

Centre de Referència en Economia Analítica

Barcelona Economics Working Paper Series

Working Paper n° 201

Managing Financial Integration

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March, 2005

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Abstract

The goal of this paper is to study the effects of globalization on the workings of asset markets and welfare. To do this, we adopt a “technological” view of the globalization process. That is, we model this process as consisting of a gradual (and exogenous) reduction in the costs of shipping goods across different regions of the world. In the absence of market frictions, globalization creates foreign trade opportunities without affecting domestic ones and, as a result, unambiguously raises welfare. In the presence of sovereign risk, however, globalization can either create or destroy both domestic and foreign trade opportunities. The net effect on welfare of this process of creation and destruction of trade opportunities might be either positive or negative. We also find that asset bubbles moderate this welfare effect. When globalization is welfare reducing, asset bubbles grow creating a positive wealth effect, and vice versa. This might come at a cost though. Asset bubbles reduce the incentives to implement reforms aimed at reducing sovereign risk.

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We consider a simple world economy with two regions. Individuals experience income shocks and want to insure against them. They can do so by trading securities with other domestic and foreign residents. Importantly, we assume throughout that securities trade in anonymous markets. This means that individuals issue securities as opposed to signing contracts¹. Initially, the costs of transporting goods between regions are high enough to make all trades between domestic and foreign residents prohibitively expensive. As a result, individuals insure their idiosyncratic risk with other domestic residents, but do not insure their region-wide aggregate risk. Globalization brings about a steady reduction in the costs of trading with foreigners allowing, in principle, to insure aggregate risk with foreign residents. We consider the implications of this reduction for risk-sharing and welfare in three different environments.

In the first environment, we assume that markets are complete. Not surprisingly, globalization leads to an increase in trading opportunities as individuals now find it cheaper to trade with foreign residents. Equilibrium trade increases and this improves the distribution of consumption across states of nature. All individuals of the world gain from this and welfare unambiguously increases.

In the second environment, we introduce sovereign risk. Namely, governments cannot commit “ex-ante” to enforce “ex-post” payments by their citizens. As a result, governments enforce payments only if this raises the welfare of domestic residents ex-post (even if this reduces the welfare of domestic residents ex-ante). Just as in the complete-markets model, globalization creates new trade opportunities by making it cheaper to trade with foreigners. But now there is an additional effect. As trade with foreigners increases, so do the temptations for governments to skip enforcing

¹Securities consist of obligations of the issuer towards the holder of the security, and can be traded freely. Contracts stipulate obligations between the signing parties that can not be traded freely.

payments in those situations in which domestic residents must make large payments to foreigners. To the extent that the government will not enforce payments in some situations, globalization now reduces trade opportunities with both foreigners and domestic residents. We show examples in which this effect is so strong that all lose from globalization. The problem, of course, is that economic integration is not accompanied by political integration and, as a result, governments act opportunistically so as to benefit their own citizens.

In the third environment, we allow for the presence of asset bubbles.² Young individuals can save for old age by purchasing bubbles from old individuals, by investing in their own projects, and by trading in securities with other young individuals. Since physical investment is more worthwhile the more individuals can insure production risk, there is a relationship between risk sharing, the level of physical investment, and the size (price) of asset bubbles. When globalization improves (worsens) risk-sharing, physical investment increases (decreases), and the size of the bubble decreases (increases). On the one hand, since bubbles provide a substitute for physical investment, their existence moderates the welfare effects of globalization. On the other hand, bubbles may have perverse effects on policy choices. For example, a policy that would allow governments to commit to enforce payments thereby solving the sovereign risk problem would increase physical investment and reduce the size of the bubble. The old would oppose such a policy since it would reduce the price at which they can sell the bubble to the young.

This paper is related to several strands of the literature. There is an extensive literature on sovereign risk that tries to explain why governments ever enforce payments from domestic to foreign residents. The usual answer is that governments want to keep their reputations so that they or their citizens can participate in foreign financial markets in the future.³ Another answer is that governments want to avoid direct sanctions associated with non-enforcement, such as interference with trade in goods. The problem with these answers is that countries do not seem to be excluded from international financial markets for that long after default episodes and defaults do not seem to have much of an effect on trade in goods.⁴ In this paper, governments enforce payments from domestic to foreign residents as a result of two assumptions. First, with anonymous markets governments cannot discriminate against foreigners when enforcing payments. Second, we assume that governments maximize average domestic utility, so they care about the distribution of consumption across domestic residents. As a result, governments face a trade off when deciding whether to enforce payments in states in which domestic residents make payments

²We consider the effect of rational bubbles, as in Samuelson (1958) and Tirole (1985).

³See Eaton and Gersovitz (1981), Bulow and Rogoff (1989a and 1989b), Cole and Kehoe (1997), Kletzer and Wright (2000), Wright (2002), and Amador (2003).

⁴The latter is still an open issue. Rose (2002) argues that there exists trade disruption after defaults, but Martinez and Sandleris (2004) find the opposite result.

to foreigners: if payments are enforced average domestic consumption is reduced but the allocation of that consumption across domestic residents improves. We show that the more important risk sharing among domestic residents is the more domestic residents can insure aggregate shocks with foreigner residents.

There is a growing literature on the relationship between domestic and foreign financial markets. Chang and Velasco (1999) emphasize the role of foreign investors in emerging-market banking systems. Caballero and Krishnamurthy (2001) emphasize the role of domestic markets in facilitating access to international markets, due to both their effects on the allocation of international collateral ex-post and their effects on the incentives to create international collateral ex-ante. Ventura (2004) shows how domestic financial frictions can give rise to asset bubbles and the role of bubbles in international capital flows. Tirole (2003) argues that in the presence of sovereign risk individual residents have incentives to overborrow. In our paper, domestic and foreign risk sharing are interconnected due to the inability of governments to discriminate against foreigners when enforcing payments. As in Caballero and Krishnamurthy (2001), domestic financial development facilitates access to international markets, but our mechanism is different. In our model the government enforces payments to foreigners (which allows for the possibility of issuing securities ex-ante) so as not to destroy valuable transfers between domestic residents. In our model, there is a second type of interdependence absent in the previous literature. When payments from domestic to foreign residents are high enough, governments prefer not to enforce payments. As a result, for extreme realizations of aggregate shocks governments do not enforce payments thereby destroying risk sharing among domestic residents.

1 Globalization with complete markets

In this section, we begin our analysis of the effects of globalization on the workings of financial markets. As mentioned in the introduction, we adopt a “technological” view of the globalization process. According to this view, globalization consists of a gradual reduction in the costs of shipping goods across different regions of the world. It seems natural to start by examining the standard case of complete markets. As expected, an improvement in the transport technology increases trade and raises welfare in this case. The goal of this section is to explain how and why this happens. The results obtained in this case will serve to build intuitions and also provide a useful benchmark against which to compare the richer results of sections 2 and 3.

Throughout we use a simple model of the world economy that abstracts from many important aspects of trade. For instance, in our model the only motive for trade within and across regions

is the desire to insure against income shocks. We therefore disregard other important sources of domestic and foreign trade such as differences in technology and factor proportions, economies of scale and differences in the rate of time preference. We would like to be able to say that abstracting from these types of trade does not meaningfully affect the results we obtain. But the truth is that we do not know this. As the next sections will reveal, the problem we are analyzing is sufficiently complex in this simple framework. Despite this, we shall offer at the end of the paper some conjectures about how introducing additional motives for trade might affect the results we obtain here.

1.1 The model

Consider a world economy with two regions: Home and Foreign. Both regions have identical population size, normalized to 1. We define I and I^* as the sets of Home and Foreign residents, respectively. As usual, we use an asterisk to denote Foreign variables, and omit the asterisk to denote Home variables. The world and its inhabitants last two periods, which we refer to as youth and old age. There is no uncertainty about youth, but there are various sources of uncertainty regarding old age. Let S be the set of all possible states of nature during old age. This set includes all the relevant aspects of the world economy that are not known during youth. We denote by π_s the probability at youth of state $s \in S$ occurring during old age. There is a single good that is costly to transport across regions. If τ (≥ 1) units of the good are shipped from any region, only one unit of the good arrives to the other region.

All individuals maximize the expected utility of old-age consumption,

$$\int_{s \in S} \pi_s \cdot u(c_{is}) \text{ if } i \in I \text{ and } \int_{s \in S} \pi_s \cdot u(c_{is}^*) \text{ if } i \in I^*, \quad (1)$$

where c_{is} and c_{is}^* are the quantities of Home and Foreign goods consumed by individual i , and the utility function is assumed to take logarithmic form, i.e. $u(\cdot) = \ln(\cdot)$. Note that the utility function of Home residents is defined exclusively as a function of Home goods, while the utility function of Foreign residents is defined exclusively as a function of Foreign goods⁵. Throughout, we assume that consumption cannot be negative, i.e. $c_{is} \geq 0$ and $c_{is}^* \geq 0$ for all $i \in I \cup I^*$.⁶

During youth, individuals receive an endowment of the single good and use it to build a project

⁵This world with one good and two locations is isomorphic to an alternative world with one location and two goods. In this alternative world, half of the agents would consume exclusively one good and the other half consume exclusively the other good. There would also exist a linear technology that converts τ of any of the goods into one unit of the other one.

⁶The assumption of logarithmic preferences ensures that consumption of Home (Foreign) goods by Home (Foreign) residents is always non-negative. But these restrictions are still necessary to ensure that consumption of Home (Foreign) goods by Foreign (Home) does not become negative.

located in their own region.⁷ Projects pay off during old age. We refer to the return to the project of individual i as his/her production. Half of Home residents are “lucky” and receive $y_{is} = (1+\iota)\cdot y_s$ and $y_{is}^* = 0$ in state s , while the other half are “unlucky” and receive $y_{is} = (1-\iota)\cdot y_s$ and $y_{is}^* = 0$, with $\iota \in [0, 1)$. Similarly, half of Foreign residents are “lucky” and receive $y_{is}^* = (1+\iota)\cdot y_s^*$ and $y_{is} = 0$ in state s , while the other half are “unlucky” and receive $y_{is}^* = (1-\iota)\cdot y_s^*$ and $y_{is} = 0$. Note that the projects of Home residents only deliver goods in Home, while the projects of Foreign residents only deliver goods in Foreign. The average productions of Home and Foreign are therefore given by y_s and y_s^* , i.e. $y_s = \int_{i \in I \cup I^*} y_{is}$ and $y_s^* = \int_{i \in I \cup I^*} y_{is}^*$.⁸ These assumptions imply that the projects of all the residents of a given region are ex-ante identical, but might differ ex-post. Throughout, we assume symmetry between regions: if there exists a state s with $\pi_s = \pi$ and $(y_s, y_s^*) = (\bar{y}, \underline{y})$, then there exists another state s' with $\pi_{s'} = \pi$ and $(y_{s'}, y_{s'}^*) = (\underline{y}, \bar{y})$. This assumption implies that the Home and Foreign regions are ex-ante identical, but might differ ex-post.

During youth, individuals have access to markets where a full set of Arrow-Debreu securities are traded. Let x_{is} and x_{is}^* be the number of securities held by individual i that promise to deliver one unit of the good in Home and Foreign, respectively. We refer to these securities as “Home” and “Foreign” securities, respectively. With no loss of generality, we assume that individuals can only issue securities that are backed by their own production,

$$x_{is} \geq -y_{is} \quad \text{and} \quad x_{is}^* \geq -y_{is}^* \quad \text{for all } i \in I \cup I^* \quad \text{and } s \in S. \quad (2)$$

We can now write the budget constraint of the young as

$$\int_{s \in S} (q_s \cdot x_{is} + q_s^* \cdot x_{is}^*) \leq 0 \quad \text{for all } i \in I \cup I^*, \quad (3)$$

where q_s and q_s^* are the prices of Home and Foreign securities that pay in state s . Equation (3) basically says that purchases of securities must be financed by corresponding sales of other securities.

During old age, individuals have access to a market where they can trade goods. Let p_s and p_s^* be the prices of goods located in Home and Foreign, respectively. We also refer to these goods as

⁷We are implicitly assuming that investing in the project dominates any other available technology to transform goods during youth into goods during old age.

⁸Rigorously, each state of nature is characterized not only by the average levels of income in each region (i.e. y_s and y_s^*) but also by how these incomes are distributed among their residents (i.e. the sets of lucky residents in each region). However, we will work with a more coarse partition of states and refer to all the states with the same average levels of income in each region as the same “state.” This constitutes a slight abuse of notation but, given the symmetry among residents within each region, it greatly simplifies the exposition.

“Home” and “Foreign” goods, respectively. The budget constraint during old age is

$$p_s \cdot c_{is} + p_s^* \cdot c_{is}^* \leq p_s \cdot (y_{is} + x_{is} + t_{is} - \tau \cdot t_{is}^*) + p_s^* \cdot (y_{is}^* + x_{is}^* + t_{is}^* - \tau \cdot t_{is}) \quad \text{for all } i \in I \cup I^* \text{ and } s \in S, \quad (4)$$

where t_{is} are the quantities of goods shipped from Foreign to Home and t_{is}^* are the quantities of goods shipped from Home to Foreign. Equation (4) states that consumption cannot exceed income. Naturally, it is not possible to ship negative quantities, so

$$t_{is} \geq 0 \quad \text{and} \quad t_{is}^* \geq 0 \quad \text{for all } i \in I \cup I^* \text{ and } s \in S. \quad (5)$$

To sum up, individuals maximize Equation (1) subject to Equations (2), (3), (4) and (5).

To complete the model, we must ensure that markets clear. During old age, the only relevant markets are those for Home and Foreign goods and these clear if and only if

$$\int_{i \in I \cup I^*} c_{is} = y_s + \int_{i \in I \cup I^*} (t_{is} - \tau \cdot t_{is}^*) \quad \text{for all } s \in S, \quad (6)$$

$$\int_{i \in I \cup I^*} c_{is}^* = y_s^* + \int_{i \in I \cup I^*} (t_{is}^* - \tau \cdot t_{is}) \quad \text{for all } s \in S. \quad (7)$$

Equations (6) and (7) ensure that the demands for Home and Foreign goods equal their respective supplies. In turn, supplies consist of domestic production plus net shipments. During young age, the relevant markets are those for Arrow-Debreu securities and market clearing requires that

$$\int_{i \in I \cup I^*} x_{is} = 0 \quad \text{for all } s \in S, \quad (8)$$

$$\int_{i \in I \cup I^*} x_{is}^* = 0 \quad \text{for all } s \in S. \quad (9)$$

Equations (8) and (9) impose the condition that there is zero net supply of Home and Foreign securities.

The competitive equilibrium of this world economy consists of a set of prices and quantities such that individuals maximize expected utility –equation (1)– subject to their budget and technological constraints –equations (2), (3), (4), (5)– and markets clear –equations (6), (7), (8), (9). As usual, Walras’ law implies that one of the market clearing conditions is redundant. We show next by construction that the assumptions made ensure that this equilibrium always exists and is unique.

1.2 Domestic and international risk sharing

The picture of trade, consumption and welfare that this model delivers is quite standard. In traditional models of international trade goods are traded according to comparative advantage. In this model, the same is true if one thinks of goods in different states of nature as being different goods. A country has a comparative advantage in goods in those states in which its output is high relative to the output of the other country.⁹ Ex-ante, agents purchase securities which pay in those states in which their output is low and sell securities which pay in those states in which their output is high. This results in risk diversification both within and between countries. The extent to which agents diversify their exposure to their country's aggregate risk depends on the transport cost. As in traditional trade models, the higher the transport cost the less relative prices converge. As a result, the higher the transport cost the less relative consumptions are equalized over different states of nature and the less agents diversify risk between the two countries.

The possibility of shipping goods between countries implies that, ex-post, the price of the good in the two countries cannot be too different since otherwise agents would ship more goods from the country where the good is cheap to the country where the good is expensive. In particular, good prices satisfy the inequalities¹⁰

$$\tau^{-1} \leq \frac{p_s}{p_s^*} \leq \tau \text{ for all } s \in S. \quad (10)$$

Equation (10) is an arbitrage condition that states that the difference in the price of Home and Foreign goods cannot be greater than the rate at which one good can be transformed into the other. In equilibrium, goods are shipped from the country with high output to the country with low output, up to the point at which the price in the importing country is no higher than the price in the exporting country plus the transport cost.

The possibility of purchasing both Home and Foreign securities regardless of where an agent

⁹This corresponds to comparative advantage because the two countries have the same ex-ante expected output. If the two countries were not symmetric, a country would have a comparative advantage in goods in those states in which its output relative to the output of the other country is high compared to its average relative output.

¹⁰To see this, note that the optimal shipment policy satisfies

$$t_{is} = \begin{cases} 0 & \text{if } p_s < \tau \cdot p_s^* \\ [0, \infty) & \text{if } p_s = \tau \cdot p_s^* \\ \infty & \text{if } p_s > \tau \cdot p_s^* \end{cases} \text{ and } t_{is}^* = \begin{cases} 0 & \text{if } p_s^* < \tau \cdot p_s \\ [0, \infty) & \text{if } p_s^* = \tau \cdot p_s \\ \infty & \text{if } p_s^* > \tau \cdot p_s \end{cases}$$

for all $i \in I \cup I^*$ and $s \in S$. If the price in one region exceeds (falls short of) the other region's price plus the transport cost, individuals ship an infinite (zero) amount of goods to that region. If the price in one region equals the price of the other region plus the transport cost, individuals are indifferent about how many goods to ship.

resides results in the following restriction on security prices,^{11,12}

$$q_s = q_s^* \cdot \frac{p_s}{p_s^*} \text{ for all } s \in S. \quad (11)$$

Equation (11) is another arbitrage condition, which is analogous to covered interest parity. It states that if agents can invest in two different securities that pay in the same state, then the return to these securities must be the same.

Finally, the equilibrium pattern of consumptions across individuals and states is given by

$$c_{is} = \begin{cases} \frac{1}{2} \cdot (y_s + \tau \cdot y_s^*) & \text{if } \tau \leq \frac{y_s}{y_s^*} \\ y_s & \text{if } \tau^{-1} \leq \frac{y_s}{y_s^*} \leq \tau \text{ and } c_{is}^* = 0 \text{ for all } i \in I \text{ and } s \in S, \\ \frac{1}{2} \cdot (y_s + \tau^{-1} \cdot y_s^*) & \text{if } \frac{y_s}{y_s^*} \leq \tau^{-1} \end{cases} \quad (12)$$

$$c_{is}^* = \begin{cases} \frac{1}{2} \cdot (y_s^* + \tau^{-1} \cdot y_s) & \text{if } \tau \leq \frac{y_s}{y_s^*} \\ y_s^* & \text{if } \tau^{-1} \leq \frac{y_s}{y_s^*} \leq \tau \text{ and } c_{is} = 0 \text{ for all } i \in I^* \text{ and } s \in S. \\ \frac{1}{2} \cdot (y_s^* + \tau \cdot y_s) & \text{if } \frac{y_s}{y_s^*} \leq \tau^{-1} \end{cases} \quad (13)$$

There is full domestic risk sharing and, as a result, all residents of a given region enjoy the same consumption regardless of whether their individual project gives a high or low return. There is, however, less than full international diversification because of the wedge in goods prices created by the transport cost. This wedge is reflected in two aspects of the optimal consumptions. First, there is a non-empty set of states in which no trade takes place even if productions differ between regions. Second, consumptions differ across regions even in those states in which there is trade.

¹¹To see this, note that the optimal portfolios satisfy

$$x_{is} = \begin{cases} -y_{is} & \text{if } q_s > q_s^* \cdot \frac{p_s}{p_s^*} \\ \left[-y_{is}, c_{is} + \frac{p_s^*}{p_s} \cdot c_{is}^* - y_{is} \right] & \text{if } q_s = q_s^* \cdot \frac{p_s}{p_s^*} \\ c_{is} + \frac{p_s^*}{p_s} \cdot c_{is}^* - y_{is} & \text{if } q_s < q_s^* \cdot \frac{p_s}{p_s^*} \end{cases} \text{ and } x_{is}^* = \begin{cases} \frac{p_s}{p_s^*} \cdot c_{is} + c_{is}^* - y_{is}^* & \text{if } q_s > q_s^* \cdot \frac{p_s}{p_s^*} \\ \left[-y_{is}^*, \frac{p_s}{p_s^*} \cdot c_{is} + c_{is}^* - y_{is}^* \right] & \text{if } q_s = q_s^* \cdot \frac{p_s}{p_s^*} \\ -y_{is}^* & \text{if } q_s < q_s^* \cdot \frac{p_s}{p_s^*} \end{cases}$$

for all $i \in I \cup I^*$ and $s \in S$. If the return to Home securities fell short of (exceeded) the return to Foreign securities, individuals would invest the minimum possible amount in Home (Foreign) securities. If this were the case, the market clearing condition (8) (condition 9) would not hold. If the return to investing in both securities were the same, individuals would be indifferent about the composition of their portfolios.

¹²Although the model has a unique equilibrium outcome in terms of consumptions and shipment of goods, there exist some indeterminacy in equilibrium portfolios. The reason is that agents only care about their net position for each state of nature, but they do not care about the composition of their portfolio between domestic securities and securities issued by the other country. Although this point does not play any role in this section, when we introduce sovereign risk we will need to revisit it.

1.3 The effects of globalization

To study the effects of globalization, we modify the model by adding an overlapping generations structure. Each generation is as described above. Generation t agents are born at time t , with an endowment which they can invest in a project that pays at $t + 1$. They maximize expected utility from consumption at $t + 1$. At time t they purchase and sell securities to diversify their production risk. Generation t agents cannot trade securities with agents in different generations: at time $t + 1$, they are old and the best they can do is to consume their output and the proceeds from the securities they traded at time t ; at time t , the only other living generation is generation $t - 1$, but since this generation is old they are not willing to trade securities either. As a result, agents invest all their endowment in their project and diversify the production risk as much as they can by purchasing and selling securities to other agents in the same generation.¹³ We assume that both the transport cost τ and the probability distribution over production levels $\{\pi_s\}_{s \in S}$ can vary over time.¹⁴ Since generations do not trade with each other, each generation t is fully characterized by the state variables $\{\tau_{t+1}, \{\pi_{s,t+1}\}_{s \in S}\}$. The equilibrium for each generation is as described in section 1.2 and is unaffected by the overlapping generations structure.

The story of globalization that comes out of this model is easy to explain and is depicted in Figure 1. Define $U = \max_{s \in S} \left\{ \frac{y_s}{y_{s^*}} \right\}$ and $L = \min_{s \in S} \left\{ \frac{y_s}{y_{s^*}} \right\}$, and note that $\ln(L) = -\ln(U)$. Assume that initially transport costs are very high, and that the process of globalization consists of reductions in transport costs until eventually they become zero. In particular, $\tau_0 > U$ (and $\tau_0^{-1} < L$), $\tau_{t+1} < \tau_t$, and $\lim_{t \rightarrow \infty} \tau_t = 1$. At time 0, transport costs are so high that there is no trade and both regions live in autarky. Since markets are complete, there is full domestic risk diversification. All states belong to the set *NIT* (no international trade). Regions live in autarky until time t such that $\tau_{t+1} < U$. At this point, some international risk diversification starts to take place. Home sells part of its production in those states in which its income is highest relative to Foreign. The set of such states is denoted X (Home exports). In exchange, Home buys part of Foreign's production in those states in which its income is lowest relative to Foreign. The set of such states is denoted X^* (Foreign exports). Further reductions in τ have two effects. First, there is an extensive margin in that the set of states in which there is international diversification increases. Second, there is an intensive margin in that the amount of international diversification that takes place in those states

¹³In the previous section, we implicitly assumed that the amount an agent invests in his own project is equal to his endowment. However, it is easy to show that this is in fact how much investors would invest if they could choose the level of investment. This is because the total amount of investment must equal the total endowments and, given the fact that projects are ex-ante identical, it is optimal to invest the same amount in each of them.

¹⁴Although we assume that the set of possible production levels $\{(y_s, y_{s^*})\}_{s \in S}$ is constant, this is without loss of generality. The reason is that we can define this set as the union of all possible production levels at all possible times, and simply assign zero probability to those which cannot take place at a particular time.

in which international diversification was already taking place also increases.

It can be easily shown that in this world economy globalization constitutes a Pareto improvement. Each and every individual in this world will be better off as a result of a reduction in τ .

2 Sovereign risk

In section 1 we assumed that agents always pay during old age for the securities they issued when young. Why would this be so? The usual answer is that governments enforce payments. However, why would governments themselves enforce payments? In the context of international financial markets, this is a very important question since governments naturally care more about domestic residents than about foreigners. This problem is usually referred to as sovereign risk.

As in section 1, we assume that there exists a full set of Arrow-Debreu securities. However, markets may be incomplete because ex-post the government might choose not to enforce payments. We make the following assumption standard in the sovereign risk literature:

Assumption 1. *SOVEREIGN RISK: (i) When state s occurs, individuals only pay for the state- s securities he/she issued if his/her government enforces payments. (ii) Governments cannot commit to enforce payments in the future. (iii) Governments only care about the welfare of domestic residents, in particular, governments maximize average utility of domestic residents.*

The literature on sovereign risk has made the implicit assumption that governments can monitor and independently enforce every transaction. As a result, it has concluded that absent long-term considerations, governments would choose ex-post not to enforce any payments to foreigners. In the context of this model, this would destroy international risk sharing and financial integration would have no effects. In this section we study sovereign risk when governments can neither commit to enforce payments nor independently enforce every transaction. We also make the following assumption regarding enforcement abilities:

Assumption 2. *NON-DISCRIMINATORY ENFORCEMENT: (i) Anonymity: securities stipulate seller but not buyer and can be freely and anonymously traded between the time when uncertainty is resolved and the time at which individuals pay them off. (ii) Equal treatment: governments cannot discriminate among issuers of a given security.*

The assumption on anonymity implies that governments cannot discriminate between security holders when enforcing payments and generate crucial interactions between domestic and international financial markets. Without these interactions international asset trade would not be feasible.

This paper is about analyzing these interactions. The assumption on equal treatment is a simplifying assumption and our qualitative results only hinge on anonymity.¹⁵

An implication of these assumptions is that we can partition the set of states according to whether the Home and Foreign governments enforce payments or not. Let E and E^* be the subset of states in which Home and Foreign enforce payments, respectively. These sets will be determined as part of the equilibrium. As we shall see, the size of these sets depends on parameter values. In fact, we can reinterpret the model of section 1 not as a model of commitment but as a model in which the lack of commitment is not binding. As in section 1, we will first analyze the two period model and add the overlapping generations structure when we discuss the effects of globalization.

2.1 The model with sovereign risk

Sovereign risk affects the individual maximization problem in that agents can only sell securities which pay in states in which their government enforces payments. Agents solve the same maximization problem as in section 1, except that restriction (2) is replaced by

$$x_{is} \geq -\hat{y}_{is} \quad \text{and} \quad x_{is}^* \geq -\hat{y}_{is}^* \quad \text{for all } i \in I \cup I^* \quad \text{and } s \in S, \quad (14)$$

where \hat{y}_{is} and \hat{y}_{is}^* are now pledgable income, defined as

$$\hat{y}_{is} = \begin{cases} y_{is} & \text{if } s \in E \\ 0 & \text{if } s \notin E \end{cases} \quad \text{and} \quad \hat{y}_{is}^* = \begin{cases} y_{is}^* & \text{if } s \in E \\ 0 & \text{if } s \notin E \end{cases} \quad \text{for all } i \in I \cup I^* \quad \text{and } s \in S. \quad (15)$$

Equation (15) states that agents cannot pledge income in states in which their government does not enforce payments. For example, a Home resident might want to sell securities that pay in a state, say s , in which his production is high in order to purchase more securities that pay in states in which his production is low. However, if in that state the Home government does not enforce payments, $s \notin E$, the resident will not pay for those securities when state s materializes. Ex-ante, the resident would want to commit to pay but, ex-post, he will not do it without the government forcing him. Knowing this, ex-ante other agents would not be willing to purchase any state- s securities from Home residents. In this sense Home production in state s is not pledgable. Similarly, no agent would be willing to purchase securities from Foreign residents that pay in states in which the Foreign government does not enforce payments.¹⁶

¹⁵It is not necessary to make any assumption regarding partial enforcement in the sense of enforcing payment of less than 100% of face value. Equal treatment plus agents' ability to condition securities on level of enforcement makes such partial enforcements irrelevant.

¹⁶If an agent could produce in both countries, we would need to specify whether governments have control over domestic residents or over domestic output. By assuming that residents only produce in their own countries, we

Sovereign risk does not affect the market clearing conditions, and equations (6)-(9) still apply. This completes the description of the model for exogenously given sets E and E^* . This allows us to find patterns of consumption and security holdings as a function of governments' enforcement decisions. However, enforcement decisions are in turn a function of the patterns of consumption and security holdings.

We assume that there exists a positive but negligible cost of enforcing payments. As a result, governments enforce payments ex-post if enforcement strictly increases the average utility of domestic residents. Namely,

$$E = \left\{ s \in S \left| \int_{i \in I} u(c_{is}) > \int_{i \in I} u(y_{is} + \tau^{-1} \cdot x_{is}^*) \right. \right\}, \quad (16)$$

$$E^* = \left\{ s \in S \left| \int_{i \in I^*} u(c_{is}^*) > \int_{i \in I^*} u(y_{is}^* + \tau^{-1} \cdot x_{is}) \right. \right\}, \quad (17)$$

where we have taken into account that the relative prices in case of non-enforcement must be equal to τ^{-1} , since the region would not be shipping any goods abroad in this case.

The competitive equilibria of this world economy consists of a set of prices, quantities, and enforcement sets such that individuals maximize expected utility –equation (1)– subject to their budget and technological constraints –equations (14), (3), (4), (5)– markets clear –equations (6), (7), (8), (9)– and enforcement is ex-post optimal –equations (16), (17).

Characterization of equilibria:

The equilibria of this model are characterized by sets of enforcement E and E^* . Given these sets, the agents' problem determines unique portfolio and consumption choices. In turn, these choices must result in ex-post enforcement in states E and E^* and non-enforcement in other states. In general, the model displays a large number of equilibria. There are three features of the set of equilibria worth emphasizing.

First, for any subsets $S' \subseteq S$ and $S'^* \subseteq S$ there exists an equilibrium in which the Home government does not enforce payments in S' and the Foreign government does not enforce payments in S'^* ; namely, $S' \cap E = S'^* \cap E^* = \emptyset$. The reason is that if agents expect non-enforcement by the Home government in a state $s \in S'$, then Home residents will not be able to issue any state- s securities. As a result, ex-post there will not be any Home securities to enforce and the average utility of Home residents would not be affected by the enforcement decision of the Home government. Thus, the Home government will choose ex-post not to enforce payments in state s . The same argument applies to states $s \in S'^*$. This property of equilibria shows that, in general,

sidestep this distinction.

there are many equilibria that correspond to arbitrarily shutting down markets in some or even all states.

Second, it is *not* true that for any subsets $S' \subseteq S$ and $S'^* \subseteq S$ there exists an equilibrium in which the Home government enforces payments in S' and the Foreign government enforces payments in S'^* ; namely, $S' \subseteq E$ and $S'^* \subseteq E^*$. In particular, $E = E^* = S$ is usually not an equilibrium. The reason is that for states with very extreme realizations of relative incomes, optimal consumption choices would imply such high transfers that the government of the region that makes payments would prefer ex-post not to enforce these payments.

Third, since we focus on symmetric equilibria we can analyze pairs of symmetric states independently. More specifically, let a state s be characterized by incomes $(y_s, y_s^*) = (\bar{y}, \underline{y})$ and let its symmetric state be the state s' with the same probability and incomes $(y_{s'}, y_{s'}^*) = (\underline{y}, \bar{y})$. (We have already assumed that such a state exists.) Since equilibria are symmetric, residents in both regions have the same budget constraint multipliers ω . Consider the possibility that $s \in E \cap E^*$ and $s' \in E \cap E^*$. In this case, since the multipliers ω are the same in both countries, it is easy to show that consumptions in states s and s' would be given as in equations (12) and (13). Given these consumption levels and associated portfolios, equations (16) and (17) determine whether it is possible to have $s \in E \cap E^*$ and $s' \in E \cap E^*$. The important point to note is that the consumption levels and associated portfolios in states s and s' and, as a result, whether enforcement is possible in these states in equilibrium is independent of the enforcement decisions in other states. By a similar argument, the possibility of other enforcement decisions in states s and s' is independent of enforcement decisions in other states as well.

Since all pairs of symmetric states can be analyzed independently, there exists a maximal equilibrium in which enforcement takes place in as many states as possible. To find this maximal equilibrium, we proceed as follows. For every pair of symmetric states, we check if (i) $s \in E \cap E^*$ and $s' \in E \cap E^*$ is consistent with ex-post enforcement. If it is, we include states s and s' in S and S^* . If it is not, we check if (ii) $s \in E$ and $s' \in E^*$ is consistent with ex-post enforcement. If it is, we include s in E and s' in E^* . If it is not, we check if (iii) $s \in E^*$ and $s' \in E$ is consistent with ex-post enforcement. If it is, we include s in E^* and s' in E . Otherwise, neither s nor s' can be included in either E or E^* .¹⁷ The maximal equilibrium found by this procedure is unique. In addition, it is the best possible equilibrium, in the sense that residents in both regions are better off than in any other equilibrium. Thus, from now on we will focus on this equilibrium.

¹⁷One can show that if (i) is not consistent with ex-post enforcement, then (ii) is possible only if $\bar{y} < \underline{y}$ and (iii) is possible only if $\bar{y} > \underline{y}$. An implication of this is that if (i) is not consistent with ex-post enforcement, then (ii) and (iii) cannot be both possible. As a result, the order in which we check (ii) and (iii) is irrelevant.

Some comments on our assumptions:

It is worth commenting on two assumptions we have implicitly made in the analysis above. First, note that for every state s either there is enforcement and agents' consumptions are unconstrained or there is no enforcement and agents cannot issue any state- s securities. This is a direct consequence of the assumption that agents take prices and government enforcement as given. However, if unconstrained consumption in state s would lead to non-enforcement, why do agents not limit their security issuance in that state to a level such that the government enforces payments? After all, in principle agents which are “small” in terms of their production and security holdings could still have “large” effects by tipping the governments' enforcement decisions. We have ruled out this possibility and instead assumed that agents perceive themselves as having only “small” effects on enforcement decisions. Although this seems sensible on a priori grounds, one must also show that it is logically consistent with the assumptions of the model. We do this in the appendix.¹⁸

Second, in the model without sovereign risk portfolio choices, as long as they were consistent with equilibrium consumptions, were irrelevant for the analysis of the model. This is not necessarily the case when enforcement decisions are endogenous. It is clear from equations (16) and (17) that the more agents diversify their risk by purchasing securities from residents in the other country the lower the incentives for the domestic government to enforce payments. We will deal with this issue by restricting our attention to those portfolio choices that maximize enforcement. Let us define an equilibrium *without two-way payments* as one in which there is no state in which Home residents receive payments from Foreign while at the same time Foreign residents receive payments from Home, namely $\left(\int_{i \in I} x_{si}^*\right) \cdot \left(\int_{i \in I^*} x_{si}\right) = 0$ for all $s \in S$. We will only consider equilibria without two-way payments. Although this restriction seems like an assumption on portfolio choices, it is not. It can be easily shown that if there exists an equilibrium characterized by $\{c_{is}, c_{is}^*, q_s, q_s^*, p_s, p_s^*\}_{s \in S}$ *with* two-way payments, then there exists another equilibrium characterized by the same $\{c_{is}, c_{is}^*, q_s, q_s^*, p_s, p_s^*\}_{s \in S}$ *without* two-way payments. The reason is that, while eliminating two-way payments in state s increases the incentive to enforce payments in state s conditional on net portfolio positions, we can always construct equilibria without two-way payments and without enforcement in state s : if no agent issued securities that pay in state s then the government would choose not to enforce payments in state s . In other words, the restriction of no two-way payments is without loss of generality. In addition, we do not need to bother considering

¹⁸There is an extensive literature emphasizing the fact that domestic agents do not internalize the effect that their actions have on the policies of the domestic government. In most contexts, this causes agents to take actions that, while privately optimal, induce the government to choose policies that are too unfriendly to foreigners. This externality worsens the terms at which other domestic residents trade with foreigners. This effect can lead to overborrowing, too much investment in the non-tradable sector, etc. See Tirole (2003) for a more thorough discussion.

all the possible patterns of portfolio choices that satisfy no two-way payments. The reason is that without two-way payments when a country is a recipient of international payments the government always enforces payments and when a country is a source of international payments the pattern of security holdings among domestic residents does not affect the enforcement decision.

2.2 Domestic and international risk sharing

As in the model without sovereign risk, globalization allows for the possibility of international risk sharing. The potential benefits from international risk sharing and the effect of changes in the costs of transport τ on these potential benefits are as in the case without sovereign risk. However, in the presence of sovereign risk individuals can only make payments in states in which their government enforces payments. This limits the amount of risk sharing that can take place, both between and within regions.

The possibility of shipping goods across regions implies that the relative price of the good in the two regions still satisfies equation (10) for all $s \in S$. The possibility of purchasing securities issued in both regions implies that the relative price of Home and Foreign securities satisfy equation (11) for all $s \in E \cap E^*$. In states in which at least one of the governments does not enforce payments equation (11) does not hold since at least one of the securities does not exist.¹⁹

As mentioned above, we will analyze the equilibrium in which the amount of risk sharing is maximized since this equilibrium Pareto dominates all the others. We start then by analyzing the set of states in which both governments enforce payments, namely $E \cap E^*$. Given the symmetry of the model and the fact that we are analyzing a symmetric equilibrium, residents in both regions have the same budget constraint multipliers ω . As a result, for states $s \in E \cap E^*$ consumption levels are given by equations (12) and (13), and there is optimal risk sharing. To determine the states that can belong to $E \cap E^*$, we need to check the states for which governments have incentives to enforce payments when consumption levels are given by these equations. As mentioned above, in the absence of two-way payments governments always enforce payments as long as there are any domestic payments to enforce and the region is not a net payer to the other region. As a result, we just need to check for what states Home chooses to enforce payments when $\tau \leq \frac{y_s}{y_s^*}$ and for what states Foreign chooses to enforce payments when $\frac{y_s}{y_s^*} \leq \tau^{-1}$. In the first case, if Home enforces payments all Home residents consume $\frac{1}{2} \cdot (y_s + \tau \cdot y_s^*)$ while otherwise lucky residents consume $y_s \cdot (1 + \iota)$ and unlucky residents consume $y_s \cdot (1 - \iota)$. In the second case, if Foreign enforces payments all Foreign residents consume $\frac{1}{2} \cdot (y_s^* + \tau \cdot y_s)$ while otherwise lucky residents consume

¹⁹For states in which only one governments enforces payments, we could define the price of the security that does not exist as the one that satisfies equation (11). In this case, the equation would hold for all $s \in E \cup E^*$.

$y_s \cdot (1 + \iota)$ and unlucky residents consume $y_s \cdot (1 - \iota)$. If we define $\kappa \equiv 1 - (1 - \iota)^{1/2} \cdot (1 + \iota)^{1/2}$, it is easy to show that

$$E \cap E^* = \left\{ s \in S \left| \tau^{-1} \cdot (1 - 2 \cdot \kappa) < \frac{y_s}{y_s^*} < \tau \cdot (1 - 2 \cdot \kappa)^{-1} \right. \right\}. \quad (18)$$

Within the set $E \cap E^*$, there are three subsets. When $\tau^{-1} < \frac{y_s}{y_s^*} < \tau$, marginal rates of substitution between states are similar in the two regions and it is not worth incurring transport costs, so there are no international flows. When $\tau < \frac{y_s}{y_s^*} < \tau \cdot (1 - 2 \cdot \kappa)^{-1}$, there are transfers from Home to Foreign, and when $\tau^{-1} \cdot (1 - 2 \cdot \kappa) < \frac{y_s}{y_s^*} < \tau^{-1}$ there are transfers from Foreign to Home. In all cases, there is perfect domestic risk sharing. When relative incomes are not too different from 1, optimal risk sharing is possible since it does not entail large international transfers. The highest amount of international transfers that can take place and still have governments want to enforce payments depends crucially on the importance of domestic markets, as reflected in κ . For example, when $\kappa = 0$ ($\iota = 0$), the set where both governments enforce payments is just equal to the set where no international flows take place, $E \cap E^* = \left\{ s \in S \left| \tau^{-1} < \frac{y_s}{y_s^*} < \tau \right. \right\}$. In other words, when domestic markets are worthless, no international flows can be sustained. On the other extreme, when $\kappa \geq \frac{1}{2}$, $E \cap E^* = S$ and enforcement takes place in every state. We study next what happens for intermediate levels of $\kappa \in \left(0, \frac{1}{2}\right)$.

Let us define the set $HHP \equiv \left\{ s \in S \left| \tau \cdot (1 - 2 \cdot \kappa)^{-1} \leq \frac{y_s}{y_s^*} \right. \right\}$, for “high Home production,” as the set in which enforcement by both governments is impeded by the fact that Home production is too high. Similarly, let us define the set $HFP \equiv \left\{ s \in S \left| \frac{y_s}{y_s^*} \leq \tau^{-1} \cdot (1 - 2 \cdot \kappa) \right. \right\}$, for “high Foreign production,” as the set in which enforcement by both governments is impeded by the fact that Foreign production is too high. We will analyze the patterns of consumptions and risk sharing in the HHP set, keeping in mind that the patterns in the HFP set are symmetric. In the HHP set Home residents cannot issue securities but they can purchase them from Foreign residents. There are two cases to consider, depending on whether the Foreign government enforces payments.

Case 1 (High Home Production - Missing Home Market) The first observation is that for

$s \in HHP$ the lucky Home residents are always constrained in the sense that they would like to sell securities but they cannot. For $\frac{y_s}{y_s^*} > \tau^{-1} \cdot (1 - \iota)^{-1}$, the unlucky Home residents are also constrained since their income is so high in these states that they would also want to sell securities to Foreign residents.²⁰ In this case, since Foreign residents do not make any

²⁰This condition corresponds to $y_s \cdot (1 - \iota)$ being higher than the consumption level unlucky Home residents would have if they shared risk with Foreign residents, which equals $\frac{1}{3} \cdot \left(y_s \cdot (1 - \iota) + 2 \cdot \frac{1}{\tau} \cdot y_s^* \right)$. As a result, unlucky Home

payments to Home residents, the Foreign government enforces payments.

For $\frac{y_s}{y_s^*} \leq \tau^{-1} \cdot (1 - \iota)^{-1}$, on the other hand, the production by unlucky Home residents is so low relative to the production by the average Foreign resident that unlucky Home residents would want to purchase securities from Foreign residents. If $\frac{y_s}{y_s^*} > \tau^{-1} \cdot (1 - \iota)^{-1} \cdot (1 - 3 \cdot \kappa)$, the payments from Foreign resident are low enough so that the Foreign government chooses to enforce payments even though Foreign residents are making payments to Home residents.²¹

Consumptions are then given by

$$c_{is} = \begin{cases} y_s \cdot (1 + \iota) & \text{if } i \in I \text{ is lucky} \\ \max \left\{ y_s \cdot (1 - \iota), \frac{1}{3} \cdot (y_s \cdot (1 - \iota) + 2 \cdot \tau^{-1} \cdot y_s^*) \right\} & \text{if } i \in I \text{ is unlucky} \end{cases} \quad (19)$$

$$c_{is}^* = \begin{cases} \min \left\{ y_s^*, \frac{1}{3} \cdot (\tau \cdot y_s \cdot (1 - \iota) + 2 \cdot y_s^*) \right\} & \text{if } i \in I^* \text{ is lucky} \\ \min \left\{ y_s^*, \frac{1}{3} \cdot (\tau \cdot y_s \cdot (1 - \iota) + 2 \cdot y_s^*) \right\} & \text{if } i \in I^* \text{ is unlucky} \end{cases} \quad (20)$$

For $\frac{y_s}{y_s^*} > \tau^{-1} \cdot (1 - \iota)^{-1}$, there is no international risk sharing, there is domestic risk sharing in Foreign, and there is no domestic risk sharing in Home. Note that even though international payments do not take place in equilibrium, their possibility leads to a breakdown in domestic risk sharing at Home. Also, note that international risk sharing breaks down precisely in those states in which it would be most useful. For $\frac{y_s}{y_s^*} \leq \tau^{-1} \cdot (1 - \iota)^{-1}$, there is optimal risk sharing between both lucky and unlucky Foreign residents and unlucky Home residents. In particular, unlucky Home residents receive payments from Foreign residents. Lucky Home residents cannot participate in the arrangement because they would like to issue securities but the Home government does not enforce payments. The intuition for why international transfers take place from the low income to the high income region is that the residents of the high income region that can participate are poor relative to the average resident of the poor region.

Case 2 (High Home Production - Missing Home and Foreign Markets)

If the amount of securities that the unlucky Home residents want to purchase from Foreign residents is so large that the Foreign government prefers not to enforce payments, i.e. $\frac{y_s}{y_s^*} \leq \tau^{-1} \cdot (1 - \iota)^{-1} \cdot$

residents would want to sell securities to Foreign residents, but they cannot do it since the Home government is not enforcing payments.

²¹This condition corresponds to the consumption of Foreign residents when they share risk with unlucky Home residents, $\frac{1}{3} \cdot (2 \cdot y_s^* + \tau \cdot y_s \cdot (1 - \iota))$, being such that transfers to unlucky Home residents are not too high. This consumption level must be higher than $y_s^* \cdot (1 - \kappa)$, since otherwise the Foreign government would not enforce payments.

$(1 - 3 \cdot \kappa)$, then risk sharing completely breaks down. Consumptions are given by

$$c_{is} = \begin{cases} y_s \cdot (1 + \iota) & \text{if } i \in I \text{ is lucky} \\ y_s \cdot (1 - \iota) & \text{if } i \in I \text{ is unlucky} \end{cases} \quad (21)$$

$$c_{is}^* = \begin{cases} y_s^* \cdot (1 + \iota) & \text{if } i \in I^* \text{ is lucky} \\ y_s^* \cdot (1 - \iota) & \text{if } i \in I^* \text{ is unlucky} \end{cases} \quad (22)$$

and there is neither international risk sharing nor domestic risk sharing in either region. In this set of states, the disappearance of enforcement in Home leads to the disappearance of enforcement in Foreign.

Finally, the existence and number of states corresponding to each of these cases depends on the parameters of the model, in particular the cost of transport τ . We explain in the next section how the process of globalization, understood as a decline in τ over time, affects payment enforcement and domestic and international risk sharing.

2.3 The effects of globalization revisited

To analyze the effects of globalization, we consider the same overlapping generations structure considered in section 1.3. In the absence of sovereign risk, generation t was fully characterized by the state variables $\{\tau_{t+1}, \{\pi_{s,t+1}\}_{s \in S}\}$. With sovereign risk and a long-lived government, there might be equilibria in which governments can commit to higher levels of enforcement due to reputational considerations. Since such reputational considerations are not the focus of this paper, we will disregard them by making the following assumption:²²

Assumption 3. *NO REPUTATION: Each generation coordinates on the equilibrium that maximizes its welfare. In particular, lack of enforcement in the past cannot act as a sunspot to trigger an equilibrium which is suboptimal for the current generation.*

Under this assumption, we recover the result that generation t is fully characterized by the state variables $\{\tau_{t+1}, \{\pi_{s,t+1}\}_{s \in S}\}$. The equilibrium for each generation is thus as described above and is unaffected by the overlapping generations structure.

In the absence of sovereign risk, the effects of globalization were simple to describe and unambiguous with respect to welfare. A reduction in transport cost τ allowed regions to better share risks internationally by increasing the set of states in which international transfers took place and by increasing the size of transfers in the inframarginal states. Furthermore, globalization had no

²² Alternatively, we could assume that the government maximizes the welfare of the current old.

effects on domestic risk sharing. As a result, globalization was unambiguously welfare improving. In the model of this section, in which governments only enforce payments ex-post if it increases average utility of domestic residents, the effects of globalization are complex and ambiguous with respect to welfare.

In figure (2) we illustrate the process of globalization in the presence of sovereign risk. Assume that initially transport costs are very high, and that the process of globalization consists of reductions in transport costs until eventually they become zero. In particular, $\tau_0 > U$ (and $\tau_0^{-1} < L$), $\tau_{t+1} < \tau_t$, and $\lim_{t \rightarrow \infty} \tau_t = 1$. As long as $\tau_{t+1} > U$ no trade takes place, even for the most extreme realizations of relative incomes. We call this the stage 1 of globalization. In this stage, all states belong to the set *NIT* (no international trade) in which there is no international risk sharing and there is perfect domestic risk sharing.

As τ decreases, eventually it becomes worth to make transfers for extreme realizations of relative incomes. This is stage 2 of globalization. The level of τ at which there is a transition from stage 1 to stage 2 is $\tau_{1,2} = U$. As τ decreases further, transfers start taking place for more states of nature (extensive margin) and become larger for the inframarginal states (intensive margin). In this stage, states with intermediate relative incomes belong to the set *NIT*, states with high Home relative income belong to the set *X* (Home exports) in which there are transfers from Home to Foreign, and states with high Foreign relative income belong to the set *X** (Foreign exports) in which there are transfers from Foreign to Home. There is perfect domestic risk sharing for all states.

In stages 1 and 2, globalization has the same effects regardless of whether governments can commit to enforce payments or not. In these stages, further globalization allows for more international risk sharing without affecting domestic risk sharing and is thus unambiguously welfare improving. The reason is that for high enough τ , the resulting international transfers are not high enough for governments to be willing to destroy domestic transfers from lucky to unlucky residents in order to avoid paying foreigners. However, at some point τ becomes low enough such that, for the most extreme realizations of relative income, governments do prefer to destroy domestic transactions to permit domestic residents not to pay foreigners. At this point, the stage 3 of globalization starts, and the results of the model without commitment start differing from those of the model with commitment. The level of τ at which there is a transition from stage 2 to stage 3 is $\tau_{2,3} = U \cdot (1 - 2 \cdot \kappa)$.^{23,24}

²³This corresponds to τ being so high that even for the highest level of $\frac{y_s}{y_s^*}$, the Home government wants to enforce payments, i.e. $\frac{y_s}{y_s^*} < \tau \cdot (1 - 2 \cdot \kappa)^{-1}$.

²⁴Note that for high enough levels of $\kappa > \frac{1}{2} (1 - U^{-1})$ there is always enforcement and globalization has the same effect with or without commitment for all values of τ .

In stage 3, there are the same sets X^* , NIT , X as in stage 2, plus sets of states with extreme realizations of relative incomes in which some markets are missing. In the set $HHP - MHM - NIT$ (high Home production-missing Home market-no international trade), there are no international transfers and there is no enforcement of payments in Home. This has two negative effects for Home residents. They cannot pledge their income to Foreign resident in states in which the average income in Home is highest and, on top of that, domestic markets are missing in these states and there is no domestic risk sharing. The same happens in the Foreign region in the set $HFP - MFM - NIT$ (high Foreign production-missing Foreign market-no international trade). In this stage, reductions in τ have both positive and negative effects on welfare. On the one hand, globalization increases international risk sharing for intermediate values of relative incomes (both intensive and extensive margins). On the other hand, it reduces international risk sharing for extreme realizations of relative incomes, and it increases the set of states in which domestic risk sharing does not exist.

Eventually, a new type of equilibrium appears. This happens when enforcement breaks down for low enough levels of relative income such that the unlucky residents in the region in which payments are not enforced have lower income than the average resident in the region in which payments are enforced. In other words, the unlucky residents in the “rich” region have lower income than the average residents in the “poor” region. At this point, transfers start taking place from the region with low relative income to the region with high relative income, thus partly overcoming the fact that the unlucky in the latter cannot share risk with the lucky in the same region since domestic markets are missing. This corresponds to stage 4 of globalization. The level of τ at which there is a transition from stage 3 to stage 4 is $\tau_{3,4} = \sqrt{\frac{1 - 2 \cdot \kappa}{1 - \iota}}$.²⁵

In stage 4 there are the same sets as in stage 3, plus two additional additional sets of “reverse capital flows,” denoted $HHP - MHM - RF$ (high Home production-missing Home market-reverse flows) and $HFP - MFM - RF$ (high Foreign production-missing Foreign market-reverse flows). Reverse capital flows take place for moderately high relative incomes, since they require both not too low relative incomes so that domestic markets disappear and not too high relative incomes so that the unlucky in the rich region are poor enough. In stage 4, as in stage 3, globalization has ambiguous welfare effects. However, the negative effects on domestic markets are partly compensated by reverse capital flows.

Finally, as τ decreases further eventually there appears a new set of states in which the fact that markets are missing in one region causes markets to disappear in the other region and there

²⁵This corresponds to τ being so high that there are no levels of output so high that $s \notin E \cup E^*$, namely $\frac{y_s}{y_s^*} \geq \tau \cdot (1 - 2 \cdot \kappa)^{-1}$, and at the same time so low that unlucky Home residents want to purchase securities from Foreign residents, namely $\frac{y_s}{y_s^*} < \tau^{-1} \cdot (1 - \iota)^{-1}$.

is no risk sharing whatsoever. This happens when the transfers from the latter to the unlucky in the former are so large that the government prefers not to enforce payments either. We denote these sets as *HHP – MHFM* (high Home production-missing Home and Foreign markets) and *HFP – MHFM* (high Foreign production-missing Home and Foreign markets). The level of τ at which there is a transition from stage 4 to stage 5 is $\tau_{3,4} = \sqrt{\frac{(1 - 2 \cdot \kappa) \cdot (1 - 3 \cdot \kappa)}{1 - \iota}}$.^{26,27} The welfare effects of globalization in stage 5 are usually negative. The reason is that the fact that markets disappear in both regions reduces the mitigating effects of transfers to the unlucky resident of the richer region, and also reduces domestic risk sharing in the poorer region.

2.4 Policy implications

State specific taxes. Since cannot commit to enforce ex-post, need ex-ante policies. With fewer assets, we have fewer instruments. In this case, optimal policy probably entails default in extreme cases to avoid killing the market in less extreme cases.

3 Bubbles and crashes

Assume now that agents are born with 1 unit of the good, which can be either invested or consumed. If agent i invests an amount k_{it} at time t he produces $k_{it} \cdot y_{ist+1}$ at time $t+1$, with y_{ist+1} distributed as in the previous sections. Up to now, we had assumed that agents did not have the choice of not investing all their endowment in their projects. Since agents do not value consumption when young, young agents would only keep part of their endowment for consumption if they could sell it to the old.²⁸ What can the old give to the young in return for additional consumption? A bubble!

The existence of bubbles enriches the model immensely, but it also complicates the analysis in a subtle but crucial way. The value of agents' endowments in the two regions would, in general, be different since the price of the goods in the two regions would be different unless $y_{st} = y_{st}^*$ or $\tau_t = 1$. Different value of endowments would break down the symmetry of the model. As a result, in this section we will only consider extreme values of τ : $\tau_t = \infty$ (or higher than U) and $\tau_t = 1$.

Given these restrictions on the process $\{\tau_t\}_{t=0}^{\infty}$, we study the following process of globalization. Initially, both regions are in autarky ($\tau_t = \infty$). There is a constant hazard rate, $\delta > 0$, of moving to

²⁶This corresponds to τ being so high that there are no levels of output so high that $s \notin E \cup E^*$, namely $\frac{y_s}{y_s^*} \geq \tau \cdot (1 - 2 \cdot \kappa)^{-1}$, and at the same time so low that unlucky Home residents purchase so many securities from Foreign residents that the Foreign government does not enforce payments, namely $\frac{y_s}{y_s^*} < \tau^{-1} \cdot (1 - \iota)^{-1} \cdot (1 - 3 \cdot \kappa)$.

²⁷For this type of equilibrium to exist, it is necessary to have both very low levels of τ (less than 1.08) and low levels of κ . For reverse flows it is also necessary to have relatively low levels of κ , but the condition is less stringent.

²⁸They would not sell it to other young agents for investment either since all the projects are ex-ante identical and there are constant returns to scale.

full and irreversible globalization ($\tau_t = 1$). Namely, the realizations of $\{\tau_t\}_{t=0}^{\infty}$ are all of the form $\tau_t = \infty$ for $t \in \{0, 1, \dots, t_g - 1\}$ and $\tau_t = 1$ for $t \in \{t_g, t_g + 1, \dots, \infty\}$, with the time of globalization t_g distributed with probability $\delta \cdot (1 - \delta)^{t_g}$.

We will consider “riskless” bubbles whose price is constant for as long as τ remains constant, but whose price can jump at the time of globalization t_g . For $t \geq t_g$ the price of the goods in both regions is the same, so a single bubble is sufficient. For $t \leq t_g$ we need two bubbles: a Home bubble with constant price in terms of Home goods and a Foreign bubble with constant price in terms of Foreign goods. We can think of these two bubbles as existing also after globalization takes place, but whose price is always the same.²⁹

Let us start the analysis by characterizing the equilibrium for $t \geq t_g$. Let b^1 be the constant value of the bubble in each country. The first order condition for investment is given by

$$\int_{s \in S} \pi_s \cdot u'(c_{is}) \cdot y_{is} = \int_{s \in S} \pi_s \cdot u'(c_{is}) \quad (23)$$

while consumptions are given by

$$c_{is} = \frac{1}{2} \cdot (y_s + y_s^*) \cdot (1 - b^1) + b^1 \quad \text{and} \quad c_{is}^* = 0 \quad \text{for all } i \in I \quad \text{and } s \in S, \quad (24)$$

$$c_{is}^* = \frac{1}{2} \cdot (y_s + y_s^*) \cdot (1 - b^1) + b^1 \quad \text{and} \quad c_{is} = 0 \quad \text{for all } i \in I^* \quad \text{and } s \in S. \quad (25)$$

4 Concluding remarks

5 References

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²⁹If expected returns on bubbles are constant and realized returns are riskless except at the time of globalization, then the prices of the bubbles must remain constant both before and after the globalization.

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6 Appendix

We assume that there is a (small) non-monetary cost governments needs to pay to enforce payments, denoted $\varepsilon(x)$, where x is the probability that payments are in fact enforced. In particular, after observing the state of nature in the second period (and taking into account asset trades in the first

period), governments choose a probability of enforcement x and pay cost $\varepsilon(x) = \bar{\varepsilon}x^\gamma$ where $\gamma > 1$. Note that $\varepsilon(\cdot) : [0, 1] \rightarrow [0, \bar{\varepsilon}]$ is convex.³⁰

In general, the model has many equilibria. For example, any state can become a non-enforcement state if there is a lot of two-way trade between the two regions. Since residents have incentives to maximize ex-ante the probability of enforcement, we will limit our analysis to equilibria in which asset holdings do not involve any two-way trade (i.e. gross flows and net flows between regions are the same). Also, it is easy to show that the absence of two-way trade implies that regions always enforce payments when they are net recipients of international flows. As a result, the governments' benefits from enforcing payments in the relevant cases in which the region is a net payer are given by

$$b_s = \int_{i \in I} u(c_{is}) - \int_{i \in I} u(y_{is})$$

$$b_s^* = \int_{i \in I^*} u(c_{is}) - \int_{i \in I^*} u(y_{is})$$

The optimal probabilities of enforcement are thus

$$x_s = \begin{cases} 1 & \text{if } b_s \geq \varepsilon'(1) \\ (\varepsilon')^{-1}(b_s) & \text{if } \varepsilon'(1) > b_s \geq \varepsilon'(0) \\ 0 & \text{if } \varepsilon'(0) > b_s \end{cases}$$

$$x_s^* = \begin{cases} 1 & \text{if } b_s^* \geq \varepsilon'(1) \\ (\varepsilon')^{-1}(b_s^*) & \text{if } \varepsilon'(1) > b_s^* \geq \varepsilon'(0) \\ 0 & \text{if } \varepsilon'(0) > b_s^* \end{cases}$$

when a region is a net payer and 1 when the region is a net recipient.

Throughout, we will assume that the cost of enforcing payments by the government are very large relative to the size of an individual resident, but very small relative to the size of the economy.

With some abuse of notation, let I be the number of Home residents. We assume that the model

³⁰If the enforcement cost were linear or concave in the probability of default or if the government's choice were just between enforcing with probability 1 or not enforcing, residents would be able to coordinate into not issuing so many securities that the government chooses not to enforce payments. This would be the case even when there are a very large number of residents. This is because at the point at which the government is indifferent between enforcing and not enforcing payments, any small increase in the number of securities issued would decrease the probability of enforcement from 1 to 0. We find this possibility highly unrealistic. When enforcement costs are convex, a small increase in security issuance has a small effect on the probability of enforcement. As a result, when there are many agents they cannot coordinate into not issuing too many securities and, thus there are states in which enforcement does not take place.

This is the simplest way to account for the fact that small changes in asset holdings should have small effects on the probability (or extent) of enforcement. Alternatively, the existence of any amount of uncertainty affecting the government's enforcement decision but on which agents cannot condition their securities would have a similar effect. Examples of such type of uncertainty include unobserved enforcement costs and unobserved government preferences.

is the limit of a model in which $I \rightarrow \infty$, $\bar{\varepsilon} \sim \sqrt{I}$.³¹ Similarly for the Foreign region.

³¹The cost could grow with the size of the economy at any power in the interval $(0, 1)$.

Figure 1: Stages of integration without sovereign risk.

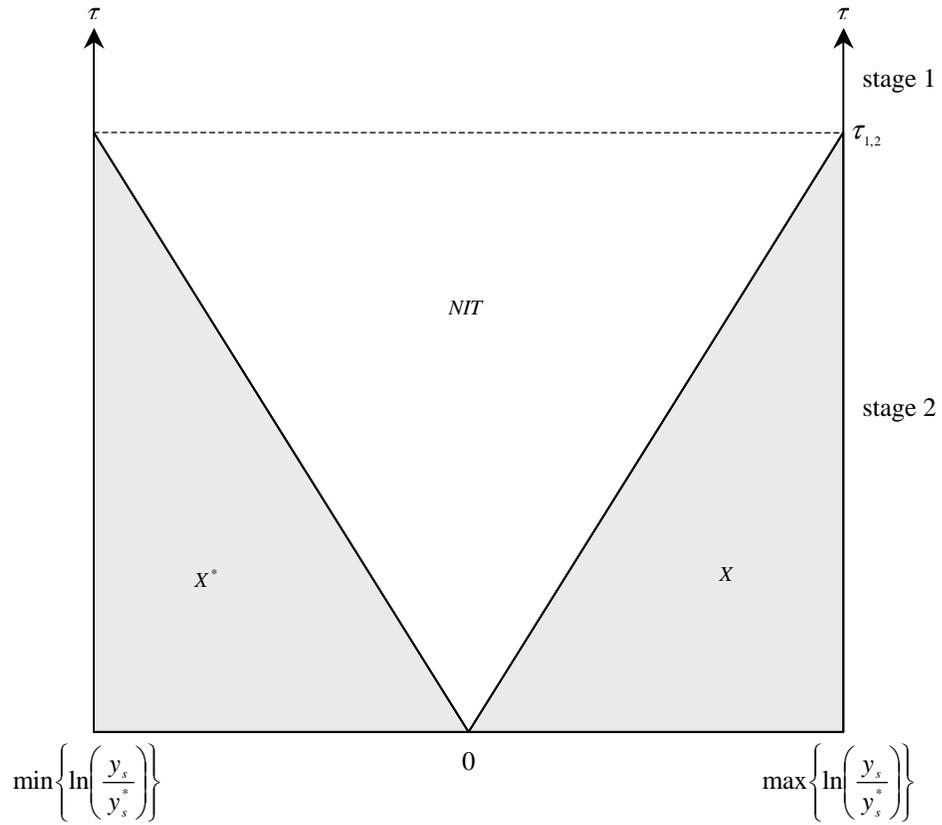


Figure 2: Stages of integration with sovereign risk.

