

# Monetary Union and Financial Integration

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PRELIMINARY AND INCOMPLETE

## Abstract

It is often argued that forming a monetary union increases financial integration and leads to a more efficient allocation of capital across member countries. To investigate this claim, this paper provides a model connecting monetary policy and international capital flows. The key feature of the model is that monetary policy affects the value of collateral that can be repossessed by creditors in case of default. Once a country has accumulated a large stock of external debt, it is optimal for the government to depreciate the exchange rate to expropriate foreign investors. Anticipating this, under flexible exchange rates international investors impose tight borrowing limits on foreign debtors. In a monetary union this source of exchange rate risk is absent, because national governments do not control monetary policy. Forming a monetary union thus increases financial integration by boosting borrowing capacity toward foreign investors. This process, however, does not necessarily lead to higher welfare. Higher financial integration may increase welfare by fostering capital flows from capital-abundant to capital-scarce countries. But a high degree of financial integration may also make episodes of inefficient capital flights out of capital-scarce countries possible.

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# 1 Introduction

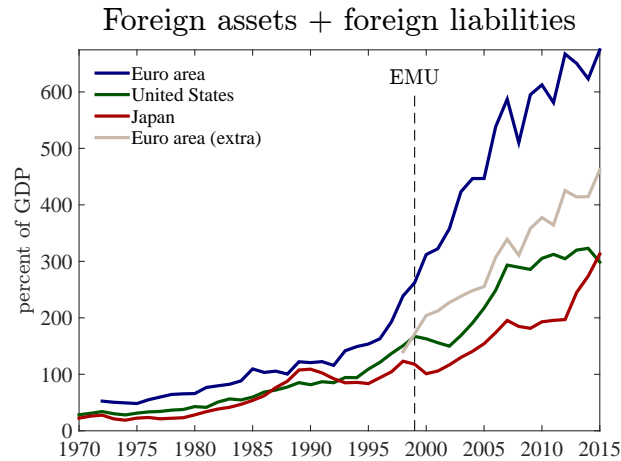
What are the benefits and costs of creating a monetary union? This question has been at the centre of a long-standing debate in international macroeconomics. [Friedman \(1953\)](#) famously claimed that giving up exchange rate flexibility by joining a currency union entails substantial losses, in the form of higher output volatility in response to country-specific shocks. [Ingram \(1973\)](#), instead, argued that forming a currency union leads to welfare gains by fostering financial integration across member countries. In his view, the absence of exchange rate risk would facilitate international financial transactions, resulting in a more efficient international allocation of capital.

Ingram's view resonates well with some aspects of the euro area experience. Indeed, the introduction of the euro has been accompanied by a sharp increase in financial flows across member countries (see Figure 1). And some commentators have concluded that the most visible consequence of the adoption of the euro has been an increase in financial integration (e.g. [Lane \(2006\)](#)). But some key questions are open. First, why should the exchange rate regime matter for financial integration and capital flows? And does higher financial integration necessarily lead to higher welfare, especially in light of the fact that several euro area countries suffered financial crises characterized by capital flights?

This paper tackles these questions by developing a simple framework connecting monetary policy and international capital flows. There are two frictions at the heart of the model. The first one is the presence of nominal wage rigidities, a classic friction in monetary economics, which implies that monetary policy has real effects on output. The second friction, typical of the macro-finance literature, is that output is used as collateral to perform financial transactions. The combination of these two frictions creates a link between monetary policy and financial flows. In fact, by affecting output monetary policy also influences the value of collateral and, potentially, capital flows.

The first result of the paper is that, in accordance with Ingram's view, forming a currency union increases financial integration across member countries. The reason is simple. An exchange rate depreciation reduces the value of the collateral that foreign investors can repossess from domestic agents. Because of this effect, under flexible exchange rates national governments face a time-consistency problem. Once a country has accumulated a large stock of external debt, in fact, it is optimal for the government to engineer a depreciation to expropriate foreign investors. But anticipating the government's behavior, international investors will be unwilling to lend large sums to foreign countries. Under flexible exchange rates international capital flows will thus be small. In a monetary union this source of exchange rate risk is absent, because national governments delegate monetary policy to a supranational authority, the union's central bank. Hence, in a currency union countries can sustain a higher stock of foreign debt. In this sense, creating a monetary union leads to higher financial integration.

But what are the welfare consequences of adopting a common currency to foster financial integration? The model suggests that the answer to this question is not clear cut. Under certain circumstances, in fact, higher financial integration increases welfare by fostering capital flows from



**Figure 1: International financial integration ratio.** Notes: The figures shows how the introduction of the euro has coincided with an increase in cross-border asset and liability positions of euro area countries. For comparison, the figure shows the same statistic for the United States and Japan which do not display a comparable break in trend around the creation of the euro. Moreover, a break in the trend is also absent if one focuses on the aggregate statistic for the euro area (grey line). This means that the increase in cross-border holdings of foreign assets and liabilities associated with the introduction of the euro is mainly due to an increase in financial flows across euro area countries. Data are from Lane and Milesi-Ferretti (2018).

capital-abundant to capital-scarce countries. But a high degree of financial integration also makes episodes of inefficient capital flights out of capital-scarce countries possible. Hence, the increase in financial integration associated with the creation of a monetary union may has a priori an ambiguous impact on welfare.

**Related literature (TO BE COMPLETED).** This paper contributes to the optimal currency area literature, which studies the costs and benefits associated with forming a monetary union. Friedman (1953) argues that joining a monetary union is costly, because the loss of independent monetary policy leads to higher output volatility in response to asymmetric shocks.<sup>1</sup> Building on this insight, a large literature has considered factors that mitigate the impact on welfare of asymmetric shocks in monetary unions. To cite a few examples, Mundell (1961) and Farhi and Werning (2014) stress the role of labor mobility, Kenen (1969) and Farhi et al. (2011) focus on fiscal transfers, Farhi and Werning (2017) consider fiscal devaluations, Farhi et al. (2011), Schmitt-Grohé and Uribe (2016) and Sergeyev (2016) study macroprudential policies, while Aguiar et al. (2015) focus on public debt and rollover crises. A smaller body of work has studied the benefits derived from creating a monetary union. For instance, in Rey (2001) sharing a common currency reduces the cost of performing international transactions. None of these papers study the interactions between the exchange rate regime and financial integration.

The notion that creating a monetary union leads to higher financial integration goes back at least to Ingram (1973), but few attempts have been made at formalizing this insight.<sup>2</sup> In my model

<sup>1</sup>See Benigno (2004) for an analysis of this argument using a modern New Keynesian open-economy model.

<sup>2</sup>To the best of my knowledge, in fact, the only exception is a recent paper by Doepke and Schneider (2017). The key friction in their model is that financial contracts are non-contingent and defaulting generates social losses.

joining a currency union fosters financial integration because it prevents national governments from using exchange rate depreciations to expropriate foreign investors. [Tirole \(2003\)](#) provides a general theory in which placing constraints on government policy facilitates international borrowing, because it limits the government's ability to expropriate foreign investors. A similar argument is made by [Jeanne \(2009\)](#), who focuses on the optimal debt maturity structure. Here I consider an alternative channel through which expropriation can occur, arising from the impact of monetary policy on collateral value.<sup>3</sup> Moreover, both [Tirole \(2003\)](#) and [Jeanne \(2009\)](#) focus on a single country. Instead, a key element of this paper is its multi-country dimension, and in particular the fact that forming a currency union facilitates financial flows both in and out member countries. Because of this reason, the impact of higher financial integration on welfare is ambiguous in my model, while it is always positive in [Tirole \(2003\)](#) and [Jeanne \(2009\)](#).

Finally, this paper is connected to the literature emphasizing how increasing international financial integration can have an ambiguous impact on welfare. Two examples are [Martin and Rey \(2006\)](#) and [Broner and Ventura \(2016\)](#). In both papers, a high degree of financial integration may open the door to pessimistic equilibria characterized by inefficient capital flights. However, these papers take the level of international financial integration as determined by exogenous forces. Here financial integration is endogenously determined, and depends on the exchange rate regime.

## 2 Model

Consider a world composed of two countries, home and foreign. There are two periods: 0 and 1. In period 0 agents sign financial contracts and make their investment decisions. In period 1 production takes place, financial contracts are settled and agents consume. Agents are rational and there is perfect foresight.

To simplify the exposition, while presenting the model I will focus on the home economy. The foreign country is, however, characterized by exactly the same equilibrium conditions. When needed, I will denote variables pertaining to the foreign country with \* superscripts.

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Sharing a common currency leads to higher international financial integration because it limits the probability that agents default in response to exogenous shocks. The channel emphasized by this paper is very different. In fact, my argument does not rest on the inability to write contingent contracts, but rather on the combination of nominal wage rigidities and collateral constraints. Moreover, in [Doepke and Schneider \(2017\)](#) relative prices and output are exogenous variables, while here the role played by monetary policy in the endogenous determination of output and the real exchange rate is at the heart of the model.

<sup>3</sup>Also in [Fornaro \(2015\)](#) and [Ottonello \(2013\)](#) monetary policy affects collateral value because of the presence of nominal wage rigidities. In their settings, however, the time-consistency problem described by this paper does not arise. The reason is that [Fornaro \(2015\)](#) and [Ottonello \(2013\)](#) implicitly assume that monetary policy is set before financial contracts are signed. Moreover, both papers focus on a single small open economy, and abstract from interactions across countries.

## 2.1 Households

The home country is populated by a continuum of measure one of identical households. Households consume and work in period 1 only, and their utility is

$$C_T + \frac{C_N^{1-\eta}}{1-\eta} - L. \quad (1)$$

In this expression,  $C_T$  and  $C_N$  denote respectively consumption of a tradable and a non-tradable good, while  $L$  denotes labor effort.<sup>4</sup>

In period 0 households are endowed with  $N$  units of the tradable good. There are two assets in which households can invest to transfer tradable goods to period 1. First, households can invest in a domestic technology, call it capital, that transforms one unit of the tradable good in period 0 into  $A$  units of the tradable good in period 1. Let  $I$  denote investment in home-country capital. In addition, households have access to a real bond denominated in units of the tradable good. Denote by  $D$  the level of debt assumed by domestic households in period 0 and due in period 1, and  $R$  the gross interest rate between the two periods. The bond is traded internationally, and  $R$  is common across the two countries.

The period 0 budget constraint of home households is thus given by

$$I = N + \frac{D}{R}. \quad (2)$$

Moreover, as it will become clear later on, each household faces a borrowing limit

$$D \leq \bar{D}. \quad (3)$$

Households' optimal investment strategy is then

$$I = \begin{cases} N + \frac{\bar{D}}{R} & \text{if } A > R \\ [0, N + \frac{\bar{D}}{R}] & \text{if } A = R \\ 0 & \text{if } A < R. \end{cases} \quad (4)$$

Intuitively, if  $A > R$  households maximize investment in domestic capital by borrowing up to their limit. Instead, if  $A < R$  investment in domestic capital is unprofitable, and households lend all their net worth on the international credit markets. Finally, if  $A = R$  households are indifferent between investment in domestic capital or in the international bond.

In period 1 households receive the return from period 0 investment, work and consume. Their period 1 budget constraint in terms of the home currency is

$$P_T C_T + P_N C_N = P_T Y_T - P_T \mathcal{R} + W L. \quad (5)$$

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<sup>4</sup>The assumption that utility is linear in consumption of the tradable good is key in order to solve the model analytically. Instead, the assumption that disutility from labor effort is linear is made purely to simplify notation, and could be easily relaxed.

The left-hand side of this expression represents the households' expenditure.  $P_T$  and  $P_N$  denote respectively the price of a unit of tradable and non-tradable good in terms of the home currency. Hence,  $P_T C_T + P_N C_N$  is the total nominal expenditure in consumption. Since period 1 is the terminal date of the economy, households hold no assets at the end of the period.

The right-hand side captures the households' income.  $Y_T$  denotes the output of tradable goods produced by the home country in period 1, given by

$$Y_T = AI. \tag{6}$$

$\mathcal{R}$  is the amount of loan repayment the households make in period 1.  $W$  denotes the nominal wage, and hence  $WL$  is the households' labor income.

In period 1, households have two decisions to make. First, each household chooses whether to honor its debt or default. In case of default, creditors appropriate a fraction  $\kappa$  of the household's income, so that the household is left with the complement fraction  $1 - \kappa$ . Clearly, households default if the value of the debt owed to foreign investors exceeds the value of the collateral that is repossessed upon default. This implies that

$$\mathcal{R} = \min \left[ D, \kappa \left( Y_T + \frac{W}{P_T} L \right) \right]. \tag{7}$$

Intuitively, the payment that households make to their creditors cannot exceed the value of their collateral.

Second, households allocate expenditure between the two consumption goods. This leads to the demand function for non-tradable goods

$$C_N = \left( \frac{P_N}{P_T} \right)^{-\frac{1}{\eta}}. \tag{8}$$

As it is intuitive, demand for non-tradables is decreasing in their relative price  $P_N/P_T$ .

## 2.2 Nominal wage rigidities

To allow for real effect from monetary policy, I introduce a simple friction in the adjustment of nominal wages. In particular, nominal wages are fixed and equal to  $W$ . This could be the result, for instance, of large menu costs from changing wages. To clear the labor market, I then assume that households satisfy firms' labor demand.

To be clear, the results that follow do not rely at all on this extreme form of wage rigidity, and would extend to a setting in which partial adjustment of nominal wages is possible. But considering an economy with fixed wages is convenient, because it simplifies the analysis and allows for a transparent characterization of the key economic forces at the heart of the model.

### 2.3 Non-tradable production and the real exchange rate

Non-traded output  $Y_N$  is produced by a large number of competitive firms. Labor is the only factor of production, and the production function is  $Y_N = L$ . Profits are given by  $P_N Y_N - WL$ . The zero profit condition implies that in equilibrium  $P_N = W$ .

The real exchange rate of the home economy, denoted by  $p$ , can thus be written as

$$p = \frac{P_N}{P_T} = \frac{W}{P_T}. \quad (9)$$

Notice that, since the nominal wage is rigid, changes in the nominal price of the tradable good affect the real exchange rate. In fact, as I will explain later on, this is the channel through which monetary policy has an impact on the real economy.

### 2.4 Market clearing and equilibrium

Market clearing for the non-tradable consumption good requires that domestic consumption is equal to domestic production

$$Y_N = C_N = p^{-\frac{1}{\eta}}. \quad (10)$$

Notice that, since by equation (8) demand for the non-tradable good is decreasing in the real exchange rate, the real exchange rate effectively determines production of non-tradable goods.

Instead, market clearing for the tradable good requires

$$C_T = Y_T - \min [D, \kappa (Y_T + pY_N)]. \quad (11)$$

This equation highlights how, in equilibrium, collateral is equal to the value of the country's output in terms of the tradable good.

Combining (10) and (11) gives an expression linking the value of collateral to the real exchange rate

$$\kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right). \quad (12)$$

In principle, the relationship between the real exchange rate and collateral value is ambiguous and depends on  $\eta$ . In what follows I will assume that  $\eta > 1$ . In this case, a real exchange rate depreciation reduces the value of collateral. Analogous market clearing conditions hold for the foreign economy.

Finally, the global market clearing conditions are

$$N + N^* = I + I^* \quad (13)$$

$$C_T + C_T^* = Y_T + Y_T^* \equiv AI + A^*I^*. \quad (14)$$

Equation (13) ensures that global investment in capital is equal to the world endowment of the tradable good in period 0. Equation (14) implies that period 1 global consumption of tradable

goods is equal to global production.

We are now ready to define an equilibrium

### 3 Exchange rate regime and financial integration

What is the relationship between monetary policy, the exchange rate regime and financial integration? To answer this question, I solve the model backward and start by characterizing the equilibrium in period 1. Throughout I will contrast two different policy regimes. First, I will consider the case of flexible exchange rates. Later on, in Section 3.2, I will turn to the case of a monetary union.

#### 3.1 Flexible exchange rates

In this simple model monetary policy amounts to setting a value for the nominal price of the tradable good. Under flexible exchange rates each country can run its own independent monetary policy. To see this point start by considering that, since the tradable good is perfectly traded across the two countries, the law of one price holds and so

$$P_T = SP_T^*, \quad (15)$$

where  $S$  denotes the nominal exchange rate, defined as the units of home currency needed to purchase one unit of the foreign currency. The key observation is that the nominal price of the traded good can differ across the two countries, because the nominal exchange rate adjusts to make sure that the law of one price holds. Thus, under flexible exchange rates national governments can freely control the domestic nominal price of the traded good. The implication is that, by equation (9), national governments can effectively choose a value for their real exchange rate.

Closing the model requires specifying how monetary policy is conducted. I will consider governments that implement the optimal non-cooperative monetary policy. In practice, each government chooses the value of the domestic real exchange rate to maximize the welfare of its country's citizens, without any concern for welfare in the rest of the world. Moreover, each government operates under discretion. This means that governments set monetary policy in period 1, without being restricted by any promise that they might have made in period 0.

For instance, in period 1 the home government chooses  $p$ ,  $Y_N$  and  $C_T$  to maximize home households' utility

$$C_T + \frac{Y_N^{1-\eta}}{1-\eta} - Y_N, \quad (16)$$

where I have used the equilibrium conditions  $C_N = Y_N = L$ . Utility is maximized subject to

$$Y_N = p^{-\frac{1}{\eta}} \quad (17)$$

$$C_T = Y_T - \min \left[ D, \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right) \right]. \quad (18)$$



Hence, by setting  $p$  the government affects two margins. First,  $p$  determines the quantity of non-tradable goods produced and consumed by domestic households. Second, if the home country is in a default state, the real exchange rate has an impact on the value of the collateral that foreign creditors can repossess from domestic agents.

I will characterize the behavior of the home government in two steps.<sup>5</sup> The first step consists in deriving the government policy, conditional on whether the country is in a default state or not. Start by assuming that  $D < \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right)$ , so that home agents do not default. Then it is optimal for the home government to set

$$p = Y_N = 1. \quad (19)$$

To understand the intuition behind this condition, consider that  $Y_N = 1$  is the natural level of non-tradable output, that is the amount of non-tradable goods that the economy would produce in absence of nominal rigidities. Hence, conditional on no default, the optimal monetary policy offsets the impact of nominal rigidities on production.

Now imagine that  $D > \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right)$ , so that home households are defaulting on their creditors. In this case the home government sets

$$p = (1 + \kappa(\eta - 1))^{-1} < 1, Y_N > 1. \quad (20)$$

Intuitively, in case of default the government has an additional incentive to depreciate the exchange rate. An exchange rate depreciation, in fact, reduces the value of collateral and thus the amount of tradable goods that foreign creditors can extract from domestic households. The counterpart of this exchange rate depreciation is the overheating of the domestic economy, in the sense that output of non-tradable goods ends up being above its natural level ( $Y_N > 1$ ). So, conditional on defaulting, the home government trades off the gains from depreciating the exchange rate to expropriate foreign creditors, with the costs associated with an inefficiently high production of the non-tradable good.

The second step consists in deriving the conditions under which default occurs. Intuitively, the country ends up defaulting whenever defaulting delivers higher welfare compared to repaying. After some algebra, one finds that default occurs if

$$D > \kappa Y_T + \frac{\eta}{\eta - 1} \left[ (1 + \kappa(\eta - 1))^{\frac{1}{\eta}} - 1 \right] \equiv \bar{D}_{flex}. \quad (21)$$

Naturally, the country defaults whenever its debt toward foreign agents is too high. In particular, default occurs whenever foreign debt exceeds the threshold  $\bar{D}_{flex}$ .

The following proposition summarizes these results.<sup>6</sup>

**Proposition 1** *Under flexible exchange rates, the home country does not default if and only if  $D \leq \bar{D}_{flex}$ . Moreover, in absence of default monetary policy sets  $p = Y_N = 1$ . Analogous expressions*

<sup>5</sup>See Appendix A.2 for a detailed derivation of the solution to the government problem.

<sup>6</sup>Appendix A contains all the proofs.

hold for the foreign country.

A couple of remarks are in order. First, since agents are rational, anticipating the government policy investors will never be willing to lend to domestic agents more than  $\bar{D}_{flex}$ . It follows that the debt ceiling imposed by foreign investors under flexible exchange rates is  $\bar{D} = \bar{D}_{flex}$ . This also means that countries will never accumulate enough debt to trigger a default, and so in equilibrium monetary policy will set  $p = Y_N = 1$  to replicate the allocation under flexible wages.

Second, under flexible exchange rates the debt ceiling imposed by foreign investors is lower than the value of collateral. In fact, it is easy to check that

$$\bar{D}_{flex} < \kappa(Y_T + pY_N) = \kappa(Y_T + 1).$$

This happens because foreign investors anticipate that, if they were to lend to a country slightly more than  $\bar{D}_{flex}$ , the domestic government would engineer a discrete depreciation of the real exchange rate. In turn, the depreciation would trigger a discrete fall in the value of collateral. Hence, under flexible exchange rates, a naive observer would conclude that borrowers never borrow enough to exhaust the value of their collateral.<sup>7</sup>

To conclude, notice that under flexible exchange rates the government is subject to a standard time consistency problem. In period 0, in fact, the government would like to commit not to depreciate the exchange rate in period 1. This would relax the borrowing limit imposed by investors on domestic agents. However, when period 1 comes the government has an incentive to forget its past promises and to expropriate foreign creditors through a depreciation. In absence of commitment, the period 0 promise not to devalue the exchange rate ex post is thus not credible.

### 3.2 Monetary union

I now turn to the case of a monetary union. In a monetary union the two countries share the same currency and so  $S = 1$ . The law of one price for the tradable good then implies that  $P_T = P_T^*$ , so that differences in the nominal price of tradables across countries cannot arise. Moreover, monetary policy is no longer controlled by national governments. It is instead run by a supranational authority, the union's central bank.

To parallel the case of flexible exchange rates, I consider a benevolent central bank that operates under discretion. The key difference is that the central bank of the union seeks to maximize the welfare of the union as a whole. In particular, I consider a central bank that attaches equal weight to the welfare of every citizen of the union.

In principle, the home and foreign country could have different pre-set nominal wages. However, in order to illustrate transparently the impact of forming a monetary union on financial integration,

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<sup>7</sup>Obstfeld and Rogoff (1996) show that a similar result applies when the return from investment in physical capital is used as collateral, and agents decide their investment strategy after credit contracts are signed (see Chapter 6, Section 2). In their setting, debtors have an incentive to reduce investment in order to decrease the value of collateral, and thus the resources that creditors repossess in case of default. This implies that a small increase in debt can trigger a discrete fall in investment and collateral value.

it is convenient to assume that  $W = W^*$ . It follows that both countries will have the same real exchange rate and the same production of non-traded goods ( $p = p^*$ ,  $Y_N = Y_N^*$ ).

The union's central bank thus maximizes

$$Y_T + Y_T^* + 2 \left( \frac{Y_N^{1-\eta}}{1-\eta} - Y_N \right), \quad (22)$$

where I have used the market clearing condition  $C_T + C_T^* = Y_T + Y_T^*$ , subject to

$$Y_N = p^{-\frac{1}{\eta}}. \quad (23)$$

It is immediate to see that the solution to this problem is

$$p = Y_N = Y_N^* = 1. \quad (24)$$

To understand this result, consider that from the point of view of the union's central bank it does not matter how tradable consumption is distributed across the two countries. Hence, the central bank of the union has no incentives to use monetary policy to redistribute resources across home and foreign agents. Instead, the optimal policy focuses on offsetting the impact of nominal rigidities on output, so that production of non-traded goods in both countries is equal to their natural level.<sup>8</sup>

The implication is that the home country will not default as long as

$$D \leq \kappa (Y_T + pY_N) \equiv \bar{D}_{mu}. \quad (25)$$

Hence  $\bar{D} = \bar{D}_{mu}$ . The debt ceiling imposed by foreign investors is thus exactly equal to collateral value.

**Proposition 2** *In a monetary union, the home country does not default if and only if  $D \leq \bar{D}_{mu}$ . Moreover, monetary policy sets  $p = Y_N = 1$ . Analogous expressions hold for the foreign country.*

Intuitively, forming a monetary union mitigates the time-consistency problem faced by national central banks. This happens because the union's central bank, which attaches equal weight to the welfare of both debtors and creditors, has no incentives to use the exchange rate to decrease collateral value and expropriate investors.<sup>9</sup>

<sup>8</sup>If the condition  $W = W^*$  did not hold, it would not be possible for the central bank of the union to replicate the allocation with flexible wages. In this case, the optimal monetary policy would be such that  $Y_N + Y_N^* = 1$ . The optimal monetary policy would thus eliminate the impact of nominal rigidities on the aggregate output of the union (see Benigno (2004) for a derivation of this result in the standard New-Keynesian open-economy model). Still, the central bank of the union would have no incentives to affect the value of collateral in order to redistribute wealth across the two countries.

<sup>9</sup>To be precise, forming a monetary union does not completely solve the time-consistency problem. In fact, in period 0 the central bank of the union might have an incentive to promise a deviation of output from its natural level in period 1, so as to increase collateral value. When period 1 comes, however, it will be optimal for the central bank to renege on its past promises, so as to replicate the allocation with flexible wages.

### 3.3 Impact of forming a monetary union on financial integration

We are now ready to trace the impact of forming a monetary union on financial integration. First, notice that the exchange rate regime does not affect the equilibrium value of the real exchange rate or non-tradable output. The exchange rate regime, however, does affect the tightness of the international borrowing constraints that agents face in period 0. In fact, it is easy to see that

$$\bar{D}_{mu} > \bar{D}_{flex}. \quad (26)$$

Hence, creating a monetary union increases the stock of foreign debt that home agents can sustain without defaulting. Importantly, since the two countries are symmetric it is also the case that

$$\bar{D}_{mu}^* > \bar{D}_{flex}^*. \quad (27)$$

This means that also the foreign assets that home agents can hold without triggering a default in the foreign country increases when a monetary union is formed.

Hence, compared to the case of flexible exchange rates, countries in a monetary union can absorb higher amounts of foreign debt and lend larger sums abroad. It is in this sense that creating a monetary union fosters financial integration across member countries.

## 4 Monetary union, financial integration and welfare

We have just seen that forming a monetary union increases financial integration. But does this process lead to higher welfare? To answer this question we need to fully characterize the equilibrium of the model. It turns out that the answer is it depends. To make this point, I will start by describing an example in which forming a monetary union unambiguously increases welfare. I will then turn to an example in which the impact on welfare is a priori ambiguous.

### 4.1 Monetary union and financial integration: the benign view

Let us start by considering a simple case in which the return from investing in capital is higher in the home country compared to the foreign one ( $A^* < A$ ). This return differential induces home agents to borrow from foreigners to finance investment in domestic capital.<sup>10</sup> Home investment is then equal to

$$I = N + \min\left(N^*, \frac{\bar{D}}{A^*}\right). \quad (28)$$

To derive this expression, notice that home agents end up being borrowing constrained if foreign savings ( $N^*$ ) are large enough. In this case, the interest rate must be such that foreign agents are indifferent between investing in foreign capital or lending to home agents ( $R = A^*$ ).

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<sup>10</sup>In accordance with most of the literature, here I assume that households can commit to an investment plan designed before credit contracts are signed. See [Obstfeld and Rogoff \(1996\)](#) (Chapter 6, Section 2) for a discussion of this assumption.

Now imagine that under flexible exchange rates the home country is borrowing constrained.<sup>11</sup> As discussed above, forming a monetary union leads to an increase in the borrowing limit  $\bar{D}$ . Once a monetary union is formed, therefore, the efficiency in the allocation of capital improves, since more capital is installed in the high-return home country, and overall welfare rises.<sup>12</sup>

There are two points worth mentioning. First, in this model forming a monetary union benefits welfare only if member countries are asymmetric in terms of their investment opportunities. Indeed, if the two countries share the same return to investment ( $A = A^*$ ) there will be no welfare gains from sharing a common currency.<sup>13</sup> This contrasts with the traditional optimal currency area literature, in which giving up exchange rate flexibility is costly precisely when countries are hit by asymmetric shocks. Second, forming a monetary union has a positive impact on welfare only if borrowing constraints bind under flexible exchange rates. Hence, it is optimal to form a currency union only if financial markets are not too developed to start with.

This example thus captures Ingram's view. Forming a monetary union boosts financial integration, and leads to a more efficient allocation of capital across member countries. But, as I will show in the next section, such a benign view is not the only possibility.

## 4.2 Monetary union and financial integration: the not-so-benign view

In this Section I present an example in which forming a monetary union has an ambiguous impact on welfare. The key idea is that high financial integration facilitates large and swift movements of capital across countries. As I will show, a high degree of capital mobility may open the door to pessimistic equilibria, characterized by inefficient capital flights.

To make this argument, let's introduce in the model a source of potential coordination failure among agents. Several options are possible. For instance, an interesting literature suggests that coordination failures are possible when investment decisions by individual agents depend on expectations of aggregate investment. This is the case in the classic contributions by Bryant (1987) and Murphy et al. (1989). In these frameworks, agents can invest in two technologies, one of which is characterized by a higher return. However, investing in the high-return technology is profitable only if enough agents do so. Agents can thus coordinate on an optimistic equilibrium, in which everybody ends up adopting the high-return technology. But expectations can also coordinate

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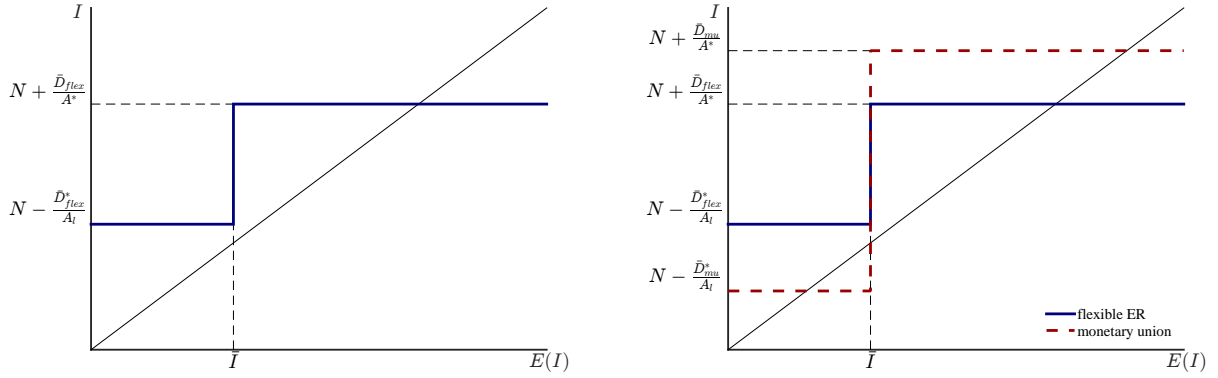
<sup>11</sup>This is the case if

$$N^* > \frac{\kappa AN + \frac{\eta}{\eta-1} \left[ (1 + \kappa(\eta - 1))^{\frac{1}{\eta}} - 1 \right]}{A^* - \kappa A},$$

and  $A^* > \kappa A$ . The first condition ensures that credit constraints are tight enough so that home agents are not able to absorb all foreign savings. The second condition implies that the credit multiplier  $\kappa A/A^*$  is smaller than 1, so that an increase in investment by one unit generates less than a unit increase in collateral value.

<sup>12</sup>Gourinchas and Jeanne (2006) find that the welfare gains strictly related to a better allocation of physical capital across countries are small, especially if compared to the welfare gains from increasing productivity. However, it is not hard to think of channels through which higher financial integration can lead to an increase in total factor productivity. For instance, as in Howitt and Aghion (1998), one could assume that investment in physical capital and innovation are complements. Gourinchas and Jeanne (2005), instead, emphasize how inflows of foreign capital can induce governments to implement reforms aiming at increasing productivity.

<sup>13</sup>This feature of the model is in line with the idea that joining the euro area would foster convergence in productivity and per capita GDP across member countries (FIND QUOTE).



**Figure 2: Equilibrium with aggregate increasing returns from investment.** Notes: left panel refers to flexible exchange rates, right panel shows impact of creating a monetary union.

on a pessimistic equilibrium, in which every agent remains stuck with the low-return inefficient technology.

To capture this idea, assume that the return on home capital depends on aggregate domestic investment

$$A = \begin{cases} A_l & \text{if } I < \bar{I} \\ A_h & \text{if } I \geq \bar{I}. \end{cases} \quad (29)$$

In words, the return to investing in domestic capital experiences an upward jump once the threshold level of aggregate investment ( $\bar{I}$ ) is reached. This is the case if switching from a low-return to a high-return technology entails positive spillovers across agents, so that the high-return technology is profitable only if it is adopted on a large-enough scale. For simplicity, assume that the return from investing in foreign capital is constant and equal to  $A^*$ . Moreover, to make things interesting, consider the case  $A_l < A^* < A_h$ . Hence, investing in the home economy is efficient only if the threshold level of investment  $\bar{I}$  is reached.

Individual investment decisions now depend on expectations of aggregate investment. In particular, if agents expect that  $I \geq \bar{I}$  they anticipate that capital will yield a higher return in the home country compared to the foreign one. It will then be optimal for home households to maximize investment in domestic capital by borrowing up to the limit. Conversely, if agents expect that  $I < \bar{I}$  it will be optimal for home agents to minimize investment in domestic capital by shipping as much capital as possible abroad.

Rather than fully characterizing all the possible equilibria of this version of the model, let me provide an example in which forming a monetary union reduces welfare. Again, restrict attention to equilibria in which the borrowing limit is always binding.<sup>14</sup> Now consider a case in which the equilibrium under flexible exchange rates is as depicted in the left panel of Figure 2.

Figure 2 plots actual investment  $I$  as a function of expected investment  $E(I)$ . If  $E(I) \geq \bar{I}$  then it is more profitable to invest in home rather than in foreign capital. In this case, home agents

<sup>14</sup>This requires that  $N$  and  $N^*$  are sufficiently large.

borrow up to the limit to maximize investment in domestic capital. The equilibrium interest rate is  $R = A^*$ , so that foreign agents are indifferent between investing in foreign capital or lending to home agents. If instead  $E(I) < \bar{I}$ , it is foreigners who will maximize borrowing from domestic agents to invest in foreign capital. The borrowing capacity of foreign agents, however, is not large enough to fully absorb savings from home households, and so there is positive investment in home capital. The equilibrium interest rate is then  $R = A_l$ , so that home agents are indifferent between investing in capital or on the credit market.

In the case shown in the figure, the only possible equilibrium is one in which investment in home-country capital is large enough so that the high-return technology is adopted. It is useful to pause for a second and consider why the pessimistic equilibrium, in which the low-return technology is adopted, is ruled out. Imagine that agents anticipate that the low-return technology will be adopted. In this case, home agents will ship capital abroad until the borrowing constraint of foreign households ends up binding. But, in the case shown in the figure, the borrowing limit of foreign agents is so tight that investment in home capital exceeds the threshold  $\bar{I}$  even if expectations coordinate on the pessimistic equilibrium. For this reason, under flexible exchange rates the pessimistic equilibrium cannot materialize.

The right panel illustrates what may happen once a monetary union is formed. Domestic agents can now sustain a higher amount of foreign debt. Hence, if the high-return technology is adopted home agents increase their foreign borrowing and more capital is installed in the home country. Graphically, this is captured by the upward shift in the investment curve for the range  $E(I) \geq \bar{I}$ . Therefore, if expectations coordinate on the optimistic equilibrium the efficiency in the international allocation of capital is higher in a monetary union compared to the case of flexible exchange rates.

But now consider what happens if agents expect that the low-return technology is adopted. Since the borrowing capacity of foreign agents is now higher, more capital flies out of the home country compared to the case of flexible exchange rates. In the case shown in the figure, this capital flight is large enough so that investment in home capital is lower than the threshold  $\bar{I}$ . Hence, the low-return technology ends up being adopted, validating agents' initial pessimistic expectations. Forming a monetary union thus creates the possibility of coordination failures in investment decisions.

In this example, the case in favor of forming a monetary union is not clear cut and depends on expectations and animal spirits. If agents are optimistic giving up exchange rate flexibility to join a monetary union leads to an increase in welfare, by fostering a more widespread use of the high-return technology in the home country. However, in a monetary union self-fulfilling episodes of inefficient capital flights are possible. In particular, if agents are pessimistic being part of a monetary union reduces welfare, by preventing the home country from adopting the high-return technology. This example thus illustrates one of the potential dangers of a high degree of international capital mobility. It is the easiness with which capital can flow across countries in a

monetary union, in fact, that creates the possibility of coordination failures across agents.<sup>15</sup>

## 5 Policy implications

TO BE WRITTEN.

## 6 Conclusion

TO BE WRITTEN.

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<sup>15</sup>There are some similarities with the results highlighted by [Bryant \(1987\)](#). In Bryant's model agents can invest in capital, which is characterized by increasing aggregate returns, and cash, which offers a fixed return. The option to invest in cash makes it possible for agents to coordinate on pessimistic equilibria in which the increasing returns from investing in capital are not exploited. The key difference is that in the model of this paper the exchange rate regime determines the extent to which agents can divert their savings away from investment in domestic capital, and thus whether multiple equilibria are possible.



# Appendix

## A Proofs

### A.1 Proof of Proposition 1

**Proposition 1** *Under flexible exchange rates, default does not occur if and only if  $D \leq \bar{D}_{flex}$ . Moreover, in absence of default monetary policy sets  $p = Y_N = 1$ . Analogous expressions hold for the foreign country.*

**Proof.** The home government chooses  $p$ ,  $Y_N$  and  $C_T$  to maximize home households' utility

$$C_T + \frac{Y_N^{1-\eta}}{1-\eta} - Y_N, \quad (\text{A.1})$$

subject to

$$Y_N = p^{-\frac{1}{\eta}} \quad (\text{A.2})$$

$$C_T = Y_T - \min \left[ D, \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right) \right]. \quad (\text{A.3})$$

Substituting the constraints in the objective function, the government problem reduces to choosing  $p$  to maximize

$$Y_T - \min \left[ D, \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right) \right] + \frac{p^{1-\frac{1}{\eta}}}{1-\eta} - p^{-\frac{1}{\eta}}. \quad (\text{A.4})$$

Let us start by assuming that  $D \leq \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right)$ , so that default does not occur. In this case, the objective function is maximized by setting

$$p = Y_N = 1 \equiv p_{nd}. \quad (\text{A.5})$$

A necessary condition for this to be an equilibrium is  $D \leq \kappa (Y_T + 1)$ .

Now turn to the case  $D > \kappa \left( Y_T + p^{1-\frac{1}{\eta}} \right)$ , so that home households default. In this case, the objective function is maximized by setting

$$p = (1 + \kappa(\eta - 1))^{-1} \equiv p_d. \quad (\text{A.6})$$

A necessary condition for this to be an equilibrium is  $D > \kappa \left( Y_T + (1 + \kappa(\eta - 1))^{\frac{1}{\eta}-1} \right)$ .

The final step consists in finding the value of  $D$  for which default is avoided. Defaulting gives higher utility compared to repaying  $D$  whenever

$$Y_T - D + \frac{p_{nd}^{1-\frac{1}{\eta}}}{1-\eta} - p_{nd}^{-\frac{1}{\eta}} < Y_T - \kappa \left( Y_T + p_d^{1-\frac{1}{\eta}} \right) + \frac{p_d^{1-\frac{1}{\eta}}}{1-\eta} - p_d^{-\frac{1}{\eta}} \quad (\text{A.7})$$

After a bit of algebra, the condition above can be written as

$$D > \kappa Y_T + \frac{\eta}{\eta - 1} \left[ (1 + \kappa(\eta - 1))^{\frac{1}{\eta}} - 1 \right] \equiv \bar{D}_{flex}. \quad (\text{A.8})$$

One can show that  $\kappa \left( Y_T + (1 + \kappa(\eta - 1))^{\frac{1}{\eta} - 1} \right) < \bar{D}_{flex} < \kappa (Y_T + 1)$ .<sup>16</sup> It follows that default is avoided if and only if  $D \leq \bar{D}_{flex}$ . The problem of the government in the foreign country is symmetric. ■

## A.2 Proof of Proposition 2

**Proposition 2** *In a monetary union, the home country does not default if and only if  $D \leq \bar{D}_{mu}$ . Moreover, monetary policy sets  $p = Y_N = 1$ . Analogous expressions hold for the foreign country.*

**Proof.** The central bank of the union chooses  $p, p^*, Y_N, Y_N^*, C_T, C_T^*$  to maximize households' utility

$$C_T + C_T^* + \frac{Y_N^{1-\eta}}{1-\eta} + \frac{Y_N^{*1-\eta}}{1-\eta} - Y_N - Y_N^*. \quad (\text{A.9})$$

Since  $Y_N = Y_N^*$  and  $C_T + C_T^* = Y_T + Y_T^*$ , the objective function can be written as

$$Y_T + Y_T^* + 2 \left( \frac{Y_N^{1-\eta}}{1-\eta} - Y_N \right), \quad (\text{A.10})$$

which is maximized subject to  $Y^N = p^{\frac{1}{\eta}}$ . The solution is  $p = Y_N = 1$ . The home country therefore does not default if and only if

$$D \leq \kappa (Y_T + 1) \equiv \bar{D}_{mu}. \quad (\text{A.11})$$

Analogous expressions hold for the foreign country. ■

## References

Aguiar, Mark, Manuel Amador, Emmanuel Farhi, and Gita Gopinath (2015) "Coordination and crisis in monetary unions," *The Quarterly Journal of Economics*, Vol. 130, No. 4, pp. 1727–1779.

<sup>16</sup>To prove the left part of the inequality, consider that it can be written as

$$\eta \left( x^{\frac{1}{\eta}} - 1 \right) > \left( 1 - \frac{1}{x} \right) x^{\frac{1}{\eta}},$$

where  $x \equiv 1 + \kappa(\eta - 1) > 1$ . Rearranging gives

$$x^{\frac{1}{\eta}} \left( \eta - 1 + \frac{1}{x} \right) > \eta.$$

To complete the proof, notice that the left-hand side is increasing in  $x$  for  $x > 1$  and the expression holds as an equality if  $x = 1$ . To prove the right part of the inequality, consider that it can be written as

$$\eta x^{\frac{1}{\eta}} - x < \eta - 1.$$

To complete the proof, notice that the left-hand side is decreasing in  $x$  for  $x > 1$  and the expression holds as an equality if  $x = 1$ .

- Benigno, P. (2004) “Optimal monetary policy in a currency area,” *Journal of International Economics*, Vol. 63, No. 2, pp. 293–320.
- Broner, Fernando and Jaume Ventura (2016) “Rethinking the effects of financial globalization,” *The Quarterly Journal of Economics*, Vol. 131, No. 3, pp. 1497–1542.
- Bryant, John (1987) “The paradox of thrift, liquidity preference and animal spirits,” *Econometrica*, pp. 1231–1235.
- Doepke, Matthias and Martin Schneider (2017) “Money as a unit of account,” *Econometrica*, Vol. 85, No. 5, pp. 1537–1574.
- Farhi, E., G. Gopinath, and O. Itskhoki (2011) “Fiscal devaluations,” NBER Working Paper No. 17662.
- Farhi, Emmanuel and Iván Werning (2014) “Labor mobility within currency unions,” NBER working paper.
- Farhi, Emmanuel and Ivan Werning (2017) “Fiscal unions,” *American Economic Review*, Vol. 107, No. 12, pp. 3788–3834.
- Fornaro, Luca (2015) “Financial crises and exchange rate policy,” *Journal of International Economics*, Vol. 95, No. 2, pp. 202–215.
- Friedman, Milton (1953) “The case for flexible exchange rates.”
- Gourinchas, Pierre-Olivier and Olivier Jeanne (2005) “Capital mobility and reform.”
- (2006) “The elusive gains from international financial integration,” *The Review of Economic Studies*, Vol. 73, No. 3, pp. 715–741.
- Howitt, Peter and Philippe Aghion (1998) “Capital accumulation and innovation as complementary factors in long-run growth,” *Journal of Economic Growth*, Vol. 3, No. 2, pp. 111–130.
- Ingram, James C. (1973) “The case for European monetary integration,” Princeton University Essays in International Finance.
- Jeanne, Olivier (2009) “Debt maturity and the international financial architecture,” *American Economic Review*, Vol. 99, No. 5, pp. 2135–48.
- Kenen, Peter (1969) “The theory of optimum currency areas: an eclectic view,” *Monetary problems of the international economy*, pp. 41–60.
- Lane, Philip R (2006) “The real effects of European monetary union,” *Journal of Economic Perspectives*, Vol. 20, No. 4, pp. 47–66.

- Lane, Philip R and Gian Maria Milesi-Ferretti (2018) “The external wealth of nations revisited: international financial integration in the aftermath of the global financial crisis,” *IMF Economic Review*, Vol. 66, No. 1, pp. 189–222.
- Martin, Philippe and Helene Rey (2006) “Globalization and emerging markets: With or without crash?” *American Economic Review*, Vol. 96, No. 5, pp. 1631–1651.
- Mundell, Robert A (1961) “A theory of optimum currency areas,” *American Economic Review*, Vol. 51, No. 4, pp. 657–665.
- Murphy, Kevin M, Andrei Shleifer, and Robert W Vishny (1989) “Industrialization and the big push,” *Journal of Political Economy*, Vol. 97, No. 5, pp. 1003–1026.
- Obstfeld, Maurice and Kenneth S Rogoff (1996) *Foundations of international macroeconomics*: MIT press Cambridge, MA.
- Ottonello, Pablo (2013) “Optimal exchange rate policy under collateral constraints and wage rigidity.”
- Rey, Helene (2001) “International trade and currency exchange,” *The Review of Economic Studies*, Vol. 68, No. 2, pp. 443–464.
- Schmitt-Grohé, Stephanie and Martín Uribe (2016) “Downward Nominal Wage Rigidity, Currency Pegs, and Involuntary Unemployment,” *Journal of Political Economy*, Vol. 124, No. 5, pp. 1466–1514.
- Sergeyev, Dmitriy (2016) “Optimal Macroprudential and Monetary Policy in a Currency Union,” Manuscript, Università Bocconi.
- Tirole, Jean (2003) “Inefficient foreign borrowing: A dual-and common-agency perspective,” *American Economic Review*, Vol. 93, No. 5, pp. 1678–1702.