

Fiscal and Monetary Policy in Open Economy **FREE**

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Summary

The development of a simple framework with optimizing agents and nominal rigidities is the point of departure for the analysis of three questions about fiscal and monetary policies in an open economy.

The first question concerns the optimal monetary policy targets in a world with trade and financial links. In the baseline model, the optimal cooperative monetary policy is fully inward-looking and seeks to stabilize a combination of domestic inflation and output gap. The equivalence with the closed economy case, however, ends if countries do not cooperate, if firms price goods in the currency of the market of destination, and if international financial markets are incomplete. In these cases, external variables that capture international misalignments relative to the first best become relevant policy targets.

The second question is about the empirical evidence on the international transmission of government spending shocks. In response to a positive innovation, the real exchange rate depreciates and the trade balance deteriorates. Standard open economy models struggle to match this evidence. Non-standard consumption preferences and a detailed fiscal adjustment process constitute two ways to address the puzzle.

The third question deals with the trade-offs associated with an active use of fiscal policy for stabilization purposes in a currency union. The optimal policy assignment mandates the monetary authority to stabilize union-wide aggregates and the national fiscal authorities to respond to country-specific shocks. Permanent changes of government debt allow to smooth the distortionary effects of volatile taxes. Clear and credible fiscal rules may be able to strike the appropriate balance between stabilization objectives and moral hazard issues.

Keywords: fiscal policy, monetary policy, open economy, currency union, exchange rates

Subjects: International Economics, Macroeconomics and Monetary Economics

Beyond Mundell–Fleming

In the public debate, the discussion of monetary and fiscal policy issues in an open economy often still revolves around some variant of the Mundell–Fleming model (Fleming, 1962; Mundell, 1963).¹

Since the early 1990s, however, the literature has moved well beyond Mundell–Fleming. Methodologically, the crucial step to revive the attention on monetary and fiscal policy in an open economy was the publication of the “Redux” paper by Obstfeld and Rogoff (1995).² The combination of explicit microfoundations, rational expectations, and price rigidities provides a coherent framework to analyze the consequences of the private sector’s intertemporal decisions

in conjunction with the real effects of monetary and fiscal policy, and their transmission across countries. The Redux paper spurred an ongoing wave of new research, sometimes labeled “New Open Economy Macroeconomics,” or NOEM (see Lane, 2001, for an early survey). This approach, both in its theoretical and its empirical incarnations, has become the dominant paradigm in international macroeconomics.

The NOEM literature is therefore a natural starting point to review a number of central questions related to monetary and fiscal policy in an open economy. The section “Flexible Inflation Targeting in an Open Economy” deals with monetary policy issues. The organizing framework is a baseline NOEM model, introduced in the subsection “A Baseline New Keynesian Open Economy Model.” The first question dates back to Friedman (1953), and concerns the optimality of flexible exchange rates. The next subsection, “Optimal Monetary Policy in the Baseline Model,” shows that in the baseline NOEM model, flexible exchange rates are indeed desirable from a global perspective. As in the closed economy case, the targeting rules that characterize optimal monetary policy only involve domestic objectives (inflation and the output gap). This result, however, is rather fragile. As the section “Fiscal Policy in an Open Economy” demonstrates, the introduction of a number of additional features, which arguably increase the realism of the baseline model, generates a rationale for targeting international variables (in deviations from their welfare-relevant target level), above and beyond their effects on domestic objectives.

While the debate in the NOEM literature has focused largely on monetary policy, two fiscal policy themes, discussed in the section “Fiscal Policy in an Open Economy,” have nonetheless attracted considerable attention. The first is the international transmission of fiscal policy shocks. In this context, the response of the real exchange rate to a government spending shock constitutes a key puzzle for a large set of standard models, whether in the Mundell–Fleming tradition or featuring optimizing households (Monacelli & Perotti, 2010). The conclusion of subsection “The International Transmission of Fiscal Policy Shocks” is that some combination of non-standard preferences and a detailed characterization of the fiscal adjustment process are necessary for the baseline model to be consistent with the data.

A second important debate on the role of fiscal policy in an open economy, reinforced by the European sovereign debt crisis that started in 2010 (see Lane, 2012, for a survey), is the lack of stabilization instruments in a currency union (Mundell, 1961). In this respect, the subsection “Currency Unions and the Stabilization Gap” highlights a key trade-off discussed in the literature. On the one hand, the optimal response to asymmetric shocks requires an aggressive fiscal response at the country level. On the other hand, while all countries are likely to rely on fiscal expansions in a crisis, at least to some extent, many are reluctant to undertake the necessary consolidation in an expansion. The result is that public debt remains high, giving rise to moral hazard problems.

“Final Remarks and Related Topics” concludes, listing a number of topics and references that are to some extent related to fiscal and monetary policy in an open economy but are not included for reasons of space.

Flexible Inflation Targeting in an Open Economy

The collapse of the Bretton Woods system in the early 1970s saw countries transition to a regime of flexible exchange rates and domestic monetary policy independence. The main lesson from the Mundell–Fleming model under flexible exchange rates is that only monetary policy affects output, while fiscal policy does not. As central banks have become more and more successful in controlling inflation, Taylor (2000) summarizes the consensus that has emerged: monetary policy has become the main stabilization tool, while the countercyclical role of fiscal policy has primarily worked through automatic stabilizers.

It is perhaps then not a coincidence that most of the NOEM literature, especially in its early days, has focused on revisiting questions related to monetary policy.³ The analysis starts with the introduction of a baseline New Keynesian model to study monetary policy in an open economy. The main result from this baseline model is that targeting domestic objectives (inflation and the output gap) is optimal, and countries should let the exchange rate adjust freely. In this sense, the literature has validated the approach followed in practice by central banks around the world. The introduction of additional realistic features, however, leads to questioning the conclusion from the baseline model.

A Baseline New Keynesian Open Economy Model

The baseline model follows Benigno and Benigno (2006), in particular their analysis of the case of an efficient steady state.⁴ This model serves as the basis for the analysis of optimal monetary policy in an open economy and as a point of departure for the introduction of a number of extensions that follow.

The world consists of two countries, Home (or H) and Foreign (or F), of size $n \in (0,1)$ and $1 - n$, respectively. In each country, identical households choose how much to consume, save, and work. Each country produces one good according to a linear technology in labor. Households consume both types of goods. Firms are monopolistically competitive and set prices in domestic currency on a staggered basis. Financial markets are complete in the sense that households can trade in a full set of one-period state-contingent assets.⁵

The law of one price holds and households in country $i = \{H, F\}$ attach a weight to the consumption of goods produced domestically equal to their country size. These two assumptions imply that purchasing power parity (PPP) also holds. The price of a Foreign consumption bundle in domestic currency is equal to the price of a Home consumption bundle, and the real exchange rate is one in every period.⁶

Up to a first order approximation, and for given monetary policy, the equilibrium of the model consists of three equations. The first is an aggregate supply relation (or Phillips curve) for country H

$$\pi_{Ht} = \kappa[y_{Ht} + (1 - n)\psi\tau_t] + \beta\mathbb{E}_t\pi_{Ht+1} + u_t,$$

$$\pi_{Ht} = \kappa[y_{Ht} + (1 - n)\psi\tau_t] + \beta\mathbb{E}_t\pi_{Ht+1} + u_t,$$

(1)

where π_{Ht} is the inflation rate of goods produced at Home, y_{Ht} is the Home output gap, τ_t is the terms of trade (the price of imports relative to the price of exports) gap, $\mathbb{E}_t(\cdot)$ is the expectation operator conditional on all the information available at time t , and u_t is a cost-push shock. Gaps represent the log-deviations of variables relative to the efficient equilibrium, that is, the equilibrium with flexible prices, no monopolistic distortions, and no cost-push shocks.⁷ Finally, $\beta \in (0,1)$ is the individual discount factor, while κ and ψ are functions of the underlying structural parameters of the model.⁸ The second equation is the aggregate supply relation for country F

$$\pi_{Ft}^* = \kappa^*(y_{Ft}^* - n\psi\tau_t) + \beta\mathbb{E}_t\pi_{Ft+1}^* + u_t^*,$$

$$\pi_{Ft}^* = \kappa^*(y_{Ft}^* - n\psi\tau_t) + \beta\mathbb{E}_t\pi_{Ft+1}^* + u_t^*,$$

(2)

where variables and parameters are defined analogously to their Home country counterparts. Lastly, the third equation relates the terms-of-trade gap to the difference in the output gaps across countries

$$\theta\tau_t = y_{Ht} - y_{Ft}^*.$$

$$\theta\tau_t = y_{Ht} - y_{Ft}^*.$$

(3)

Equations (1)–(3) deserve a few comments. First, these conditions are sufficient to characterize an equilibrium provided monetary policy is defined in terms of domestic inflation rates π_{Ht} and π_{Ft}^* .⁹ Second, the Phillips curves (1) and (2) are the result of an optimal price setting decision. In particular, in each country, a continuum of monopolistically competitive firms produce differentiated goods, which competitive retailers purchase and combine into a final good. Wholesale producers set prices on a staggered basis (Calvo, 1983), and hence are the source of nominal rigidities in the model.¹⁰ Importantly, the assumption in the baseline model is that price setting occurs in domestic currency independently of the market of destination (producer currency pricing, or PCP). Therefore, exchange rate movements affect the price setting decision

through foreign demand for domestic goods. The presence of the terms of trade in the Phillips curves captures the expenditure-switching effect. Effectively, a depreciation of the terms of trade (an increase in τ_t) acts as an endogenous cost-push shock.¹¹ Third, equation (3) results from taking the difference between the goods market clearing conditions in the two countries, and substituting the relationship between the relative price of each good and the terms of trade.

Optimal Monetary Policy in the Baseline Model

The building blocks of the baseline model borrow heavily on the New Keynesian literature (see Woodford, 2003, for a comprehensive treatment). In the benchmark closed economy New Keynesian model, optimal monetary policy can be represented in terms of an inflation targeting rule. In particular, in the absence of cost-push shocks, strict inflation targeting is optimal. More generally, when cost-push shocks affect the economy, the optimal targeting rule aims to strike a balance between the stabilization of inflation and the output gap. A natural question is how the open economy dimension changes the optimal policy problem.¹²

The first issue that arises in an open economy is the definition of the welfare objective. The easiest benchmark to consider is the cooperative solution. Up to a second order approximation, Benigno and Benigno (2006) show that a benevolent policymaker who seeks to maximize welfare for the representative households in the two countries, with weights given by the country sizes, chooses the sequence $\{y_{Ht}, y_{Ft}^*, \pi_{Ht}, \pi_{Ft}^*, \tau_t\}_{t=0}^{\infty}$ to minimize

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[n y_{Ht}^2 + (1-n) y_{Ft}^{*2} + n \lambda_{\pi} \pi_{Ht}^2 + (1-n) \lambda_{\pi}^* \pi_{Ft}^{*2} + n(1-n) \lambda_{\tau} \tau_t^2 \right],$$

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[n y_{Ht}^2 + (1-n) y_{Ft}^{*2} + n \lambda_{\pi} \pi_{Ht}^2 + (1-n) \lambda_{\pi}^* \pi_{Ft}^{*2} + n(1-n) \lambda_{\tau} \tau_t^2 \right],$$
(4)

subject to (1), (2), and (3), where λ_{π} , λ_{π}^* , and λ_{τ} are positive weights functions of the underlying structural parameters of the model.¹³

As in the closed economy case, inflation and output are part of the welfare objective. Notice, however, that domestic inflation (corresponding to the inflation rate of the Producer Price Index, or PPI), not the Consumer Price Index (CPI) inflation rate, enters the loss function. The reason is that the CPI includes the nominal exchange rate, which is a flexible price. When nominal rigidities in price setting are the only friction in the economy, welfare losses only arise from the prices that are not free to adjust in every period. The other main difference with the closed economy case is the presence of the terms of trade among the target variables in the loss function. In general,

fluctuations in the terms of trade bring about welfare losses. The exception ($\lambda_\tau = 0$) is the knife-edge case in which the product of the intertemporal and intratemporal elasticity of substitution is equal to one.¹⁴

In terms of results, the optimality of strict inflation targeting in the absence of cost-push shocks extends to the open economy case under cooperation. Suppose u_t and u_t^* are zero in every period. If the policymaker credibly sets π_{Ht} and π_{Ft}^* equal to zero in every period, so that expected PPI inflation is also zero at all times, the Phillips curves (1) and (2) imply

$$y_{Ht} + (1 - n)\psi\tau_t = 0 \text{ and } y_{Ft}^* - n\psi\tau_t = 0.$$

$$y_{Ht} + (1 - n)\psi\tau_t = 0 \text{ and } y_{Ft}^* - n\psi\tau_t = 0.$$

Taking the difference between these two expressions and replacing into (3) yields $\tau_t = 0$, which in turn implies $y_{Ht} = y_{Ft}^* = 0, \forall t$. The only qualification relative to the closed economy case is that optimality arises from strict inflation targeting of the domestic price index. This difference, however, should not come as a surprise since, as already stressed, the welfare costs of nominal rigidities arise from the domestic price setting.

The optimal policy prescription with non-zero cost-push shocks is also isomorphic to the closed economy case. As Benigno and Benigno (2006) show, the minimization of (4) subject to (1)–(3) yields a system of first order conditions that can be rewritten in terms of a pair of targeting rules

$$\kappa\lambda_\pi\pi_{Ht} + \Delta y_{Ht} = 0 \text{ and } \kappa^*\lambda_\pi^*\pi_{Ft}^* + \Delta y_{Ft}^* = 0,$$

$$\kappa\lambda_\pi\pi_{Ht} + \Delta y_{Ht} = 0 \text{ and } \kappa^*\lambda_\pi^*\pi_{Ft}^* + \Delta y_{Ft}^* = 0,$$

(5)

where $\kappa\lambda_\pi = \kappa^*\lambda_\pi^* = \xi$ (the elasticity of substitution among varieties).

The two targeting rules in (5) represent the natural assignments for the policymakers in country H and F , respectively. The two notable features of these rules are that targeting domestic variables is sufficient to implement the optimal policy, and that their form corresponds to the closed economy case provided the appropriate inflation rate is used.

Targeting External Objectives

The conclusion that optimal monetary policy corresponds to assigning inward-looking targeting rules to national central banks is a clear message in support of the consensus for flexible exchange rates (Friedman, 1953).

In the context of the baseline model, this result critically relies on three key assumptions: cooperation, producer currency pricing, and complete international financial markets.¹⁵ Relaxing any of these three assumptions breaks down the isomorphism of optimal monetary policy in closed and open economies and introduces a rationale for targeting external variables.

Deviations From Cooperation

The assumption of cooperation to derive the optimal monetary policy in the baseline model is particularly convenient to keep the analysis tractable and abstract from issues related to strategic interaction. In the non-cooperative case, optimal monetary policy typically does not admit a closed-form representation in terms of targeting rules.¹⁶ In general, both countries target the same variables as in (4), albeit assigning different weights. The exception is again the special case in which both the elasticity of intertemporal and intratemporal substitution are equal to one, which delivers a clean separation of objectives. With this parameter configuration, each country's loss only features domestic inflation and output gap. This result is not surprising since, in this case, movements of the terms of trade do not cause direct welfare costs. Importantly, however, benefits from cooperation may still emerge. Benigno and Benigno (2006) show that the cooperative and non-cooperative solutions coincide only if, in addition to the restrictions on the elasticity parameters, government spending is zero in steady state and only productivity shocks affect the economy. With different disturbances, or with non-zero steady state government spending, even symmetric shocks can give rise to benefits from cooperation.

An alternative, more tractable approach to relax the assumption of cooperation is to study the optimal monetary policy problem from the perspective of a small open economy (De Paoli, 2009).¹⁷ The small open economy assumption avoids issues of strategic interaction by taking the rest of the world as exogenous.¹⁸

Starting from the two-country setting of the baseline model, the Home country becomes “small” in the limit for n that approaches zero. In order to keep the model well defined, the literature (following Sutherland, 2005) has linked the parameter ν that captures the share of consumption of domestic goods to the country size according to

$$\nu \equiv 1 - (1 - n)\lambda,$$

$$\nu \equiv 1 - (1 - n)\lambda,$$

where $\lambda \in (0,1)$ measures the degree of openness. When n becomes arbitrarily small, $\nu \rightarrow 1 - \lambda$, so that the degree of openness corresponds to the weight on imported goods.¹⁹

As a side consequence, this formulation also introduces home bias in consumption.²⁰ Therefore, PPP does not hold and the real exchange rate generally differs from one.²¹ Exchange rate volatility affects inflation through the Phillips curve, as in the baseline model, and through demand,

because of both a relative price effect and a risk-sharing channel. However, in spite of the PPP failure, the real exchange rate does not play a separate role relative to the terms of trade in the model since these two relative prices are proportional to each other.²²

The welfare-based loss function for the small open economy features the standard terms in inflation and the output gap, but also, as in the cooperative case, a term that penalizes the volatility of the term of trade

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(y_{Ht}^2 + \Phi_{\pi} \pi_{Ht}^2 + \Phi_{\tau} \tau_t^2 \right),$$

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(y_{Ht}^2 + \Phi_{\pi} \pi_{Ht}^2 + \Phi_{\tau} \tau_t^2 \right),$$
(6)

where Φ_{τ} and Φ_{π} are positive welfare weights, a function of the underlying parameters of the model. These weights are generally different from λ_{π} and λ_{τ} in (4), not only because of the small open economy and home bias assumptions but also because the steady state in De Paoli (2009) is inefficient. The combination of home bias and monopoly power among domestic producers gives rise to a terms-of-trade externality (Corden, 1974), which plays an important role in the results.

After substituting out the risk sharing condition, the set of equilibrium relationships that constrain the optimal monetary policy problem collapses to two equations. The first is a Phillips curve similar to (1)

$$\pi_{Ht} = \tilde{\kappa}(y_{Ht} + \tilde{\psi} \tau_t) + \beta \mathbb{E}_t \pi_{Ht+1} + \tilde{u}_t,$$

$$\pi_{Ht} = \tilde{\kappa}(y_{Ht} + \tilde{\psi} \tau_t) + \beta \mathbb{E}_t \pi_{Ht+1} + \tilde{u}_t,$$
(7)

where $\tilde{\kappa}$ and $\tilde{\psi}$ are positive functions of the structural parameters of the model, and \tilde{u}_t is a cost-push shock.²³

The second constraint is the aggregate demand equation

$$y_{Ht} = \phi \tau_t + \chi_t,$$

$$y_{Ht} = \phi \tau_t + \chi_t,$$
(8)

where ϕ is a function of the structural parameters and χ_t is a composite shock.²⁴ As long as the product between the elasticity of intratemporal and intertemporal substitution is bigger than one, $\phi > 0$ and increasing in λ . Therefore, higher trade integration implies larger effects of terms-of-trade fluctuations on output.

The optimal monetary policy plan under a timeless-perspective commitment is the solution to the minimization of (6) subject to (7) and (8). Combining the first order conditions of the optimal monetary policy problem to eliminate the Lagrangian multipliers gives the targeting rule

$$\Psi_{\pi} \pi_{Ht} + \Psi_{\tau} \Delta \tau_t + \Delta y_{Ht} = 0,$$

$$\Psi_{\pi} \pi_{Ht} + \Psi_{\tau} \Delta \tau_t + \Delta y_{Ht} = 0,$$

(9)

where Ψ_{π} and Ψ_{τ} are positive functions of the structural parameters of the model, both through the welfare weights and the parameters in (7) and (8). Differently from the rules in (5), optimal policy for the small open economy features an independent concern for stabilization of the terms of trade, which would appear in the targeting rule even if CPI inflation were to replace domestic inflation in (9).

If Home and Foreign goods are substitutes, the volatility of the terms of trade under optimal policy is actually lower than in the case of domestic inflation targeting (and vice versa if the goods are complement). The reason is that a lower volatility of the terms of trade is associated with a higher average appreciation, which increases welfare through a terms-of-trade externality. Therefore, optimal policy trades off output stabilization for terms-of-trade stabilization, implying that output is generally below its flexible-price counterpart. Interestingly, in relation to the debate on the optimality of flexible exchange rates, a nominal exchange rate peg emerges as the preferred target among simple rules that achieve full stabilization of only one variable at a time when the elasticities of both intertemporal and intratemporal substitution are high.

One special case of this model is worth mentioning. If the government sets a subsidy that eliminates the steady state monopolistic distortions, the shock χ_t disappears when the elasticities of both intratemporal and intertemporal substitution are equal to one. Hence, the terms-of-trade gap and the output gap return to be proportional to each other as in the baseline model. In turn, the loss function (6) and the Phillips curve (7) can be expressed in terms of inflation and output gap only. The optimal policy problem becomes once again isomorphic to the closed economy case (Galí & Monacelli, 2005). As a result, flexible domestic inflation targeting is optimal, and monetary policy is completely inward-looking as in the case of full cooperation.

Local Currency Pricing

The second crucial assumption behind the result that in the baseline model optimal monetary policy is completely inward-looking concerns the currency in which producers price their goods.

The baseline model maintains that firms set prices in their own currency (PCP). In the absence of other frictions, PCP implies that the degree of pass-through of nominal exchange rate changes is complete. Empirically, however, neither consumer nor import prices appear to respond much to changes in the nominal exchange rate (Campa & Goldberg, 2005; Mussa, 1986).

Monacelli (2005) shows that if prices are sticky at the level of importers, pass-through is incomplete. Nominal rigidities, however, are only part of the story. Gopinath, Itskhoki, and Rigobon (2010) present evidence that, even conditional on price changes, pass-through is much less than perfect, and offer a microfounded model of endogenous currency choice.

For the sake of contrast with PCP, the discussion here focuses on the implications of the polar opposite assumption, that is, “local currency pricing” (or LCP), whereby firms set prices in the currency of the country where goods are sold. The analysis follows Engel (2011), who develops a variant of the baseline model with LCP.²⁵

With LCP, the law of one price does not hold and the gap between prices in the two countries for the same good (a “currency misalignment”) becomes a welfare-relevant target. In the absence of home bias, this gap corresponds to the real exchange rate, denoted with q_t .²⁶ The optimal monetary policy problem under cooperation is particularly transparent if written in terms of relative (R) and average world (W) variables. The loss function is

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Wt}^2 + \frac{1}{\sigma^2} q_t^2 + \frac{\xi}{\kappa} (\pi_{Rt}^2 + \pi_{Wt}^2) \right],$$

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Wt}^2 + \frac{1}{\sigma^2} q_t^2 + \frac{\xi}{\kappa} (\pi_{Rt}^2 + \pi_{Wt}^2) \right],$$
(10)

where, for any pair of Home and Foreign variables x_t and x_t^* , $x_{Rt} \equiv (x_t - x_t^*)/2$ and $x_{Wt} \equiv (x_t + x_t^*)/2$. Since the price rigidity parameter is the same across countries, the average Phillips curve (obtained taking the world average of the country-specific Phillips curves) is

$$\pi_{Wt} = \kappa y_{Wt} + \beta \mathbb{E}_t \pi_{Wt+1} + u_{Wt},$$

$$\pi_{Wt} = \kappa y_{Wt} + \beta \mathbb{E}_t \pi_{Wt+1} + u_{Wt},$$
(11)

while the relative Phillips curve (obtained taking the difference of the country-specific Phillips curves) is

$$\pi_{Rt} = \frac{\kappa}{2} q_t + \beta \mathbb{E}_t \pi_{Rt+1}.$$

$$\pi_{Rt} = \frac{\kappa}{2} q_t + \beta \mathbb{E}_t \pi_{Rt+1}.$$

(12)

Average inflation depends on the average output gap, while relative inflation depends on the currency misalignment, as measured by the real exchange rate.

With PCP (and no home bias) as in the baseline model, the real exchange rate is always equal to one because PPP holds, and optimal monetary policy need not worry about relative inflation. With LCP, the deviations of the real exchange rate from steady state reflect currency misalignments, and relative inflation matters for welfare because such deviations are inefficient.

As in the baseline model, two targeting rules characterize the optimal monetary policy plan in this case. The first is a rule for average inflation

$$\xi \pi_{Wt} + \Delta y_{Wt} = 0.$$

$$\xi \pi_{Wt} + \Delta y_{Wt} = 0.$$

(13)

This rule coincides with the average of (5) when the two countries are perfectly symmetrical (same size and same degree of price rigidity). LCP does not change the mandate for average world inflation.

The second optimal targeting rule is

$$\xi \pi_{Rt} + \frac{1}{2\sigma} \Delta q_t = 0.$$

$$\xi \pi_{Rt} + \frac{1}{2\sigma} \Delta q_t = 0.$$

(14)

With LCP, optimal monetary policy cannot achieve the optimal trade-off between average inflation and output while at the same time completely closing inflation differentials across countries because currency misalignments, which are generally non-zero, determine the latter.²⁷

Even though a characterization in terms of world averages and ratios is convenient, a representation that assigns optimal targeting rules to each country nevertheless exists. Using the definitions of average and relative inflation, (13) and (14) become

$$\xi\pi_t + \Delta y_{wt} + \frac{1}{2\sigma}\Delta q_t = 0 \text{ and } \xi\pi_t^* + \Delta y_{wt} - \frac{1}{2\sigma}\Delta q_t = 0.$$

$$\xi\pi_t + \Delta y_{wt} + \frac{1}{2\sigma}\Delta q_t = 0 \text{ and } \xi\pi_t^* + \Delta y_{wt} - \frac{1}{2\sigma}\Delta q_t = 0.$$

(15)

The first observation is that, under LCP, the central bank in each country should optimally target CPI rather than PPI inflation. Second, in this representation, optimal policy involves targeting external objectives, in particular the average world output gap and the real exchange rate. From the perspective of one individual country, targeting CPI inflation with the average world output gap and the currency misalignment ensures the optimal balance between domestic price distortions and international currency misalignment, provided the other country does the same.

Interestingly, substituting the risk sharing condition ($\sigma c_{Rt} = q_t/2$) in (15) and using the definition of average output and consumption together with market clearing ($y_{wt} = c_{wt}$), the two rules give

$$\xi\pi_t + \Delta c_t = 0 \text{ and } \xi\pi_t^* + \Delta c_t^* = 0.$$

$$\xi\pi_t + \Delta c_t = 0 \text{ and } \xi\pi_t^* + \Delta c_t^* = 0.$$

While this alternative representation appears once again completely inward-looking, reference to external objectives is still present indirectly through CPI inflation.

Incomplete International Financial Markets

The third key assumption behind the optimality of inward-looking monetary policy in an open economy is that international financial markets are complete so that the representative household in each country can perfectly insure against asymmetric shocks via state-contingent securities. In the baseline model, since PPP holds, full risk sharing implies that in every period, consumption is equal across countries ($c_t = c_t^*, \forall t$), or relative consumption is equal to zero ($c_{Rt} = 0, \forall t$). More generally (e.g., with home bias or LCP), relative consumption is proportional to the real exchange rate in each state of the world.

As in most of the literature, the modification of the baseline model considered here replaces the full set of state-contingent securities with a single one-period risk-free nominal bond traded across countries.²⁸ As a consequence, the risk sharing condition holds in expectations, as opposed to state-by-state as with complete markets. Up to a first order approximation, relative consumption follows a random walk

$$c_{Rt} = \mathbb{E}_t c_{Rt+1}.$$

$$c_{Rt} = \mathbb{E}_t c_{Rt+1}.$$

(16)

The optimal policy analysis follows Corsetti, Dedola, and Leduc (2018), although abstracting from home bias and LCP to isolate the role of incomplete international financial markets and minimize the departures from the baseline model. Therefore, PPP holds and the real exchange rate is always equal to one. In a symmetric world economy ($n = 0.5$), the loss function under cooperation becomes

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Ht}^2 + y_{Ft}^{*2} + \lambda_{\pi} \pi_{Ht}^2 + \lambda_{\pi}^* \pi_{Ft}^{*2} + \frac{1}{2} (\lambda_{\tau} \tau_t^2 + \sigma c_{Rt}^2) \right].$$

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Ht}^2 + y_{Ft}^{*2} + \lambda_{\pi} \pi_{Ht}^2 + \lambda_{\pi}^* \pi_{Ft}^{*2} + \frac{1}{2} (\lambda_{\tau} \tau_t^2 + \sigma c_{Rt}^2) \right].$$

(17)

The constraints for the optimal policy problem are the equation for the terms of trade (3), the risk sharing condition (16), and the Phillips curves for the two countries, which become

$$\pi_{Ht} = \kappa \left[y_{Ht} + \frac{1}{2} (\psi \tau_t + \sigma c_{Rt}) \right] + \beta \mathbb{E}_t \pi_{Ht+1} + u_t,$$

$$\pi_{Ht} = \kappa \left[y_{Ht} + \frac{1}{2} (\psi \tau_t + \sigma c_{Rt}) \right] + \beta \mathbb{E}_t \pi_{Ht+1} + u_t,$$

(18)

and

$$\pi_{Ft}^* = \kappa^* \left[y_{Ft}^* - \frac{1}{2}(\psi\tau_t + \sigma c_{Rt}) \right] + \beta \mathbb{E}_t \pi_{Ft+1}^* + u_t^*.$$

$$\pi_{Ft}^* = \kappa^* \left[y_{Ft}^* - \frac{1}{2}(\psi\tau_t + \sigma c_{Rt}) \right] + \beta \mathbb{E}_t \pi_{Ft+1}^* + u_t^*.$$
(19)

The presence of relative consumption is the only difference in comparing (17) with (4). Departures from consumption equalization across countries represent an additional source of welfare losses because of imperfect risk sharing. The same term also shows up in the Phillips curves. When relative consumption differs from zero, the lack of perfect risk sharing implies a further demand channel for the determination of inflation.

In spite of these differences with the case of complete markets, optimal policy under commitment still implies a global rule identical to (13), which in turn corresponds to the average of the two rules in (5). The absence of perfect risk sharing does not affect the way in which monetary policy should manage the trade-off between average inflation and average output gap.

The difference arises in the stabilization of relative variables. Because of the absence of state-contingent transfers, the policymaker can only manage the relative inflation–output trade-off in expectations

$$\xi \mathbb{E}_t \pi_{Rt+1} + \mathbb{E}_t \Delta y_{Rt+1} = 0.$$

$$\xi \mathbb{E}_t \pi_{Rt+1} + \mathbb{E}_t \Delta y_{Rt+1} = 0.$$
(20)

The combination of the average and relative targeting rule yields an expression for the country-specific optimal targeting rules under cooperation

$$\xi \pi_{Ht} + \Delta y_{Ht} + \frac{\Omega_c}{2} \Delta c_{Rt} = 0 \text{ and } \xi \pi_{Ht} + \Delta y_{Ht} - \frac{\Omega_c}{2} \Delta c_{Rt} = 0,$$

$$\xi \pi_{Ht} + \Delta y_{Ht} + \frac{\Omega_c}{2} \Delta c_{Rt} = 0 \text{ and } \xi \pi_{Ht} + \Delta y_{Ht} - \frac{\Omega_c}{2} \Delta c_{Rt} = 0,$$
(21)

where Ω_c is a function of the structural parameters of the model.²⁹ As expected, the rule encompasses the one obtained under complete markets (and no home bias) when relative consumption equals zero in all periods. With incomplete markets, a trade-off between output and inflation arises not only as a consequence of markup shocks, but also through endogenous movements in relative consumption across countries (which map into movements in relative wealth) due to any other source of exogenous variation.³⁰ The bottom line is that optimal monetary policy is no longer purely inward-looking. Incomplete international financial markets introduce a rationale for targeting an external variable, in particular one that captures movements in relative wealth.

Fiscal Policy in an Open Economy

As discussed, the post-Bretton Woods international financial system has seen monetary policy emerging, in practice and in theory, as the primary stabilization tool. Conversely, political economy considerations have become increasingly dominant in analyzing fiscal policy (see, e.g., Persson & Tabellini, 2000, for a survey).

Two dimensions of fiscal policy have nevertheless attracted considerable attention in the international macroeconomics literature. The first is the analysis of the international transmission of fiscal policy shocks. The second is the role of fiscal policy for stabilization purposes in a currency union.

The International Transmission of Fiscal Policy Shocks

If changes in the fiscal stance are largely independent of stabilization objectives, treating fiscal variables as exogenous “shocks” may be a reasonable approximation. Yet understanding the consequences of fiscal shocks remains an interesting question.

The debate on the effects of fiscal policy shocks in a closed economy is still very much open (see Ramey, 2019, for a recent survey). An increase in government spending boosts output, but one key question the literature has debated is whether the “multiplier” (the percentage increase in output given a 1% increase in spending) is bigger or smaller than one. The answer depends on a number of qualifications, including the state of the business cycle (expansions versus recessions), the level of nominal interest rates (in particular, if the interest rate is at the zero lower bound), and the type of government spending (e.g., consumption versus infrastructure).

The response of consumption is one dimension in which the empirical evidence on the response to government spending shocks has important implications for competing economic theories. The structural vector autoregression approach of Blanchard and Perotti (2002) suggests that consumption increases in response to government spending shocks, while alternative methodologies, for example the “narrative” approach in Ramey and Shapiro (1998) or the “sign-restriction” approach in Mountford and Uhlig (2009), find no significant effects. Both these findings are at odds with frictionless and standard New Keynesian optimizing models. Galí,

López-Salido, and Vallés (2007) show that the introduction of hand-to-mouth agents in a model with price and wage rigidities can generate a positive response of consumption to an increase in government spending.

The inclusion of open economy variables further complicates the mapping between theory and empirics. Monacelli and Perotti (2010) and Ravn, Schmitt-Grohé, and Uribe (2012) identify government spending shocks as in Blanchard and Perotti (2002) and find that, in addition to an increase in output and consumption, the trade balance deteriorates while the real exchange rate depreciates.³¹

Like the response of consumption, the depreciation of the real exchange rate is particularly challenging for optimizing equilibrium models, with and without nominal rigidities. The reason is that in theory the government spending increase (a demand shock) should drive up domestic prices, thus appreciating the real exchange rate. The introduction of rule-of-thumb consumers, which helps with the response of consumption, does not fully solve the puzzle.³²

Ravn et al. (2012) suggest that “deep habits” can contemporaneously account for the positive response of consumption and the depreciation of the real exchange rate following an expansionary government spending shock.

The standard formulation of habits in consumption posits that utility depends not only on the current level of consumption but also on its lags. The theory of deep habits postulates that this dependence is at the level of individual goods, rather than at the level of the consumption bundle that households purchase. Formally, this assumption corresponds to a consumption aggregator for a generic good i of the form

$$X_{it} = \left\{ \int_0^1 [C_{it}(j) - \theta_i S_{it-1}(j)]^{\frac{\eta-1}{\eta}} dj \right\}^{\frac{\eta}{\eta-1}},$$

$$X_{it} = \left\{ \int_0^1 [C_{it}(j) - \theta_i S_{it-1}(j)]^{\frac{\eta-1}{\eta}} dj \right\}^{\frac{\eta}{\eta-1}},$$

where $\theta_i \in [0,1)$ and the stock of habits S_{it} evolves according to

$$S_{it}(j) = \rho S_{it-1}(j) + (1 - \rho) \tilde{C}_{it}(j),$$

$$S_{it}(j) = \rho S_{it-1}(j) + (1 - \rho) \tilde{C}_{it}(j),$$

with $\rho \in (0,1]$ and $\tilde{C}_{it}(j)$ representing average per capita consumption of variety j . If $\theta_i = 0$, the formulation of the consumption bundles corresponds to the standard CES aggregator.

In an otherwise standard open economy setup (like the baseline model) with flexible prices, Ravn et al. (2012) show that deep-habits preferences can account for the response of consumption and the real exchange rate, both qualitatively and quantitatively.

The presence of deep habits generates time-varying markups. In particular, in response to a positive government spending shock, firms selling in domestic markets have an incentive to lower markups. Prices in the economy that experiences the shock fall relative to the rest of the world, thus leading to a depreciation of the real exchange rate. Importantly, the same mechanism also accounts for the increase in consumption through an increase of the real wage, thus generating the co-movement between consumption and real exchange rate conditional on a government spending shock observed in the data.

Corsetti, Meier, and Müller (2012) propose an alternative explanation for the puzzling response of the real exchange rate to a positive government spending shock. Their framework is very similar to the baseline model, except for a richer specification of fiscal policy. The mechanism works through an endogenous response of government spending after the initial shock such that eventually spending falls below trend. The idea is that fiscal authorities typically manage sustainability over the long term through the adjustment of all instruments at their disposal, including government spending.

To illustrate the approach, consider the government budget constraint in real terms

$$b_t = \frac{1 + i_{t-1}}{1 + \pi_t} b_{t-1} + g_t - \tau_t,$$

$$b_t = \frac{1 + i_{t-1}}{1 + \pi_t} b_{t-1} + g_t - \tau_t,$$

where b_t is government debt, i_t is the nominal interest rate, g_t is government spending, and τ_t represents tax revenues. Fiscal sustainability requires that the intertemporal government budget constraint be satisfied.³³ The standard assumption in the literature is that current fiscal deficits correspond one-for-one to higher taxes in the future. A tax rule whereby the tax rate responds to the level of outstanding real debt is a common formulation to ensure intertemporal sustainability

$$\tau_t = \psi_\tau b_{t-1},$$

$$\tau_t = \psi_\tau b_{t-1},$$

(22)

where $\psi_r > 0$ (and large enough) is the coefficient that governs the speed of tax adjustment to the level of debt b_t .³⁴ The main insight in Corsetti et al. (2012) is that a more general fiscal adjustment should include a similar rule for government spending, such as

$$g_t = \rho_g g_{t-1} + \psi_b b_{t-1} + \varepsilon_{gt},$$

$$g_t = \rho_g g_{t-1} + \psi_b b_{t-1} + \varepsilon_{gt},$$

(23)

where $\rho_g \in [0,1)$, $\psi_b < 0$, and $\varepsilon_{gt} \sim \mathcal{N}(0,1)$. The government spending rule (23) includes some persistence and a shock, as in standard models in which government spending is fully exogenous. In addition, however, the rule also includes a correction term that induces spending reversals. Since the coefficient ψ_b is negative, a higher level of debt requires a larger reduction of government spending.

Together with nominal rigidities, the spending reversals are crucial in generating an increase in consumption and a depreciation of the real exchange rate in response to a positive spending innovation. Because the reversals are part of the rule—and hence systematic—the private sector anticipates the future decline of government spending associated with a current increase. Expectations of lower spending in the future map into expectations of future low nominal and real interest rates, since demand will eventually be low. Low future short-term rates affect long-term rates today, which in turn lead current consumption to increase and the real exchange rate to depreciate. At the core of the mechanism is the fact that taxes do not need to increase one-for-one with current deficits. Therefore, households do not need to save as much today in view of higher future taxes.

All in all, the combination of a more thorough characterization of the fiscal adjustment process and a deeper foundation of consumer preferences may indeed fully explain the apparent puzzling response of consumption and the real exchange rate to a positive government spending shock. At the same time, other implications of deep habits and the fiscal adjustment process are worth considering. For example, the ability of deep habits to generate the correct response of consumption, real exchange rate, and the trade balance across exchange rate regimes (Born, Juessen, & Müller, 2013) is unclear. Similarly, the existence of spending reversals beyond the case of the United States (Leeper, Traum, & Walker, 2017) is yet to be systematically documented. Both dimensions constitute fruitful avenues for further research.

Currency Unions and the Stabilization Gap

Perhaps the area where the NOEM literature has devoted most of its attention to fiscal policy is on the debate regarding currency unions. In the early 1960s, Mundell (1961) was the first to recognize how the delegation of monetary policy decisions to a supranational authority among a group of sovereign countries creates a domestic stabilization gap. Not long after, Kenen (1969) explored the role of fiscal policy in filling in this gap.

Contrary to the case of flexible exchange rates, in a fixed exchange rate regime the Mundell–Fleming model predicts that fiscal policy can play a powerful stabilization role.³⁵ The NOEM approach contributed to revitalizing the so-called “Optimum Currency Area” literature and revisiting its main conclusions. Ferrero (2009) extends the baseline model to include distortionary taxation (either on labor income or on firms’ sales) and one-period nominal risk-free government debt. As in Benigno (2004), the two countries in the model are assumed to participate in a currency union. Taxes have supply-side consequences, showing up like an endogenous cost-push shock in the Phillips curves. The absence of lump-sum instruments implies that any monetary and fiscal policy configuration must be compatible with intertemporal government solvency.³⁶

Assuming for simplicity a symmetric degree of price rigidities across countries, the loss function for the union as a whole is

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Wt}^2 + \lambda_{\pi} \pi_{Wt}^2 + n(1-n)(\lambda_{\tau} \tau_t^2 + \lambda_{\pi} \pi_{Rt}^2) \right].$$

$$\mathcal{L}_0 \propto \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[y_{Wt}^2 + \lambda_{\pi} \pi_{Wt}^2 + n(1-n)(\lambda_{\tau} \tau_t^2 + \lambda_{\pi} \pi_{Rt}^2) \right].$$
(24)

The Phillips curve for average (union-wide) inflation is

$$\pi_{Wt} = \kappa [\delta_y y_{Wt} + \omega_{\zeta} (\zeta_{Wt} - \tilde{\zeta}_{Wt})] + \beta \mathbb{E}_t \pi_{Wt+1},$$

$$\pi_{Wt} = \kappa [\delta_y y_{Wt} + \omega_{\zeta} (\zeta_{Wt} - \tilde{\zeta}_{Wt})] + \beta \mathbb{E}_t \pi_{Wt+1},$$
(25)

where δ_y and ω_{ζ} are combinations of the structural parameters, ζ_{Wt} is the log-deviation of the average tax rate across countries from steady state, and $\tilde{\zeta}_{Wt}$ is a combination of exogenous shocks. Similarly, the Phillips curve for relative inflation is

$$\pi_{Rt} = \kappa[\delta_\tau \tau_t + \omega_\zeta(\zeta_{Rt} - \tilde{\zeta}_{Rt})] + \beta \mathbb{E}_t \pi_{Rt+1},$$

$$\pi_{Rt} = \kappa[\delta_\tau \tau_t + \omega_\zeta(\zeta_{Rt} - \tilde{\zeta}_{Rt})] + \beta \mathbb{E}_t \pi_{Rt+1},$$
(26)

where δ_τ is a combination of the structural parameters, ζ_{Rt} is the log-deviation of the relative tax rate across countries from steady state, and $\tilde{\zeta}_{Rt}$ is a combination of exogenous shocks.

On the fiscal side, the paths of taxes and debt must satisfy the government budget constraint in each country, which can also be combined to yield an average condition

$$\mathcal{B}_{Wt} = (1 - \beta)[\gamma_y y_{Wt} + \omega_g(\zeta_{Wt} - \tilde{\zeta}_{Wt})] + \beta \mathbb{E}_t \mathcal{B}_{Wt+1},$$

$$\mathcal{B}_{Wt} = (1 - \beta)[\gamma_y y_{Wt} + \omega_g(\zeta_{Wt} - \tilde{\zeta}_{Wt})] + \beta \mathbb{E}_t \mathcal{B}_{Wt+1},$$
(27)

where

$$\mathcal{B}_{Wt} \equiv b_{Wt-1} - \tilde{\sigma} y_{Wt} - \pi_{Wt} + \psi_{Wt}.$$

$$\mathcal{B}_{Wt} \equiv b_{Wt-1} - \tilde{\sigma} y_{Wt} - \pi_{Wt} + \psi_{Wt}.$$

The parameter $\tilde{\sigma}$ is the coefficient of relative risk aversion adjusted for the steady state consumption share of output, while γ_y is a combination of underlying structural parameters. The variable b_{Wt} represents the average real value of debt at maturity (i.e., inclusive of interest rate spending). Finally, the composite shock ψ_{Wt} is a combination of exogenous disturbances. Similarly, the relative government budget constraint can be written as

$$\mathcal{B}_{Rt} = (1 - \beta)[\gamma_\tau \tau_t + \omega_g(\zeta_{Rt} - \tilde{\zeta}_{Rt})] + \beta \mathbb{E}_t \mathcal{B}_{Rt+1},$$

$$\mathcal{B}_{Rt} = (1 - \beta)[\gamma_\tau \tau_t + \omega_g(\zeta_{Rt} - \tilde{\zeta}_{Rt})] + \beta \mathbb{E}_t \mathcal{B}_{Rt+1},$$
(28)

where

$$\mathcal{B}_{Rt} \equiv b_{Rt-1} + \psi_{Rt}.$$

$$\mathcal{B}_{Rt} \equiv b_{Rt-1} + \psi_{Rt}.$$

Analogously to the average block, γ_τ is a combination of underlying structural parameters, b_{Rt} represents the relative real value of debt at maturity, and the composite shock ψ_{Rt} is a combination of exogenous disturbances.

The terms $\tilde{\zeta}_{Wt}$ and $\tilde{\zeta}_{Rt}$ in (25) and (26) can be equivalently interpreted as tax targets or cost-push shocks, since fiscal authorities could in principle set tax rates to completely offset their effects on output and inflation. Differently from the baseline model, however, these disturbances also carry fiscal consequences. The terms ψ_{Wt} and ψ_{Rt} capture the extent to which contemporaneous stabilization of output and inflation is not possible.

Finally, participation in the currency union implies that the nominal exchange rate does not absorb cross-country inflation differentials. Therefore, the evolution of the terms of trade also constitutes a constraint for the optimal policy plan

$$\tau_t = \tau_{t-1} - \pi_{Rt} - \Delta \tilde{\tau}_t,$$

$$\tau_t = \tau_{t-1} - \pi_{Rt} - \Delta \tilde{\tau}_t,$$

(29)

where $\tilde{\tau}_t$ is the welfare-relevant terms-of-trade target.

The optimal policy problem features a full separation of the average and relative block. Minimization of the loss function (24) subject to the constraints (25) and (27) yields two targeting rules that characterize optimal monetary and fiscal policy for the union as a whole. The first generalizes the standard monetary policy targeting rule to take into account the presence of government debt

$$\pi_{Wt} + m_\pi \pi_{Wt-1} + n_y \Delta y_{Wt} = 0,$$

$$\pi_{Wt} + m_\pi \pi_{Wt-1} + n_y \Delta y_{Wt} = 0,$$

(30)

where m_π and n_y are coefficients, a function of the structural parameters. Since inflation surprises change the real value of debt at maturity, the central bank needs to induce a certain degree of inertia in inflation in addition to managing the standard inflation–output trade-off. Quantitatively, this additional stabilization motive corresponds to placing an even higher weight on inflation. Full inflation stabilization approximates well the optimal monetary policy mandate.

The second rule requires fiscal authorities to maintain expectations of average inflation well anchored

$$\mathbb{E}_t \pi_{Wt+1} = 0.$$

$$\mathbb{E}_t \pi_{Wt+1} = 0.$$

(31)

Since tax changes have inflationary consequences, fiscal adjustments occur through permanent changes in the level of debt, which minimize inflation volatility.³⁷

The combination of (30) and (31) coincides with the optimal monetary and fiscal policy plan in the closed economy analysis of Benigno and Woodford (2003). The additional element in the optimal policy plan for a currency union is the characterization of fiscal policy for the relative block, which follows from minimizing (24) subject to (26), (28), and (29). The resulting targeting rule is

$$\mathcal{T}_t = \mathcal{T}_{t-1} + \varepsilon_{\tau t} - \rho_\tau \varepsilon_{\tau t-1},$$

$$\mathcal{T}_t = \mathcal{T}_{t-1} + \varepsilon_{\tau t} - \rho_\tau \varepsilon_{\tau t-1},$$

(32)

where

$$\varepsilon_{\tau t} \equiv \mathcal{T}_t - \mathbb{E}_{t-1} \mathcal{T}_t,$$

$$\varepsilon_{\tau t} \equiv \mathcal{T}_t - \mathbb{E}_{t-1} \mathcal{T}_t,$$

and

$$\mathcal{T}_t \equiv \ell_\zeta (\zeta_{Rt} - \tilde{\zeta}_{Rt}) + \ell_\tau \tau_t,$$

$$\mathcal{T}_t \equiv l_\zeta(\zeta_{Rt} - \tilde{\zeta}_{Rt}) + l_\tau \tau_t,$$

with ρ_τ , l_ζ , and l_τ all functions of the underlying parameters. The target variable \mathcal{T}_t is a combination of relative tax rates and the terms of trade. In a flexible exchange rate regime, the nominal exchange rate adjusts to equilibrate cross-country inflation misalignments. In a currency union, inflation differentials correspond to permanent terms-of-trade movements. When countries can use fiscal instruments for stabilization purposes, however, tax changes can address the deviations of the terms of trade from their desired target. In the absence of surprises, the target itself follows a unit root. When shocks generate a gap between the target and last period's expectations, taxes adjust as to realign the target to its long-run equilibrium while minimizing supply-side distortions. As for the average block, the optimal policy response involves permanent variations in relative government debt.

Ferrero (2009) also shows that a combination of a strict inflation targeting rule for monetary policy and a couple of flexible debt targeting rules for fiscal policy approximates well the joint optimal policy plan. In spite of potential cross-country differences in the degree of price rigidities (Benigno & López-Salido, 2005), the welfare losses associated with departing from targeting inflation at the aggregate level are rather small. Conversely, as Mundell (1961) originally noted, the main source of welfare losses arises from not responding to country-specific shocks. In this respect, allowing national fiscal authorities to adjust taxes and debt following an asymmetric disturbance can mimic the optimal policy plan, in particular if the associated change in debt is very persistent. In the spirit of Kenen (1969), this type of fiscal rules can thus mitigate, at least in part, the stabilization gap in a currency union.

The fiscal rules that approximate the optimal policy plan are fully countercyclical, allowing for deficits in recessions but requiring surpluses in expansions. In principle, their simplicity and transparency can also ensure that fiscal authorities are held accountable to behave responsibly over the business cycle. One caveat is nevertheless important to bear in mind. The credibility and enforceability of fiscal rules is crucial for the good functioning of the currency union. Focusing on the stabilization gap, the NOEM literature is silent about the moral hazard issues that tighter rules, such as those embedded in the Stability and Growth Pact (1997) and in the more recent Fiscal Compact (2012), attempt to prevent (Chari & Kehoe, 2007).³⁸

Final Remarks and Related Topics

Since the early 1990s, the international macroeconomic literature has developed a new class of dynamic stochastic general equilibrium open economy models. Common to these frameworks is the presence of rational agents operating in environments with various nominal and real frictions. The explicit microfoundations have allowed for a thorough re-evaluation of the monetary and fiscal policy prescriptions arising from traditional Keynesian models in the Mundell–Fleming tradition.

Monetary policy has been the dominant subject of the analysis. The baseline model supports the long-standing consensus that a flexible exchange rate is optimal. Even more strongly, the conclusion is that targeting domestic variables is sufficient so that optimal policy is fully inward-looking. Yet the presence of a number of realistic frictions questions the robustness of such a conclusion. The open question is perhaps the extent to which the departures from exchange rate flexibility are quantitatively relevant.

While monetary policy issues have taken center stage in the literature, the financial crisis of 2008 and the euro debt crisis of 2010 have revived the interest in the role of fiscal policy. The analysis of government spending shocks in an open economy has brought to light the puzzling response of the real exchange rate and of the trade balance relative to the predictions of standard theories. A satisfactory account of this puzzle requires either a modification of commonly used preferences in the direction of deep habits or a richer specification of the endogenous fiscal adjustment to include spending reversals.

In a currency union, fiscal policy can fill the stabilization gap left by the delegation of monetary policy to a supranational central bank. While the welfare gains of more active fiscal policy at the national level can be large, a full cost–benefit analysis should also take into account the associated moral hazard issues.

A number of additional topics to some extent related to fiscal and monetary policy in an open economy did not find space in the discussion. One example is the conduct of monetary policy when a country faces large external imbalances, as in the case of the United States before the financial crisis of 2008 (Ferrero, Gertler, & Svensson, 2010), or within the euro area until the sovereign debt crisis of 2010 (Boivin, Giannoni, & Mojon, 2009). Another topic that has been left out is the recent evidence on the international transmission of financial shocks (Rey, 2016) and their implications for monetary and fiscal policy. Finally, both fiscal devaluations (e.g. Farhi, Gopinath, & Itskhoki, 2014) and trade wars (e.g., Erceg, Prestipino, & Raffo, 2018) are related to several dimensions of the optimal policy framework in an open economy.

As the global macroeconomic outlook continues to be characterized by a high degree of uncertainty, the times is ripe to incorporate some of these issues in the existing framework and push forward the research frontier tackling questions related to fiscal and monetary policy in an open economy.

References

- Barro, R. (1979). On the determination of public debt. *Journal of Political Economy*, 87, 940–971.
- Beetsma, R., & Jensen, H. (2005). Monetary and fiscal policy interaction in a micro-founded model of a monetary union. *Journal of International Economics*, 67, 320–352.
- Benigno, G., & Benigno, P. (2006). Designing targeting rules for international monetary policy coordination. *Journal of Monetary Economics*, 53, 473–506.
- Benigno, P. (2004). Optimal monetary policy in a currency union. *Journal of International Economics*, 63, 293–320.

- Benigno, P., & López-Salido, D. (2005). Inflation persistence and optimal monetary policy in the euro area. *Journal of Money, Credit and Banking*, 38, 587–614.
- Benigno, P., & Woodford, M. (2003). Optimal monetary and fiscal policy: A linear-quadratic approach. In M. Gertler & K. Rogoff (Eds.), *NBER macroeconomics annual 2003* (Vol. 18, pp. 271–333). Cambridge, MA: MIT Press.
- Blanchard, O., & R. Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *Quarterly Journal of Economics*, 117, 1329–1368.
- Boivin, J., Giannoni, M., & Mojon, B. (2009). How has the euro changed the monetary transmission mechanism? In D. Acemoglu, K. Rogoff, & M. Woodford (Eds.), *NBER macroeconomics annual 2008* (Vol. 23, pp. 77–125). Chicago, IL: University of Chicago Press.
- Born, B., Juessen, F., & Müller, G. (2013). Exchange rate regimes and fiscal multipliers. *Journal of Economic Dynamics and Control*, 37, 446–465.
- Calvo, G. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics*, 12, 383–398.
- Campa, J., & Goldberg, L. (2005). Exchange rate pass-through into import prices. *Review of Economics and Statistics*, 87, 679–690.
- Chari, V., & Kehoe, P. (2007). On the need for fiscal constraints in a monetary union. *Journal of Monetary Economics*, 54, 2399–2408.
- Clarida, R., Galí, J., & Gertler, M. (2002). A simple framework for international monetary policy analysis. *Journal of Monetary Economics*, 49, 879–904.
- Cole, H., & Obstfeld, M. (1991). Commodity trade and international risk sharing: How much do financial markets matter? *Journal of Monetary Economics*, 28, 3–24.
- Corden, M. (1974). *Trade policy and economic welfare*. Oxford, UK: Clarendon Press.
- Corsetti, G., Dedola, L., & Leduc, S. (2010). Optimal monetary policy in open economies. In B. Friedman & M. Woodford (Eds.), *Handbook of monetary economics* (Vol. 3, pp. 861–933). Amsterdam, the Netherlands: Elsevier.
- Corsetti, G., Dedola, L., & Leduc, S. (2018). Exchange rate misalignment, capital flows and optimal monetary policy tradeoffs. Unpublished.
- Corsetti, G., Kuester, K., & Müller, G. (2013). Floats, pegs and the transmission of fiscal policy. In L. Cespedes & J. Gal (Eds.), *Fiscal policy and macroeconomic performance* <<https://ideas.repec.org/h/chb/bcchsb/v17c01pp01-25.html>> (Vol. 17, pp. 235–281). Santiago, Chile: Central Bank of Chile.
- Corsetti, G., Meier, A., & Müller, G. (2012). Fiscal stimulus with spending reversals. *Review of Economics and Statistics*, 94, 878–895.
- Corsetti, G., & Müller, G. (2006). Twin deficitis: Squaring theory, evidence and common sense. *Economic Policy*, 100, 599–638.
- De Ferra, S., & Romei, F. (2020). Sovereign default in a monetary union. Unpublished.

- De Paoli, B. (2009). Monetary policy and welfare in a small open economy. *Journal of International Economics*, 77, 11–22.
- Engel, C. (2011). Currency misalignments and optimal monetary policy: A reexamination. *American Economic Review*, 101, 2796–2822.
- Erceg, C., Prestipino, A., & Raffo, A. (2018). The macroeconomic effects of trade policy. International Finance Discussion Papers 1242. Washington, DC: Board of Governors of the Federal Reserve.
- Faia, E., & Monacelli, T. (2008). Optimal monetary policy in a small open economy with home bias. *Journal of Money, Credit and Banking*, 40, 721–750.
- Farhi, E., Gopinath, G., & Itskhoki, O. (2014). Fiscal devaluations. *Review of Economic Studies*, 81, 725–760.
- Farhi, E., & Werning, I. (2016). Fiscal multipliers: Liquidity traps and currency unions. In J. Taylor & H. Uhlig (Eds.), *Handbook of macroeconomics* (Vol. 2, pp. 2417–2492). Amsterdam, the Netherlands: Elsevier.
- Ferrero, A. (2009). Fiscal and monetary rules for a currency union. *Journal of International Economics*, 77, 1–10.
- Ferrero, A., Gertler, M., & Svensson, L. E. (2010). Current account dynamics and monetary policy. In J. Galí & M. Gertler (Eds.), *International dimensions of monetary policy* (pp. 199–244). Chicago, IL: University of Chicago Press.
- Fleming, M. (1962). Domestic financial policies under fixed and floating exchange rates. *IMF Staff Papers*, 9, 369–379.
- Friedman, M. (1953). The case for flexible exchange rates. In *Essays in positive economics* (pp. 157–203). Chicago, IL: University of Chicago Press.
- Galí, J., López-Salido, D., & Vallés, J. (2007). Understanding the effects of government spending on consumption. *Journal of the European Economic Association*, 5, 227–270.
- Galí, J., & Monacelli, T. (2005). Monetary policy and exchange rate volatility in a small open economy. *Review of Economic Studies*, 72, 707–750.
- Galí, J., & Monacelli, T. (2008). Optimal monetary and fiscal policy in a currency union. *Journal of International Economics*, 76, 116–132.
- Gopinath, G., Itskhoki, O., & Rigobon, R. (2010). Currency choice and exchange rate pass-through. *American Economic Review*, 100, 304–336.
- Kenen, P. (1969). The theory of optimum currency areas: An eclectic view. In R. Mundell & A. Swoboda (Eds.), *Monetary problems of the international economy* (pp. 41–60). Chicago, IL: University of Chicago Press.
- Kim, S., & Roubini, N. (2008). Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S. *Journal of International Economics*, 74, 362–383.
- Lane, P. (2001). The new open economy macroeconomics: A survey. *Journal of International Economics*, 54, 235–266.
- Lane, P. (2012). The European sovereign debt crisis. *Journal of Economic Perspectives*, 26, 49–68.

- Leeper, E., Traum, N., & Walker, T. (2017). Clearing up the fiscal multiplier morass. *American Economic Review*, 107, 2409–2454.
- Mankiw, G. (2010). *Macroeconomics* (7th ed.). New York, NY: Worth Publishers.
- Monacelli, T. (2005). Monetary policy in a low pass-through environment. *Journal of Money, Credit and Banking*, 37, 1047–1066.
- Monacelli, T., & Perotti, R. (2010). Fiscal policy, the real exchange rate, and traded goods. *Economic Journal*, 120, 437–461.
- Mountford, A., & Uhlig, H. (2009). What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, 24, 960–992.
- Mundell, R. (1961). A theory of optimum currency area. *American Economic Review*, 51, 657–665.
- Mundell, R. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economic and Political Science*, 29, 475–485.
- Mussa, M. (1986). Nominal exchange rate regimes and the behavior of real exchange rates: Evidence and implications. *Carnegie-Rochester Conference Series on Public Policy*, 36, 163–209.
- Obstfeld, M., & Rogoff, K. (1995). Exchange rate dynamics redux. *Journal of Political Economy*, 103, 624–660.
- Obstfeld, M., & Rogoff, K. (2000). The six major puzzles in international macroeconomics: Is there a common cause? In B. Bernanke & K. Rogoff (Eds.), *NBER macroeconomics annual* (Vol. 15, pp. 339–390). Cambridge, MA: MIT Press.
- Persson, T., & Tabellini, G. (2000). *Political economics*. Cambridge, MA: MIT Press.
- Ramey, V. (2019). Ten years after the financial crisis: What have we learned from the renaissance in fiscal research? *Journal of Economic Perspectives*, 33, 89–114.
- Ramey, V., & Shapiro, M. (1998). Costly capital reallocation and the effects of government spending. *Carnegie-Rochester Conference on Public Policy*, 48, 145–194.
- Ravn, M., Schmitt-Grohé, S., & Uribe, M. (2012). Consumption, government spending, and the real exchange rate. *Journal of Monetary Economics*, 59, 215–234.
- Rey, H. (2016). International channels of transmission of monetary policy and the Mundellian trilemma. *IMF Economic Review*, 64, 6–35.
- Rotemberg, J. (1982). Sticky prices in the United States. *Journal of Political Economy*, 90, 1187–1211.
- Sargent, T., & Wallace, N. (1981). Some unpleasant monetarist arithmetic. *Federal Reserve Bank of Minneapolis Quarterly Review*, 5, 1–17.
- Sutherland, A. (2005). Incomplete pass-through and the welfare effects of exchange rate variability. *Journal of International Economics*, 65, 375–399.

- Svensson, L., & van Wijnbergen, S. (1989). Excess capacity, monopolistic competition, and international transmission of monetary disturbances. *Economic Journal*, 99, 785–805.
- Taylor, A., & Taylor, M. (2004). The purchasing power parity debate. *Journal of Economic Perspectives*, 18, 135–158.
- Taylor, J. (2000). Reassessing discretionary fiscal policy. *Journal of Economic Perspectives*, 14, 21–36.
- Woodford, M. (1995). Price level determinacy without control of a monetary aggregate. *Carnegie-Rochester Conference Series on Public Policy*, 43, 1–46.
- Woodford, M. (1999). Commentary: How should monetary policy be conducted in an era of price stability? In *New Challenges for Monetary Policy* <<https://www.kansascityfed.org/publications/research/escp/symposiums/escp-1999>> (pp. 277–316). Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, WY.
- Woodford, M. (2003). *Interest and prices: Foundations of a theory of monetary policy*. Princeton, NJ: Princeton University Press.

Notes

1. This model also typically constitutes the entry point for open economy topics at the undergraduate level (see, e.g., Mankiw, 2010).
2. The other seminal paper in this literature is Svensson and van Wijnbergen (1989). The main difference with Obstfeld and Rogoff (1995) is the assumption about the structure of international financial markets, which will play a crucial role in the subsection “Incomplete International Financial Markets.”
3. The other reason is most likely the emergence of the New Keynesian literature on closed economies (Woodford, 2003), with its emphasis on monetary policy.
4. Clarida, Galí, and Gertler (2002) is a special case of this model with symmetric country size and unit elasticity of intratemporal substitution.
5. Fiscal policy remains in the background. Exogenous government spending is one of the demand shocks considered in the model, but the presence of lump-sum taxes makes the government financing decisions irrelevant.
6. Corsetti, Dedola, and Leduc (2010) generalize this model to the case of home bias, in which the representative household in each country places a weight on domestic goods higher than the country size.
7. In the efficient equilibrium, output in country i generally depends on productivity and government spending in both countries.
8. In particular, $\kappa \equiv (1 - \alpha)(1 - \alpha\beta)(\sigma + \eta)/[\alpha(1 + \xi\eta)]$, and $\psi \equiv (1 - \sigma\theta)/(\sigma + \eta)$, where $\alpha \in (0,1)$, where is the probability that prices remain unchanged in any given period, $\sigma > 0$ is the coefficient of relative risk aversion, $\eta > 0$ is the inverse elasticity of labor supply, $\xi > 1$ is the elasticity of substitution among varieties, and $\theta > 0$ and is the elasticity of substitution between Home and Foreign goods.

9. The Home CPI inflation rate is $\pi_t = n\pi_{Ht} + (1 - n)\Delta e_t \pi_{Ft}^*$, where e_t is the nominal exchange rate and $\Delta e_t \equiv e_t - e_{t-1}$. The Foreign CPI inflation rate is defined equivalently. An intertemporal Euler equation (aggregate demand) residually determines the nominal interest rate that is consistent with the desired inflation rate (abstracting from a lower bound on the nominal interest rate).
10. Up to a first order approximation, the Phillips curves would be identical if producers were subject to quadratic adjustment costs as in Rotemberg (1982).
11. Typical calibrations imply $\psi < 0$. From the perspective of the Home country, a depreciation of the terms of trade makes Foreign goods less competitive, thus switching expenditure towards domestic goods.
12. For concreteness, the focus here is on the commitment solution, assuming the existence of additional time-zero constraints that make the problem time-invariant, and hence policy optimal from a “timeless perspective” (Woodford, 1999). The discretionary solution modifies the main result as in the closed economy case.
13. One important caveat for the derivation of this loss function is that the government in each country is assumed to be able to set a steady state subsidy that eliminates the monopolistic distortions in the goods-producing sector so that the steady state allocation is efficient.
14. This parameter configuration implies $\psi = 0$ so that the terms of trade disappears from the Phillips curves (1) and (2). The welfare weight λ_τ is proportional to ψ and thus becomes zero as well. In this case, the terms of trade provide efficient insurance across countries in response to productivity shocks also with incomplete international financial markets (Cole & Obstfeld, 1991).
15. Additionally, the baseline model assumes no home bias, so that PPP holds. The same targeting rules, however, characterize optimal monetary policy under cooperation if home bias is symmetric (Corsetti et al., 2010).
16. A second complication that arises in the non-cooperative solution is the possibility that policymakers have an incentive to generate macroeconomic volatility above and beyond what fundamentals bring about to exploit a terms-of-trade externality.
17. Faia and Monacelli (2008) characterize the non-linear optimal monetary policy plan in a similar model under different assumptions for nominal rigidities (price set one period in advance or subject to adjustment costs).
18. Technically, the assumption is that the Home country does not affect the equilibrium in the rest of the world (represented by the Foreign country), while Foreign variables are exogenous to the Home country.
19. The Foreign country representative household attaches a weight $\nu^* \equiv n\lambda$ to consumption of Home goods. Therefore, in the limit for n that goes to zero, country F effectively becomes a closed economy, although its variables still influence exogenously the small open economy.
20. The model features home bias both before and after taking the limit $n \rightarrow 0$ since $\nu > n$ and, by definition, $1 - \lambda > 0$.
21. Empirically, PPP does not hold, at least in the short run (Taylor & Taylor, 2004). Theoretically, trade costs are one way to microfound home bias in consumption (Obstfeld & Rogoff, 2000).
22. Up to a first order approximation, $q_t = (1 - \lambda)\tau_t$, where q_t denotes the real exchange rate in deviations from its welfare-relevant target. De Paoli (2009) solves the model in terms of the real exchange rate. For the sake of comparability with the baseline model, the terms of trade is the key variable here.

23. While the interpretation of the parameters and of the cost-push shock is similar to the baseline model, the exact expressions differ. In particular, $\tilde{\kappa} \equiv \kappa\eta/(\sigma + \eta)$ and $\tilde{\psi} \equiv \tilde{\kappa}/\eta$, while \tilde{u}_t is a linear function of the gaps between the welfare-relevant targets for output and the terms of trade, and their flexible-price counterparts.
24. In particular, $\phi \equiv [1 + (\sigma\theta - 1)\lambda(2 - \lambda)]/\sigma$. Like u_t , the shock χ_t is also a linear function of the gaps between the welfare-relevant targets for output and the terms of trade, and their flexible-price counterparts.
25. In addition, the model features four additional parametric restrictions: equal country size, same degree of price rigidity across countries, unit elasticity of substitution between Home and Foreign goods, and linear disutility of labor. The first three restrictions are qualitatively innocuous for the results. Linear disutility of labor simplifies the analysis by making the terms of trade exogenous under LCP. However, since the labor disutility parameter does not enter the optimal targeting rules in the baseline model, this restriction does not influence the comparison of optimal monetary policy under LCP versus PCP.
26. With home bias, the terms of trade in the two countries, which are not just the inverse of each other as with PCP, also affect the expression of the real exchange rate. While Engel (2011) also allows for home bias in consumption, most of the analytical results and the intuition follow from the case with no home bias discussed here.
27. With home bias, currency misalignments would no longer be proportional to the real exchange rate. The average targeting rule (13) would stay the same while the relative targeting rule (14) would also feature the first difference of relative output gaps. In spite of the slightly more complicated representation, the basic intuition would remain unchanged.
28. The presence of additional risk-free bonds does not change the risk sharing opportunities in international financial markets. The typical convention is that the central bank of the country of denomination sets the nominal interest rate on the riskless bond. More generally, international financial markets remain incomplete as long as the number of independent assets traded is less than the number of shocks.
29. In particular, $\Omega_c \equiv \sigma(\theta - 1)/(1 + \eta\theta)$. Whether the optimal combination of inflation and output gap in the baseline model increases or decreases with relative consumption depends on the elasticity of intratemporal substitution.
30. If PPP does not hold, so that the real exchange rate fluctuates over time, the welfare-relevant variable is the wealth gap, which depends on both relative consumption and the real exchange rate gap.
31. The response of the trade balance is one element of disagreement within the empirical literature. Kim and Roubini (2008) find that an improvement of the trade and current account balance is the typical response to a positive government spending shock. Corsetti and Müller (2006) show that the response of the trade balance to government spending shocks depends on country characteristics, such as the degree of openness, and on the persistence of the shocks.
32. The exchange rate regime (float versus peg) appears to matter, making the puzzle even more challenging to address. Born, Juessen, and Müller (2013) report a depreciation on impact in a float but a significant real exchange rate appreciation about one year after the fiscal expansion in a peg. Their model, which is a small open economy version of the baseline with hand-to-mouth agents, is successful in replicating the empirical response of the real exchange rate across regimes but fails to produce a deterioration of the trade balance in a float.
33. The treatment here abstracts from monetary financing (Sargent and Wallace, 1981) and issues related to the fiscal theory of the price level (Woodford, 1995).
34. The rule (22) may contain additional terms, for example a feedback to the level of real government spending, as well as a tax shock, or could be specified in terms of primary deficit.

35. In spite of finding evidence in support of larger fiscal multipliers in a peg than in a float regime, Born et al. (2013) conclude that the transmission channel of fiscal policy with fixed exchange rates is not consistent with the Mundell–Fleming model. As Corsetti, Kuester, and Müller (2013) clarify, the issue arises because short- and long-term real rate may move in opposite directions, and investment reacts to the latter. See also Farhi and Werning (2016) for further discussions.
36. Beetsma and Jensen (2005) and Galí and Monacelli (2008) emphasize the optimal provision of government spending while abstracting from distortionary taxation and government debt.
37. The optimal fiscal policy plan induces a unit root on real variables reminiscent of the tax smoothing result in Barro (1979).
38. Relatedly, the treatment of fiscal policy in a currency union has largely abstracted from the issue of default, and its interaction with high levels of debt and monetary policy (De Ferra and Romei, 2020).

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