/B_f. That is, the productivity of physical capital is higher and FIs tend to recompose their portfolios toward FDI. It is worth pointing out that there exists evidence that indicates that institutional quality indexes are directly linked to the composition of capital flows (especially FDI-to-loans or FDI-to-total-liabilities

ratios).[23] Another key aspect of the model to highlight is related to debt liabilities (D_f^f). Since economies with better institutions are more profitable from a FI's viewpoint (higher R_f), FIs' total portfolio size is larger in those economies and, in turn, loans in foreign currency to domestic consumers are larger as well. That is, not only FDI liabilities but also debt liabilities are higher in an economy with high institutional quality. Note also that the debt-to-consumption ratio (D_f^f/C) is higher under high institutional quality. This implication is relevant in explaining the main results shown before.[24]

Second, we also note that total output (Y) expands as institutions improve. This is basically the result of the expansion of foreign-owned firms' activities. Similarly, total consumption increases as a consequence of the higher income in the economy. Consistent with the increase in aggregate demand, the real exchange rate (s) falls (real appreciation).

4.6 Model Dynamics

4.6.1 Impulse Responses

Figures 4-6 plot the impulse responses when there is a one-percent shock of: (1) the external demand for home goods, (2) productivity in the domestically-owned sector, and (3) productivity in the foreign-owned sector.

External Demand for Home Goods

Figures 4A and 4B show the effects of a positive export shock when the economy is characterized by low and high institutional quality, respectively. The first row of each figure presents the plots for total output (domestic- and foreign-owned firms' production) and the nominal interest rate set by the central bank. There is an increase in output due to the rise in external demand for home goods. Higher demand for home goods are accompanied with a real appreciation (i.e., an increase in the relative price of home goods). The real appreciation operates through two opposite channels. One the one hand, it directly generates incentives for a labor supply expansion, and on the other, it reduces the real value of debt denominated in foreign currency and thus causes a labor supply contraction. When IQ is low, the steady-state debt liabilities of the economy are relatively low since poor institutional quality discourages the levels of both FDI and loans to domestic consumers. This implies that the reduction of the real value of debt caused by the real appreciation is smaller. Given this low wealth effect, the first channel dominates. The real appreciation also entails a nominal appreciation because of the presence of price rigidities in the economy. This fact implies a lower consumer price level and a higher incentive to work (i.e., a higher opportunity cost of leisure). Thus, there is an expansion of the labor supply and hence real wages, expressed in terms of home goods, drop. As a result, marginal costs and domestic inflation diminish, especially during the impact period ($t = 0$). This leads to a cut in the nominal interest rate

[23] Wei (2000) reports a significant relationship between the ratio of bank loans to FDI flows and indexes of corruption for a set of developing and developed economies, spanning from 1994 to 1996. As Shleifer (2000) properly pointed out, the indexes used by Wei might be capturing other aspects of low institutional quality, such as, poor security of property rights or poor quality of the judiciary. Wei (2006) confirms his previous results for a larger dataset controlling for the possibility of endogeneity. There is also evidence that institutions promotes FDI inflows in levels (Alfaro, *et al.* 2005a,b; Bussea and Hefeker, 2007). For instance, in a cross section of EMEs and other developing countries, Faria and Mauro (2008) find that equity-like liabilities (FDI and equity), as a share of countries' total external liabilities are positively and significantly associated with indicators of institutional quality. They conclude that, holding other factors constant, better institutions tilt countries' capital structures significantly away from portfolio debt and toward FDI.

[24] It is worth mentioning also that Papaioannou (2009) reports a statistically significant relationship between external bank loans and an index of institutional quality for a set of developing and developed countries.

by the central bank. The authority later raises the policy rate to stabilize output. Overall, we observe a negative comovement between the nominal interest rate and real output.[25]

Figure 4B shows that when Q is high total output and the interest rate are positively related in a stronger fashion. The rise in exports generates similar results as in the previous case except for the trajectories of wages and inflation rates. In this scenario, we observe an increase in output and a real appreciation. This, in turn, reduces the real value of debt which, in the case of high Q, is higher than the case of low Q. This wealth effect allows more consumption and leisure. Labor supply contracts and wages (expressed in terms of home goods) increase. As a consequence, domestic inflation increases in the impact period. The central bank reacts by increasing the interest rate to push demand and inflation back to their steady-state values.

Productivity Shock in the Domestically-owned Sector[26]

Figures 5A and 5B display the effects of a positive productivity shock in the domestically-owned sector when the economy is characterized by low and high institutional quality, respectively. The solution of the model implies that the optimal response of the central bank to productivity shocks is negative. In general, figures 5A and 5B illustrate that the output-interest rate comovement is negative. The increase in productivity implies lower marginal costs and a lower rate of inflation. Additionally, a rise in productivity entails a real depreciation (i.e., a decrease in the relative price of home goods) which expands the aggregate demand for domestic goods and total output. The central bank cuts the interest rate since its major concern -given its loss function and parameterization of the model- is focused on domestic inflation. The result is an inverse link between the policy rate and output. This explanation also holds for high institutional quality with the key difference that the magnitudes of the responses of output and the interest rate are higher under low institutionality (see figure 5B).

Productivity Shock in the Foreign-owned Sector

In figures 6A and 6B we can observe the responses of the variables of interest when the economy is hit by a positive productivity shock in the foreign-owned sector and the quality of institutions is low and high, respectively. This positive productivity shock can also be interpreted as a terms-of-trade shock since foreign-owned companies export all of their production of the intermediate good and face a perfectly elastic demand in the world market. The rise in productivity expands the demand for labor and increases the real wage. This generates higher consumption and output as well as inflationary pressures. Accordingly, we also observe a real appreciation, that is, a jump in the relative price of home goods. Since output and inflation are increasing, the central bank reacts by raising the policy rate. That is, the optimal response under discretion involves a direct link between the policy rate and this kind of shock. Similar dynamics are observed under high institutional quality but with a weaker comovement between the level of output and interest rate (see figure 6B).

[25] Note also that in period $t = 4$, the interest rate is above its steady-state level while output is below its long-run equilibrium. This and the impact effect suggest that the comovement between these two variables is (weakly) negative in this context or, at least, relatively weaker than the case of high institutional quality.

[26] Productivity shocks in the model might be associated with changes beyond the technological aspects of production, such as an improvement or a worsening of macroeconomic policies and reforms. We share this view with Aguiar and Gopinath (2004). In other words, changes in productivity might be capturing the implementation but also the undoing of macroeconomic reforms in EMEs.

4.6.2 Volatility and Comovement

The model predicts higher volatility in output as well as the interest rate with lower Q because (i) output reacts more sharply to productivity shocks (figures 5A and 5B), and (ii) output shows more persistence to export shocks in the domestically-owned sector (see figures 4A and 4B). Put differently, the central bank can more easily stabilize output only under high institutionality. Since shocks of the same size have a lower impact on economic activity, the variability of the central bank's policy rate also declines.

Aside from that, the model predicts a negative relationship between total output and the interest rate when Q is relatively low. The reason is twofold. First, when Q is low the steady-state value of debt liabilities and the debt-to-consumption ratio are low. This implies that the real appreciation entails a low wealth effect. Consumption falls and labor supply expands. Wages and inflation drop and the central bank reacts by cutting its policy rate, generating a procyclical monetary policy. In general, this leads to a negative relationship between output and the policy rate. Second, in this context, productivity shocks in the domestically-owned sector play also a role. Since they imply a negative link between the policy rate and output, their presence contributes to define the sign of the link between those variables. It is worth adding that productivity shocks in the foreign-owned sector do not play an important role because the foreign sector's size is relatively small in the case of weak institutionality.

4.7 Sensitivity Analysis

This sections presents sensitivity analysis to check how robust the outcomes described above are to different parameter values. This exercise is particularly necessary if we consider that EMEs, and developing countries in general, are very heterogeneous SOEs. Figures 7I through 7I display the results of changing certain values in a neighborhood of ψ_S (± 0.06), ψ_y (± 0.3), ρ_x (± 0.1), ρ_{ah} (± 0.1), ρ_{af} (± 0.1), σ_x (± 0.008), σ_{ah} (± 0.001), σ_{af} (± 0.001), and the substitution of total output by output produced by domestically-owned firms with parameter ψ_{yh} (± 0.3). Each perturbation is carried out from the values in the baseline parameterization (see table 4) leaving the rest of parameters unchanged. The next paragraphs discuss the results of these robustness checks with respect to the benchmark case shown in figure 3.

Loss Function Parameters

Figure 7A shows that the absence of a managed float regime (that is, a fully free floating regime, $\psi_S = 0$) does not change the main results from a qualitative viewpoint. The output volatility curve is higher than the one under managed floating now because the monetary authority does not smooth variations in the nominal exchange rate and, therefore, the real exchange rate fluctuations are larger. This is consistent with the higher variability of the nominal interest rate shown in the last plot of figure 7A. As a result, the output-interest correlation tends to be larger in absolute value, so that its curve is pushed down (up) towards the lower bound -1 (upper bound +1) for low (high) levels of Q.

A similar pattern is observed for the three statistics under various values of ψ_y (see figure 7B). Not surprisingly, when ψ_y is lowered, the central bank reduces its concern about output fluctuations and output volatility increases. The same figure also shows the extreme and unrealistic case in which interest volatility increases with institutional quality. Similar conclusions can be drawn from the analysis of figure 7C in which domestic production (output from domestically-owned firms) replaces total production with parameter ψ_{yh} in the loss function.

Persistence of Exogenous Shocks

Figures 7D through 7I present sensitivity to the parameters related to the persistence and volatility of the exogenous shocks $\left(\widehat{X}_t,\ \widehat{A}_{ht},\ \widehat{A}_{ft}\right)'$. Persistence of shocks to exports of home goods (ρ_x) generates a higher relative importance of these shocks in both the fluctuations of the economy and the correlation between output and the interest rate. Since the interest rate responds directly to external shocks to home goods demand, the output-interest rate correlation curve gets closer to the zero line for low values of Q. Additionally, the output volatility curve moves upwards as demand shocks become more persistent (see figure 7D). This is due to the increase in their unconditional volatility. On the other hand, the main results remain basically unaltered when the coefficients that govern productivity-shocks persistence (ρ_{ah}, ρ_{af}) are perturbed by more than 20% from their baseline values (see figures 7E and 7F).

Volatility of Exogenous Shocks

Similar results are found when the volatility of home goods exports shocks is changed (σ_x). As might be expected, the curves showing output and interest rate volatilities seem to be more affected. In particular, the interest-rate volatility curve becomes flatter over the range of values for Q (see figure 7G). Analogous outcomes can be observed in the sensitivity exercises for productivity volatilities in both sectors (see figures 7H and 7I).

To sum up, based on the plots, one can infer that in general, (i) the output-interest rate correlation displays a relatively similar S-shaped curve as in figure 3; and (ii) when institutions are poor, more negative correlations can be achieved when there are(is) lower weight of nominal depreciations or (total or domestic) output fluctuations, or less persistent external shocks to demand for home goods.

4.8 Evidence on the Transmission Mechanism

In this paper we propose an explanation that relates the quality of institution to the cyclicality of monetary policy. This relationship relies on a transmission mechanism in which the inflation rate and real wages play an important role. In this section we investigate whether there is evidence that supports the fact that both the inflation rate and real wages react negatively to a external demand shock in economies with low institutional quality but react positively in economies with good institutions.

This analysis, however, faces some data limitations that are worth mentioning. First, the identification of shocks in the external demand for home goods is one of the issues. The lack of data on exports of home goods in both developed and developing countries prevents us from using a proper empirical counterpart of the main shocks in our theoretical framework. Second, data of nominal wages are not available (from the source we use) for many developing countries, including Indonesia, as well as some industrialized countries like Switzerland. Finally, the use of small time-series samples for several developing economies might affect our analysis in terms of hypothesis testing.

That said, we opt to follow a simple analysis using total exports as a proxy of external demand for home goods and a small set of countries that report the series needed in each group per their institutional quality level. Given that Indonesia and Switzerland do not record series of wages in our data source, we extend this set by including Ecuador, Romania, Czech Republic, and Spain. Among the low-institutional-quality countries, Ecuador might work as an adequate approximation to Indonesia because it shows an average ICRG of 60.7 and an output-interest-rate correlation of -0.43 (see table 1).

Romania can also be regarded as a useful and illustrative case because its monetary policy cyclicality (correlation of -0.01) is very close to the average monetary policy cyclicality of the set of developing and emerging economies (-0.012). The cases of Czech Republic and Spain can be representative of the set of high-institutional-quality countries since their output-interest-rate correlations are similar to the median and mean, respectively, of such a group (see table 1).

For each of these countries we employ –as in section 2– the cyclical components of real exports, real GDP, the real wage (nominal wage deflated by the consumer price index; except for Indonesia and Switzerland), and the inflation rate. Using these variables, we proceed to estimate identified VAR systems for each economy. The main identification assumption consists of nullifying any contemporaneous effect of GDP, wages, and inflation rate on the equation of real exports. The objective is to try to isolate exports shocks from domestic shocks and obtain an exogenous source of variation. The number of lags in each VAR is chosen by using Akaike or Schwarz criteria provided that stability conditions are satisfied.

Figures 8a and 8b show the impulse response functions (IRFs) along with one-standard-deviation bands when there is a (positive) shock in our measure of external demand. In the case of Indonesia and Switzerland, we only report responses of GDP and the inflation rate for the reason explained above. From a qualitative viewpoint, the IRFs are consistent with the transmission mechanisms of the model. As figure 8a displays, output reacts positively while both the rate of inflation and real wages (for the cases of Ecuador and Romania) fall –at least on the impact period. Figure 8b shows the IRFs for Czech Republic, Spain, and Switzerland. These are also qualitatively consistent with the responses of the model when there is an external demand shock. At the initial period, all the variables, GDP, the inflation rate, and real wages (for Czech Republic and Spain) move in the same direction of the shock.

5 Concluding Remarks

This paper presents evidence that backs the linkage among the quality of institutions, the cyclicality of monetary policy, and the volatility of output and the nominal interest rate. Using a sample of 56 economies, the paper shows that unconditional and conditional measures of monetary cyclicality are significantly related to an institutional quality index. Alternative conjectures such as lack of either financial integration or central bank independence do not have empirical support as explained in section 2. Countries with strong institutions usually exhibit positive output-interest-rate correlations, while EMEs tend to show weak institutionality accompanied with negative (or zero) correlations. The latter fact is usually understood as a sign of procyclical (or acyclical) monetary policies. Moreover, economies with weak institutionality also show a higher volatility of output and interest rates.

This work proposes a simple model to understand these facts. Foreign investors that face institutional risk are introduced in a simple dynamic stochastic model with price rigidities and a discretionary central bank that primarily seeks to smooth inflation and output fluctuations. Foreign agents invest directly into the economy and lend to domestic households that finance consumption and other expenditures. Foreign investors also face a probability of incurring an output loss (partial confiscation) which works as a proxy of institutional quality.

For calibration purposes, Indonesia is chosen within the sample of countries because it shows the lowest average institutional quality index as well as the most negative output-interest-rate correlation. The model is parameterized to replicate some of its features, such as its external debt-to-output ratio

and FDI-liability-to-output ratios. As a result of this, it can also match the highly negative correlation between output and interest rate and its GDP volatility. From a quantitative viewpoint, the model does a satisfactory work in matching the sample variance-covariance matrix of output and the interest rate for Indonesia and Switzerland (the latter with highest positive correlation). Consistent with empirical evidence (e.g., Alfaro, *et al.* 2005a,b; Papaioannou, 2009), one of the model's prediction in the long run is that FDI and debt liabilities tend to be lower under low institutional quality.

A key model prediction is the negative relationship between total output and the nominal interest rate at relatively low levels of institutional quality. If institutions are weaker, the economy attracts less foreign investment and lending to domestic agents. Consequently, the reduction of the real value of the debt in foreign currency caused by the real appreciation is smaller than the case of high institutional quality. Given this low wealth effect, when there is an export shock, the real exchange rate drops and expands the labor supply. As a result, wages drop and inflation diminishes. The central bank reduces the policy rate to stabilize inflation. The final outcome is a negative comovement between output and interest rate. On the other hand, since the foreign-owned sector is small under weak institutionality, productivity shocks from this sector do not play a crucial role. In the domestically-owned sector, productivity shocks only contribute by reinforcing the sign of the output-interest rate comovement. In sum, the overall result is a negative link between the policy rate and output or, more generally, a lower correlation between those variables compared to the case of high institutional quality.

Any evaluation of the role that monetary policies play in countries with low institutional quality should not be restricted to the sign of the output-interest-rate comovement. Negative correlations between policy rates and output are not necessarily an indicator of destabilizing polices even in the presence of demand shocks. In this work we showed that such negative comovements can be perfectly consistent with a central bank which seeks to stabilize both inflation and output gap fluctuations in the context of weak institutionality.

6 Appendix

6.1 Data

Definitions

Output: Cyclical component of the log of real GDP (nominal GDP divided by its deflator index) at quarterly frequency. Seasonally adjusted series are used. If non-seasonally adjusted series were only available, X12 procedure was used to remove the seasonal component. Source: International Financial Statistics (IFS), International Monetary Fund (IMF).

Interest rate: Cyclical component of the log of gross nominal central bank's discount rate at quarterly frequency. Whenever the discount rate was not available, money market rates were used. Source: IFS (IMF), codes 60 and 60B.

Inflation rate: Cyclical component of the gross CPI percent change.

Currency depreciation rate: Cyclical component of the gross percent change of the nominal exchange rate (domestic currency per USD).

The cyclical components are obtained from de-trending the variables using the Hodrick-Prescott filter (or a quadratic trend filter for robustness checks).

Institutional Quality: level of the International Country Risk Guide (ICRG). The ICRG index ranges from 0 (the lowest level of institutional quality) to 100 (the highest level) and has 12 components: (a) Government Stability (with a maximum of 12 points), (b) Socioeconomic Conditions (12 points), (c) Investment Profile (12 points), (d) Internal Conflict (12 points), (e) External Conflict (12 points), (f) Corruption (6 points), (g) Military in Politics (6 points), (h) Religious Tensions (6 points), (i) Law and Order (6 points), (j) Ethnic Tensions (6 points), (k) Democratic Accountability (6 points), and (l) Bureaucracy Quality (4 points). Source: Political Risk Service (PRS) Group. The ICRG index has monthly frequency, thus figure 1 and table 1 reports average over the corresponding country's period. The description of the subindexes is as follows (based on Alfaro, *et al.* 2005a):

- Bureaucracy quality: institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize revisions of policy when governments change.
- Corruption: assessment of corruption within the political system.
- Democratic accountability: government responsiveness to people. In general, the highest number of risk points is assigned to alternating democracies, while the lowest number of risk points is assigned to autarchies.
- Ethnic tensions: degree of tension within a country attributable to racial, nationality, or language divisions.
- External conflict: the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc.) to violent external pressure (cross-border conflicts to all-out war).
- Government stability: the government's ability to carry out its declared program(s), and its ability to stay in office.

- Investment profile: factors affecting the risk to investment that are not covered by other political, economic and financial risk components. It includes: contract viability/expropriation, profits repatriation, payment delays.
- Internal conflict: political violence in the country and its actual or potential impact on governance.
- Law and order: strength and impartiality of the legal system; popular observance of the law.
- Military in politics: protection from the military involvement in politics.
- Religious tensions: protection from the religious tensions in society.
- Socioeconomic conditions: public satisfaction with economic policies.

Exchange rate regime indicator: multivalue variable constructed based on the annual database developed by Ilzetzki, Reinhart, and Rogoff (2008). Periods/countries of lack of monetary independence such as under a currency board or unilateral/multilateral currency unions are removed from the sample. Since the indicator ends in 2007, we assumed the same regime for 2008.

Financial openness (Chinn-Ito Index): it is defined as the principal component of 4 measures (including a moving average of the last 5 years) of capital control measures of the IMF. It is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.

Central bank independence index: measure proposed by Cukierman (1992) and updated by Polillo and Guillén (2005). This index is not reported for Belarus, Cyprus, Ecuador, Jamaica, Thailand, and Tunisia. Therefore, when this index is used the number of observations is reduced to 50 countries. Given the short coverage and the fact that the index does not change significantly over time, we compute the average for each country during the period of estimation (sample shown in table 1) or the closest time interval.

Sample

Developed countries: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Iceland, Israel, Italy, Japan, Korea, Malta, The Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States, and the Euro Area.

Emerging and developing countries: Argentina, Belarus, Bolivia, Botswana, Brazil, Chile, Colombia, Costa Rica, Croatia, Ecuador, Hungary, Indonesia, Jamaica, Latvia, Lithuania, Malaysia, Mexico, Morocco, Peru, The Philippines, Poland, Romania, the Russian Federation, South Africa, Thailand, Tunisia, and Turkey. The classification belongs to the IMF (see World Economic Outlook, October 2009). For the sample periods see table 1.

6.2 Non-stochastic Steady State Equilibrium

In the symmetric steady-state equilibrium, the model owns basically 26 endogenous variables denoted by C_f^*, C_h, C_f, C, R_f, Π_f, Ω_f, B_f, B_w, L, L_h, L_f, K_f, Y_f, Y_h, Π_h, D_f^f, D_h^f, d_h^h, X_h, mc, T/P_h, P/P_h w, r, and s, with $w \equiv W/P_h$ and $s \equiv S/P_h$. Now we can characterize the zero-inflation-rate equilibrium by the following equations:

$$R_f \equiv 1 + \frac{\Pi_f}{B_f} \tag{6.1}$$

$$\Omega_f = p_c^* C_f^* + B_w + B_f \tag{6.2}$$

$$\Omega_f = R_w B_w + R_f B_f - (\psi_w/2)\left(B_w - \bar{B}_w\right)^2 - (\psi_f/2)\left(B_f - \bar{B}_f\right)^2 \tag{6.3}$$

$$1 = \beta\left[R_w - \psi_w\left(B_w - \bar{B}_w\right)\right] \tag{6.4}$$

$$1 = \beta\left[R_h - \psi_f\left(B_f - \bar{B}_f\right)\right] \tag{6.5}$$

$$B_f = K_f + D_f^f \tag{6.6}$$

$$Y_f = A_f K_f^{\alpha_k} L_f^{\alpha_l} \tag{6.7}$$

$$\Pi_f = Q A_f K_f^{\alpha_k} L_f^{\alpha_l} - \delta K_f + r_d D_f^f \tag{6.8}$$

$$\alpha_k Q A_f K_f^{\alpha_k - 1} L_f^{\alpha_l} = r_d + \delta \tag{6.9}$$

$$\alpha_l Q A_f K_f^{\alpha_k} L_f^{\alpha_l - 1} = \frac{w}{s} \tag{6.10}$$

$$\frac{P}{P_h} = s^{1-\gamma} \tag{6.11}$$

$$\frac{PC + T}{P_h} + r_d s D_h^f = wL + \frac{\Pi_h}{P_h} \tag{6.12}$$

$$\nu_0 C^{\chi_h} L^{\nu - 1} = \frac{w}{s^{1-\gamma}} \tag{6.13}$$

$$1 + r = 1 + r_d = \beta^{-1} \tag{6.14}$$

$$C_h = \gamma s^{1-\gamma} C \tag{6.15}$$

$$C_f = (1-\gamma) s^{-\gamma} C \tag{6.16}$$

$$Y_h = A_h L_h \tag{6.17}$$

$$\frac{\Pi_h}{P_h} = Y_h - w L_h \tag{6.18}$$

$$w = mc A_h \tag{6.19}$$

$$mc = \frac{\vartheta - 1}{\vartheta} \tag{6.20}$$

$$X_h = s\bar{X} \tag{6.21}$$

$$T/P_h = G_h \tag{6.22}$$

$$D_f^f = D_h^f \tag{6.23}$$

$$d_h^h \equiv D_h^h / P_h = 0 \tag{6.24}$$

$$Y_h = C_h + G_h + X_h \tag{6.25}$$

$$L = L_h + L_f \tag{6.26}$$

This is a system of nonlinear multidimensional equations that is directly solved by using a trust-region dogleg algorithm.

6.3 Loglinearization

Recall that the model is loglinearized around the deterministic steady-state equilibrium and that variables like "$\hat{x}_t$" denote logdeviations of "x_t" from its steady-state value "x". Domestic and CPI inflation rates that are expressed in percent changes, e.g. $\pi_{ht} \equiv p_{ht} - p_{ht-1}$. The loglinearized model can be reduced to the following system of first-order difference equations:

$$\eta_{bf}\widehat{B}_{ft} + \eta_{bw}\widehat{B}_{wt} = \eta_{rh}\widehat{B}_{ft-1} + \eta_{rw}\widehat{B}_{wt-1} - \eta_{cf}\widehat{C}^*_{ft} + \left(\eta_{bf}R_f\right)\widehat{R}_{ft} \tag{6.27}$$

$$\widehat{R}_{ft+1} = \left(\frac{R_dB_f - \Pi_f}{R_fB_f}\right)\widehat{B}_{ft-1} - R_f^{-1}\widehat{B}_{ft} - \frac{\alpha_l QY_f}{R_fB_f}(\widehat{w}_t - \widehat{s}_t) + \frac{QY_f}{R_fB_f}\widehat{A}_{ft} \tag{6.28}$$

$$\widehat{B}_{ft} = \frac{K_f}{B_f}\widehat{K}_{ft} + \frac{D_f}{B_f}\widehat{D}^f_{ft} \tag{6.29}$$

$$\eta_{tb}\widehat{D}^f_{ft} = (\eta_{tb}R_d)\,\widehat{D}^f_{ft-1} + r_d\left[\eta_{tb} + (1-\gamma)\eta_c\right]\widehat{s}_t - r_d\left[\widehat{Y}_{ht} + \eta_{lf}\left(\widehat{w}_t + \widehat{L}_{ft}\right) - \eta_c\widehat{C}_t\right] \tag{6.30}$$

$$\widehat{Y}_{ht} = \frac{C_h}{Y_h}\widehat{C}_t + \left[\frac{(1-\gamma)C_h + X_h}{Y_h}\right]\widehat{s}_t + \frac{X_h}{Y_h}\widehat{X}_t \tag{6.31}$$

$$\pi_t = \pi_{ht} + (1-\gamma)\Delta\widehat{s}_t \tag{6.32}$$

$$\alpha_k\widehat{K}_{ft-1} + (\alpha_l - 1)\widehat{L}_{ft} + \widehat{A}_{ft} = (\widehat{w}_t - \widehat{s}_t) \tag{6.33}$$

$$(\upsilon - 1)\left[\frac{L_h}{L}\left(\widehat{Y}_{ht} - \widehat{A}_{ht}\right) + \frac{L_f}{L}\widehat{L}_{ft}\right] + \chi_h\widehat{C}_t = \widehat{w}_t - (1-\gamma)\widehat{s}_t \tag{6.34}$$

$$\widehat{X}_t = \rho_x\widehat{X}_{t-1} + \xi_{xt} \tag{6.35}$$

$$\widehat{A}_{ft} = \rho_{af}\widehat{A}_{ft-1} + \xi_{ft} \tag{6.36}$$

$$\widehat{A}_{ht} = \rho_{ah}\widehat{A}_{ht-1} + \xi_{ht} \tag{6.37}$$

$$\widehat{s}_t = E_t\widehat{s}_{t+1} - \widehat{R}_t + E_t\pi_{ht+1} \tag{6.38}$$

$$\pi_{ht} = \beta E_t\pi_{ht+1} + \psi_{mc}\left(\widehat{w}_t - \widehat{A}_{ht}\right) \tag{6.39}$$

$$\chi_f\widehat{C}^*_{ft} = \chi_f E_t\widehat{C}^*_{ft+1} - (\beta\psi_w B_w)\widehat{B}_{wt} \tag{6.40}$$

$$\alpha_l E_t \widehat{L}_{ft+1} - E_t \widehat{A}_{ft+1} = (1-\alpha_k)\widehat{K}_{ft} \tag{6.41}$$

$$E_t \widehat{R}_{ft+1} = \left(\frac{\psi_f B_f}{R_f}\right)\widehat{B}_{ft} - \left(\frac{\psi_w B_w}{R_f}\right)\widehat{B}_{wt} \tag{6.42}$$

where $\eta_{bf} \equiv \frac{B_f}{\Omega_f}, \eta_{bw} \equiv \frac{B_w}{\Omega_f}, \eta_{rf} \equiv \left[R_f - \psi_f(B_f - \bar{B}_f)\right]\eta_{bf}, \eta_{rw} \equiv \left[R_w - \psi_w(B_w - \bar{B}_w)\right]\eta_{bw}$, $\eta_{cf} \equiv 1 - \eta_{bw} - \eta_{bf}, \eta_{tb} \equiv \frac{tb}{Y_h}, tb \equiv Y_h + wL_f - \frac{P}{P_h}C - G_h, \eta_c \equiv \frac{PC}{P_h Y_h}, \eta_{lf} \equiv \frac{wL_f}{Y_h}, \psi_{mc} \equiv \frac{(1-\theta)(1-\beta\theta)}{\theta}$. The loglinearized model in its state-space form is

$$H_x \begin{bmatrix} \hat{x}_{1t+1} \\ E_t \hat{x}_{2t+1} \end{bmatrix} = A_x \begin{bmatrix} \hat{x}_{1t} \\ \hat{x}_{2t} \end{bmatrix} + B_x \hat{R}_t + \begin{bmatrix} \xi_{t+1} \\ \mathbf{0} \end{bmatrix} \tag{6.43}$$

where $\widehat{x}_{1t} \equiv \left(\widehat{B}_{wt-1}, \widehat{B}_{ft-1}, \widehat{K}_{ft-1}, \widehat{D}_{ft-1}, \widehat{Y}_{ht-1}, \pi_{t-1}, \widehat{w}_{t-1}, \widehat{C}_{t-1}, \widehat{X}_t, \hat{A}_{ft}, \hat{A}_{ht}, \widehat{s}_{t-1}\right)'$, $\widehat{x}_{2t} \equiv \left(\widehat{s}_t, \pi_{ht}, \widehat{C}^*_{ft}, \widehat{L}_{ft}, \widehat{R}_{ft}\right)'$, be the control variable, ξ_t is a vector that contains zeros and the shocks $\left(\xi_{xt}, \xi_{ft}, \xi_{ht}\right)'$, $\mathbf{0}$ stands for a vector of zeros whose size is the same as vector x_{2t}, and H_x, A_x, B_x are matrices of coefficients.

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Table 1. Interest-Rate-Output Correlation, Output Volatility, Interest Rate Volatility, and ICRG Average

Country	Classification	Sample	Corr(Y,R)	SD(Y)	SD(R)	Mean(ICRG)
Argentina	EDC	02.I-08.IV	0.19	4.21	8.95	66.1
Australia	DC	84.I-08.IV	0.45	1.09	1.45	83.8
Austria	DC	84.I-98.IV	0.17	4.31	0.73	86.3
Belarus	EDC	98.II-08.IV	-0.10	10.46	14.59	60.9
Belgium	DC	84.I-98.IV	0.19	2.52	0.86	80.3
Bolivia	EDC	96.I-08.IV	0.03	4.69	1.31	63.5
Botswana	EDC	96.I-08.IV	0.18	4.87	0.42	76.2
Brazil	EDC	96.III-08.IV	-0.24	2.49	4.55	66.1
Canada	DC	84.I-08.IV	0.64	1.25	1.21	84.6
Chile	EDC	96.I-08.IV	-0.07	2.38	2.00	78.1
Colombia	EDC	94.I-08.IV	0.26	1.83	2.85	54.9
Costa Rica	EDC	00.I-08.IV	-0.17	2.44	2.07	74.7
Croatia	EDC	98.IV-08.IV	-0.19	4.66	0.89	72.8
Cyprus	DC	95.I-07.IV	0.08	3.74	0.40	78.0
Czech Republic	DC	94.I-08.IV	0.22	3.38	1.56	79.5
Denmark	DC	84.I-08.IV	-0.04	2.51	0.69	87.2
Ecuador	EDC	91.I-99.IV	-0.43	2.09	5.64	60.7
Euro Area	DC	99.I-08.IV	0.90	0.93	0.69	85.1
Finland	DC	84.I-98.IV	0.09	4.64	0.67	87.6
France	DC	84.I-98.IV	0.62	0.82	0.79	79.3
Germany	DC	91.I-98.IV	-0.12	0.75	0.70	81.2
Hungary	EDC	95.I-08.IV	0.13	5.02	1.19	80.3
Iceland	DC	97.I-08.IV	0.14	3.32	1.32	89.8
Indonesia	EDC	97.I-08.IV	-0.53	3.66	7.15	52.3
Israel	DC	84.I-08.IV	-0.01	2.16	18.09	57.7
Italy	DC	84.I-98.IV	0.47	1.14	1.03	76.6
Jamaica	EDC	98.I-08.IV	0.07	0.99	3.37	73.1
Japan	DC	84.I-08.IV	0.51	1.35	0.63	83.7
Korea, Republic of	DC	84.I-08.IV	0.14	6.70	0.47	72.2
Latvia	EDC	98.IV-08.IV	0.12	6.70	0.29	73.7
Lithuania	EDC	02.I-08.IV	0.24	5.44	0.45	76.0
Malaysia	EDC	91.I-98.IV	0.34	4.66	1.16	74.4
Malta	DC	96.I-07.III	0.13	4.61	0.27	85.9
Mexico	EDC	84.I-08.IV	-0.30	3.07	8.23	69.5
Morocco	EDC	94.I-08.IV	0.11	3.07	0.18	70.4
Netherlands, the	DC	84.I-98.IV	0.34	0.78	0.91	87.2
New Zealand	DC	87.II-08.IV	0.40	1.41	1.19	85.9
Norway	DC	84.I-08.IV	0.05	2.87	1.05	86.9
Peru	EDC	84.I-08.IV	-0.25	6.60	46.49	53.3
Philippines, the	EDC	84.I-06.III	0.04	6.06	1.63	56.6
Poland	EDC	95.I-08.IV	0.08	5.40	2.08	78.5
Portugal	DC	84.I-98.IV	0.20	1.43	2.43	75.8
Romania	EDC	98.I-08.IV	-0.01	20.85	2.59	69.8
Russian Federation	EDC	95.I-08.IV	-0.05	6.98	10.46	61.5
Singapore	DC	03.I-08.IV	0.49	2.64	0.71	84.5
Slovak Republic	DC	93.I-08.IV	0.00	3.96	0.76	77.0
Slovenia	DC	98.IV-06.IV	0.13	2.25	1.10	80.6
South Africa	EDC	84.I-08.IV	0.41	1.37	1.95	64.8
Spain	DC	84.I-98.IV	0.28	1.38	1.45	73.0
Sweden	DC	84.I-08.IV	0.04	5.90	1.03	86.8
Switzerland	DC	84.I-08.IV	0.69	1.07	0.78	90.0
Thailand	EDC	93.I-08.IV	-0.06	4.48	1.44	67.6
Tunisia	EDC	00.I-07.IV	-0.05	1.00	0.21	73.0
Turkey	EDC	87.I-07.IV	-0.07	13.00	3.53	57.4
United Kingdom	DC	84.I-08.IV	0.24	1.09	1.28	83.0
United States	DC	84.I-08.IV	0.60	0.92	1.07	82.3
Developed Countries (DC)						
Min			-0.12	0.75	0.27	57.7
Mean			0.28	2.44	1.56	81.8
Median			0.20	2.16	0.91	83.7
Max			0.90	6.70	18.09	90.0
Emerging and Developing Countries (EDC)						
Min			-0.533	0.99	0.18	52.3
Mean			-0.012	5.13	5.03	67.6
Median			-0.014	4.66	2.07	69.5
Max			0.407	20.85	46.49	80.3

Notation: R stands for the (logged) gross nominal discount or interbank interest rate, Y denotes (logged) real seasonal-adjusted GDP, ICRG is the International Country Risk Guide. Interest rates and GDP series are HP detrended. Classification of countries per World Economics Outlook Database (IMF, October 2009). Sources: IFS-IMF, PRS Group; author's elaboration.

Table 2. Cross Section Regressions for Unconditional Correlations and Volatilities and Institutional Quality
Dependent Variables: CORR(Y,R), SD(Y), and SD(R)
Sample: 56 countries

I. Regression of Output-Interest Rate Comovement	(1)		(2)		(3)		(4)	
Dependent variable: CORR(Y,R)	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter
Regressor								
Institutional quality (ICRG)	0.015	0.013					0.012	0.013
standard error	0.002	0.003					0.004	0.004
p-value	0.000	0.000					0.002	0.005
Financial openness			0.097	0.074			0.022	-0.009
standard error			0.025	0.028			0.035	0.034
p-value			0.000	0.011			0.537	0.799
Central bank independence					-0.018	0.150	0.035	0.227
standard error					0.232	0.274	0.219	0.255
p-value					0.939	0.587	0.873	0.377
Akaike criterion	-0.016	0.335	0.142	0.448	0.336	0.527	0.113	0.429
Schwarz criterion	0.056	0.407	0.215	0.520	0.413	0.603	0.266	0.582
No. observations	56	56	56	56	50	50	50	50

II. Regression of Output Volatility	(1)		(2)		(3)		(4)	
Dependent variable: SD(Y)	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter
Regressor								
Institutional quality (ICRG)	-0.001	-0.001					-0.001	-0.001
standard error	0.0005	0.0004					0.0005	0.000
p-value	0.016	0.016					0.084	0.055
Financial openness			-0.009	-0.008			-0.004	-0.003
standard error			0.003	0.003			0.004	0.003
p-value			0.006	0.010			0.227	0.404
Central bank independence					-0.016	-0.020	-0.017	-0.023
standard error					0.025	0.026	0.024	0.024
p-value					0.528	0.449	0.480	0.343
Akaike criterion	-4.013	-4.027	-4.001	-3.998	-3.879	-3.907	-3.944	-3.967
Schwarz criterion	-3.941	-3.954	-3.929	-3.926	-3.803	-3.830	-3.791	-3.814
No. observations	56	56	56	56	50	50	50	50

III. Regression of Interest Rate Volatility	(1)		(2)		(3)		(4)	
Dependent variable: SD(R)	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter	HP filter	QT filter
Regressor								
Institutional quality (ICRG)	-0.004	-0.005					-0.005	-0.007
standard error	0.001	0.002					0.002	0.003
p-value	0.005	0.009					0.037	0.039
Financial openness			-0.010	-0.013			0.016	0.024
standard error			0.005	0.006			0.014	0.021
p-value			0.026	0.026			0.275	0.253
Central bank independence					0.079	0.110	0.041	0.056
standard error					0.053	0.077	0.024	0.036
p-value					0.146	0.156	0.095	0.125
Akaike criterion	-2.812	-2.044	-2.507	-1.773	-2.448	-1.697	-2.740	-1.958
Schwarz criterion	-2.740	-1.972	-2.435	-1.701	-2.371	-1.620	-2.587	-1.805
No. observations	56	56	56	56	50	50	50	50

Notes: Newey-West HAC t-statistics and p-values are reported below estimates. SD(Y) and SD(R) expressed in percent points. Notation: HP denotes Hodrick-Prescott filter, QT stands for quadratic trend filter; see also notes in table 1. Regressions in columns I are baseline regressions as shown in figures of section 2. Regressions in columns 2 and 3 are the ones either on the financial openness index proposed by Chinn and Ito (2007) or the central bank independence index proposed by Cukierman (1992) and extended by Polillo and Guillen (2005), respectively. Since this index is not reported for Belarus, Cyprus, Ecuador, Jamaica, Thailand and Tunisia, the number of observations is reduced to 50 countries.

Table 3. Cross Section Regressions for Conditional Interest Rate-Output Comovement and Institutional Quality

Dependent variable: Output coefficient from a Taylor Rule estimated by TSLS

Sample: 56 countries

Regressor	(1) HP filter	(1) QT filter	(2) HP filter	(2) QT filter	(3) HP filter	(3) QT filter	(4) HP filter	(4) QT filter
Institutional quality (ICRG)	0.017	0.015					0.024	0.019
standard error	0.010	0.008					0.014	0.011
p-value	0.080	0.055					0.089	0.075
Financial openness			0.058	0.060			-0.115	-0.083
standard error			0.057	0.054			0.099	0.082
p-value			0.312	0.271			0.250	0.315
Central bank independence					0.263	0.298	0.484	0.468
standard error					0.440	0.352	0.413	0.356
p-value					0.553	0.401	0.247	0.195
Statistics								
Akaike criterion	1.922	1.622	1.990	1.690	2.070	1.718	2.062	1.717
Schwarz criterion	1.995	1.694	2.062	1.762	2.147	1.794	2.214	1.870
No. observations	56	56	56	56	50	50	50	50

Notes: Newey-West HAC t-statistics and p-values are reported below estimates.Notation: HP denotes Hodrick-Prescott filter, QT stands for quadratic trend filter; see also notes in table 1. Dependent variable is the output coefficient in a Taylor rule regression that also includes inflation deviations from its long-run value for each country. Such a regression is estimated using Two-Stage Least Squares (TSLS) and lags of the regressors and dependent variable as instruments. Regressions in columns 2 and 3 are the ones against either the financial openness index proposed by Chinn and Ito (2007) or the central bank independence index proposed by Cukierman (1992) and extended by Polillo and Guillen (2005), respectively. Since this index is not reported for Belarus, Cyprus, Ecuador, Jamaica, Thailand and Tunisia, the number of observations is reduced to 50 countries.

Table 4. Panel Data Regressions for the Cyclical Degree of Monetary Policy

Dependent Variable: Cyclical component of nominal interest rate

Estimation Methods: LS and GMM

Sample: 56 countries, 1984.1-2008.4

Regressors	(1) LS		(2) GMM IV Set 1		(3) GMM IV Set 2		(4) GMM IV Set 3	
Inflation rate (deviation from its long-run value)	0.386	0.401	1.921	2.031	1.870	3.027	1.601	2.429
standard error	0.036	0.038	0.383	1.331	0.418	0.819	0.348	0.768
p-value	0.000	0.000	0.000	0.127	0.000	0.000	0.000	0.002
Output gap	-0.073	-0.006	-6.811	-6.875	-8.411	-6.804	-8.414	-7.549
standard error	0.038	0.005	2.981	3.109	2.810	2.814	2.784	2.746
p-value	0.052	0.235	0.022	0.027	0.003	0.016	0.003	0.006
Output gap x Institutional Quality Index (ICRG)	0.001	0.001	0.110	0.111	0.133	0.109	0.132	0.119
standard error	0.000	0.001	0.046	0.048	0.044	0.044	0.044	0.043
p-value	0.003	0.004	0.017	0.021	0.002	0.013	0.002	0.006
Currency depreciation (deviation from its long-run value)	…	-0.006	…	-0.088	…	-0.979	…	-0.801
standard error	…	0.005	…	1.070	…	0.579	…	0.616
p-value	…	0.235	…	0.934	…	0.091	…	0.194
Statistics								
F-statistic (1)	88.054	68.722	…	…	…	…	…	…
p-value	0.000	0.000	…	…	…	…	…	…
F-statistic (2)	39.830	37.845	4.190	4.148	4.728	3.586	4.641	3.864
p-value	0.000	0.000	0.015	0.016	0.009	0.028	0.010	0.021
J-statistic	…	…	0.125	0.115	3.376	1.171	3.975	4.048
p-value	…	…	0.989	0.990	0.497	0.883	0.553	0.543
Sum of squared residuals	23.885	23.819	41.176	41.624	46.087	47.582	43.059	44.068
Average number of periods	62	62	61	61	60	60	60	60
No. observations	3459	3459	3403	3403	3350	3350	3347	3347
Acyclical-Policy Index (ICRG*)	49.6	3.9	62.1	62.2	63.2	62.5	63.6	63.5

HP filters were used to extract the cyclical components of the interest rate, output, inflation rate, and currency depreciation. GMM estimations were performed using White diagonal instrument weighting matrix. Instrumental variables are sets composed of lagged regressors. Set 1 is composed of {R(t-1), π(t-1), Y(t-1), Y(t-2), Q(t-1), Q(t-2)}, where the variables R, π, and Y denote cyclical components of the interest rate, the inflation rate, and output; while Q is the institutional quality index (ICRG). Set 2 is composed of Set 1 and π(t-2). Set 3 is composed of Set 2 and R(t-2). LS estimates were obtained by linear estimation after one-step weighting matrix. White standard errors and covariances were used to compute t-statistics and p-values. F-statistic (1) is related to the null that all the slope parameters are nonsignificant. F-statistic (2) is related to the null that only the second and third slope parameters are nonsignificant. The acyclical-policy index (ICRG*) results from dividing the negative of the coefficient of the output gap by the coefficient of the multiplicative term (Output gap x Institutional Quality Index).

Table 5. Parameter Values of Baseline Model

Parameter/variable	Symbol	Value
Foreign investors		
Coefficient of risk aversion	χ_f	2
Subjective discount factor	β	0.99
Portfolio adjustment cost parameter (assets in SOE)	$\bar{B}_f$	5.85
Portfolio adjustment cost parameter (assets in ROW)	$\bar{B}_w$	0.08
Portfolio adjustment cost parameter (SOE and ROW)	ψ_f, ψ_w	0.001
Capital share	α_k	0.35
Labor share	α_l	0.55
Depreciation rate	δ	0.025
World risk-free interest rate	r_w	0.010
Foreign-currency interest rate	r_d	0.011
Ouput loss under low institutional quality	$1-\phi$	0.5
Persistence of productivity shocks	ρ_{af}	0.6
Productivity shocks volatility	σ_{af}	0.005
Domestic-owned firms		
Degree of price stickiness	θ	0.6
Elasticity of substitution across varieties	ϑ	6
Persistence of productivity shocks	ρ_{ah}	0.6
Productivity shocks volatility	σ_{ah}	0.005
Households		
Coefficient of risk aversion	χ_h	2
Curvature parameter of labor disutility	ν	2
Parameter of labor disutility	ν_0	1
Home bias preferences	γ	0.75
External demand for home goods		
Persistence of external demand shocks	ρ_x	0.6
Foreign demand shocks volatility	σ_x	0.037
External demand shock mean	$\bar{X}$	0.2
Fiscal and Monetary Policy		
Exogenous government spending	G_h	0.08
Weight of output gap in loss function	ψ_y	0.5
Weight of currency depreciation in loss function	ψ_S	0.06

Table 6. Model Implied and Sample Statistics

	Indonesia		Switzerland	
Statistic	Model	Data	Model	Data
Output-interest-rate correlation, $\rho_{y,r}$	-0.594	-0.593	0.762	0.775
Standard deviation of output, σ_y	0.037	0.037	0.008	0.010
Standard deviation of the interest rate, σ_r	0.019	0.013	0.011	0.002

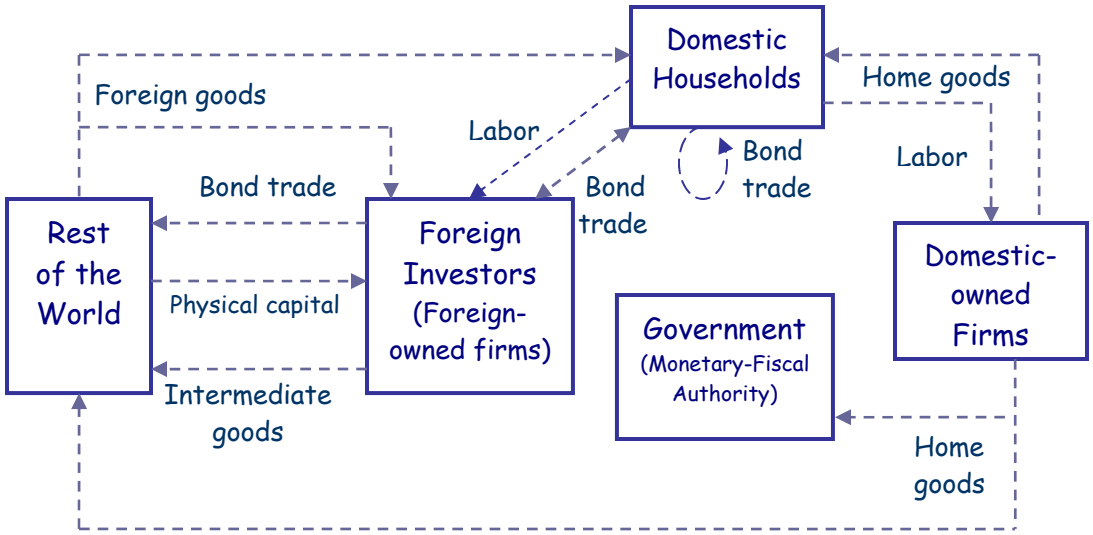


Diagram 1. Flow of goods, services and assets

Figure 1. Sample Statistics and Institutional Quality (ICRG average)
Output-Interest Rate Correlation (CORR(Y,R)), Output Volatility (SD(Y))
and Interest Rate Volatility (SD(R))

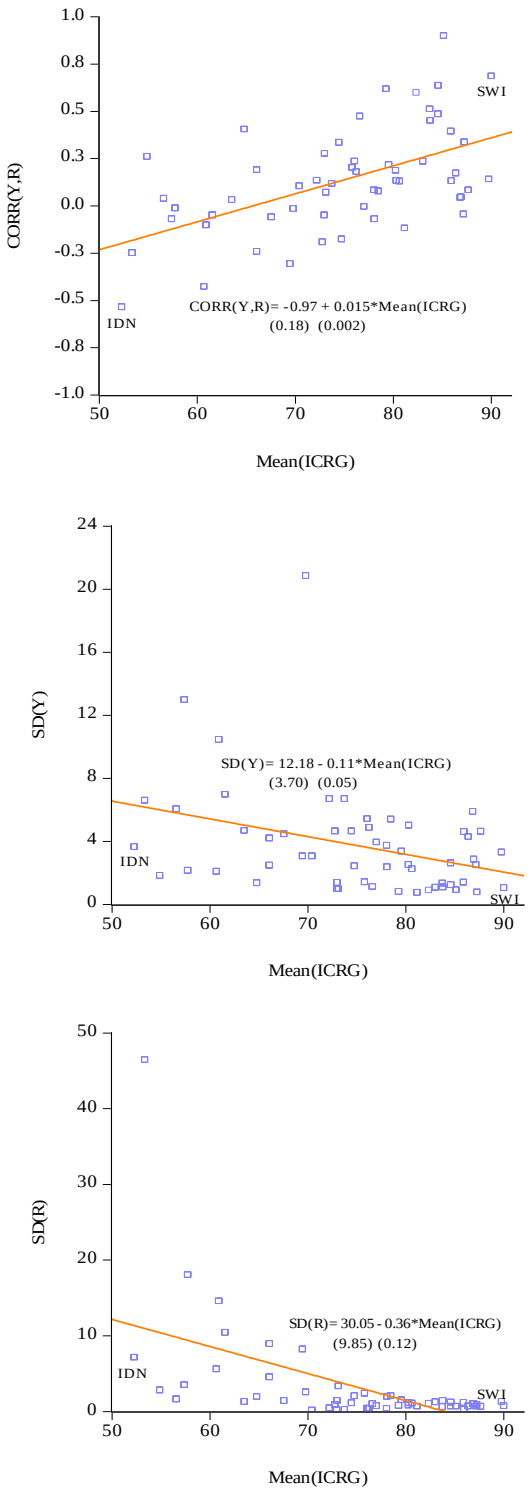
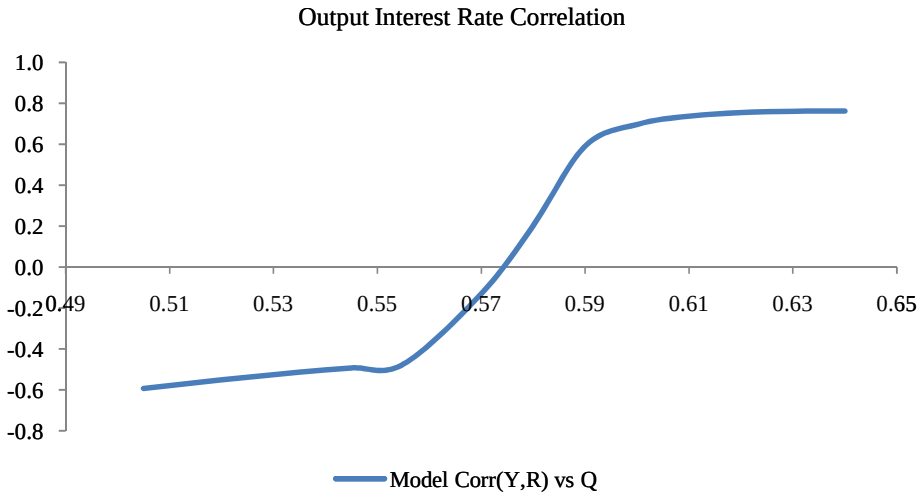
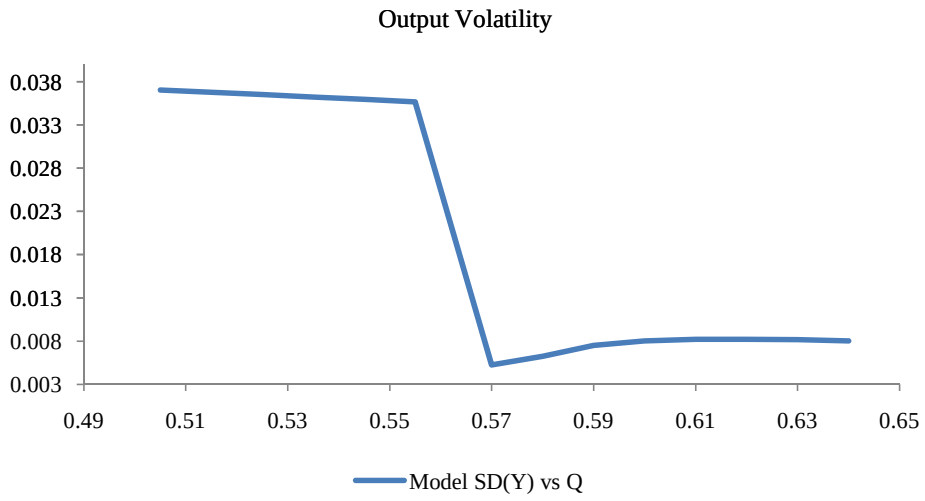


Figure 2. Model Implied Statistics and Institutional Quality





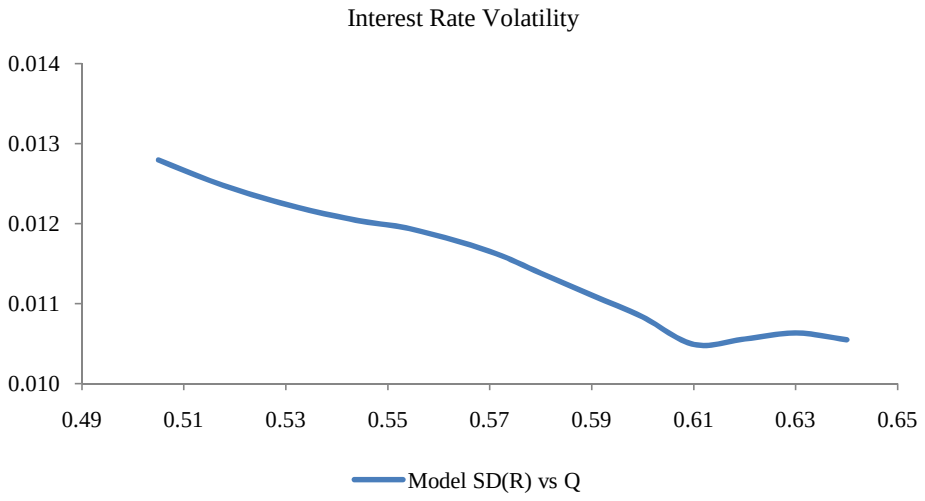


Figure 3. Steady-State Equilibrium and Institutional Quality

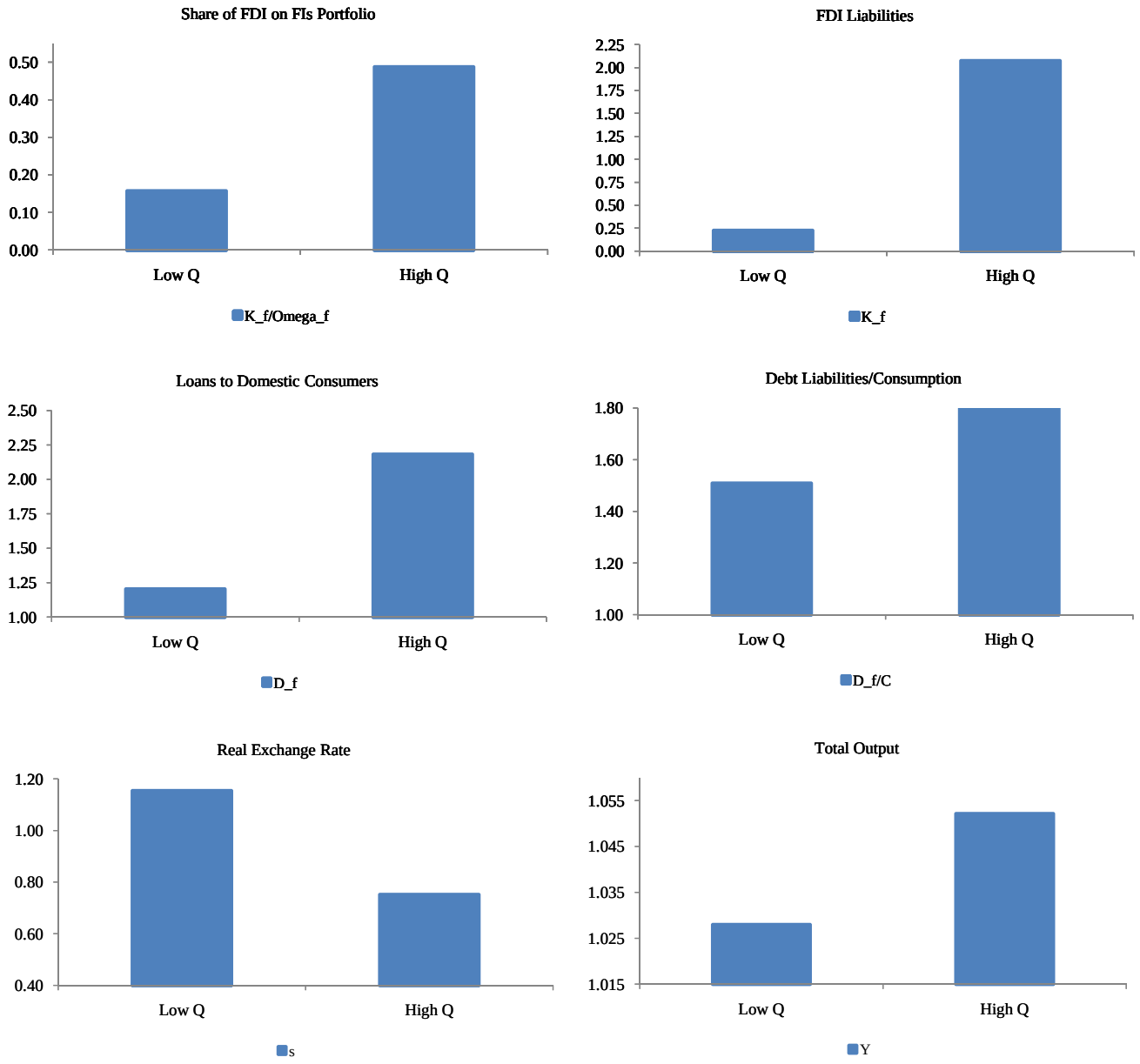


Figure 4A. Positive Export Shock under Low Institutional Quality

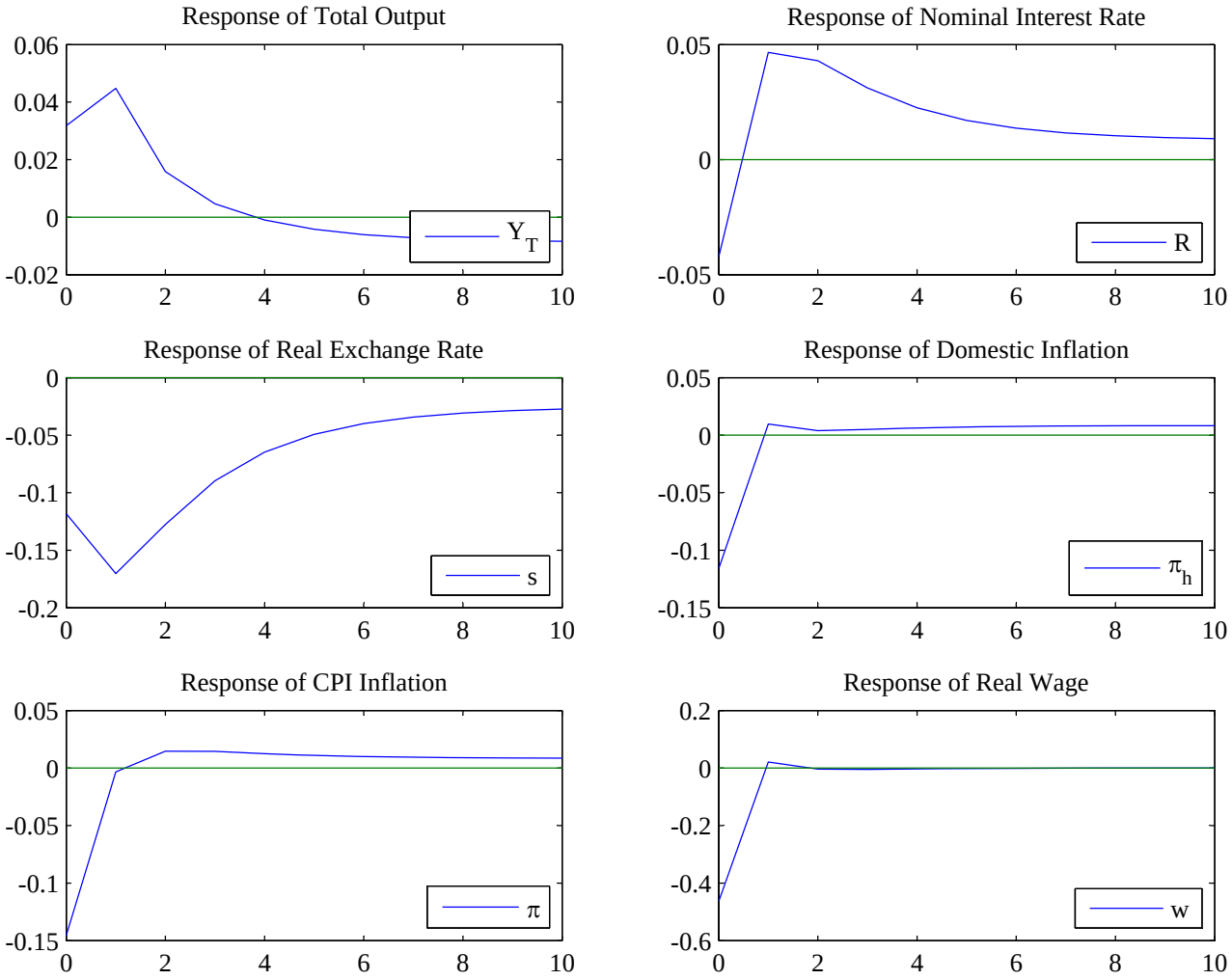


Figure 4B. Positive Export Shock under High Institutional Quality

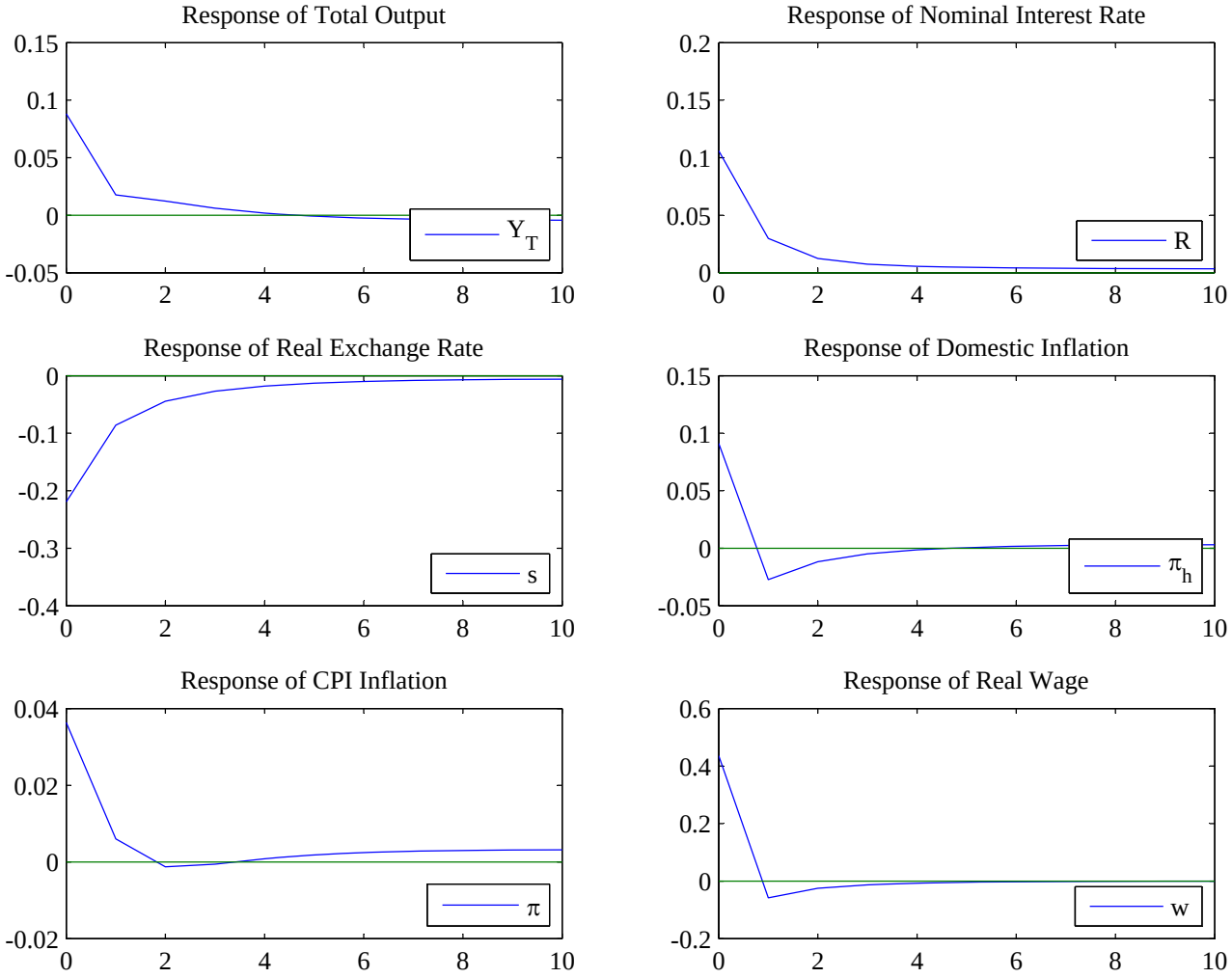


Figure 5A. Positive Productivity Shock (Domestic-owned Firms) under Low Institutional Quality

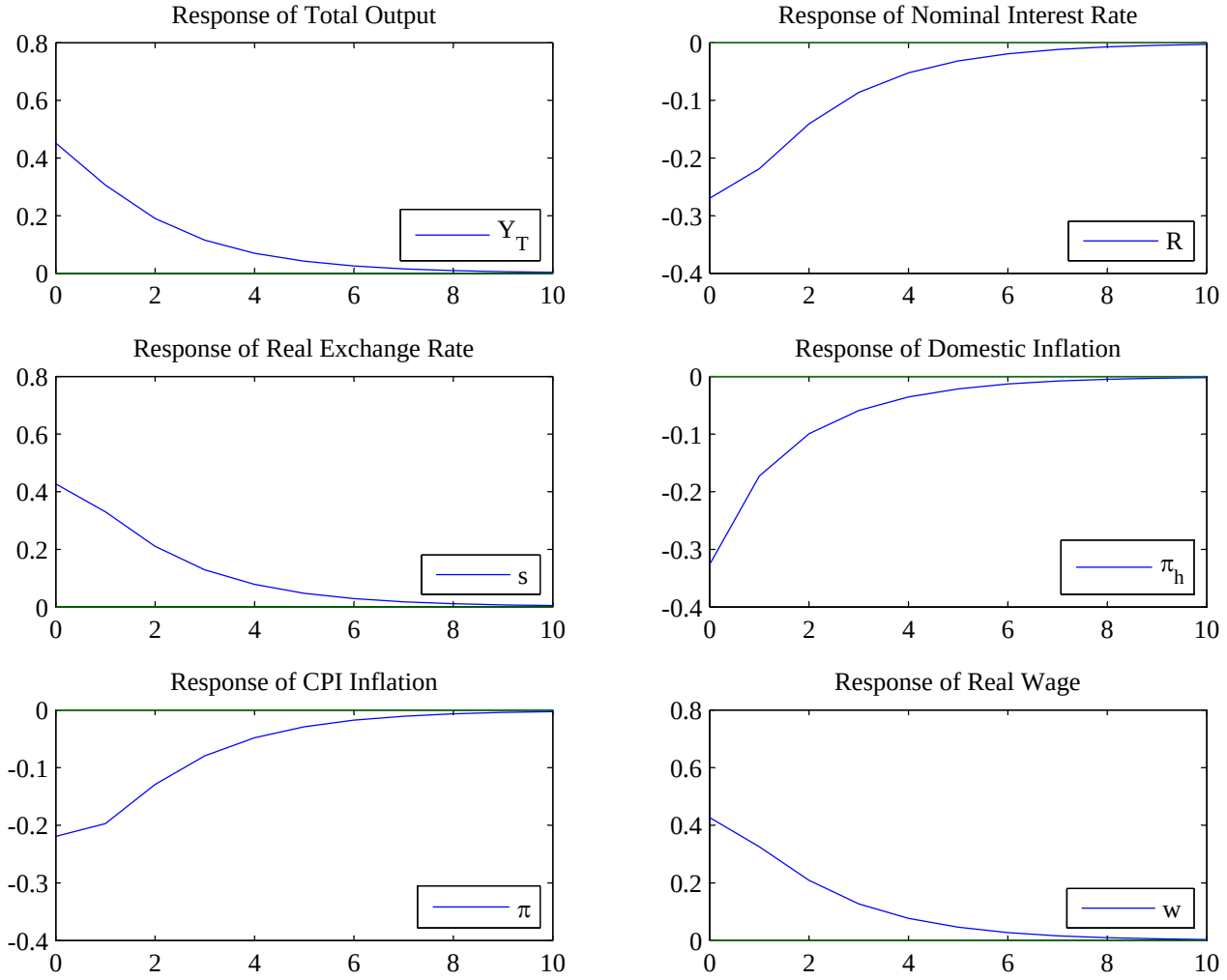


Figure 5B. Positive Productivity Shock (Domestic-owned Firms) under High Institutional Quality

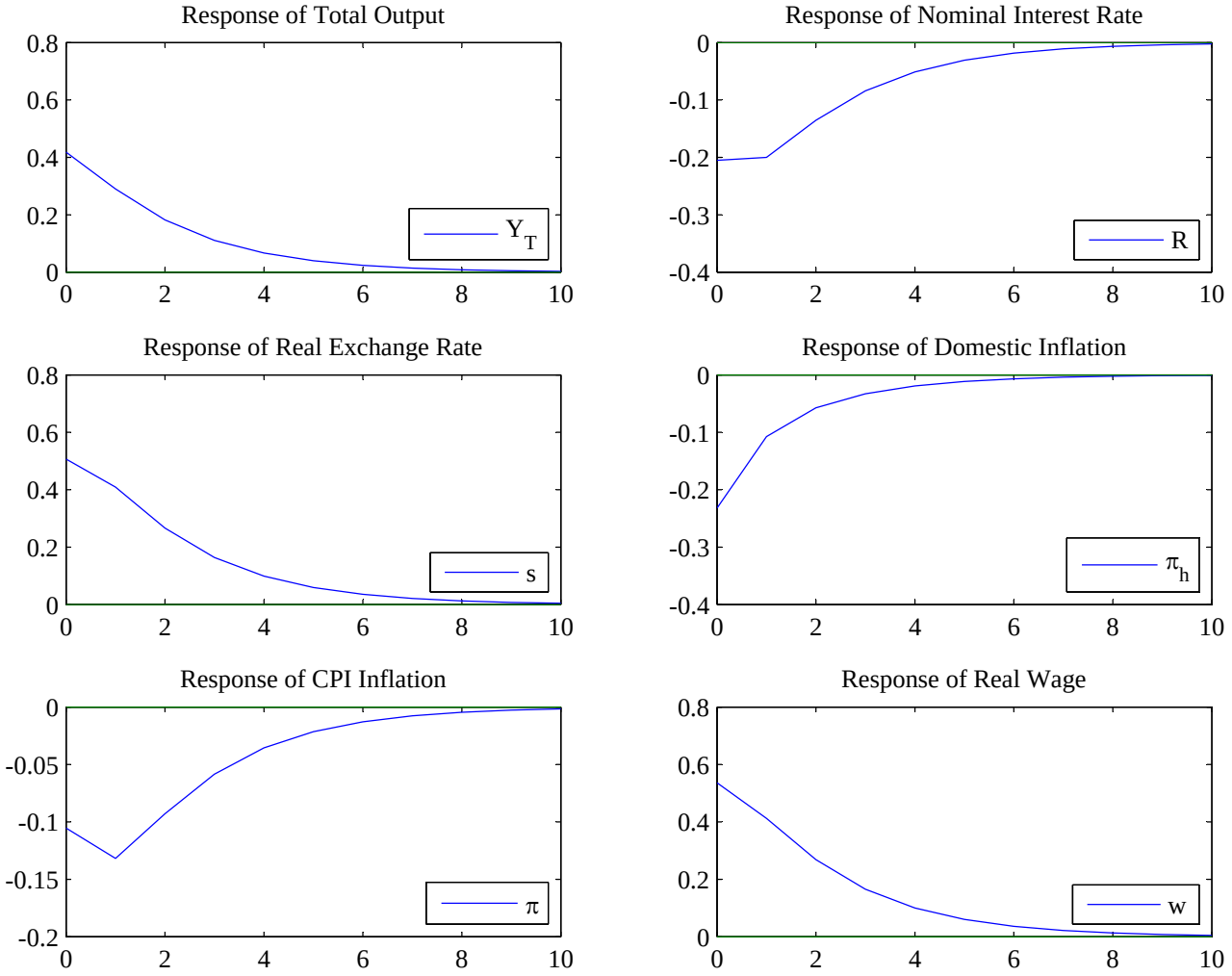


Figure 6A. Positive Productivity Shock (Foreign-owned Firms) under Low Institutional Quality

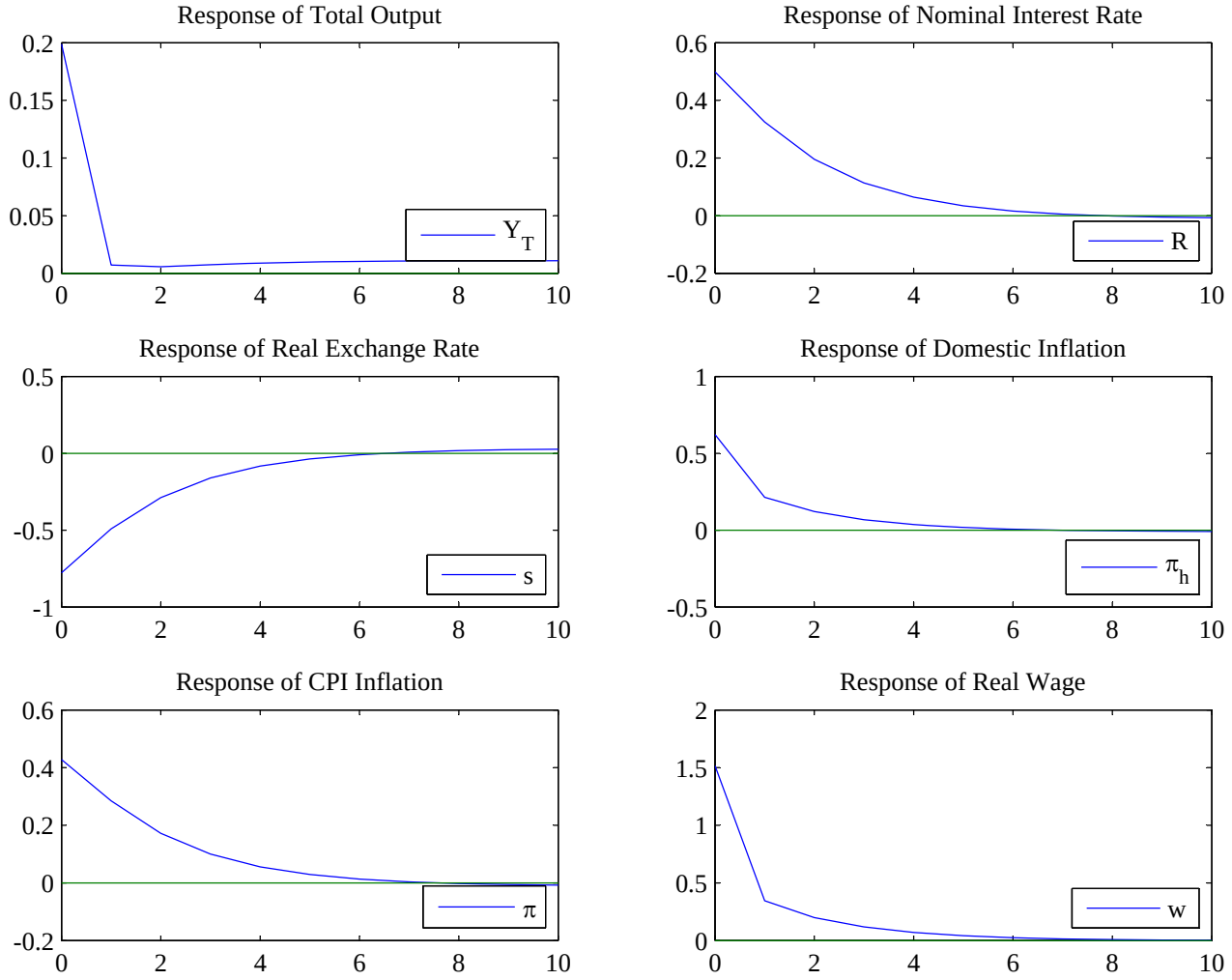


Figure 6B. Positive Productivity Shock (Foreign-owned Firms) under High Institutional Quality

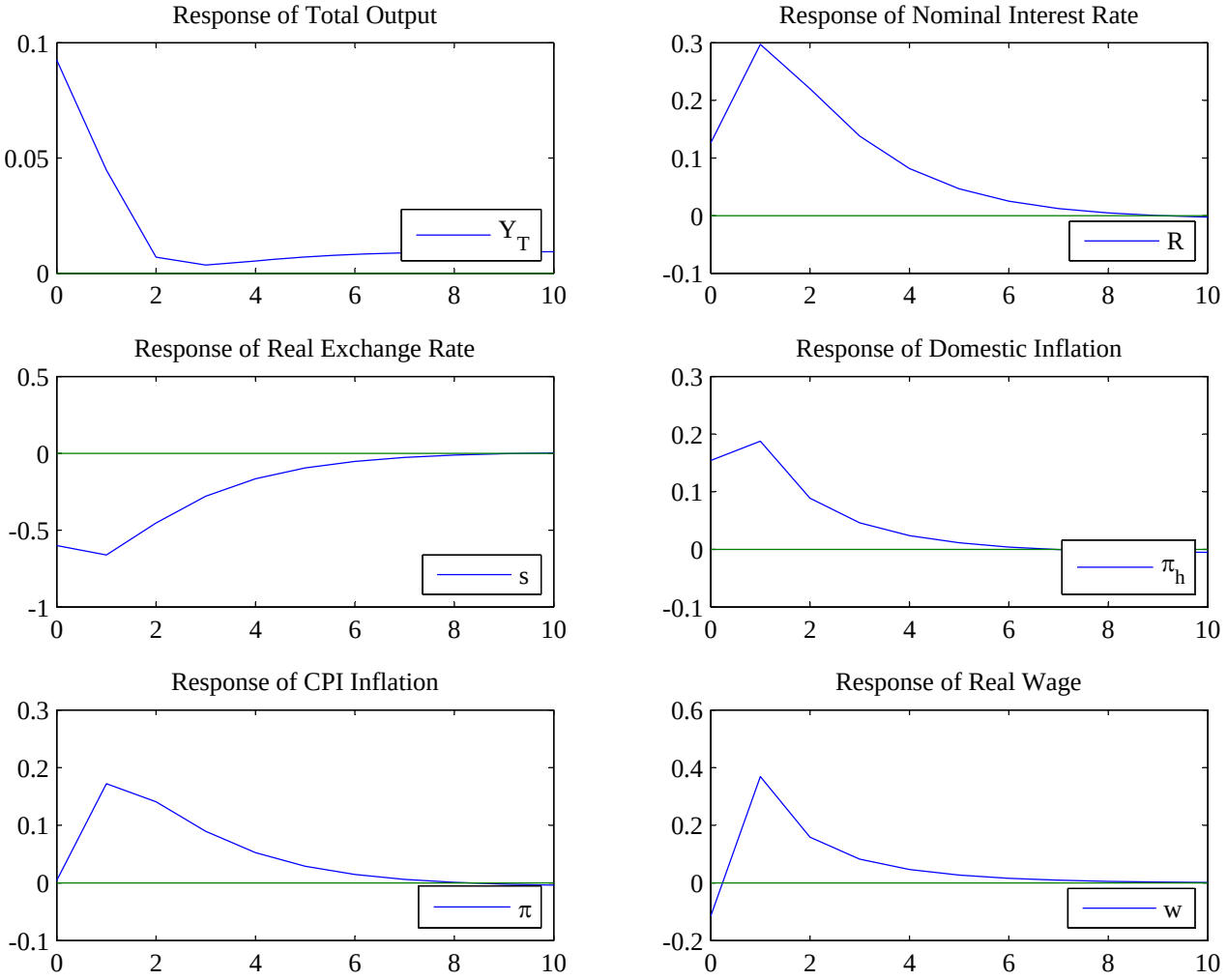


Figure 7A. Sensitivity Analysis: ψ_S

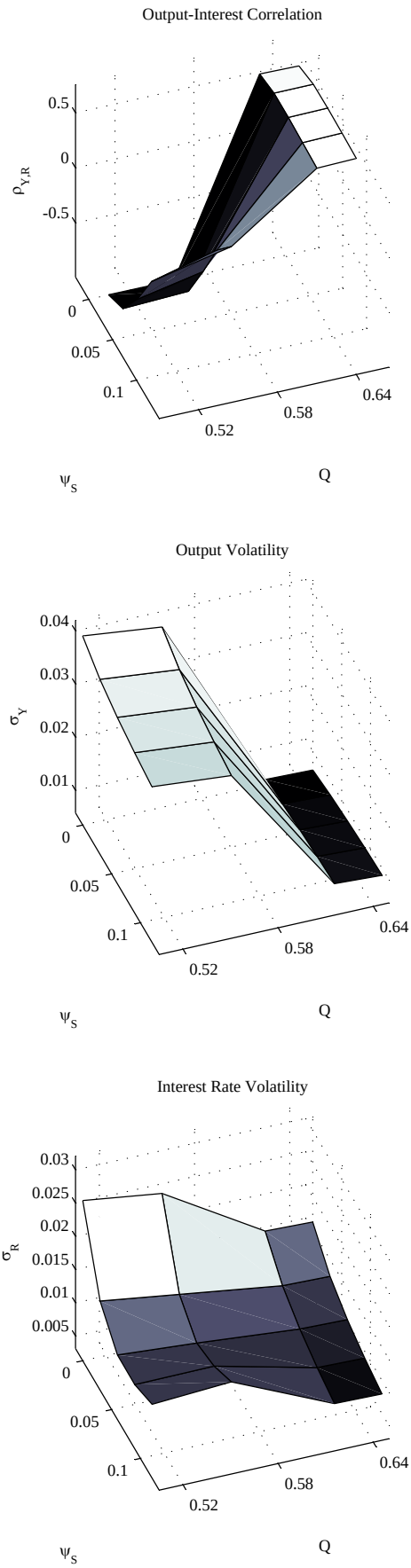


Figure 7B. Sensitivity Analysis: ψ_Y

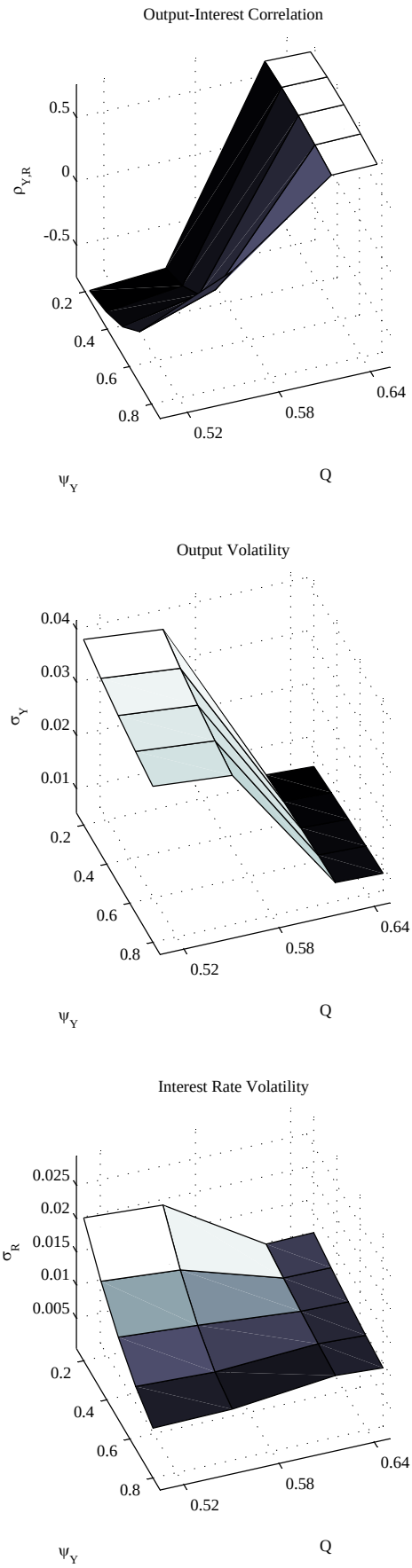
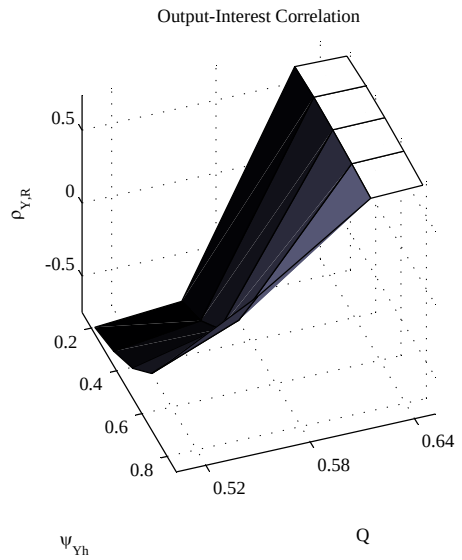
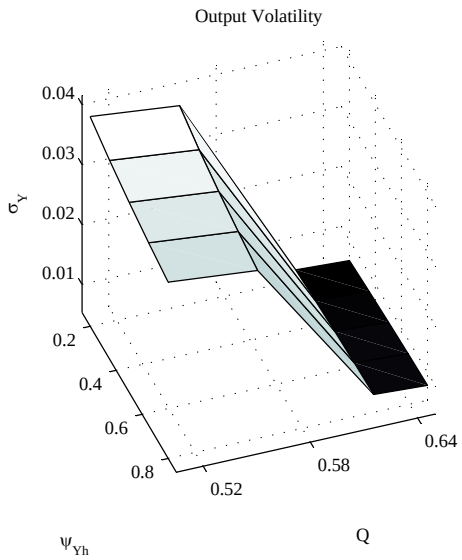


Figure 7C. Sensitivity Analysis: ψ_{Yh}





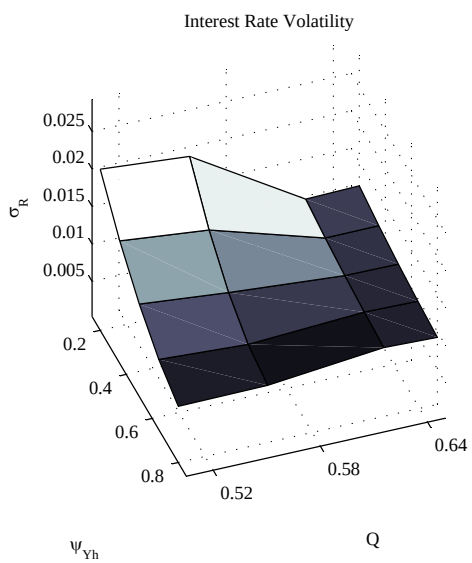


Figure 7D. Sensitivity Analysis: ρ_x

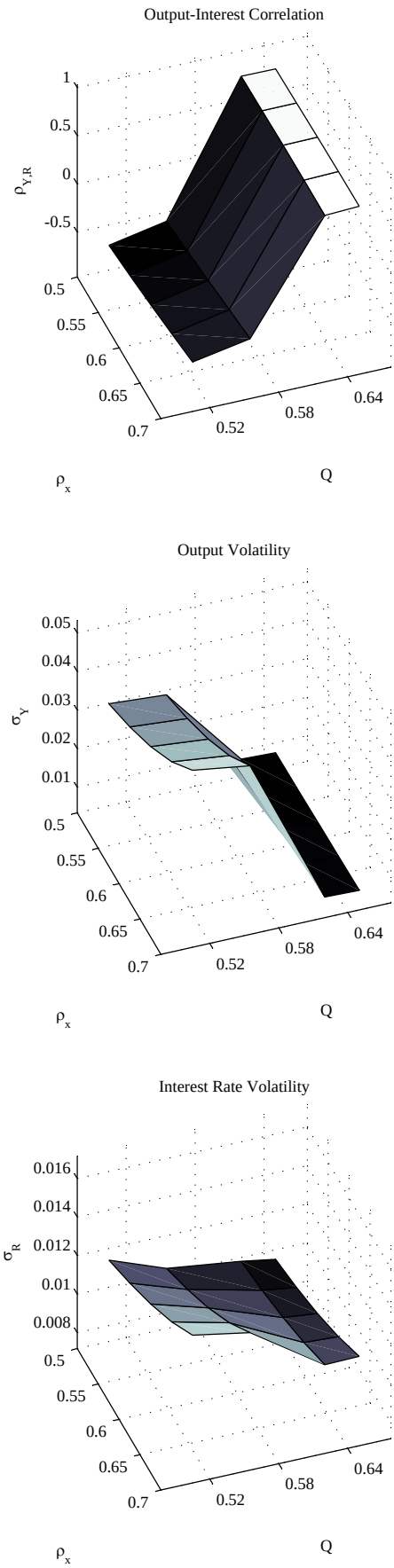
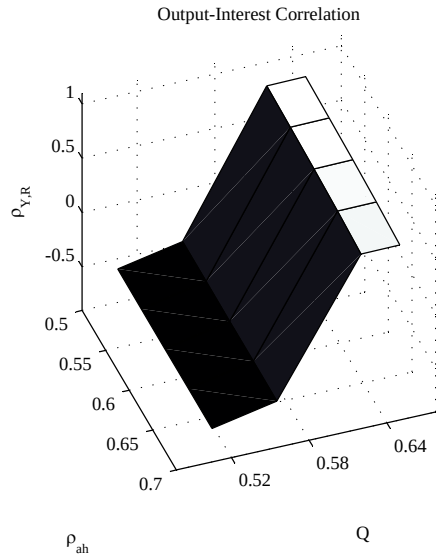
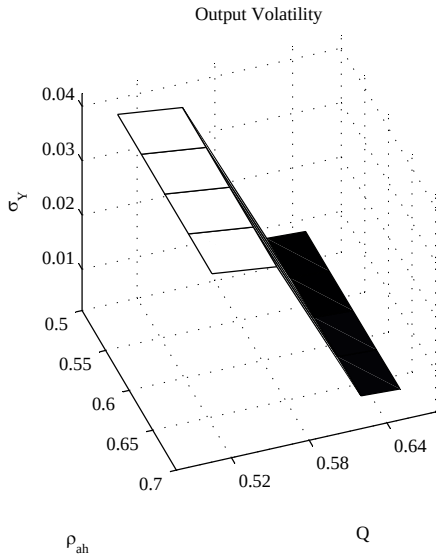


Figure 7E. Sensitivity Analysis: ρ_{ah}





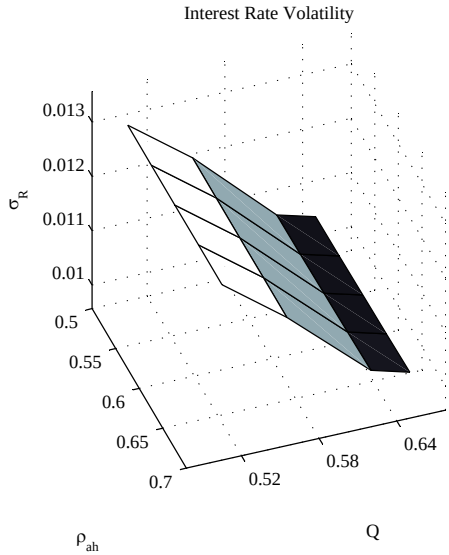
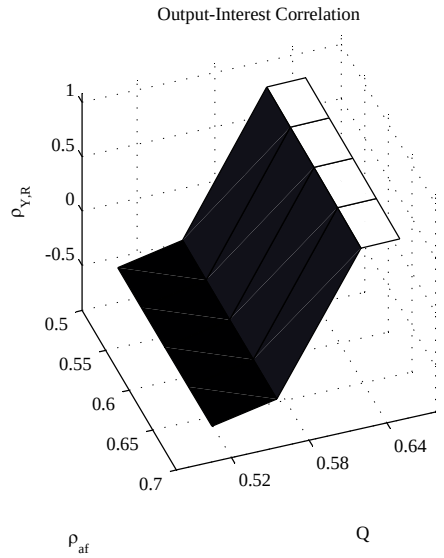
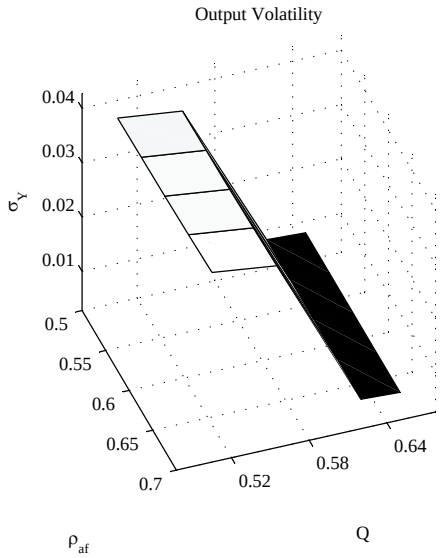


Figure 7F. Sensitivity Analysis: ρ_{af}





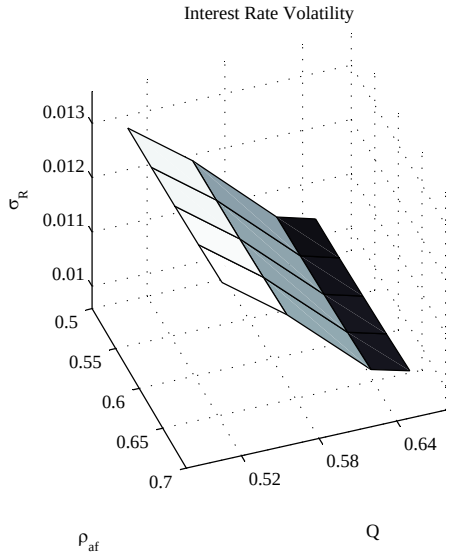


Figure 7G. Sensitivity Analysis: σ_x

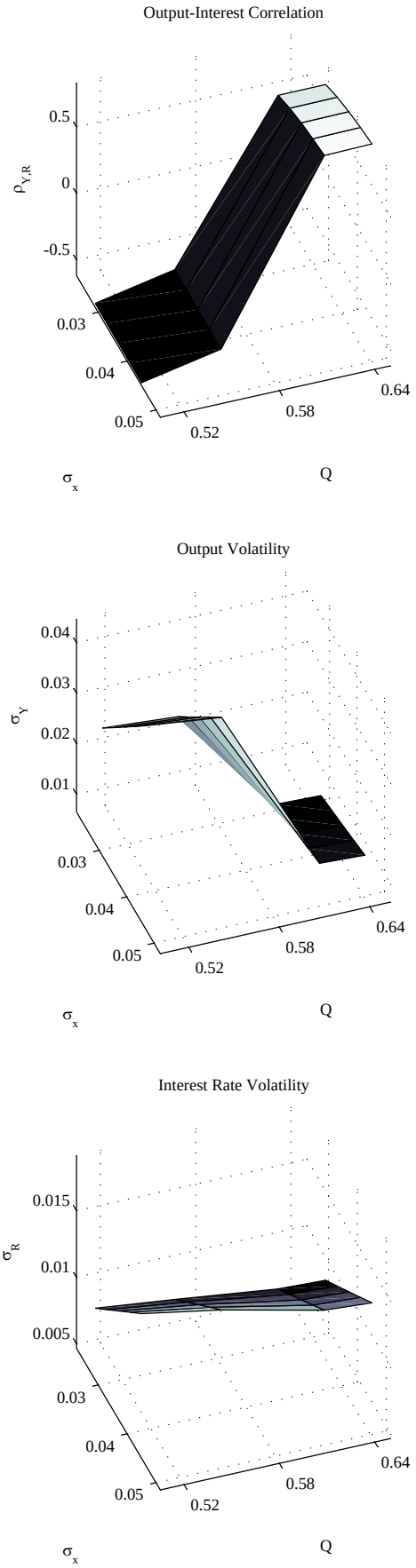
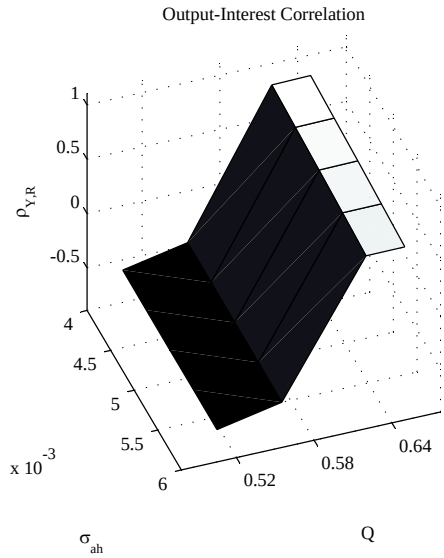
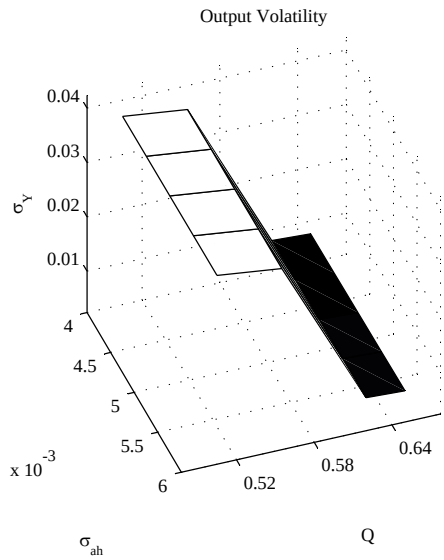


Figure 7H. Sensitivity Analysis: σ_{ah}





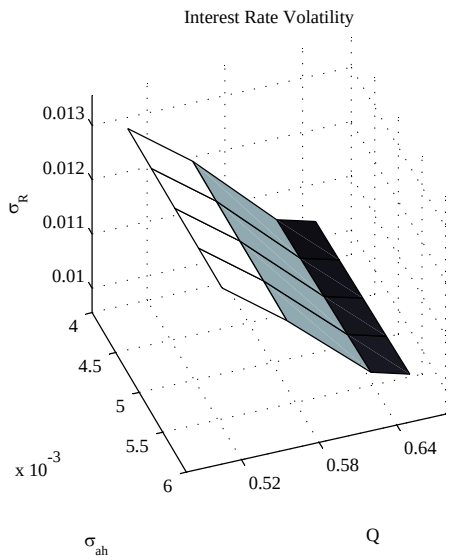
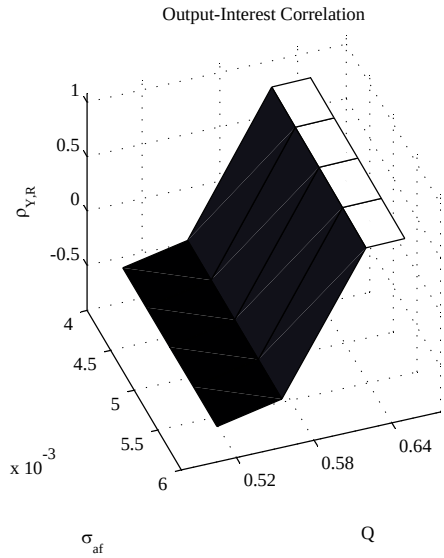
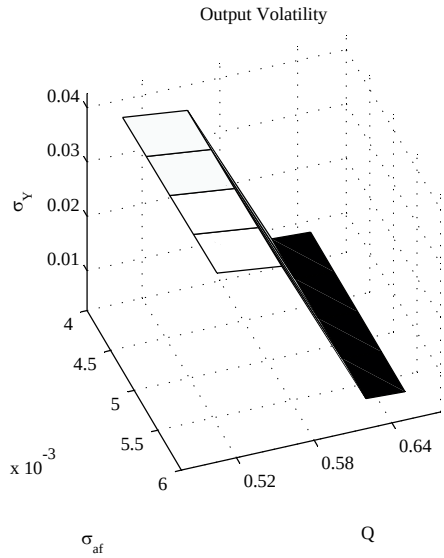


Figure 7I. Sensitivity Analysis: σ_{af}





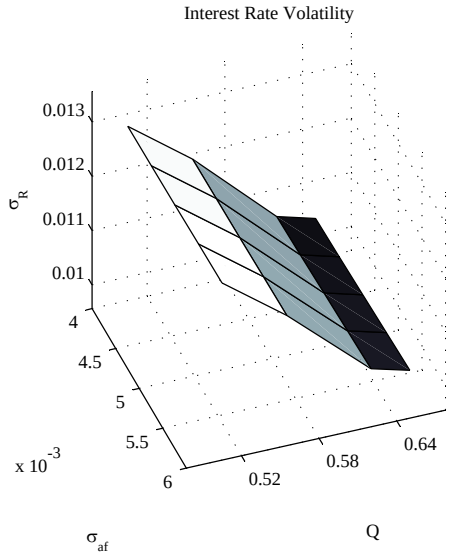
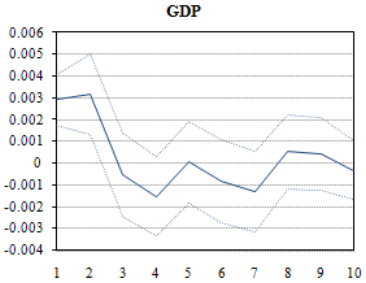
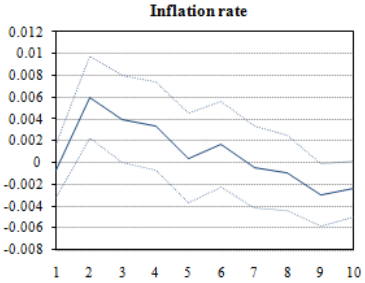


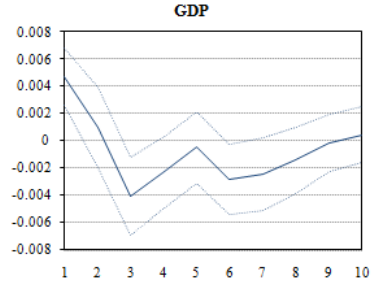
Figure 8a. Responses to one-SD external demand shock (Low-IQL economies)

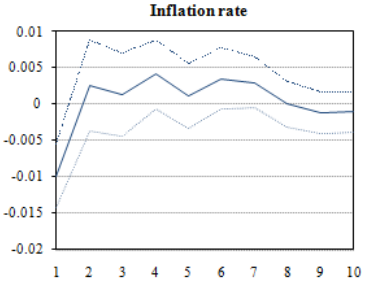
Indonesia

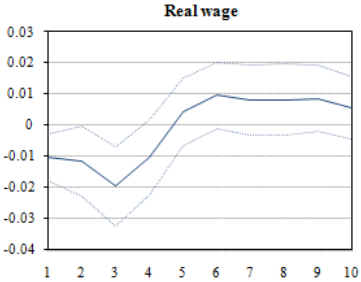




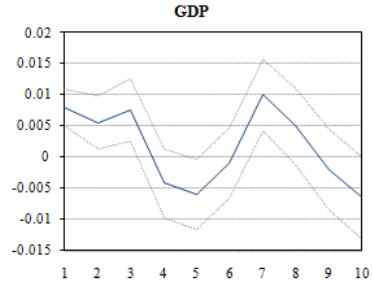
Ecuador

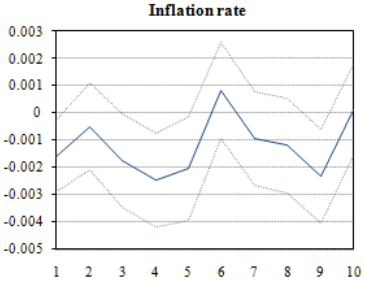






Romania





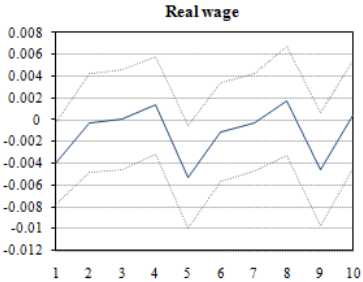
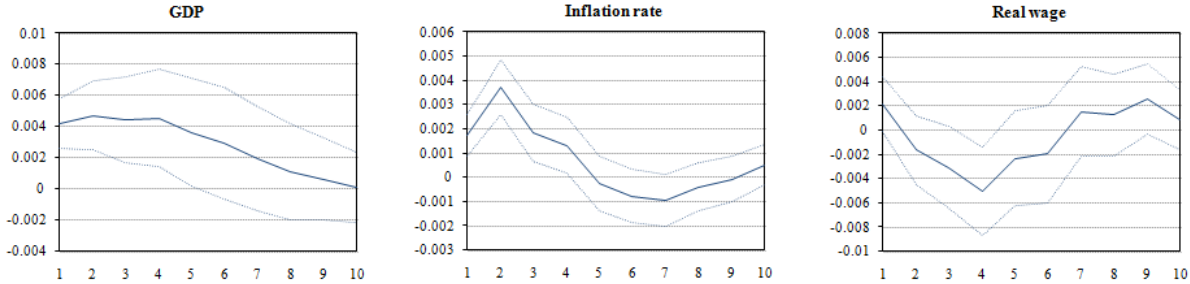
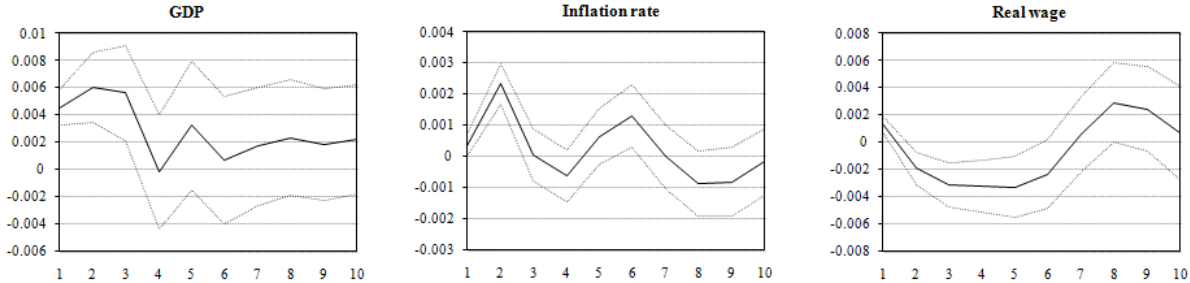


Figure 8b. Responses to one-SD external demand shock (High-IQL economies)

Czech Republic



Spain



Switzerland