International Competitiveness and Monetary Policy

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PRELIMINARY. NOT FOR QUOTE.

Abstract

A classic question in open macro concerns the contribution of monetary and exchange rate policy to a country’s international competitiveness. We bring a new perspective on this question by developing an open-economy monetary model that encompasses comparative advantage. In each country there are two sectors producing two types of tradables. In one sector (manufacturing), firms produce differentiated goods under monopolistic competition subject to sunk entry costs and nominal rigidities; in the other, firms produce non-differentiated goods under perfect competition. We show that domestic stabilization of output gap and marginal costs fosters competitiveness by encouraging investment and entry in the differentiated goods sector. Conversely, the adoption of a peg or monetary regimes implying limited stabilization tends to skew the endogenous export specialization toward the non-differentiated goods. Empirical evidence confirms that monetary regimes such as exchange rate pegs and inflation targeting influence the composition of production and trade consistent with the theoretical prediction.

Keywords: international coordination, monetary policy, production location externality, firm entry, optimal tariff

JEL classification: F41

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1. Introduction

This paper brings a new perspective on how monetary and exchange rate policy may affect economic activity and social welfare by supporting a country’s international competitiveness. The conventional approach in the Keynesian tradition emphasizes the competitive gains from currency devaluation, as a way to lower the relative cost of production, and therefore the international price of domestic goods, over the span of time that prices and wages are sticky in local currency. Conversely, the New Open Economy Macroeconomics (NOEM) or the new-Keynesian literature emphasize that monetary policy contributes to welfare by improving a country’s terms of trade. As this typically means a higher international price of home goods, the main transmission mechanism appears to be the opposite of improving competitiveness.1 In this paper, we show that these different perspectives naturally reconcile once the monetary model is appropriately developed as to account for comparative advantage, reconnecting open-macro to trade. Our main argument is that monetary policy aimed at stabilizing marginal costs and demand conditions at an aggregate level is likely to have asymmetric effects across sectors, more consequential for firms facing higher entry costs and nominal price distortions—usually firms producing differentiated manufacturing goods. Via this channel, monetary rules that systematically react to country-specific shocks (thus weakening or strengthening the exchange rate in response to cyclical disturbances) can be expected to influence the composition of production and exports beyond the short run. Exchange rate and monetary regimes can thus have long-lasting effects on a country’s international competitiveness.

On theoretical grounds, we draw on trade theory to model open economies with incomplete specialization across two tradable sectors: in one sector, conventionally identified with manufacturing, firms produce an endogenous set of differentiated varieties operating

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1 In virtually all contributions to the new-open economy macroeconomics and New-Keynesian literature, the trade-off between output gap and exchange rate stabilization is mainly modeled emphasizing a terms-of-trade externality (see Obstfeld and Rogoff (2000) and Corsetti and Pesenti (2001,2005), Canzoneri et al. (2005) in the NOEM literature, as well as Benigno and Benigno (2003), and Corsetti et al. (2010) in the New-keynesian literature, among others). Provided the demand for exports and imports is relatively elastic, an appreciation of the terms of trade of manufacturing allows consumers to substitute manufacturing imports for domestic manufacturing goods, without appreciable effects in the marginal utility of consumption, while reducing the disutility of labor. The opposite is true if the trade elasticity is low.
under imperfect competition; in the other sector, firms produce non-differentiated goods under perfect competition. Our argument builds on the idea that, because manufacturing industries supplying differentiated goods are typically associated with a combination of monopoly power, price stickiness and sunk (entry) investment in establishing a differentiated product, the need to sustain upfront entry costs and to take forward looking pricing decisions makes them more sensitive to uncertainty about future macroeconomic shocks than are other industries. We argue that, by contributing to domestic macroeconomic stability, efficient monetary policy creates favorable conditions for such industries, with long-lasting effects on their competitiveness. Furthermore, to the extent that the production of manufacturing differentiated goods bears social benefits for the country not internalized by individual firms, the welfare gains from efficient stabilization could potentially be larger than accounted for by standard models.\(^2\) These gains would however materialize by virtue of what is best described as a pro-competitive effect of stabilization, rather than in terms of ‘competitive devaluations’ and/or ‘terms of trade manipulation’ emphasized in existing literature.

Our theoretical strategy consists of embedding a two-sector market structure in a stochastic general equilibrium monetary model. In the presence of nominal rigidities, as shown in previous work carried out in a closed economy context (such as Bergin and Corsetti (2008) and Bilbiie, Ghironi and Melitz (2008)), uncertainty can imply the analog of a ‘risk premium’ in a firm’s prices, depending on the covariance of demand and marginal costs, i.e. the variability of the ex-post markups.\(^3\) By affecting this covariance, monetary policy rules can contribute to firms setting low, competitive prices on average, which in turn boost domestic demand. Low prices and higher domestic demand foster the comparative advantage of the country in producing and exporting differentiated manufacturing goods. Endogenous firm entry amplifies the relocation of production between countries.

A key testable implication of the theory is that countries with a reduced ability to stabilize macro shocks, say, because of the adoption of a fixed exchange rate regime, will tend

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2 For example, product differentiation is associated in the literature with additional trade and search costs, due to the lack of an organized exchange or reference prices that are typical for non-differentiated goods; producing this good domestically avoids these additional trade costs.

3 See also Corsetti and Pesenti (2005) and Obstfeld and Rogoff (2000).
(all else equal) to specialize away from differentiated goods, relative to the countries with an independent monetary policy. We test this prediction by conducting panel regressions of the composition of exports to the U.S. by country, on the exchange rate and monetary regime of that country, including a number of controls. Through extensive analysis, we find that a peg reduces the share of differentiated goods in exports by about 3-5 percentage points. This result is robust to changing the reference sample (e.g. to excluding oil exports and oil exporting countries), as well as to adopting alternative classifications of the exchange rate regime, and/or of instruments designed to control for the endogeneity of a peg. Conversely, we find that adopting an inflation-targeting regime raises the differentiated share a similar amount.

We should stress here that our theoretical and empirical contribution is entirely distinct from the macroeconomic literature stressing and testing the effect of exchange rate volatility on the volume of exports, with often inconclusive results; we instead provide theoretical arguments and evidence, in favor of the view that exchange rate and monetary regimes have appreciable effects on the composition of exports.

Our theoretical results suggest an insightful re-interpretation of the different ways in which the traditional (Mundell-Fleming) and the new (NOEM) literature characterize the policy trade-off between output gap stabilization and the terms of trade. According to our model, stabilization policies have pro-competitive effects by helping firms in the manufacturing sector to keep average markups low, which in turn may/may not result is low average international relative prices of domestically produced manufacturing. Whether or not the international price of domestic manufacturing falls with well-designed stabilization policies, however, overall terms of trade of the country become stronger. This is because efficient stabilization policies favor the production and exports of high value-added manufacturing goods, raising their weight in the basket of exports. So, while lower manufacturing markups tends to (and under certain conditions do) worsen a country’s terms of trade, the endogenous shift in the composition of exports counteracts this effect, and causes an overall improvement. Our results concerning the pro-competitive effects of monetary stabilization are thus fully consistent with a key conclusion
in the NOEM literature, that efficient stabilization may strengthen the terms of trade of a
country.4

Without loss of generality, we model the social benefits from gaining comparative
advantage in the manufacturing sector assuming a ‘production relocation externality,’ as
developed in Ossa (2011) in a trade context. In the presence of such externality, acquiring a
larger share of the world production of differentiated goods produces welfare gains due to
savings on trade costs. In this paper, we show that a production relocation externality has a
macroeconomic dimension, since it potentially causes monetary policy to have first-order
effects on welfare via its influence on the composition of output and export. We stress,
however, that our main conclusions would also apply to other types of externalities, impinging
on the welfare implications of acquiring comparative advantage in manufacturing. 5

The text is structured as follows. The next section describes the model. Section 3
derives some analytical results for a special case, and section 4 uses stochastic simulations to
demonstrate a broader set of implications Section 5 presents empirical evidence in support of
the theory. Section 6 concludes.

2. Model

Consider a model of two countries, home and foreign. While most of the model is a
standard two-country DSGE monetary model, there is a key novel element, in the way we

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4 Our theory has implications for the analysis of cross-border policy cooperation. Namely, the impact of
monetary policy on trade and production patterns creates welfare incentives to deviate from monetary rules
that are efficient from a global perspective, defining a policy game over comparative advantages. While
related to the NOEM literature studying strategic policy and coordination (see e.g. Benigno and Benigno
(2003), Corsetti and Pesenti (2005), Corsetti et al. (2010), Obstfeld and Rogoff (2002) and Sutherland
(2004)), the mechanism producing gains from cooperation in our model are different. Our argument is also
conceptually distinct from the conclusions of the literature assuming a traded and a non-traded goods sector
(see e.g. Canzoneri et. al 2005). Gains from coordination in this case may result from trade-offs in stabilizing
marginal costs across two sectors in each country, potentially creating stronger cross-border spillovers than
in the standard model where all goods are traded. Our work is instead related to Corsetti et. al (2007), which
considers the role of the home market effect in a real trade model, as well as Ghironi and Melitz (2005). We
differ in modeling economies with two tradable sectors, as well as considering the implications of price
stickiness and monetary policy.

5 There are a number of contributions studying the effects of monetary policy regimes on entry, see, e.g.,
Cavallari (2010), or the effect of exchange rate policy on trade, see, e.g., Staiger and Sykes (2010).
However, to our knowledge, no study has focused on competitiveness encompassing production relocation.
specify the goods market structure. Namely, two types of tradable goods can be produced in either country. The first type of good comes in differentiated varieties produced under monopolistic competition. This is the market with firm entry and preset prices. The second type of good is produced by perfectly competitive firms, and is modeled according to the standard specification in real business cycle models. For this good, there is perfect substitutability among producers within a country (indeed, the good is produced under perfect competition), but imperfect substitutability across countries, as summarized by an Armington elasticity.

2.1. Goods market structure

Households consume goods from two sectors. The \( D \) sector consists of differentiated goods, associated with manufacturing, which are produced by \( n \) and \( n^* \) monopolistically competitive firms in the home and foreign country, respectively—from now on, foreign variables will be denoted with an asterisk \( * \). The \( N \) sector consists of non-differentiated goods, produced by perfectly competitive firms. The home and foreign versions of the \( N \) and \( D \) good are imperfect substitutes for each other, with elasticity \( \phi \) and \( \eta \), respectively. The overall consumption index is specified:

\[
C_t \equiv C_{D,t}^{\theta} C_{N,t}^{1-\theta},
\]

where

\[
C_{D,t} = \left\{ \int_0^{n_h} c(h)^{\phi-1} \, dh + \int_0^{n_f} c(f)^{\phi-1} \, df \right\}^{\phi-1}
\]

is the index over the home and foreign varieties of manufacturing good, \( c(h) \) and \( c(f) \), and

\[
C_{N,t} \equiv \left\{ v^\eta C_{N,h,t}^{\eta-1} + (1-v)^\eta C_{N,f,t}^{\eta-1} \right\}^{\eta-1}
\]

is the index over non-differentiated goods.

The corresponding price index is
\[ P_t = \frac{P_{D_t} P_{D_t}^\theta}{\theta^t (1 - \theta)^{1-\theta}}, \]  

(1)

where

\[ P_{D_t} = \left( n_t p_t \left( \frac{1}{1-\phi} \right) + n_t^* p_t^* \left( \frac{1}{1-\phi} \right) \right)^{1-\phi} \]  

(2)

is the index over the prices of all varieties of home and foreign manufacturing goods, and

\[ P_{N_t} = \left( \nu P_{N_t} \left( \frac{1}{1-\eta} \right) + (1-\nu) P_{N_t}^* \left( \frac{1}{1-\eta} \right) \right)^{1-\eta} \]  

(3)

is the index over the prices of home and foreign non-differentiated goods.

These definitions imply relative demand functions for domestic residents:

\[ c_t(h) = \left( \frac{p_t(h)}{P_{D_t}} \right)^{1-\phi} C_{D_t} \]  

(4)

\[ c_t(f) = \left( \frac{p_t(f)}{P_{D_t}} \right)^{1-\phi} C_{D_t} \]  

(5)

\[ C_{D_t} = \theta P_t C_t / P_{D_t} \]  

(6)

\[ C_{N_t} = (1 - \theta) P_t C_t / P_{N_t} \]  

(7)

\[ C_{I_t} = \nu \left( \frac{P_{I_t}}{P_{N_t}} \right)^{1-\eta} C_{N_t} \]  

(8)

\[ C_{F_t} = (1 - \nu) \left( \frac{P_{F_t}}{P_{N_t}} \right)^{1-\eta} C_{N_t} \]  

(9)

2.2. Home household problem

The representative home household derives utility from consumption \( (C) \), holding real money balances \( (M/P) \), and disutility from labor \( (l) \). The household derives income by selling labor at the nominal wage rate \( (W) \), receiving real profits from home firms \( (\pi(h)) \), and interest income on holding domestic bonds \( (iB) \), which are in zero net supply. International trade in goods is balanced since there is no international trade in assets. They pay lump-sum taxes \( (T) \).

Household optimization for the home country may be written:
\[
\max E_0 \sum_{t=0}^{\infty} \beta U \left( C_t, l_t, \frac{M_t}{P_t} \right)
\]

subject to the budget constraint:

\[
P_t C_t = W_t l_t + \int_0^\infty \pi_t(h) dh - W_t \theta K_t + M_t - M_{t-1} + B_t - (1+i_{t-1})B_{t-1} - T_t.
\]

Utility is defined by

\[
U_t = \frac{1}{1-\sigma} C_t^{1-\sigma} + \ln \frac{M_t}{P_t} - \frac{1}{1+\psi} l_t^{1+\psi},
\]

Defining \( \mu_t = P_t C_t^\nu \), optimization implies an intertemporal Euler equation:

\[
\frac{1}{\mu_t} = \beta (1+i_t) E_t \left[ \frac{1}{\mu_{t+1}} \right]
\]

(10)

a labor supply condition:

\[
W_t = L_t^\nu \mu_t
\]

(11)

and a money demand condition:

\[
M_t = \chi \mu_t \left( \frac{1+i_t}{i_t} \right).
\]

(12)

The problem and first order conditions above are analogous for the foreign household.

### 2.3. Home firm problem and export entry condition

In the differentiated goods sector, production is linear in labor:

\[
y_t(h) = \alpha_{h_t} l_t(h),
\]

(13)

where \( l(h) \) is the labor employed by firm \( h \), and \( \alpha_h \) is stochastic technology common to all production firms in the country. Exports involve an iceberg trade cost, \( \tau_D \), so that

\[
y(h) = d_t(h) + (1+\tau_D)d_t^*(h),
\]

(14)
where \( d_i(h) = c_i(h) + d_{iC}(h) + d_{iK,h}(h) \) is total demand for the product in the home country, for use in consumption, adjustment costs, and entry costs, respectively; \( d'_i(h) \) is the corresponding demand for home goods abroad. Firm profits are computed as:

\[
\pi_i(h) = p_i(h) d_i(h) + e_i p'_i(h) d'_i(h) - W_i y_i(h)/\alpha_i - AC_{p,h}(h). \tag{15}
\]

There is free entry into the export market with a one-period lag subject to a one-time sunk cost, \( K_i \). The sunk cost is composed of a fixed proportion of labor units \( (\theta_k) \) and differentiated goods units \((1-\theta_k)\). It is assumed that a fraction \( \delta \) of all firms must exogenously exit each period. Let \( n_i \) represent the number of firms, and define new entrants to the export market, \( n_{e_i} \), by the flow condition:

\[
n_{e_{i+1}} = (1-\delta)(n_i + n_{e_i}). \tag{16}
\]

The value function of firms that enter period \( t \) as an exporter may be represented as the discounted sum of profits of domestic sales and export sales,

\[
v_i(h) = E_t \left[ \sum_{s=0}^{\infty} (\beta(1-\delta))^s \frac{\mu_{ss}}{\mu_k} \pi_{ss}(h) \right].
\]

Firms enter until the point that firm value equals the entry cost:

\[
(\theta_k W_i + (1-\theta_k) P_{ih}) K_i = v_i(h). \tag{17}
\]

The goods portion of entry cost uses a composite of differentiated goods, following the consumption index:

\[
d_{iK,h}(h) = \left( \frac{p_i(h)}{P_{ih}} \right)^\phi (1-\theta_k) n_{e_i} K_i \tag{18}
\]

\[
d_{iK}(f) = \left( \frac{p_i(f)}{P_{ih}} \right)^\phi (1-\theta_k) n_{e_i} K_i. \tag{19}
\]

The home firm \( h \) sets a price \( p(h) \) in domestic currency units for domestic sales. Under the assumption of producer currency pricing, this implies a foreign currency price

\[
p^*(h) = (1+\tau_{M}) p_i(h)/e_i, \tag{20}
\]

where the nominal exchange rate, \( e_i \), is defined as home currency units per foreign currency unit. Firms face a nominal cost of adjusting prices

\[
AC^e_i(h) = \frac{\psi e}{2} \left( \frac{p_i(h)}{p_{i-1}(h)} - 1 \right)^2 p_i(h)y_i(h). \tag{21}
\]
We follow Bilbiie et. al (2008) in making the simplifying assumption that new firm entrants inherit from the price history of incumbents the same price adjustment cost, and so make the same price setting decision. The aggregate value of adjustment costs are:

$$AC_i(h) = \eta_i AC_i(h) .$$  (22)

The adjustment cost uses final goods, and the composition follows that assumed for consumers in equation (4)-(9):

$$d_{AC}(h) = \left(\frac{p_i(h)}{P_M}\right)^\phi D_{AC,i}$$  (23)

$$d_{AC}(f) = \left(\frac{p_i(f)}{P_M}\right)^\phi D_{AC,i}$$  (24)

$$D_{AC,\text{MT}} = \theta P_i AC_i / P_{DF}$$  (25)

$$D_{AC,\text{NN}} = (1 - \theta) P_i AC_i / P_{NN}$$  (26)

$$D_{AC,JH} = v(P_{Jh} / P_{N})^{-\eta} D_{AC,Jh}$$  (27)

$$D_{AC,FI} = (1 - v)(P_{Fh} / P_{N})^{-\eta} D_{AC,FI} .$$  (28)

Maximizing firm value subject to the constraints above leads to the price setting equation:

$$p_i(h) = \frac{\phi}{\phi - 1} \alpha_i \left(\frac{W_i}{\kappa} \left(\frac{p_i(h)}{p_{i-1}(h)} - 1\right)^2 p_i(h) - \kappa \left(\frac{p_i(h)}{p_{i-1}(h)} - 1\right)^2 \right) p_i(h)^2$$

$$+ \frac{\beta}{\phi - 1} E_i \left[ \frac{\alpha_i}{\Omega_i} \left(\frac{p_{i+1}(h)}{p_i(h)} - 1\right) \left(\frac{p_{i+1}(h)}{p_i(h)}\right)^{2-\phi} \right]$$  (29)

where the optimal pricing is a function of the average price of world manufacturing:

$$\Omega_i = P_M \left[ C_D_{i+1} + D_{AC,Di+1} + (1 - \theta) ne_i K_i \right] + (1 + \tau_D)^{\phi} \left( e_i P_{Ni+1} \right)^{\phi} \left( C_D_{i+1} + D_{AC,Di+1} + (1 - \theta) ne_i K_i \right) .$$

In the second sector firms are assumed to be perfectly competitive in producing a good differentiated only by country of origin. The production function for the home non-differentiated good is linear in labor:

$$y_{i,h} = \alpha_{i,h} l_{i,h} .$$  (30)
where $\alpha_{H,t}$ is subject to shocks. It follows that the price of the homogeneous goods in the home market is equal to marginal costs:

$$p_{H,t} = W_t / \alpha_{H,t}.$$  \hfill (31)

An iceberg trade cost specific to the non-differentiated sector implies prices of the home good abroad are

$$p_{H,t}^* = p_{H,t}^* \left(1 + \tau_N \right) / \epsilon_t.$$  \hfill (32)

Analogous conditions apply to the foreign non-differentiated sector.

2.4. Government

The model abstracts from public consumption expenditure, so that the government uses seigniorage revenues and taxes to finance transfers, assumed to be lump sum. The home government faces the budget constraint:

$$M_t - M_{t-1} + T_t = 0.$$  \hfill (33)

Since in this text we do not address issues in the design of optimal stabilization, we specify monetary policy primarily in the form of a Taylor rule:

$$1 + \lambda_t = \left(1 + \hat{\lambda} \right) \left( \frac{p_t(h)}{p_{t-1}(h)} \right)^{\gamma_t} \left( \frac{Y_t}{\bar{Y}} \right)^{\gamma_t}.$$  \hfill (34)

This Taylor rule defines inflation in terms of differentiated goods producer prices, and defines $Y$ a measure of output defined as:

$$Y_t = \left( \int_0^\alpha p_t(h) y_t(h) \, dh + p_{H,t} y_{H,t} \right) / P_t.$$  

In running the model, we will use either this definition of output, or a narrower definition, including only manufacturing. Given our calibration of the Taylor rule, with a high coefficient on inflation, this will be immaterial for our results. The foreign country will in general be assumed in simulations to follow an exchange rate peg:

$$\epsilon_t = \tilde{\epsilon}.$$  \hfill (35)
2.5. Market clearing

The market clearing condition for the manufacturing goods market is given in equation (14) above. Market clearing for the non-differentiated goods market requires:

\[ y_{H,t} = C_{H,t} + D_{AC,H,t} + D'_{AC,H,t} \]  \hspace{0.1in} (36)
\[ y_{F,t} = C_{F,t} + D_{AC,F,t} + D'_{AC,F,t} \]  \hspace{0.1in} (37)

Labor market clearing requires:

\[ \int_0^n l_t(h) dh + l_{t,i} + \theta n e K_i = l_i. \]  \hspace{0.1in} (38)

Bond market clearing requires:

\[ B_t = 0. \hspace{0.1in} (39) \]

Balance of payments in this case requires balanced goods trade:

\[ \int_0^n p_t^*(h) c_t h + d_t h + d'_{AC,t} h dh - \int_0^n p_t(f) c_t f + d_t f + d'_{AC,t} f df + P_{th} (C_{th} + D'_{AC,th}) - P_{f} (C_{th} + D_{AC,f}) = 0. \]  \hspace{0.1in} (40)

2.6. Equilibrium definition and shocks:

The productivity shocks follow the joint log normal distribution:

\[
\begin{bmatrix}
\log\alpha_{D_t} - \log\bar{\alpha}_D \\
\log\alpha_{D_t} - \log\bar{\alpha}_0 \\
\log\alpha_{J_t} - \log\bar{\alpha}_H \\
\log\alpha_{F_t} - \log\bar{\alpha}_F
\end{bmatrix} = \rho
\begin{bmatrix}
\log\alpha_{D,t-1} - \log\bar{\alpha}_D \\
\log\alpha_{D,t-1} - \log\bar{\alpha}_0 \\
\log\alpha_{J,t-1} - \log\bar{\alpha}_H \\
\log\alpha_{F,t-1} - \log\bar{\alpha}_F
\end{bmatrix} + \varepsilon_t
\]

With the covariance matrix 
\[ E\left[ \varepsilon_t^i \varepsilon_t^j \right] = \Omega. \]

2.7. Relative price measures:

Along with the real exchange rate \( \left( \varepsilon_t P_t^* / P_t \right) \), we report two alternative measures of international prices. First, as common practice in the production of statistics on international
relative prices, we compute the terms of trade weighting goods with their respective expenditure shares:

$$TOTS_t = \frac{\omega_{ht} p(h) + \left(1 - \omega_{ht}\right) p_{FH}}{\omega_{ht} \epsilon_h p^*(f) + \left(1 - \omega_{ht}\right) \epsilon_f p_{FH}^*},$$

where the weights are:

$$\omega_{ht} = \frac{p^*(h) n_{ht} \left(c^*(h) + d^*_{KC}(h) + d^*_{ACJ}(h)\right)}{p^*(h) n_{ht} \left(c^*(h) + d^*_{KC}(h) + d^*_{ACJ}(h)\right) + P_{FH}^* \left(C_{FH} + D_{AC,HJ}\right)};$$

$$\omega_{ht}^* = \frac{p^*(f) n_{ht}^* \left(c^*_f(f) + d^*_{KC}(f) + d^*_{ACJ}(f)\right)}{p^*(f) n_{ht}^* \left(c^*_f(f) + d^*_{KC}(f) + d^*_{ACJ}(f)\right) + P_{FH}^* \left(C_{FH} + D_{AC,FH}\right)}.$$

Following the trade literature, however, we also compute the terms of trade as the ratio of ex-factory prices set by home firms relative to foreign firms in the manufacturing sector:

$$TOTM_t = p(h) / \left(c, p^*_f(f)\right).$$

This measure ignores the non-differentiated good sector.

3. Analytical Results Insights from a Simple Version of the Model

In this section, we will study the consequences of alternative stabilization policy regimes on competitiveness and welfare in the two economies, working out a simplified version of the model that is amenable to analytical results. Despite a number of simplifying assumptions needed to make the model tractable, we will be able to derive key predictions that remain valid in our more general model specification.

The section is organized as follows. After stating the main assumptions, we will characterize the flex-price allocation, and analyze the consequences of nominal rigidities. In doing so, we will first clarify the mechanism by which macro uncertainty about demand and marginal costs impinge on firms’ pricing. We will then establish that symmetric monetary policy rules of full markup stabilization support the flex-price allocation, showing that, in our simplified model, these policies are the same as in the baseline NOEM model without entry (see, e.g., Corsetti and Pesenti 2005). We conclude with the analysis of a unilateral peg.

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6 This is the same definition used in Ossa (2011), though in our case it does not imply the terms of trade are constant at unity, because monetary policy does affect factory prices. See also Helpman and Krugman (1989), as well as Campolmi et al. (2012).
3.1 Model Specification

In order to illustrate the monetary transmission mechanism as clearly as possible, we will make the following assumptions. First, we posit that manufacturing firms operate for one period only (implying $\delta = 1$ in the entry condition), and symmetrically preset prices over the same horizon. Entry costs are in labor units only. Second, we simplify the non-differentiated good by setting its trade costs to zero ($\tau_N = 0$) and letting the elasticity substitution between home and foreign goods approach infinity ($\eta \to \infty$). This implies the sector acts like a homogeneous good, an assumption frequently made in the trade literature. Correspondingly, we limit productivity shocks in the Differentiated good sector to the i.i.d. case, while productivity in the Non-differentiated good sector is not subject to shocks. Finally, we assume that utility is log in consumption and linear in leisure.

Under these assumptions, it is convenient to represent policy as a rule that responds directly to shocks: $\mu_t = \mu_t(\alpha, \alpha^*)$, where $\mu_t = PC_t$ (see Bergin and Corsetti 2006). The firms’ problem becomes

$$\max_{\alpha_t(h)} E_t \left[ \beta \frac{H_t}{\mu_{t+1}} \pi_{t+1}(h) \right].$$

The optimal preset price in the domestic market is:

$$p_{t+1}(h) = \frac{\phi}{\phi-1} \frac{E_t \left[ \Omega_{t+1} \frac{\kappa \mu_{t+1}}{\alpha_{t+1}} \right]}{E_t \left[ \Omega_{t+1} \right]}.$$

The home entry condition is a function of price setting and the exchange rate:

$$\frac{\kappa K_t}{\beta \theta} = E_t \left[ \left( p_{t+1}(h) - \frac{\kappa \mu_{t+1}}{\alpha_{t+1}} \right) p_{t+1}(h) \right]^{\frac{\phi}{\phi-1}} \Omega_{t+1}.$$

where upon appropriate substitutions (detailed in the appendix) $\Omega_{t+1}$ can be written as:

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7 Different from the trade literature, however, we do treat this sector as an integral part of the (general) equilibrium allocation, e.g., exports/imports of the homogeneous good sector enters the terms of trade of the country.
Provided that the price setting rules can be expressed as functions of the exogenous shocks and policy settings (a condition satisfied in several useful cases), the home and foreign equilibrium entry conditions along with the exchange rate solution above comprise a three equation system in the three variables: $e, n$ and $n^*$. This system admits analytical solutions for several configurations of the policy rules.

Before proceeding, we should stress two key implications of our assumptions. Since both economies produce the same homogeneous good with identical technology under perfect competition, with no trade costs in this sector, arbitrage ensures that $P_D \equiv e_P P^*$. Using the labor supply condition (11) for the case of a unitary elasticity ($\psi = 0$), the exchange rate may be expressed as:

$$e_t = \frac{P_{Dt}}{P^*_t} = \frac{W_t}{W^*_t} = \frac{P_t C_t}{P^*_t C^*_t} = \frac{\mu_t}{\mu^*_t}. \quad (44)$$

As long as both economies produce the homogeneous goods, the exchange rate is thus determined through arbitrage in the perfectly competitive sector of the goods market. Given symmetric technology in labor input only, the law of one price implies that nominal wages are equalized (once expressed in a common currency) across the border. By the equilibrium condition in the labor market with an infinite labor supply elasticity, then, the exchange rate is a function of the ratio of nominal consumption demands (and hence is the ratio of the monetary policy stance variables).

A further notable implication is that risk sharing is perfect regardless of the structure of financial markets and/or the way we specify production and trade in the other sector. Rewrite the above equation as:

$$\frac{e P^*_t}{P_t} = rer_t = \frac{C_t}{C^*_t}. $$
This is the risk sharing condition implied by complete asset markets for the case of log utility: home consumption rises relative to foreign consumption only in those states of the world in which its relative price (i.e. the real exchange rate) is weak. In our economy, risk sharing is complete per effect of nominal wage equalization (due to trade in a single homogenous good whose production is not subject to shocks), even in the absence of trade in financial assets.

3.2. Flexible prices versus nominal rigidities

If firms are able to set prices after observing (productivity) shocks, with constant demand elasticity, managers will charge a constant markup over marginal costs, which in our case coincide with unit labor costs:

\[ p_{t+1}^{\text{flex}}(h) = \frac{\phi}{\phi - 1} \kappa \frac{\mu_t}{\alpha_t}, \quad p_{t+1}^{*\text{flex}}(f) = \frac{\phi}{\phi - 1} \kappa \frac{\mu^*_t}{\alpha^*_t}. \]

Substituting into the entry condition (27) above, it is easy to derive the equilibrium number of firms under price (and wage) flexibility:

\[ n_{t+1}^{\text{flex}} = n_{t+1}^{*\text{flex}} = \frac{\beta \theta}{\kappa q \phi} E_t \left[ 2 \left( \frac{\alpha_{t+1}}{\alpha^*_t} \right)^{1-\phi} \left( (1+\tau)^{1-\phi}/(1+\tau^{\phi-1}) \right) \left( (1+\tau)^{1-\phi}/(1+\tau^{\phi-1}) \right) \right]. \]

Since in our simple model we assume i.i.d. shocks and the number of firms is predetermined, \( n \) and \( n^* \) are not time-varying (do not respond to current productivity). With no monetary policy response to shocks (\( \mu_t = \mu^*_t = 1 \), as none is needed under flexible prices), the exchange rate will be constant at \( e_t = \mu_t / \mu^*_t = 1 \).

Consider now nominal rigidities impinging on prices of manufacturing goods. To best appreciate the transmission mechanism underlying our results, it is convenient to rewrite (42) as follows:

\[ p_{t+1}(h) = \frac{\phi}{\phi - 1} E_t \left[ \frac{\text{Cov}_t \left[ \frac{\kappa \mu_{t+1}}{\alpha_{t+1}} \right]}{E_t \left[ \Omega_{t+1} \right]} \right] \]
The covariance term on the RHS of this expression shows that optimal preset pricing depends on the comovements of nominal wages and labor productivity (determining firms’ marginal costs $\kappa \mu_{t+1}/\alpha_{t+1}$), and the world price of manufacturing, scaled by the expected price of world manufacturing. Since both marginal costs and the world price of manufacturing are functions of monetary stances, the effect of stabilization rules on pricing crucially hinges upon their effect on this covariance term.

To appreciate the consequences on optimal pricing and entry, without loss of generality set, as before, $\mu_t = \mu_t' = 1$, implying a constant exchange rate ($e_t = \mu_t / \mu_t' = 1$). With i.i.d. shocks, there are no dynamics in predetermined variables such as prices and numbers of firms. We can thus solve for both analytically. As regards prices, firms preset them optimally charging the constant, equilibrium markup over expected marginal costs:

$$p_{1,1}^{no\, stab} (h) = \frac{\phi}{\phi - 1} \kappa E_t \left[ \frac{1}{\alpha_{t+1}} \right]$$

Note that, with a monetary policy unresponsive to productivity shocks, these optimal pricing decisions do not depend on the world wide price of manufacturing term $\Omega$ (hence do not vary with trade costs and firms entry), as they do in the general case. The number of firms can be computed by substituting these prices into the entry condition (43), so to obtain:

$$n_{1,1}^{no\, stab} = \frac{\beta \theta}{\kappa q \phi}.$$

Intuitively, with preset prices and no change in the exchange rate, there is no change in the terms of trade or the real exchange rate. For a given monetary stance, there is no change in consumption demands, and so no change in the level of production in any good. An i.i.d. shock lowering productivity in the home manufacturing sector necessarily leads to an increase in the level of employment in the same sector (not compensated by a change in employment in the other sectors of the economy). Firms end up producing at high marginal costs and thus suboptimally low markups, as nominal rigidities prevent them from re-pricing and scaling down production. By the same token, given nominal prices and demand, an economy experiencing a rise in productivity will end up producing too little at low marginal costs, hence suboptimally high markups. These two contrasting effects do not wash out on average.
From the above pricing functions, it is easy to see that, in a regime of non-contingent monetary policy, a high variance of productivity shocks leads firms to optimally preset relatively high prices --- inducing a risk-premium like term in pricing. As discussed in Corsetti and Pesenti (2005) and Bergin and Corsetti (2008), given nominal demand, high preset prices allow firms to contain overproduction when low productivity squeezes markups, rebalancing demand across states of nature. High average markups, in turn, tend to reduce demand, production and employment on average, discouraging entry.

3.3. Markup and output gap stabilization

Since the model posits that the homogenous good sector operates under perfect competition and flexible prices, there is no trade-off in stabilizing output across different sectors. It is therefore possible to replicate the flex-price allocation under the following simple monetary policy rule: the monetary stance in each country moves in proportion to productivity in the differentiated good sector: \( \mu_i = \alpha_i, \quad \mu_i^* = \alpha_i^* \). The exchange rate in this case is not constant, but contingent on productivity differentials. Namely, the home currency depreciates in response to an asymmetric rise in home productivity:

\[ e_t = \frac{\alpha_t}{\alpha_t^*}. \]

The active monetary policy just described specifically affects optimal pricing by firms. By ensuring that the nominal marginal costs \( \kappa \mu / \alpha \) remain constant, the above policy ensures that the covariance term in (see (42')) is zero, thus insulating the optimal price preset by home manufacturing firms from the variance of productivity shocks.\(^8\) The price firms preset is thus lower than in an economy with no stabilization:

\[ p_{t+1}^{stab} (h) = \frac{\phi}{\phi - 1} \kappa < p_{t+1}^{no} (h), \]

\(^8\) As is well understood, the policy works as follows: in response to a incipient fall in domestic marginal costs domestic demand and a real depreciation boost foreign demand for domestic product. As nominal wages rise with aggregate demand, marginal costs are completely stabilized at a higher level of production. Vice versa, by curbing domestic demand and appreciating the currency when marginal costs are rising, monetary policy can prevent overheating, driving down demand and nominal wages. Again, marginal costs are completely stabilized as a result.
given that, by Jensen’s inequality, $E_t \left[ \frac{1}{\alpha_{t+1}} \right] > \frac{1}{E_t[\alpha_{t+1}]} = 1$. Note that, by stabilizing marginal costs completely, such policy stabilizes markups at their flex-price equilibrium level. As shown in the appendix, it follows that the number of manufacturing firms is the same as under flexible prices:$^9$

$$n_{t+1}^{stab} = n_{t+1}^{flex}.$$  

Despite nominal rigidities, policy makers are able to stabilize the output gap relative to the natural-rate, flex-price allocation --- a result that is familiar from the classical NOEM literature (without entry) assuming that prices are sticky in the currency of the producers (Corsetti and Pesenti (2001, 2005) and Devereux and Engel (2003), among others).

### 3.4. Inefficient stabilization: the case of a unilateral currency peg

The key insight from the model follows from the analysis of asymmetric policies. Consider the case in which one country adopts a currency peg, while the other stick to efficient inward-looking policy rules. Namely, we posit that the home government fully stabilizes its output gap, while the foreign country maintains its exchange rate fixed against the home currency:

$$\mu_t = \alpha_t, \quad e_t = 1 \quad \text{so} \quad \mu_t^* = \nu_t = \alpha_t. \quad ^{10}$$

Under the asymmetric policy scenario of a currency peg just described, the optimally preset prices of domestically and foreign produced differentiated goods are, respectively:

$$p_{t+1}(h) = \frac{\phi}{\phi-1} \kappa, \quad p_{t+1}^*(f) = \frac{\phi}{\phi-1} \kappa E_t[\alpha_{t+1}].$$

While the home policy makers manage to stabilize the markup of manufacturing firms completely, the foreign firms producing under the peg regime face stochastic marginal costs

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$^9$ As discussed in the appendix, it is not possible to determine analytically whether symmetric stabilization policies raise the number of firms compared to the no stabilization case. Model simulations suggest that there is no positive effect for log utility, and a small positive effect for CES utility with a higher elasticity of substitution. Nonetheless, we are able to provide below an analytical demonstration of asymmetric stabilization, which is our main objective.

$^{10}$ A related exercise consists of assuming that the foreign country keeps its money growth constant ($\mu_t^* = 1$) while home carries out its stabilization policy as above.
driven by shocks to productivity, both domestically and abroad. With i.i.d. shocks, preset prices will be increasing in the term $E_t(1/\alpha^*_{t+1})$, as in the no stabilization case. The equilibrium number of firms $n$ and $n^*$ instead solve the following two-equation system:

$$\frac{1}{n_{t+1} + A n^*_{t+1}} + \frac{1}{n_{t+1} + B n^*_{t+1}} = \frac{\kappa q \phi}{\beta \theta}$$

$$\frac{A}{n_{t+1} + A n^*_{t+1}} + \frac{B}{n_{t+1} + B n^*_{t+1}} = \frac{\kappa q \phi}{\beta \theta}$$

where

$$A \equiv \left(E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right)^{1-\phi} (1 + r)^{1-\phi}, \quad B \equiv \left(E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right)^{-1} (1 + r)^{-1}.$$

While it is not possible to solve for the number of firms in closed form, the system above does allow one to prove that $n>n^{\text{flex}} > n^*$ (see the appendix). Other things equal, the constraint on macroeconomic stabilization implied by a currency peg tends to reduce the size of the manufacturing sector in the foreign country: there will be fewer firms charging higher prices. The home country’s manufacturing sector correspondingly expands. In other words, the country pegging its currency will tend to specialize in the homogeneous good sector.

To understand the mechanism: insofar as inefficient stabilization under a peg raises markups and exacerbate monopolistic distortions in the foreign manufacturing sector, foreign consumption both falls overall, and shifts towards the non-differentiated good sector, reducing the incentive for firms to enter. In this process, the terms of trade of the Foreign country weakens (although the welfare-relevant real exchange rate appreciates driven by the fall in domestic varieties available to the consumers). Correspondingly, in the Home country, stronger terms of trade boost consumption, raising world demand for Home-produced manufacturing.

As a result, with a foreign country passively pegging its currency, there are extra benefits for the home country from being able to pursue stabilization policies. Lack of stabilization abroad undermines the foreign comparative advantage in industries that are sensitive to shocks and uncertainty, providing a boost to the home domestic manufacturing sector. This sector expands driven by higher Home demand overall, and fills part of the gap in manufacturing production no longer supplied by foreign firms. At the same time, the shifting
pattern of specialization ensures that the home demand for the homogeneous good is satisfied via additional imports from foreign.

4. Numerical simulation

We now evaluate the quantitative implications of the core mechanism described in the simplified model, by conducting stochastic simulations of the full model. Relative to the simple model, in our economy, first, factor prices (wages) are not equalized (in terms of the non-differentiated good) across borders. Second, depending on the interplay of the elasticities governing saving, risk aversion, labor supply and cross-border trade, a lower average markup in Home pricing does not necessarily result in lower international prices of manufacturing (since the increase in the demand for the Home goods tends to raise production costs). Third, entry costs are specified in terms of goods rather than labor, and thus may move with international prices.\footnote{In related work (Bergin and Corsetti 2008), we stress a reason to prefer our specification in Section 2, as the alternative implies that, counterfactually, monetary expansions should be systematically associated with exit.} Finally shocks are not restricted to be i.i.d..

Despite these differences, we will show that key results from the simple version of our model continue to hold in the general one. Namely, it will still be true that, if the foreign country moves from efficient stabilization to a peg, while the Home country sticks to efficient stabilization rules (a) the Foreign average markups in manufacturing will tend to increase and (b) there will be production relocation---firm entry in the foreign country will fall on average, while entry in the Home country will rise on average (correspondingly, average consumption will rise at Home relative to Foreign). We will see that, on average, this relocation will be associated with a Home terms of trade improvements (while the Home welfare-relevant real exchange rate depreciates). The international price of Home manufacturing goods may or may not fall, depending on Home costs.

We first discuss our calibration of the model, then present our main results.
4.1. Calibration

The model is calibrated for an annual frequency, to match the frequency of the data available for sectoral productivity used to calibrate our shocks. The time preferences is calibrated at $\beta = 0.97$. We calibrate risk aversion at the usual value of $\frac{1}{\sigma} = 2$. Labor supply elasticity is set at $\frac{1}{\psi} = 1.9$ from Hall (2009).

The price stickiness parameter is set at $\kappa = 77$, following the estimate in Ireland (2001). The death rate is set at $\delta = 0.1$, which is four times the standard rate of 0.025 to reflect the annual frequency. As is standard, the sunk cost of entry is normalized to the value of 1.

To calibrate the differentiated and non-differentiated sectors we draw on Rauch (1999). Differentiated goods represent around half of U.S. trade in value, so we calibrate $\theta = 0.5$. The home share of non-differentiated goods is set at $\nu = 0.5$, which implies a trade share of about 30%, given the trade costs and elasticities below. To set the elasticities of substitution for the Differentiated and Non-differentiated goods we draw on the estimates by Broda and Weinstein (2006), classified by sectors based on Rauch (1999). The Broda and Weinstein (2006) estimate of the elasticity of substitution between differentiated goods varieties is 5.2 (the sample period is 1972-1988). The corresponding elasticity of substitution for nondifferentiated commodities is 15.3.

To calibrate trade costs, we need to think beyond costs associated with just transportation. These are often thought to be higher for commodities than for high value differentiated goods. As Rauch (1999) points out, differentiated goods involve search and matching costs, whereas commodities and goods traded on an organized exchange with a published reference price avoid such costs. Estimates are available for the tariff equivalent of language costs, with a value of 11% in Hummels (1999) or 6% in Anderson and van Wincoop (2004), so we use 8% in between. Since Obstfeld and Rogoff (2000) recommend a calibration of total trade costs at 16%, our calibration implies that half of this is due to language and

12 Values vary by year and by whether a conservative or liberal aggregation is used. For example, in 1980, the conservative aggregate indicates a differentiated goods share of 51.5%, and the liberal 48.9%.
matching costs, and the other half due to transportation. This implies a calibration of $\tau_d = 0.16$ for differentiated goods, and $\tau_n =0.08$ for non-differentiated goods.

The parameters in the home monetary policy rule are determined by the values that maximize home utility. As typically found, the optimal weight on inflation is the maximum value considered in the grid search ($\gamma_p =1000$), and the optimal value on output is $\gamma_y =0$. The foreign country is assumed to peg its exchange rate at parity with the home country: $e=1$.

To our knowledge, no one else who has calibrated a DSGE model with sectoral shocks distinct to differentiated and nondifferentiated goods. Time series for sectoral productivities are available on an annual basis from the Groningen Growth and Development Centre (GGDC), on an annual basis 1980-2007. Data for the U.S. is used to calibrate shocks to the Home country, and an aggregate of the EU 10 for the foreign country. TFP is calculated on a value added basis. For each country, the differentiated goods sector includes total manufacturing excluding wood, chemical, minerals, and basic metals; the non-differentiated goods sector includes agriculture, mining, and subcategories of manufacturing excluded from the differentiated sector. To calculate the weight of each subsector within the differentiated (or non-differentiated) sector, we use the 1995 gross value added (at current prices) of each subsector divided by the total value added for the differentiated (or non-differentiated) sector. After taking logs of the weighted series, we de-trend each series using the HP filter. Parameters $\rho$ and $\Omega$, reported in Table 1, are obtained from running a VAR(1) on the four de-trended series.

4.2. Simulation Results

We start by analyzing the dynamics of the benchmark model in response to a one standard deviation positive shock to home differentiated goods productivity. Assuming efficient stabilization policy in both countries, for each variable of interest, Fig.1 plots the percentage deviation from the unconditional mean. As Home policymakers react to the shock by expanding domestic demand and depreciating the exchange rate, Home production temporarily shifts from the non-differentiated goods sector to differentiated goods—non-
differentiate output actually falls. Due to positive correlation in shocks across countries, foreign production of differentiated goods also rises, but by a smaller amount than in the home country. In contrast with the home country, foreign production in non-differentiated goods rises. This shift in production of differentiated goods is mirrored in a rise in the number of firms in both countries, by a larger amount at home.

Table 2 characterizes unconditional means of key variables coming from stochastic simulations of a second order approximation of the benchmark model. Column (1) reports the values of these means when both countries use stabilization policy, column (2) when the foreign country adopts an exchange rate peg; in column (3) we report the percent change between the previous columns when foreign switches from inflation stabilization to a peg, accounting for changes across stochastic steady states. Note that country means are not completely symmetric even under the symmetric policies in column (1), due to the asymmetries in the calibrated shocks.

The simulation results fully confirm the main analytical insights from the previous section. When the foreign country pegs, average production of the differentiated good shifts away from the foreign country and toward the home country; the foreign country instead has higher production of the non-differentiated good. This shift in production is reflected in a 1.3 percent fall in the number of foreign differentiated goods firms, corresponding to a 1.1 percent rise at home. The share of differentiated goods in exports falls by 1.2% in the Foreign country, while rises by 1.1% in the Home country.

Consistent with the transmission mechanism highlighted by the analytical results based on the simplified version of our model, what drives the Foreign loss in the differentiated goods market share is a higher markup charged by differentiated goods producers on average. Even if falling wages in the foreign country lead to falling prices of all foreign goods, the price of differentiated goods rises relative to both wages and non-differentiated goods.

Another notable implication of the simulation is that the terms of trade including the homogenous good, $TOTS$, actually worsen for the foreign country when it abandons efficient stabilization policy. This stands in contrast with the conventionally defined terms of trade including only differentiated goods, $TOTM$, which does not worsen, reflecting the rise in
foreign markups on differentiated exports. The contrasting behavior of the TOTS is due to a composition effect: the shift in foreign export share away from differentiated goods means these more costly goods receive a smaller weight in the average price of foreign exports and a larger weight in the average price of foreign imports. The table also indicates that relative consumption levels are affected, with a fall in foreign consumption and arise at Home.

Table 3 summarizes the robustness of our key results for alternative specifications and calibrations of the model. To save space, we only report the percentage change in number of firms and percent change in differentiated export share when the foreign country switches from inflation stabilization to exchange rate peg. We report these differences both cumulated and by country, as the latter will be useful in making comparisons to the empirical section to follow. The first column reiterates the key result for the benchmark case from Table 2, adding that the total change in differentiated export share between countries is 2.2 percentage points. Column (2) indicates that the percent changes in differentiated export share shrink by more than an order of magnitude when the number of firms is held fixed exogenously. We conclude that the endogenous shift in number of firms between countries is essential for the change in monetary policy to translate into quantitatively meaningful effects on export shares.

The assumption of balanced trade plays no key role in our results: columns (3) and (4) indicate that the model keeps predicting a significant reallocation of production and a change in the composition of trade when agents can trade non-contingent bonds or have access to complete asset markets---in the appendix we detail changes in our model specification to introduce these alternative asset market arrangements. Columns (5) and (6) show that, as expected, the size of reallocation can be larger when the labor supply elasticity is infinite, as we assumed in the analytical section above. A rising labor supply elasticity is not the only factor in amplification, though. Our strongest result obtains when we set an infinite labor supply elasticity together with a relative risk aversion coefficient of 5, as in, e.g., Fernandez-Villaverde et al. (2011). This combination of elasticities greatly magnifies the effects of policy on the trade shares: the convexity of the utility function tends to raise the risk-like covariance term in pricing, magnifying the differential effects of a peg; an elastic labor supply helps smooth out reallocation and contain the effects of a large increase in entry on local costs. When
the foreign country adopts a peg, the share of differentiated goods in foreign export drops 9.7%, and that of the home country rises 15.7%.

The last three columns of Table 3 analyze the role of entry costs. The Table shows that, when entry costs are specified in labor units, magnitudes of percent changes in firm number and export shares shrink. Note that wages tend to rise in the country with more firm entry: if costs are in labor units, this effect tends to counteract the incentive to set up new production lines. Conversely, when entry costs depend on domestic manufacturing goods prices rather than wages, so that entry costs are valued in the same units in which a firm evaluates its profits and firm value, results are very similar to our benchmark---in which the initial investment also includes expenditure on imports. This suggests that our benchmark result is not driven by the Home terms of trade appreciation, driving down the portion of entry costs falling on imported goods.

Entry costs are obviously consequential. The final column shows that the strong results obtained in column (7) for the case of a high labor elasticity and a high risk aversion combined become closer to our benchmark when the entry cost is in labor units, rather than units of a firm’s good. The difference is that the initial investment no longer hinges on falling prices in goods. In column (7) indeed, when more firms enter, the home price index of differentiated goods falls, driving down entry costs, in turn inducing further entry, and so on.

5. Empirical evidence

To carry out an empirical exploration of our main argument, we focus on a key testable implication of the model: countries with monetary policy focused on domestic macro stabilization will have greater specialization of production and export in differentiated products, relative to countries with monetary policy driven instead by the objective of maintaining a fixed exchange rate. Our empirical strategy consists of taking the U.S. as the base country, and run panel regressions to test whether countries with independent monetary policy tend to have a greater share of their exports to the U.S. in industries classified as differentiated.
5.1. Data construction and description

To distinguish countries with or without monetary policy independence, we use information on both the exchange rate and the monetary regimes. Namely, we proxy lack of independence by the adoption of a pegged exchange rate regime. At the other extreme, we consider a country as pursuing independent monetary policy when it formally embraces an inflation targeting regime.

For the classification of exchange rate regimes, we rely on two sources. The International Monetary Fund produces a classification of exchange rate regimes based upon the observed degree of exchange rate flexibility and the existence of formal or informal commitments to exchange rate paths. The definition of peg includes countries with no separate legal tender, currency board arrangements, exchange rate bands, or crawling pegs; this excludes countries classified as managed floating and independent floating. We will also consider the classification system of Shambaugh (2004), which identifies a peg if a country sets its interest rates systematically following the policy decision in a base country. One advantage of this classification focuses on monetary independence rather than exchange rate regime per se, and our theory says pegs matter mainly for the loss of monetary independence. For example, Germany was classified as having monetary independence despite participating in pegs over the sample, because it acted as a leader within a pegging block. Further countries where capital controls insulated domestic monetary policy from global market pressure are also classified as having monetary independence. Further, China is classified as having monetary independence in much of the sample.

We date the adoption of an inflation targeting (IT) regime drawing on Roger (2009). This author distinguishes two phases in the adoption process: an initial disinflation period, that lasts for one or more years; and a ‘stable IT’ regime --- possibly motivating the use of a dynamic specification of the regression model. Around 20 countries adopt an IT regime in the years covered by our sample, both high and middle-income ones.

To identify exports of differentiated goods, we rely on Rauch (1999). This author provides a classification of 4-digit SITC industries in terms of the degree of differentiation among products. Some products are traded on organized exchanges, while some others have
reference prices published in trade journals. Those products for which neither is true are
classified as differentiated. Roughly 58% of the industries fall into the differentiated category.

Trade data come from the World Trade Flows Database (see Feenstra, et al., 2005).
Exports to the U.S. (in dollars) are available disaggregated by country and by four-digit
industry, on an annual basis for the period 1972-2004.

The set of countries covered both by the trade data and exchange rate classification
number 164. The sample years are determined by the availability of U.S. disaggregated import
data, covering the period 1972-2004.

5.2. Empirical Specification

Our dependent variable is the share of differentiated goods in exports. Let \( x_{ijt} \) denote
the dollar value of exports in industry \( i \) from country \( j \) to the U.S. in year \( t \). Let \( DIF \) takes the
value of 1 for a differentiated industry and 0 otherwise. For country \( j \) in year \( t \), we define a
measure of the share of differentiated goods in the overall exports of a country to the U.S.:

\[
SDIF_{jt} = \frac{\sum_i DIF_i \cdot x_{ijt}}{\sum_i x_{ijt}}.
\]

The index takes values on the continuous interval between 0 and 1. In some of our experiments
we will restrict attention to manufacturing exports only. In this case, we will only consider \( x_{ijt} \) if
belonging to SITC sector with code starting with 5 through 8.

When using the exchange rate regime as an indicator of constraints on monetary
stabilization, our regression specification is

\[
SDIF_{jt} = \beta_0 + \beta_1 MR_{jt} + \beta_2 X_{jt} + \chi_{jt} + \epsilon_{jt},
\]

where the monetary regime MR dummy is, respectively, PEG or IT, \( X \) is vector of additional
variables that we may include in the analysis as additional controls and \( \chi \) are country and year
fixed effects. When we proxy monetary independence with the exchange rate regime, \( PEG \)
takes the value of 1 for a fixed exchange rate and 0 otherwise. For the case of inflation
targeting, the dummy variable PEG replaced by IT --- which takes the value of 1 in the years in
which a country adopts that monetary regime, 0 otherwise. In some of our specifications, we
will enter the PEG or the IT regressor with a lag, to allow for the possibility of delayed effects. Across all our regressions, standard errors are clustered by country.

Note that the country fixed effects control for standard factors that determine comparative advantage, such as factor endowments and institutions that do not vary over the sample period. Among the controls, we include macroeconomic variables that may have an effect on the composition of trade above and beyond the mechanism highlighted by our model, such as the current account (CA_GDP), and dates of currency (CRISIS_C) or banking crises (CRISIS_B). Access to credit and exposure to credit conditions may in fact vary across industries, in part reflecting the type of markets in which they operate. We also include the real exchange rate level (RER), as an additional control for the effects on export of large swings in international prices.

5.3. Regression Results

For the PEG regression, the model predicts $\beta_i < 0$: the share of a country’s exports in differentiated goods falls when it adopts a fixed exchange rate policy. Results from the regression model are shown in table 4 (without controls) and table 7 (with controls). The evidence supports the model’s prediction. By the point estimate shown in column 1 of table 4, when a country adopts a peg, the share of its exports in differentiated goods falls by about 6 percentage points. Given that for the typical country differentiated goods account for about half of its exports, the estimated coefficient implies that the export share drops by about 12% of its value. This effect is larger than that implied by the benchmark calibration of our theoretical model, though it lies within the range of theoretical results we report for calibrations with a more generous labor elasticity and risk aversion. The remainder of the table shows that this result is robust to various subsamples of goods and countries, as well as an alternative regime classification scheme.

A concern with endogeneity is raised by the possibility that countries that discover oil or other commodities in their territory may choose to peg their currencies to the dollar because these commodities are priced in U.S. dollars. In this case, a peg regime would be the consequence, rather than the cause, of a change in the composition of production and exports away from differentiated goods. One way to address this potential issue consists of excluding
Opec members and other large oil exporters from the data set (column 2) and to exclude fuel from the set of export industries (SITC categories beginning with 3, see column 6). In either exercise, our estimations continue to support our claim. We also show below that the result is robust to instrumenting for endogenous choice of exchange rate regime.

The table shows that our result is robust to using the Shambaugh classification of exchange rate regime (column 7), which in principle reflects monetary independence countries retain despite a peg, due to capital controls or being the leader of a pegging block.

Another source of concern is that poor countries may produce mostly non-differentiated goods, and adopt some form of currency peg. We check for robustness by limiting the sample to more developed countries, with cutoffs in per-capita income of $1035, $4085 and $12,615, according to the World Bank classification. Results are shown in columns 3 to 5. The only case for which, while the sign and magnitude of the coefficient is unaltered, the result is not statistically significant is the case of the richest countries. Nonetheless, we find that the result becomes significant if we allow some dynamics in the specification, or we re-estimate the model using five-year averages, to better account for the effects of monetary regimes. Table 5 introduces a lagged Peg regressor, which turns out to be significant for the case of the rich countries. Furthermore, Table 6 shows that if we average over dynamics, with 5 year non-overlapping averages, the peg coefficient is significant for all these cases, including the richest countries.13 Finally, results appear robust to specifications including controls, shown in Table 7.

We should note that the inclusion of fixed effects in the regression specification takes care of a number of potential issues, by which time-invariant characteristics of a country determine the composition of exports, and this motivates the adoption of a fixed exchange rate by the authorities. We have provided a discussion of the case of oil exports above. As there could be other reasons for a country to choose a regime of fixed exchange rates at least in part in reaction to the composition of their exports, that are not time invariant, we also run some IV regressions.

---

13 In this case, a country is classified as pursuing a peg if, over the five year comprised in each observation, PEG=1 for 3 years. Results are robust to changing this threshold to 4.
To deal with potential sources of endogeneity, we instrument for the exchange rate regime choice with the variable proposed by Klein and Shambaugh (2006). This consists of the share of neighboring countries that also peg their currency to the same base country. The logic is that if, for instance, France pegs its currency to the U.S. dollar, in doing so it might be motivated by the goal of stabilizing its currency to its neighbor Germany, which also pegs to the dollar. To the degree that these regional ties dictate the choice exchange rate regime, one can conclude that a French peg to the dollar is not endogenously driven by its trade relationship with the U.S., nor, more importantly, by the composition of its trade with the U.S. For logical consistency, we run our IV estimation adopting the classification of the peg regime by Shambaugh (2004), as in the last column of Tables 2 and 3. We thus ensure that the definitions of both our instrument and the PEG variable follow the same methodology. The results, shown in Table 8, continue to support our claim, with a statistically significant negative coefficient on the peg term. The table also shows that our main results are robust to using another instrument, the lagged exchange rate regime dummy, that is also widely adopted in the literature. Again, for consistency and to verify robustness of our result, in this case the table reports estimation based on the exchange rate classification regime by the IMF.

In assessing the above results, we should stress that the exchange rate regime provides only an imperfect proxy for the extent to which monetary policy can stabilize the domestic economy. For instance, one could argue that a peg may be a good stabilization strategy depending on the type of shocks. In the presence of financial shocks, a credible strategy of fixed exchange rate could ensure better stabilization than a float. Moreover, the presence of capital controls may relax the external financial constraints on monetary policy even under regimes of limited exchange rate flexibility. While these considerations are well-grounded, we observe that they both work against our hypothesis: other things equal, they tend to smooth out differences between a peg and a floating regime, in terms of their implications on competitiveness. In other words, if the estimation is confounded by such forms of endogeneity, our estimates would underestimate the importance of efficient domestic stabilization policy on competitiveness, biasing our results towards zero.
So far, we have proceeded in our analysis under the presumption that a peg affects comparative advantage via the implied loss of effective stabilization policy. We now elaborate on our theoretical prediction, and run the model focusing on the formal adoption of an inflation targeting regime. Countries that adopt an inflation-targeting regime are widely regarded as using prudent domestic stabilization policy. Consistently with our model, they should provide a better economic environment for industries producing differentiated goods to invest and prosper.

In what follows, we run our empirical model replacing the peg indicator with the inflation targeting indicator variable, and estimate the benchmark regression with and without a lag. For the IT regression, the model predicts $\beta_i > 0$: the share of a country’s exports in differentiated goods rises when policymakers adopt an IT regime.

For the share of differentiated goods in total exports (not reported in the table), results have the correct sign (positive: IT countries have a larger share of differentiated exports), yet they are not statistically different from zero consistently across subsamples---they tend to be so for OECD countries, and upper- and middle-income countries, but not for the sample as a whole. Results are however consistently significant if we use as dependent variable the share of differentiated goods in manufacturing exports. Results for this case are shown in tables 9 and 10: the coefficient on inflation targeting is positive and significant with a magnitude similar to that of the peg in earlier regressions.

As a final exercise, we also use the IT dummy as an instrument in the peg regression. The idea is to identify more sharply the set of countries that, under a flexible exchange rate, would make use more fully of the stabilization properties of monetary policy. This strategy works well in favor of our hypothesis, especially for the sample of high income and non-oil exporting countries, for which the evidence is mixed in the non-IV regressions.
6. Conclusion

According to a widespread view in policy and academic circles, monetary policy can contribute to national welfare by boosting the competitiveness of the domestic manufacturing sector, with potential beggar-thy-neighbor effects. This paper revisits the received wisdom on this issue, exploring a new direction for open-economy monetary models.

The literature has so far focused on terms of trade externalities as key considerations shaping strategic policy interactions across countries. In the standard new-Keynesian model, optimal monetary policy essentially acts as if it pursued an ‘optimal tariff’ objective, moving the terms of trade in favor of the domestic residents. In contrast, the main idea underlying our approach consists of allowing for incomplete specialization in the production of two (or more) tradable goods, with fundamental asymmetries regarding their contribution to national welfare. In our specification, acquiring comparative advantage in the monopolistic sector producing differentiated goods is desirable, insofar as it brings about saving in trade costs --- the main implication of a production relocation externality. Alternative specifications could build upon differences in market power across sectors, (knowledge) externalities and other sources of increasing returns.

We have shown that the standard model augmented with two tradable sectors and a production relocation externality brings the main lessons from the literature closer to addressing core concerns shaping the policy debate, regarding the implications of monetary and exchange rate policies for competitiveness. Industries with monopoly power are typically associated with sunk (entry) investment and price stickiness, arguably making them more sensitive to macroeconomic uncertainty than other industries. By stabilizing macro shocks affecting their marginal costs and revenues, monetary policy can attract such industries, leading to potentially large welfare gains.

Monetary rules thus contribute to shape domestic comparative advantage in manufacturing, by creating conditions for domestic firms to charge low average prices on their exports and so acquire a larger share of world demand for manufacturing. In spite of low domestic manufacturing prices, however, per effect of a changing composition of output and exports towards high markup goods, the country actually improves its overall terms of trade.
While monetary policy cannot be expected to play the same pivotal role as real factors such as factor endowments and taxation, in determining a country’s competitiveness, nonetheless, the theoretical and empirical results from our analysis suggest that its potential role is far from negligible, and may be larger than the standard welfare gains from stabilization in the monetary policy literature.

References


Hummels, David. 1999. "Have International Transportation Costs Declined?" work paper Purdue University.


Appendix:

1. Entry condition:

Substituting (12) into (15) and simplifying:

\[ W_q = E_i \left[ \beta \frac{\mu_i}{\mu_{i+1}} \left( p_{i+1}(h) - \frac{W_{i+1}}{\alpha_{i+1}} \right) c_{i+1}(h) + \left( e_{i+1}p_{i+1}(h) - (1 + \tau) \frac{W_{i+1}}{\alpha_{i+1}} \right) c^*(h) \right] \]

Under producer currency pricing of exports:

\[ W_q = E_i \left[ \beta \frac{\mu_i}{\mu_{i+1}} \left( p_{i+1}(h) - \frac{W_{i+1}}{\alpha_{i+1}} \right) c_{i+1}(h) + (1 + \tau) p_{i+1}(h) - (1 + \tau) \frac{W_{i+1}}{\alpha_{i+1}} c^*(h) \right] \]

Using demand equations for \( CM \) and \( c(h) \), as well as definition of \( PM \):

\[ W_q = E_i \left[ \beta \frac{\mu_i}{\mu_{i+1}} \left( p_{i+1}(h) - \frac{W_{i+1}}{\alpha_{i+1}} \right) (c_{i+1}(h) + (1 + \tau) c^*(h)) \right] \]

Under log utility, where \( W_i = \kappa \mu_i \) and \( PC_i = \mu_i \), this becomes equation (27).

2. Entry under full stabilization

Substitute prices, \( p_{i+1}(h) = p^*_{i+1}(f)(\phi/(\phi - 1)) \kappa \), and policy rules \( (\mu = \alpha, \quad \mu^* = \alpha^*) \) into (27) and simplify:

\[ \frac{\kappa \phi}{\beta \theta} E_i \left[ n_{i+1} + n^*_{i+1} \left( \frac{\alpha_{i+1}}{\alpha_{i+1}} \right)^{\phi-1} \left( (1 + \tau)^{1-\phi} \right)^{-1} \right] \]

Impose symmetry across countries:

\[ n_{i+1} = \frac{\beta \theta}{\kappa \phi} E_i \left[ 1 + \left( \frac{\alpha_{i+1}}{\alpha_{i+1}} \right)^{1-\phi} \left( (1 + \tau)^{1-\phi} \right)^{-1} \right] \]

\[ n^*_{i+1} = \frac{\beta \theta}{\kappa \phi} E_i \left[ 2 + \left( \frac{\alpha_{i+1}}{\alpha_{i+1}} \right)^{1-\phi} \left( (1 + \tau)^{1-\phi} + (1 + \tau)^{1-\phi} \right) \right] \]

Which is the same as for the flexible price case.

To compare to the no stabilization case, write this as
\[
\nu_{t+1}^{stab} = n_{t+1}^{no\, stab} E_i \Omega_{t+1}
\]

where

\[
\Omega = \frac{2 + \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left[ (1 + \tau)^{\phi-1} + (1 + \tau)^{1-\phi} \right]}{1 + \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left[ (1 + \tau)^{\phi-1} + (1 + \tau)^{1-\phi} \right] + \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{2(1-\phi)}}.
\]

Note that \( n_{t+1}^{stab} > n_{t+1}^{no\, stab} \) if \( E_i \Omega_{t+1} > 1 \). However, \( \Omega_{t+1} \) switches from a concave function of \( \alpha_{t+1} / \alpha_{t+1}^{stab} \) to a convex function near the symmetric steady state value of \( \alpha_{t+1} / \alpha_{t+1}^{stab} = 1 \). Hence we cannot apply Jensen’s inequality to determine whether \( E_i \Omega_{t+1} > 1 \). This finding reflects the fact that the effects of symmetric stabilization are small. Our analysis, nonetheless, will show that the effects of asymmetric stabilization can be large.

3. Case of fixed exchange rate rule:

Substitute prices and policy rules \( \mu = \alpha_{t+1}, \mu^* = \mu = \alpha \) (so \( e = 1 \)) into (27):

\[
\frac{\kappa \phi}{\beta \theta} = E_i \left[ \left( \frac{\phi - \kappa - \kappa}{\phi - 1} \right)^{1-\phi} \left( \frac{\phi - \kappa}{\phi - 1} \right)^{1-\phi} \left[ n_{t+1} \left( \frac{\phi - \kappa}{\phi - 1} \right)^{1-\phi} + n_{t+1}^* \left( \frac{\phi - \kappa}{\phi - 1} \kappa E_i \left[ \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right] \right)^{1-\phi} \right] \right] \]

Pass through expectations and simplify

\[
\frac{\kappa \phi}{\beta \theta} = \left( n_{t+1} + n_{t+1}^* \right) \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi} + \left( n_{t+1} + n_{t+1}^* \right) \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi}
\]

Do the same for the foreign entry condition:

\[
\frac{\kappa \phi}{\beta \theta} = E_i \left[ \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left( n_{t+1} \left( \frac{\alpha_{t+1}^{stab}}{\alpha_{t+1}} \right) \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi} + \left( n_{t+1} \left( \frac{\alpha_{t+1}^{stab}}{\alpha_{t+1}} \right) \right)^{1-\phi} \left( n_{t+1} \left( 1 + \tau \right)^{1-\phi} \right) \right]
\]

Rewrite the home and foreign conditions as fractions:

\[
\frac{\kappa \phi}{\beta \theta} = \frac{1}{n_{t+1} + A n_{t+1}^* + B n_{t+1}^*}
\]

Foreign:

\[
\frac{\kappa \phi}{\beta \theta} = \frac{A}{n_{t+1} + A n_{t+1}^*} + \frac{B}{n_{t+1} + B n_{t+1}^*}
\]

Where we define,

\[
A = E_i \left[ \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi} \right], \quad B = E_i \left[ \left( \frac{\alpha_{t+1}}{\alpha_{t+1}^{stab}} \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi} \right]
\]

Equating across countries:
Note that the denominator will be negative provided the standard deviation of shocks is small relative to the iceberg costs, which will be true for all our cases:

\[
\frac{2n_{t+1} + (A+B)n^*_{t+1}}{(n_{t+1} + An^*_{t+1})(n_{t+1} + Bn^*_{t+1})} = \frac{(A+B)n_{t+1} + 2ABn^*_{t+1}}{(n_{t+1} + An^*_{t+1})(n_{t+1} + Bn^*_{t+1})}
\]

\[
\frac{n_{t+1}}{n^*_{t+1}} = \frac{2AB - A - B}{2 - A - B}
\]

so \( \frac{n_{t+1}}{n^*_{t+1}} > 1 \) if \( \frac{2AB - A - B}{2 - A - B} > 1 \)

Note that the denominator will be negative provided the standard deviation of shocks is small relative to the iceberg costs, which will be true for all our cases:

\[
\sigma < \left( \ln \left( \frac{2}{\left( (1+\tau)^{1-\phi} + (1+\tau)\phi^{-1} \right)} \right) / \frac{1-\phi}{2} \right)^{0.5}
\]

For shocks independently log normally distributed with standard deviation \( \sigma \) so that

\[
E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] = e^{\frac{1-\phi}{2}}
\]

. For example, with \( \tau=0.1 \) and \( \phi=6 \), \( \sigma \) must be less than 0.209. Our calibration of \( \sigma \) is 0.017.

So \( \frac{n_{t+1}}{n^*_{t+1}} > 1 \) if \( 2AB - A - B < 2 - A - B \) or \( AB < 1 \)

\[
AB = \left( E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right)^{1-\phi} \left( 1 + \tau \right)^{1-\phi} \left[ E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right]^{\phi-1} = \left( E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right)^{2(1-\phi)}
\]

For independent log normal distributions of productivity:

\[
\left( E_t \left[ \frac{\alpha_{t+1}}{\alpha^*_{t+1}} \right] \right)^{2(1-\phi)} = e^{(1-\phi)\sigma^2} < 1 \text{ since } \phi > 1
\]

We can conclude that \( n > n^* \).

4. Specification of alternative asset market arrangements:

To introduce complete asset markets, the balance trade condition (40) is replaced by the risk sharing condition:

\[
\frac{\mu_i}{\mu} = e_t.
\]

To specific international asset trade limited to noncontingent nominal bonds, we introduce the notation \( B_h \) for home holding of home currency bonds and \( B_f \) home holding of foreign currency bonds, with foreign holdings indicated with a ‘*’.

The balanced trade condition (40) now is replaced by a richer balance of payments condition including asset trades:

\[
\int_0^{n_i} p_1^* (h) (c_i^* (h) + d_k^* (h) + d_{AC}$h) (h))dh - \int_0^{n_f} p_1 (f) (c_i (f) + d_k (f) + d_{AC} (f))df
\]

\[
+ P_{ih}^* (C_{ih} + D_{ih}) - P_{if}^* (C_f + D_{AC,f}) - i_{ih} B_{ih} + e_i^{t+1} B_f = (B_{ih} - B_{ih-1}) + e_i (B_f - B_{f-1})
\]

We also have two asset market clearing conditions:
\[ B_{Ht} + B'_{Ht} = 0 \]
\[ B_{Fr} + B'_{Fr} = 0 \]
As well as two distinct uncovered interest rate parity conditions governing asset choices. Note that there is a small quadratic cost of holding bonds of the other country, \( \psi_B \), calibrated at 0.001.

\[
E_t \left[ \frac{\mu}{\mu_{t+1}} e_t \left( 1 + i_t^* \right) \left( 1 + \psi_B \left( \frac{e_t B_{Ht}}{p_{Ht} y_{Ht}} \right) \right) \right] = E_t \left[ \frac{\mu}{\mu_{t+1}} \left( 1 + i_t \right) \right]
\]

\[
E_t \left[ \frac{\mu^*}{\mu_{t+1}} e_t \left( 1 + i_t^* \right) \left( 1 + \psi_B \left( \frac{B'_{Ht}}{e_t^* p_{Ht}^* y_{Ht}^*} \right) \right) \right] = E_t \left[ \frac{\mu^*}{\mu_{t+1}} \left( 1 + i_t^* \right) \right]
\]
Table 1. Benchmark Parameter Values

<table>
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<tr>
<th>Preferences</th>
<th>Value</th>
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<td>Risk aversion</td>
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<tr>
<td>Time preference</td>
<td>$\beta = 0.97$</td>
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<tr>
<td>Labor supply elasticity</td>
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<tr>
<td>Differentiated goods share</td>
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<tr>
<td>Non-differentiated goods home bias</td>
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<tr>
<td>Differentiated goods elasticity</td>
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<td>Non-differentiated elasticity</td>
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<table>
<thead>
<tr>
<th>Technology</th>
<th>Value</th>
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<tr>
<td>Price stickiness</td>
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<tr>
<td>Differentiated good trade cost</td>
<td>$\tau_D = 0.16$</td>
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<td>Non-differentiated good trade cost</td>
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<table>
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<th>Shocks:</th>
<th></th>
</tr>
</thead>
<tbody>
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<td>$\rho$</td>
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| $\begin{bmatrix}
0.6665 & -0.6145 & 0.1328 & -0.2064 \\
0.3724 & 0.0447 & 0.0360 & -0.0250 \\
0.5194 & -1.6747 & 0.1289 & 0.6588 \\
0.2646 & -0.4435 & -0.0474 & 0.4407
\end{bmatrix}$ |           |

| $\Omega$                                  |           |
| $\begin{bmatrix}
5.11e-4 & 1.68e-4 & 9.25e-5 & 3.45e-5 \\
1.68e-4 & 1.45e-4 & 1.82e-5 & 6.47e-5 \\
9.25e-5 & 1.82e-5 & 6.76e-4 & 7.50e-5 \\
3.45e-5 & 6.47e-5 & 7.50e-5 & 1.70e-4
\end{bmatrix}$ |           |
Table 2: Unconditional Means under Alternative Policies

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<tr>
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<td>p*(f)</td>
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<td>1.2642</td>
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<tr>
<td>p(h)/pdh</td>
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<td>1.2389</td>
<td>0.00</td>
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<tr>
<td>p*(f)/pdf*</td>
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<td>TOT-total</td>
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Results come from a stochastic simulation of a second-order approximation to the model.
## Table 3: Summary of implications of alternative model specifications for key variables

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</table>

Table reports the percent change in a variable when the foreign country replaces inflation stabilization with exchange rate peg. Table also reports the difference between the home and foreign percent changes. Results come from a stochastic simulation of a second-order approximation to the model.
<table>
<thead>
<tr>
<th></th>
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<td>Exclude Low</td>
<td>High &amp; Upper</td>
<td>High</td>
<td>No Energy</td>
<td>Shambaugh Peg</td>
</tr>
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<td></td>
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<td>Income</td>
<td>Middle Income</td>
<td>Income &amp; Non-oil</td>
<td>Goods</td>
<td>Peg</td>
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<td>-0.0585***</td>
<td>-0.0635***</td>
<td>-0.0632***</td>
<td>-0.0667***</td>
<td>-0.0234</td>
<td>-0.0487***</td>
<td>-0.0367**</td>
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<tr>
<td></td>
<td>(0.0163)</td>
<td>(0.0166)</td>
<td>(0.0169)</td>
<td>(0.0195)</td>
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<td>3256</td>
<td>2942</td>
<td>2094</td>
<td>953</td>
<td>3645</td>
<td>4757</td>
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<td>R-sq</td>
<td>0.741</td>
<td>0.725</td>
<td>0.786</td>
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<td>0.818</td>
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<td>0.718</td>
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<td>adj. R-sq</td>
<td>0.728</td>
<td>0.710</td>
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<td>0.803</td>
<td>0.696</td>
<td>0.706</td>
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<td>yes</td>
</tr>
<tr>
<td>Year Fixed Effect</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
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<td>yes</td>
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Notes: DIF not included as regressor because subsumed in fixed effects.
Standard errors (clustered by country) in parentheses:
* significance at 10%; ** significance at 5%; ***significance at 1%
Table 5: Baseline Regression with Lagged Peg

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td>Benchmark</td>
<td></td>
<td>Non-oil export</td>
<td>Exclude Low In</td>
<td>High &amp; Upper M</td>
<td>High Inc Non-o</td>
<td>No Energy G</td>
<td>Shambaugh Peg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>countries</td>
<td>come</td>
<td>Middle Income</td>
<td>s Oil &amp; Non-o</td>
<td>s</td>
<td>Peg</td>
</tr>
<tr>
<td>PEG</td>
<td>-0.0270*</td>
<td>-0.0292*</td>
<td>-0.0487**</td>
<td>0.0000364</td>
<td>-0.0177</td>
<td>-0.0177</td>
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</tr>
<tr>
<td></td>
<td>(0.0158)</td>
<td>(0.0176)</td>
<td>(0.0212)</td>
<td>(0.0140)</td>
<td>(0.0146)</td>
<td>(0.0127)</td>
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<tr>
<td>L.PEG</td>
<td>-0.0360**</td>
<td>-0.0422***</td>
<td>-0.0192</td>
<td>-0.0253*</td>
<td>-0.0348*</td>
<td>-0.0257**</td>
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</tr>
<tr>
<td></td>
<td>(0.0154)</td>
<td>(0.0156)</td>
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<td>(0.0124)</td>
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<td>2809</td>
<td>1997</td>
<td>911</td>
<td>3480</td>
<td>4580</td>
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<td>R-sq</td>
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<td>0.791</td>
<td>0.824</td>
<td>0.820</td>
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<td>0.727</td>
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<td>adj. R-sq</td>
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<td>0.805</td>
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<td>0.715</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Yes</td>
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<td>yes</td>
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</tbody>
</table>

Notes: DIF not included as regressor because subsumed in fixed effects.
Standard errors (clustered by country) in parentheses:
* significance at 10%; ** significance at 5%; ***significance at 1%
Table 6: Non-Overlapping 5-Year Averages

<table>
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<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
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<td>Benchmark</td>
<td>Non-oil</td>
<td>Exclude Low</td>
<td>High &amp; Upper</td>
<td>High Income &amp; Non-oil</td>
<td>No Energy Goods</td>
<td>Shambaugh Peg</td>
</tr>
<tr>
<td>PEG</td>
<td>-0.0579***</td>
<td>0.0662***</td>
<td>-0.0681***</td>
<td>-0.0709***</td>
<td>-0.0397*</td>
<td>-0.0533***</td>
<td>-0.0402**</td>
</tr>
<tr>
<td></td>
<td>(0.0199)</td>
<td>(0.0208)</td>
<td>(0.0199)</td>
<td>(0.0231)</td>
<td>(0.0222)</td>
<td>(0.0197)</td>
<td>(0.0202)</td>
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<td>712</td>
<td>643</td>
<td>459</td>
<td>209</td>
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<td>1030</td>
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<td>R-sq</td>
<td>0.824</td>
<td>0.813</td>
<td>0.843</td>
<td>0.868</td>
<td>0.879</td>
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<td>0.808</td>
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<td>adj. R-sq</td>
<td>0.780</td>
<td>0.766</td>
<td>0.803</td>
<td>0.835</td>
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<tr>
<td>Country Fixed Effect</td>
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<tr>
<td>Year Fixed Effect</td>
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<td>yes</td>
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<td>yes</td>
<td>yes</td>
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</tbody>
</table>

Notes: DIF not included as regressor because subsumed in fixed effects.
Standard errors (clustered by country) in parentheses:
* significance at 10%; ** significance at 5%; *** significance at 1%
Table 7: Baseline Regressions with Controls

<table>
<thead>
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<th>(1) benchmark</th>
<th>(2) 5 year averages</th>
<th>(3) high income nonoil</th>
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<td><strong>PEG</strong></td>
<td>-0.0528***</td>
<td>-0.0475**</td>
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<tr>
<td></td>
<td>(0.0186)</td>
<td>(0.0218)</td>
<td>(0.0180)</td>
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<tr>
<td><strong>L.PEG</strong></td>
<td></td>
<td></td>
<td>-0.0301*</td>
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<td></td>
<td></td>
<td></td>
<td>(0.0174)</td>
</tr>
<tr>
<td><strong>CA_GDP</strong></td>
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<td>0.00107</td>
<td>0.00203***</td>
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<tr>
<td></td>
<td>(0.000619)</td>
<td>(0.00178)</td>
<td>(0.000326)</td>
</tr>
<tr>
<td><strong>RER</strong></td>
<td>0.00855</td>
<td>0.0185*</td>
<td>-0.0250***</td>
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<td>(0.0122)</td>
<td>(0.00995)</td>
<td>(0.00617)</td>
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<td>0.00646</td>
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<td>-0.00405</td>
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<tr>
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<td>(0.0261)</td>
<td>(0.0328)</td>
<td>(0.0318)</td>
</tr>
</tbody>
</table>

|                |             |                     |                        |
| **Obs.**       | 2523        | 641                 | 2626                   |
| **R-sq**       | 0.785       | 0.855               | 0.774                  |
| **adj. R-sq**  | 0.769       | 0.807               | 0.758                  |
| **Country and Year Fixed Effects** | yes | yes | yes |
Table 8: IV Regressions

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<tr>
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<th>IV: Lagged IMF Exchange Rate</th>
<th>IV: Klein-Shambaugh Index</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>-0.0739***</td>
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<td>(0.0206)</td>
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<tr>
<td>Obs.</td>
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<td>3481</td>
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<tr>
<td>R-sq</td>
<td>0.183</td>
<td>0.183</td>
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<tr>
<td>adj. R-sq</td>
<td>0.137</td>
<td>0.137</td>
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<td>Clustered</td>
<td>Robust</td>
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<td>Country Fixed Effect</td>
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<td>yes</td>
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<tr>
<td>Year Fixed Effect</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Notes: DIF not included as regressor because subsumed in fixed effects.
If the instrument is Klein and Shambaugh, the instrumented variable is the Shambaugh peg;
If the instrument is the lagged IMF exchange rate index, the instrumented is the contemporaneous IMF exchange rate index.
Under "IV: Klein-Shambaugh Index":
Standard errors (either clustered by country or heteroskedasticity-robust) in parentheses:
* significance at 10%; ** significance at 5%; *** significance at 1%
Table 9: Baseline Regressions with Inflation Target and Lag (Sample: manufacturing goods)

<table>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<td></td>
<td>Full Sample</td>
<td>Exclude Low</td>
<td>High &amp; Upper</td>
<td>High &amp; Upper</td>
<td>High</td>
<td>OECD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Income</td>
<td>Middle Income</td>
<td>Middle Income&amp;</td>
<td>Income</td>
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<tr>
<td>IT</td>
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<td>-0.00866</td>
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<td>(0.0226)</td>
<td>(0.0244)</td>
<td>(0.0253)</td>
<td>(0.0369)</td>
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</tr>
<tr>
<td>L.IT</td>
<td>0.0284**</td>
<td>0.0391***</td>
<td>0.0390***</td>
<td>0.0339**</td>
<td>0.0327**</td>
<td>0.0495***</td>
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<td>(0.0133)</td>
<td>(0.0135)</td>
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<td>R-sq</td>
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<td>adj. R-sq</td>
<td>0.733</td>
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<tr>
<td>Year Fixed Effect</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
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Notes: DIF not included as regressor because subsumed in fixed effects.
Standard errors (clustered by country) in parentheses:
* significance at 10%; ** significance at 5%; *** significance at 1%
Table 10: Baseline Regressions with Inflation Target, 5 year averages (Sample: manufacturing goods)

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<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full Sample</td>
<td>Exclude Low Income</td>
<td>High &amp; Upper Middle Income</td>
<td>High &amp; Upper Middle Income and Non-Oil</td>
<td>High Income</td>
<td>OECD</td>
</tr>
<tr>
<td>IT</td>
<td>0.0605*</td>
<td>0.0756**</td>
<td>0.0968**</td>
<td>0.0810*</td>
<td>0.144***</td>
<td>0.0692*</td>
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<td>(0.0328)</td>
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<td>(0.0382)</td>
<td>(0.0430)</td>
<td>(0.0535)</td>
<td>(0.0382)</td>
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<td>565</td>
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<td>0.721</td>
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<td>0.713</td>
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<td>yes</td>
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<td>yes</td>
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</tbody>
</table>

Notes: DIF not included as regressor because subsumed in fixed effects.
Standard errors (clustered by country) in parentheses:
* significance at 10%; ** significance at 5%; ***significance at 1%
Fig 1: Responses to a 1 std dev rise in home manufacturing productivity

Vertical axis is percent deviation (0.01=1%) from steady state levels. Horizontal axis is time (in quarters).