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Capital regulation and trade in banking services

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Capital regulation and trade in banking services

Preliminary and incomplete

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Abstract

We set up a two-country, regional model of trade in financial services. Competitive firms in each country manufacture untraded consumer goods in an uncertain productive environment, borrowing funds from a bank in either the home or the foreign market. Duopolistic banks can choose their levels of monitoring of firms and thus the level of risk-taking, where the risk of bank failure is ultimately borne by taxpayers in the bank's home country. Moreover, each bank chooses the share of lending allocated to domestic and to foreign firms, respectively, but the bank's overall loan volume may be fixed by a capital requirement set in its home country. In this setting we consider two types of financial integration. A reduction in the transaction costs of cross-border banking reduces aggregate output and increases risk-taking, thus harming consumers and taxpayers in both countries. In contrast, a reduction in the costs of screening foreign firms is likely to be beneficial for banks, consumers, and taxpayers alike.

Keywords: G18, F36, H81

JEL classifications: cross-border banking, capital regulation, economic integration

1 Introduction

International trade in banking services has increased rapidly over the last few decades, and in particular during the past 15 years. The ratio of total international bank lending, as a share of world GDP, rose gradually until the year 2000. It then accelerated sharply and almost doubled between the years 2000 and 2009, reaching 40% of world GDP in that year.¹ Another indicator of the prevalence of cross-border lending comes from a country study of all German banks (more than 2200 in total) by Buch et al. (2011). The authors find that 96% of all German banks held international assets during the period 2002-2006, and 85% were engaged in cross-border lending.

The financial crisis of 2007-2008 has shown, however, that this increasing internationalization in the banking sector is not without risk. Many banks worldwide have suffered huge losses from subprime financial products that originated in the U.S. housing market.² Financial integration was thus a key factor in transforming the crisis in the U.S. housing market into a worldwide banking crisis during which large financial institutions in many countries had to be rescued by taxpayer monies. In several countries, such as Ireland or Iceland, the public bailout was so massive that it threatened the entire state of public finances.

One important reason as to why the increasing internationalization of the banking sector may increase its exposure to risk is the limited information about foreign loan markets. Empirical evidence shows that ‘gravity models’, in which distance acts as a proxy for information costs or information asymmetries, are able to explain international transactions in financial services at least as well as goods trade transactions (Portes *et al.*, 2001; Portes and Rey, 2005). Furthermore, the importance of informational constraints in banking is shown in cross-country evidence that information sharing across lenders increases lending volumes and reduces default rates (Jappelli and Pagano, 2002).

Against this background, the present paper sets up a model of international trade in services where banks engage in cross-border lending to small, competitive firms and

¹See Committee on the Global Financial System (2010), Graph 1. This source also contains a detailed overview of further developments in international banking.

²Econometric evidence for a sample of large banks across the world confirms that, during this period, the exposure to the U.S. real estate market was a factor that significantly contributed to stock market losses (Beltratti and Stulz, 2012).

make monitoring decisions that determine the riskiness of their operations in their domestic and foreign markets, respectively. International lending is subject to two frictions that are not present when the banks lend domestically. Firstly, foreign loans are subject to a transaction cost that arises, for example, from the need to employ the services of a foreign-based intermediary. Secondly, information costs are higher in the foreign country than in the domestic one due, for example, to different accounting rules or as a result of (higher) information asymmetries.

Our model involves active governments that set optimal capital requirements that limit the total loan volume of their national bank. In setting such a capital requirement, a government balances its impact on the bank's aggregate profits in the domestic and foreign markets against the expected costs to taxpayers that arise from the probability of bank failure. When governmental capital requirements binds the bank's total volume of lending, the bank is left to determine the shares of lending between firms in its home and foreign markets.

The focus of our analysis lies on the effects that economic integration has on banks, consumers and taxpayers. We show that these effects differ critically on which international friction is reduced. If financial integration lowers the transaction costs for cross-border lending while information costs remain unchanged, then its effects are predominantly negative: overall lending and aggregate output fall in equilibrium, as a result of banks redirecting a given total loan volume towards the foreign country, where its costs are higher. At the same time, the expected losses to taxpayers increase, as each bank makes relatively more loans in its foreign market where information is more costly and monitoring levels are therefore low.

In contrast, if the information costs in the foreign market fall as a result of financial integration, then the effects of financial integration are most likely positive. A shift towards more lending in the foreign market is now accompanied by increased monitoring, raising expected consumer surplus while reducing the risks to taxpayers. Overall then, the conclusion from our analysis is that it is crucial for financial integration to be accompanied by policies that increase market transparency and reduce information costs, such as common accounting standards.

(Effects of financial integration on regulatory competition to be added here.)

Our paper combines elements from across the literature. With respect to international trade theory, there is a small strand of the literature that explicitly examines the

banking sector. Following the early work by Eaton (1994). Lehner and Schnitzer (2008) analyze the spillover effects of FDI in the banking sector on the host country's banking system. In contrast, Niepmann (2012) and de Blas and Russ (2013) analyze the banks' choices between foreign direct investment and cross-border lending. These papers do not incorporate any policy instruments, however.³ On the other hand, a sizeable literature has studied the effects of economic integration on policy competition in trade models with imperfect competition (e.g. Kind *et al.*, 2005; Ottaviano and van Ypersele, 2005; Haufler and Wooton, 2010), but these have not been applied to the specific policy issues facing the banking sector.

We also draw on the literature on capital regulation. In a closed economy, several authors have stressed that capital regulation increases the risk buffer of banks and curbs risky behaviour (Rochet, 1992; Hellman *et al.*, 2000). De Nicolò *et al.* (2012) study optimal capital regulation in a dynamic model of banking in a closed economy. The literature on regulatory competition in the banking sector stresses the result that nationally set capital standards are inefficiently low from a global welfare perspective (Sinn, 1997; Acharya, 2003). In contrast, Haufler and Maier (2013) have recently argued that policy competition can also lead to a “race to the top” in regulatory standards when the latter introduce selection effects among heterogeneous banks. The present paper is closest to Dell’Ariccia and Marquez (2006), where regulators choose nationally optimal capital requirements by trading off the aggregate level of banks’ profits against the benefits of financial stability. We link their model to the trade literature and incorporate different type of trade frictions. This allows us to study the effects of economic integration on different agents in the economy, as well as on policy competition in capital standards.

A final related literature strand studies issues of risk-taking in connection with the internationalization strategies of banks. The theoretical contributions in this literature are typically based on portfolio-choice models, however, and the microeconomic contributions are primarily empirical (e.g. Beltratti and Stulz, 2012; Buch *et al.*, 2013; Ongena *et al.*, 2013).

The remainder of this paper is set up as follows. Section 2 introduces our trade model with goods production and cross-border lending by banks. Section 3 studies the optimal capital regulation by the government. Section 4 analyzes the effects of financial inte-

³For a survey of the more general literature on trade in services and public policy, see Francois and Hoekman (2010).

gration on the different agents in our model. Section 5 turns to the effects of economic integration on regulatory competition between the two governments (to be done). Section 6 concludes.

2 The model

We consider a world of two countries i and j . In both countries, goods are produced by competitive firms which have to borrow in order to be able to produce output. Each country is the host to a single bank, which can lend to producers in either country. In this respect the model is closely related to the “reciprocal dumping” model of international trade in identical products, originally developed by Brander and Krugman (1983). In the absence of international lending, each bank is a monopolist in its domestic market and the opportunity to trade results in each bank seeking to acquire a share in the foreign market. This is done by offering loans that are fundamentally identical to those offered by the domestic incumbent but, due to the greater distance between bank and borrower, are more expensive to provide.

Our model departs from that of Brander and Krugman in the respects that the banks choose different levels of monitoring and that each bank’s activities are regulated by its national government. Regulators of the banks set equity requirements that can limit the quantity of loans that banks are able to offer to firms. Consequently, when this restriction is binding on a bank, it faces a choice as to where to lend its limited funds.⁴

The timing in our model is as follows. In the first stage, the two governments simultaneously set the equity requirements for each of their banks. In the second stage, the banks decide upon their lending to each market. If the total funds available to lend exceeds a bank’s desired lending, then the bank treats each market separately. If, in contrast, the equity requirement restricts the bank to less lending than it would optimally choose, then the total lending of the bank is given by the exogenous constraint and the bank decides upon the shares of the funds to lend to firms in its domestic and foreign markets. In the third stage, the banks choose the level of monitoring of loans in each of their markets. Finally, in the fourth stage, firms produce output which is sold

⁴The absence of a binding restriction allows a bank to “segment” its markets, setting lending in each country independently of conditions in the other market. If, however, overall lending is constrained, the bank has to decide upon its lending to the two countries simultaneously.

and consumed domestically. We solve the model using backwards induction.

2.1 Goods production

A homogeneous good is produced in each country by small, competitive firms. There are no fixed costs to production, but each firm requires a bank loan to finance its output activity. Every firm plans to produce one unit of output using a single unit of an input. This input is the numeraire, such that every firm has to borrow a single unit of currency in order to acquire its services. Firms have the choice of whether to borrow from the local or foreign banks. Each firm in country i with a loan from a bank based in country $h \in \{i, j\}$ succeeds in production with probability q_{ih} . This probability of success is a function of the level of monitoring offered by the lender. A profit-maximising, small firm will be indifferent between the two lenders when its expected profits are the same regardless of the source of funds.

Expected output, Q_i , in country i is

$$Q_i = q_{ii}L_{ii} + q_{ij}L_{ij} \quad (1)$$

where L_{ih} is the number of loans made by bank h in country i . The good is produced exclusively for domestic consumption. The market inverse demand curve for the good is linear, with the expected price, P_i , being

$$P_i = A - b_i Q_i. \quad (2)$$

Substituting (1) into (2) yields the expected price as the function of the effectiveness of the loans in the market,

$$P_i = A - b_i (q_{ii}L_{ii} + q_{ij}L_{ij}). \quad (3)$$

Expected profit for a firm in country i borrowing from bank h at cost R_{ih} is

$$\pi_{ih} = q_{ih} (P_i - R_{ih}) + (1 - q_{ih}) 0 \quad \forall h \in \{i, j\}. \quad (4)$$

Firms that fail earn nothing and default on their loans while each successful firm will sell its (unit of) output at the prevailing price. We assume that there is free entry into the goods sector and consequently zero expected profits. This means, from (4), that

the cost of a loan from either bank must equal the expected price of the product:⁵

$$R_{ih} = R_i = P_i \quad \forall h \in \{i, j\}. \quad (5)$$

Demand for loans can be seen as the derived demand for the consumption good that is produced by firms using the bank loans. Thus the expected price of loans made by banks in country i is

$$R_i = A - b_i (q_{ii}L_{ii} + q_{ij}L_{ij}). \quad (6)$$

2.2 Banks

There are two banks, one based in each country. Each bank can lend in both markets, but faces higher costs in its foreign market where, for example, it may have to engage the services of a local financial intermediary. There is no opportunity for firms to arbitrage loans internationally. If the banks' ability to lend were unlimited, the markets would then be segmented, in that lending decisions could be made separately for each market. However, the leading case in our analysis is characterized by the total lending volume of each bank being restricted by capital regulation. Consequently each bank must determine the volume of its loans to each market, subject to the total amount of loans that it is able to make. The allocation of loans between the two markets can be written as

$$\begin{aligned} L_{ii} &= \gamma_i L_i; & L_{ij} &= (1 - \gamma_j) L_j; \\ L_{ji} &= (1 - \gamma_i) L_i; & L_{jj} &= \gamma_j L_j. \end{aligned} \quad (7)$$

where γ_i is the share of bank i 's lending to its domestic market and L_i is the total amount of loans that country i makes.

Banks' funds come from domestic sources: a combination of domestic deposits and equity. In line with actual practice in virtually all OECD countries, deposits are insured and the risk of a bank failure is effectively shifted onto taxpayers. Therefore depositors do not face any risk and we assume that they supply their savings to the bank for a fixed return, normalized to unity. Let the equity held by the bank in country i be E_i .

⁵Eq. (5) implies that a firm is indifferent between two equally priced loans in our model, regardless of the levels of monitoring associated with the loans. This is because the firms have zero expected profits. If a firm is successful with production, it repays the loan with the revenue from selling its output. If a firm fails, it defaults on its loan. In either circumstance, the firm breaks even. Thus monitoring of a loan only affects the expected profits of the lending institution, not the firm.

For simplicity, we further assume that the bank's cost of equity is also unity.⁶ In this setting, the cost of equity will still exceed the cost of deposits, because the latter is not paid back by the bank in case of a firm defaulting on its loan. It is this implicit subsidy from the taxpayers which makes a higher equity ratio expensive for the bank. Our model captures this element while minimizing notation.

With these specifications, the costs of finance for bank i in its local and foreign markets are

$$\begin{aligned} C_{ii} &= 1 - (1 - q_{ii})(1 - k_i), \\ C_{ji} &= (1 + \tau) - (1 - q_{ji})(1 - k_i). \end{aligned} \tag{8}$$

where τ reflects the higher costs of servicing a loan in the bank's foreign market. The second term in each expression in (8) reflects the implicit subsidy from the taxpayer that the bank will receive as a result of deposit insurance. This subsidy equals the product of the probability of default ($1 - q_{hi}$) and the share of financing through deposits ($1 - k_i$). Therefore, the greater cost of capital associated with a higher capital ratio only arises in our model because raising k_i reduces the implicit subsidy to the bank that occurs through the deposit insurance system.

If, in the extreme case, all firms are expected to fail ($q_{ii} = q_{ji} = 0$) then bank i 's exposure on each defaulted loan is k_i , the share of the loan financed through equity. More generally, q_{hi} is the likelihood that a firm in country h successfully produces its unit of output and is able to repay its loan to bank i . We assume that the risks across the different firms in country h are perfectly correlated so that the probability of failure by firms equals the probability that bank i will also fail.⁷ Effectively, we therefore model country-specific risks, not firm-specific risks.

The banking regulator in country i imposes a capital-adequacy standard, k_i , that represents the minimum proportion of bank lending that is backed by the bank's equity, as opposed to consumer deposits. The total lending of a bank, L_i , may then be limited

⁶There is an intense debate in the literature on whether higher capital requirements increase banks' cost of capital even in the *absence* of an implicit subsidy scheme. Admati et al. (2010) argue that the effects of a higher capital ratio on the bank's cost of capital are zero in equilibrium, even if equity is more expensive than debt, because a better capitalized bank will face a lower risk premium by its equity holders. This is effectively an application of the Modigliani-Miller theorem. Our analysis implicitly makes the same assumption by equalizing the bank's cost of debt and of equity.

⁷See Dell'Ariccia and Marquez (2006) for a similar assumption.

by the quantity of equity that it owns:

$$L_i \leq \frac{E_i}{k_i}. \quad (9)$$

We shall investigate the implications of (9) being a binding constraint on the bank's lending activities, where it has to balance the benefits of lending in one market relative to the other.

Monitoring decision We assume that a bank can affect the probability that a firm succeeds through the level of monitoring (or support) that the bank provides. The greater the monitoring, the greater the likelihood that the good will be produced and sold, and the higher the probability that the loan will be repaid. Suppose that the likelihood of a firm's success is linear in monitoring such that (with the appropriate normalisation) q_{ji} of monitoring by bank i to a firm in country j yields a probability of industrial success equal to q_{ji} . Thus monitoring of q_{ji} results in the bank's expected earnings on the loan equalling $P_j q_{ji}$.

While monitoring raises the expected return on a loan, it is costly to provide. We assume that monitoring costs are quadratic in the amount of monitoring and that they are sufficiently large that there will never be perfect monitoring in equilibrium. Each bank makes an individual decision as to how much monitoring it should conduct on each loan. As firms are assumed to be identical, a bank will optimally choose the same level of monitoring for all firms in a particular (domestic or foreign) market. Given that the product market is competitive and hence each firm contributes an insignificant share of total output, banks will not anticipate any impact on the expected market price of an increase in the monitoring of any individual loan.⁸

The expected operating profit of bank i is Π_i , which is the sum of its net expected earnings in its home and foreign markets. Using (7), this can be written as

$$\Pi_i = \alpha_{ii}L_{ii} + \alpha_{ji}L_{ji}, \quad (10)$$

⁸An alternative motivation for why banks cannot strategically exploit their market power through their monitoring decision is that the risks of firms in each country are perfectly correlated (see above). Therefore, while lowering q_{ji} will increase the probability that all firms fail, it will not increase the market price that firms receive when they (simultaneously) succeed, and will therefore not increase their willingness to pay for the bank loan.

where α_{ii} and α_{ji} are bank i 's expected returns on domestic and foreign loans, respectively:

$$\alpha_{ii} \equiv P_i q_{ii} - C_{ii} - \frac{s}{2} q_{ii}^2 \quad \alpha_{ji} \equiv P_j q_{ji} - C_{ji} - \frac{s(1+\sigma)}{2} q_{ji}^2. \quad (11)$$

In (11), s is a constant factor in the cost of monitoring and σ reflects the additional information cost of monitoring a foreign loan.⁹

Substituting (8) into (10) and differentiating with respect to levels of monitoring (treating expected price as a constant), yields first-order conditions for the profit-maximising levels of monitoring in both markets:

$$q_{ii}^* = \frac{P_i - (1 - k_i)}{s} \quad q_{ji}^* = \frac{P_j - (1 - k_i)}{s(1 + \sigma)}. \quad (12)$$

Thus a bank's monitoring of firms in a market is positively related to both the expected price of output and the capital constraint facing the bank. High product prices make successful performance more rewarding while a higher capital constraint increases the cost of failure. Finally, and importantly, the probability of a failing loan is always greater for the foreign bank, because of its higher information costs.¹⁰

The monitoring levels in (12) can be substituted into (11) to find the expected earnings on optimally monitored loans in each market

$$\alpha_{ii}^* = \frac{[P_i - (1 - k_i)]^2}{2s} - k_i \quad \alpha_{ji}^* = \frac{[P_j - (1 - k_i)]^2}{2s(1 + \sigma)} - (k_i + \tau). \quad (13)$$

Loan volumes The optimal allocation of lending between bank i 's markets is found by partially differentiating (10) with respect to γ_i , taking into account (6) and (7). This gives the first-order condition

$$\frac{\partial \Pi_i}{\partial \gamma_i} = \alpha_{ii}^* - \alpha_{ji}^* - [\gamma_i b_i q_{ii}^{*2} - (1 - \gamma_i) b_j q_{ji}^{*2}] L_i = 0. \quad (14)$$

Solving yields the optimal allocation of lending:

$$\gamma_i^* = \frac{1}{b_i q_{ii}^{*2} + b_j q_{ji}^{*2}} \left(\frac{\alpha_{ii}^* - \alpha_{ji}^*}{L_i} + b_j q_{ji}^{*2} \right).$$

⁹See Portes et al. (2001) for empirical evidence that information costs are rising in the distance between borrowers and lenders, leading to lower levels of trade in financial assets as distance is increased.

¹⁰In a setting where the risks are perfectly correlated between the individual firms, such a difference between the risks involved for domestic and foreign banks can be interpreted, for example, by the domestic banks being more familiar with the accounting rules that underlie the firms' accounts, and therefore their resilience towards macroeconomic shocks.

This can be rewritten as

$$\gamma_i^* = \frac{s(1+\sigma) [(1+\sigma)\phi_{ii}^2 - \phi_{ji}^2 + 2s(1+\sigma)\tau] + 2L_i b_j \phi_{ji}^2}{2L_i [(1+\sigma)^2 b_i \phi_{ii}^2 + b_j \phi_{ji}^2]} \quad (15)$$

where

$$\phi_{ii} \equiv P_i - (1 - k_i) \quad \phi_{ji} \equiv P_j - (1 - k_i).$$

Symmetry Suppose now that the two countries are identical to each other, having the same population size $b = b_i = b_j$, while prices will be the same and so $P = P_i = P_j$. Taking these assumptions together, our expression for the optimal share of lending allocated to the home market (15) simplifies to

$$\gamma_i^* = \frac{1}{bL_i [(1+\sigma)^2 + 1]} \left[bL_i + \frac{s(1+\sigma)\sigma}{2} + \frac{s^2(1+\sigma)^2\tau}{[P_i - (1 - k_i)]^2} \right]. \quad (16)$$

Note that if there are no additional costs to operating in the foreign market, then $\sigma = \tau = 0$ and (16) simplifies further to $\gamma_i^* = 1/2$ (see Dell’Ariccia and Marquez, 2006). Any higher costs of foreign market operations ($\sigma, \tau > 0$) result in the bank increasing its focus on its home-market lending ($\gamma_i^* > 1/2$).

3 Government regulation

The banking regulator of the government in country i can intervene in the financial market through setting k_i , the equity requirement for bank i ’s lending. As a benchmark, we first consider the case where no capital requirements are set by national regulators, and hence the constraint (9) does not bind. We then look at the implications of increases in k_i that are large enough to affect a bank’s lending decisions in both markets.

3.1 No capital regulation

When the total loan volume that can be made by a bank exceeds its desired volume of lending ($L_i < E_i/k_i$), government equity requirements do not limit the activities of the bank. In this setting the banks make independent decisions regarding their lending in their respective domestic and foreign markets. Thus, rather than making a decision regarding the allocation of limited lending between the two markets to maximise (??),

bank i is free to choose its lending in each market to maximize each of $\Pi_{ii} \equiv \alpha_{ii}L_{ii}$ and $\Pi_{ji} \equiv \alpha_{ji}L_{ji}$. The financial products provided by the two banks in a particular market will differ, in that there will be different levels of monitoring of loans by a domestic bank as compared to its foreign rival.

Total lending in market i will result from each bank choosing its optimal number of loans, given its rival's lending decision.¹¹ Differentiating the bank's profits in each market, we can solve the first-order conditions to obtain the optimal loan volumes

$$L_{ii}^* = \frac{\alpha_{ii}^*}{b_i q_{ii}^{*2}}, \quad L_{ij}^* = \frac{\alpha_{ij}^*}{b_i q_{ij}^{*2}}, \quad (17)$$

where α_{ii}^* and α_{ij}^* are given in (13). Taking into account the inverse demand function (3) which links the lending levels of the two banks, we can derive the reaction functions for lending by the domestic and foreign banks in the market

$$\begin{aligned} L_{ii}^*(L_{ij}) &= \frac{1}{2b_i} \left[\frac{A - (1 - k_i)}{q_{ii}^*} - \frac{s}{2} - \frac{k_i}{q_{ii}^{*2}} \right] - \frac{q_{ij}^* L_{ij}}{q_{ii}^* 2}, \\ L_{ij}^*(L_{ii}) &= \frac{1}{2b_i} \left[\frac{A - (1 - k_j)}{q_{ij}^*} - \frac{(1 + \sigma)s}{2} - \frac{k_j + \tau}{q_{ij}^{*2}} \right] - \frac{q_{ii}^* L_{ii}}{q_{ij}^* 2}. \end{aligned} \quad (18)$$

It is immediately apparent from (18) that one bank's lending is a strategic substitute for loans from the other bank. Further, we can see that, for any level of lending being provided by the domestic bank, the foreign bank's lending is affected negatively by both the trade cost τ that it faces as well as the additional information cost parameter σ .

The slopes of the two reaction functions depend upon the levels of monitoring imposed by the domestic and foreign banks, q_{ii}^* and q_{ij}^* , respectively. If these were the same, both reaction functions would have a slope of (negative) $\frac{1}{2}$. To get a clearer idea of the Cournot-Nash equilibrium that would occur in lending in this market, assume that the capital requirements are the same for both banks ($k_i = k_j$). Substituting this into (12) yields

$$q_{ij}^* = \frac{q_{ii}^*}{1 + \sigma}$$

showing that foreign loans are less well-monitored than those made by a local lender

¹¹We assume that each bank behaves as a Cournot competitor in that, in making its decision as to the quantity of loans that it will offer in a market, it assumes that its competitor's response will be to maintain its level of lending.

and results in the following reaction functions

$$\begin{aligned} L_{ii}^*(L_{ij}) &= \frac{1}{2b_i} \left[\frac{A - (1 - k)}{q_{ii}^*} - \frac{s}{2} - \frac{k}{q_{ii}^{*2}} \right] - \frac{1}{(1 + \sigma)} \frac{L_{ij}}{2}, \\ L_{ij}^*(L_{ii}) &= \frac{(1 + \sigma)}{2b_i} \left[\frac{A - (1 - k)}{q_{ii}^*} - \frac{s}{2} - \frac{(1 + \sigma)(k + \tau)}{q_{ii}^{*2}} \right] - (1 + \sigma) \frac{L_{ii}}{2}. \end{aligned} \quad (19)$$

These are illustrated in Figure 1 where the reaction functions for $\sigma = \tau = 0$ are compared to those when the foreign bank faces additional costs compared to its local rival. It is clear from (19) that the foreign bank's reaction function $L_{ij}^*(L_{ii})$ is steeper than that of the domestic bank $L_{ii}^*(L_{ij})$ as a result of the additional information costs associated with lending in a foreign market ($\sigma > 0$). The higher these costs, the greater the disparity in the slopes of the two reaction functions, resulting in a greater share of the lending in the domestic market being made by the local bank. This will be reinforced by the negative impact of the trade cost ($\tau > 0$) on the foreign bank's intercept. However, this effect may be offset by the impact of changes in the information cost on the intercepts of the reactions functions where, for the foreign bank, the expression in the square brackets in (19) is smaller than that for the domestic bank but is multiplied by a larger factor. Essentially, in the face of higher information costs, the foreign bank provides an increasingly inferior (that is, less well-monitored) product than the local bank and this may crowd out the superior local product.

To summarize, we have established that, if trade and information costs are not too high, a domestic market will be served by both local and foreign lenders but that the additional costs facing the foreign institution will limit its share of the lending in the market.

3.2 Binding capital regulation

We now consider how the allocation of lending changes when a bank's total lending L_i is constrained by their equity holdings and the equity requirement (9) imposed by the regulator. Therefore increasing k_i will reduce the total amount of bank lending. With limited funds to lend, a bank will allocate them between its domestic and foreign markets such that the marginal profitability of loans in both markets are equalized. We assume that the total volume effect of the change in equity requirements dominates any reallocation of loans between markets, so that the total loan volume of bank i falls

in both markets:

$$\frac{\partial L_{ii}}{\partial k_i} < 0, \quad \frac{\partial L_{ji}}{\partial k_i} < 0. \quad (20)$$

We assume that the welfare of domestic residents depends positively on the expected profits of the domestic bank, Π_i , and negatively on taxpayers' expected losses, T_i from loans that go bad. We now examine the impact of changes in k_i on each of these components.

Effect on expected bank profits Differentiating (10) with respect to k_i we obtain

$$\frac{\partial \Pi_i}{\partial k_i} = L_{ii} \frac{\partial \alpha_{ii}^*}{\partial k_i} + \alpha_{ii}^* \frac{\partial L_{ii}}{\partial k_i} + L_{ji} \frac{\partial \alpha_{ji}^*}{\partial k_i} + \alpha_{ji}^* \frac{\partial L_{ji}}{\partial k_i}. \quad (21)$$

We find first the impact of changing the equity requirement on the expected earnings on optimally monitored loans. Differentiating (13) with respect to k_i and substituting (12) yields

$$\frac{\partial \alpha_{ii}^*}{\partial k_i} = q_{ii}^* \left(1 + \frac{\partial P_i}{\partial k_i} \right) - 1, \quad \frac{\partial \alpha_{ji}^*}{\partial k_i} = q_{ji}^* \left(1 + \frac{\partial P_j}{\partial k_i} \right) - 1.$$

We can also differentiate (6) with respect to k_i to find

$$\frac{\partial P_i}{\partial k_i} = -b_i q_{ii}^* \frac{\partial L_{ii}}{\partial k_i} > 0, \quad \frac{\partial P_j}{\partial k_i} = -b_j q_{ji}^* \frac{\partial L_{ji}}{\partial k_i} > 0. \quad (22)$$

Given our assumptions in (20), these expressions are both positive. Thus the market price of goods rises in both markets when lending is further constrained. Substituting these expressions into (21) yields

$$\frac{\partial \Pi_i}{\partial k_i} = -B_i + \mu_{ii} \frac{\partial L_{ii}}{\partial k_i} + \mu_{ji} \frac{\partial L_{ji}}{\partial k_i} \quad (23)$$

where

$$B_i \equiv (1 - q_{ii}^*) L_{ii} + (1 - q_{ji}^*) L_{ji} > 0 \quad (24)$$

and

$$\mu_{ii} \equiv \alpha_{ii}^* - b_i q_{ii}^{*2} L_{ii}, \quad \mu_{ji} \equiv \alpha_{ji}^* - b_j q_{ji}^{*2} L_{ji}. \quad (25)$$

B_i gives the expected losses from bank i 's total volume of loans and hence the value of the implicit subsidy from the deposit insurance scheme.

The first term in (23) is negative. To sign the remaining two terms, consider what level of lending would take place by banks in the absence of any constraint on the overall

funds available. In this case μ_{ii} and μ_{ji} would both be zero, as is seen from comparing (25) with (17). Given that the equity requirements are binding on the banks, they will be unable to lend as much as they would chosen in the absence of the constraints. Consequently L_{ii} is below L_{ii}^* in (17) and therefore $\mu_{ii} > 0$. A similar argument will hold for $\mu_{ji} > 0$. Thus an increase in a bank's equity requirement will not only reduce the funds that it has to lend, but will unambiguously lower the expected profits of the affected bank.

Effect on taxpayers The expected value of taxpayers' losses in country i is the expected value of loans that go bad in the two countries that are backed by insured deposits, as opposed to being funded from the domestic bank's own equity. Thus T_i is

$$T_i = (1 - k_i) B_i, \quad (26)$$

where B_i is given in (24). Increasing the equity requirement will directly lower taxpayers' exposure to losses but will also reduce the total volume of loans and the monitoring of loans that continue to be made. Differentiating (26) with respect to k_i yields:

$$\frac{\partial T_i}{\partial k_i} = -B_i + (1 - k_i) \left[(1 - q_{ii}^*) \frac{\partial L_{ii}}{\partial k_i} + (1 - q_{ji}^*) \frac{\partial L_{ji}}{\partial k_i} - L_{ii}^* \frac{\partial q_{ii}^*}{\partial k_i} - L_{ji}^* \frac{\partial q_{ji}^*}{\partial k_i} \right]. \quad (27)$$

The first term on the right-hand side of (27) and the first two terms in the squared brackets are all unambiguously negative, implying that a higher capital requirement k_i reduces expected losses for taxpayers.

The remaining task is to sign the effects of changing capital requirements on the optimal levels of monitoring. Differentiating (12) with respect to k_i and substituting (22) gives:

$$\frac{\partial q_{ii}^*}{\partial k_i} = \frac{1}{s} \left[1 - b_i q_{ii}^* \frac{\partial L_{ii}}{\partial k_i} \right] > 0, \quad \frac{\partial q_{ji}^*}{\partial k_i} = \frac{1}{s(1 + \sigma)} \left[1 - b_j q_{ji}^* \frac{\partial L_{ji}}{\partial k_i} \right] > 0. \quad (28)$$

Hence, the bank's optimal monitoring levels will increase as a result of the higher equity requirement and, therefore, the reduced subsidization of banks in case of failure. If we substitute (28) into (27) and maintain our assumption that lending will decline in both markets as a result of more stringent equity requirements, we see that the cost to taxpayers of the deposit insurance scheme will unambiguously decline with higher equity requirements. This arises because less of the financing is subsidised, there is less lending in both markets, and banks increase their monitoring resulting in fewer bad debts.

Optimal capital regulation If the owners of the domestic bank are residents of the country then the effect of changes in k_i on national earnings will be the sum of the expected changes in bank profits and tax losses. Our measure of national welfare W_i is the (equally weighted) sum of these two elements:

$$W_i \equiv \Pi_i - T_i.$$

By choosing an optimal capital requirement k_i^* , the government thus trades off the loss in banks' profits from a rise in the capital requirement against the gains to taxpayers that result from lower exposure to risk [see eqs. (23) and (27)]. If the equity requirements change, a bank will change its lending in both of its markets as well as altering the levels of monitoring of its loans. Differentiating W_i with respect to k_i yields

$$\frac{\partial W_i}{\partial k_i} = \nu_{ii} \frac{\partial L_{ii}^*}{\partial k_i} + \nu_{ji} \frac{\partial L_{ji}^*}{\partial k_i} + (1 - k_i) \left(L_{ii} \frac{\partial q_{ii}^*}{\partial k_i} + L_{ji} \frac{\partial q_{ji}^*}{\partial k_i} \right), \quad (29)$$

where

$$\nu_{ii} \equiv \mu_{ii} - (1 - k_i)(1 - q_{ii}^*), \quad \nu_{ji} \equiv \mu_{ji} - (1 - k_i)(1 - q_{ji}^*).$$

Equation (29) implicitly determines the government's optimal equity requirement. To see that an interior solution $0 < k_i^* < 1$ emerges for the optimal capital requirement, consider first the case where banks are required to fund their lending entirely from equity, that is $k_i = 1$. Then none of the bank's lending is insured and taxpayers are exposed to no risk from bad debts. In that case, $\nu_{ii} = \mu_{ii} > 0$ and $\nu_{ji} = \mu_{ji} > 0$ follows from our discussion above [see eq. (25)]. At the same, the last term of (29) will be zero. Thus, given that $\partial L_{ii}/\partial k_i, \partial L_{ji}/\partial k_i < 0$, the overall derivative $\partial W/\partial k_i$ is negative and welfare has been driven down by an excessively high equity requirement. If, instead, $k_i = 0$ then there is no constraint on the bank's lending in each market and hence μ_{ii} and μ_{ji} are both zero. This implies that ν_{ii} and ν_{ji} are both negative and hence the first term in (29) is positive. Since the second term is also positive from (28), the derivative $\partial W/\partial k_i$ is unambiguously positive in this case. Hence welfare can be increased by raising the capital requirement above zero. Together these results imply that welfare is maximized for an interior level of k_i^* that optimally trades off the losses to banks from higher capital requirements against the gains that accrue to taxpayers.¹²

¹²De Nicolò et al. (2012) find a similar result in a dynamic banking model of a closed economy, as bank efficiency and welfare first rise when capital standards are increased, and then fall when capital standards become 'too stringent'. In their model, however, the trade-off arises from behavioral responses within the banking sector, not from the diverging interests of banks and taxpayers, as is the case here.

Effect on consumers In addition to the effects on bank profits and taxpayers, the change in the equity requirements facing a bank will have consequences for the quantities of goods produced in the bank's home and foreign markets and will therefore have an impact on consumer surplus in both nations. We focus on the effects of the policy on consumers in the bank's home country. Expected consumer surplus in country i is

$$CS_i = \frac{b_i}{2} (q_{ii}^* L_{ii}^* + q_{ij}^* L_{ij}^*)^2, \quad (30)$$

where we have substituted for P_i using (3). Differentiating (30) with respect to k_i yields the impact of stronger equity requirements on consumers:

$$\frac{\partial CS_i}{\partial k_i} = b_i (q_{ii}^* L_{ii}^* + q_{ij}^* L_{ij}^*) \left(q_{ii}^* \frac{\partial L_{ii}^*}{\partial k_i} + L_{ii}^* \frac{\partial q_{ii}^*}{\partial k_i} + q_{ij}^* \frac{\partial L_{ij}^*}{\partial k_i} + L_{ij}^* \frac{\partial q_{ij}^*}{\partial k_i} \right). \quad (31)$$

The impact of higher equity requirements on consumer surplus is ambiguous. The first partial derivative in (31) is negative [from (20)] while the second and fourth terms are positive [from (28)]. The sign of the third partial derivative is less clear, as it measures the response in lending by the foreign bank to an increase in its rival's equity requirement. The source of the ambiguity is that the increase in k_i lowers the volume of lending while, at the same time, monitoring of the loans increases. Thus while the production activity at home declines the success rate of the remaining firms improves.

4 Economic integration

Improvements in technology or information can reduce the cost to a bank of lending in a foreign market. This enhances the entry of financial institutions into foreign markets and has implications for the overall level of lending as well as the quality of loans. In our model we have two parameters that capture different elements of economic integration. A reduction in the transactions cost parameter τ facilitates access to the foreign market, but leaves unchanged the extra costs of monitoring foreign loans. On the other hand, improved information on foreign loans that would result, for example, from uniform bank rules or accounting standards, are captured by a decrease in the information cost parameter σ . As we shall show, changes in these two parameters have very different welfare implications.

4.1 Reduced transaction costs

Effect on expected profits We can firstly determine the impact of transaction costs on the profits of banks. Substituting (7) into (10) yields

$$\Pi_i = [\alpha_{ii}^* \gamma_i^* + \alpha_{ji}^* (1 - \gamma_i^*)] L_i, \quad (32)$$

which we partially differentiate with respect to τ :

$$\frac{\partial \Pi_i}{\partial \tau} = (\alpha_{ii}^* - \alpha_{ji}^*) L_i \frac{\partial \gamma_i^*}{\partial \tau} + \gamma_i^* L_i \frac{\partial \alpha_{ii}^*}{\partial \tau} + (1 - \gamma_i^*) L_i \frac{\partial \alpha_{ji}^*}{\partial \tau}. \quad (33)$$

Partially differentiating (11) with respect to τ and substituting (12) yields¹³

$$\frac{\partial \alpha_{ii}^*}{\partial \tau} = q_{ii}^* \frac{\partial P_i}{\partial \tau}, \quad \frac{\partial \alpha_{ji}^*}{\partial \tau} = q_{ji}^* \frac{\partial P_j}{\partial \tau} - 1,$$

while partial differentiation of (6) yields

$$\frac{\partial P_i}{\partial \tau} = -b_i \left(q_{ii}^* L_i \frac{\partial \gamma_i^*}{\partial \tau} - q_{ij}^* L_j \frac{\partial \gamma_j^*}{\partial \tau} \right), \quad \frac{\partial P_j}{\partial \tau} = -b_j \left(q_{ji}^* L_i \frac{\partial \gamma_i^*}{\partial \tau} - q_{jj}^* L_j \frac{\partial \gamma_j^*}{\partial \tau} \right).$$

Substituting these expressions into (33) and assuming complete symmetry between the two countries gives

$$\frac{\partial \Pi_i}{\partial \tau} = -(1 - \gamma_i^*) L_i + (\alpha_{ii}^* - \alpha_{ji}^*) L_i \frac{\partial \gamma_i^*}{\partial \tau} + b_i L_i^2 \frac{\partial \gamma_i^*}{\partial \tau} (q_{ij} - q_{ii}) [\gamma_i^* q_{ii}^* + (1 - \gamma_i^*) q_{ji}^*], \quad (34)$$

where differentiation of (7) with respect to τ yields

$$\frac{\partial \gamma_i^*}{\partial \tau} = \frac{s^2 (1 + \sigma)^2}{b L_i [(1 + \sigma)^2 + 1] \phi_i^2} > 0. \quad (35)$$

The first term in (34) is negative, such that bank enjoy higher profits when trade costs fall as a result of financial integration. This arises because existing lending to the bank's overseas market becomes cheaper, and hence more profitable, if the transactions cost declines. The second term is positive, however, as a reduction in τ implies that a higher share of loans is offered in the foreign country, where profitability is lower. Finally, the third term is negative, as the larger share of foreign lending induced by a reduction in τ causes aggregate production to fall in both countries, and this leads to higher prices and bank profits.

¹³Note that the effects of τ operating through induced changes in the optimal monitoring levels q_{ii}^* and q_{ji}^* sum to zero from the envelope theorem.

Equation (34) can be simplified using the first-order condition for the optimal share of domestic loans γ^* , as given in (14). This shows that the increase in output prices, and therefore in loan rates R_i , cannot compensate for the effect of lower aggregate loan volumes. Employing (14), using (35) and cancelling terms gives, as a final expression:

$$\frac{\partial \Pi_i}{\partial \tau} = \left[-(1 - \gamma_i^*) + \frac{(1 + \sigma)}{[(1 + \sigma)^2 + 1]} (2\gamma^* - 1) \right] L_i \geq 0. \quad (36)$$

Equation (36) shows that the direct first effect of higher profits when τ falls is counteracted by an indirect second effect. This latter effect arises because a decline in trade costs results in larger share of the fixed aggregate loan volume being supplied to the less-profitable foreign country. When the initial level of γ^* is sufficiently large ($\gamma^* > 3/4$) and σ is small, the indirect effect can dominate the direct effect. In such a case, a fall in transaction costs will therefore lead to a *reduction* in the profits of each bank in the symmetric equilibrium with financial integration.

Effect on taxpayers We can differentiate taxpayers' losses (26) with respect to transactions costs τ to find

$$\frac{\partial T_i}{\partial \tau} = (1 - k_i) L_i (q_{ji}^* - q_{ii}^*) \frac{\partial \gamma_i^*}{\partial \tau} < 0. \quad (37)$$

With symmetry between countries, expression (37) will be negative from (35) and (12). This implies that a fall in transaction costs increases taxpayers' losses. As neither the total lending volume nor the monitoring levels change, the only effect on taxpayers' obligations comes from the reallocation of loans towards the foreign country following a decline in transactions costs. As τ declines, banks lend more in their riskier foreign markets, where monitoring levels are lower, and this increases the expected costs to taxpayers as a consequence.

Effect on consumers Partially differentiating (30) with respect to τ yields the effect on consumer surplus:

$$\frac{\partial CS_i}{\partial \tau} = b_i (q_{ii}^* L_{ii}^* + q_{ij}^* L_{ij}^*) \left(q_{ii}^* L_i \frac{\partial \gamma_i^*}{\partial \tau} - q_{ij}^* L_j \frac{\partial \gamma_j^*}{\partial \tau} \right). \quad (38)$$

We can evaluate (38) when the model is close to being symmetric, with both markets and banks being similar in size. In that case the expression is positive, as banks optimally provide more monitoring of their domestic loans than of their lending in

foreign markets. Consequently, the falling τ associated with economic integration will result in less monitoring in aggregate in the markets, and consequently lower expected production of the final good.

Our analysis thus shows that the effects of financial integration are largely detrimental, when the transaction costs for cross-border lending are reduced while the information costs of screening foreign firms remain unchanged. We summarize these results in the following proposition:

Proposition 1 *If countries are symmetric, a reduction in the transaction costs of cross-border lending, τ , reduces consumer surplus and raises the expected losses of taxpayers in both countries. A reduction in τ also reduces banks' expected profits, if the share of loans provided in each bank's home country is sufficiently large initially ($\gamma^* > 3/4$).*

4.2 Reduced information costs

We now turn to the effects of a fall in the information cost parameter σ . We proceed in the same way as in the previous subsection, and analyze the effects on bank profits, taxpayers, and consumers in turn.

Effect on expected profits Differentiating the bank's profit equation (32) with respect to σ gives

$$\frac{\partial \Pi_i}{\partial \tau} = (\alpha_{ii}^* - \alpha_{ji}^*) L_i \frac{\partial \gamma_i^*}{\partial \tau} + \gamma_i^* L_i \frac{\partial \alpha_{ii}^*}{\partial \sigma} + (1 - \gamma_i^*) L_i \frac{\partial \alpha_{ji}^*}{\partial \sigma}. \quad (39)$$

Differentiating (11) with respect to σ and using (12) leads to

$$\frac{\partial \alpha_{ii}^*}{\partial \tau} = q_{ii}^* \frac{\partial P_i}{\partial \sigma}, \quad \frac{\partial \alpha_{ji}^*}{\partial \sigma} = q_{ji}^* \frac{\partial P_j}{\partial \sigma} - \frac{s}{2} (q_{ij})^2 + P_j \frac{\partial q_{ij}}{\partial \sigma}.$$

The new effect in this analysis is the last effect in the expression for $\partial \alpha_{ji}^* / \partial \sigma$. From eq. (12), this effect is unambiguously negative:

$$\frac{\partial q_{ij}}{\partial \sigma} = \frac{-q_{ji}}{(1 + \sigma)} < 0. \quad (40)$$

Hence a *fall* in information costs σ increases the monitoring of foreign loans in each bank's optimum and thus increases the success probability of these loans.

The effects on price levels P_i and P_j are analogous to the analysis for τ . The effect on the loan shares γ and $(1 - \gamma)$ is more complicated for a change in σ , however. Differentiating (7) yields, after some manipulations:

$$\frac{\partial \gamma_i^*}{\partial \sigma} = \frac{bL_i(1 + \sigma)}{bL_i[(1 + \sigma)^2 + 1]} \left\{ s \left[1 + \frac{\sigma(2 + \sigma)}{2(1 + \sigma)} \right] + \frac{2s^2\tau}{\phi^2} - 2b_iL_i \right\} \geq 0. \quad (41)$$

The effect of a change in information costs on the allocation of loans is ambiguous. By the positive first and second effects, a reduction in σ tends to increase the share of foreign loans. This is analogous to the fall in transaction costs [eq. (35)]. For a change in σ there is a negative third effect, however, which tends to increase γ when information costs fall. This is because the higher monitoring of foreign loans [eq. (40)] causes the bank to perceive a stronger negative effect on the price level in the foreign loan market from each loan that it allocates to this market. By this isolated effect, loans should thus be reallocated to the home market, where the success probability of loans remains unchanged.

Equation (41) can be signed for certain initial values of the loan allocation γ^* . Consider first the case where information costs are almost prohibitive initially, and almost all loans are therefore allocated to the domestic country ($\gamma \rightarrow 1$ and therefore $L_{ii} \rightarrow L_i$). In this case, it follows from eq. (17) that $2bL_i < s$ must be true when the capital requirement is binding, and therefore eq. (41) is unambiguously positive in this case. Conversely, if σ and τ are both low initially, so that γ^* is not substantially above $1/2$, then the curly bracket in (41) reduces to $-2bL_i + s$. At the same time, the unconstrained level of $L_{ii} = L_i/2$ satisfies $2bL_i = 2s$ in this case. Hence, unless the constraint on aggregate lending levels is very severe, the curly bracket in (41) will be negative.

Equation (39) can again be simplified by using the first-order condition for γ^* in (14). The total effects of a change in σ on bank profits are then given by

$$\frac{\partial \Pi_i}{\partial \sigma} = -L_{ji} \frac{s}{2} (q_{ji})^2 + L_{ji} \{ P_j - bL_i[\gamma q_{ii} + (1 - \gamma)q_{ji}] \} \frac{\partial q_{ji}}{\partial \sigma} + bL_i q_{ii} q_{ji} (2\gamma^* - 1) \frac{\partial \gamma^*}{\partial \sigma}. \quad (42)$$

The first effect in (42) is unambiguously negative as a fall in information costs directly increases banks' profits. The second effect is also negative, as the term in the curly bracket represents the positive marginal revenue from the increase in the share of successful foreign loans that follows from the reduction in σ . The third term depends on the sign of $d\gamma^*/d\sigma$ and is ambiguous, in general. However, as discussed above, it will also be negative if transaction and information costs are both low in the initial

equilibrium, and the share of domestic loans is therefore not far above 1/2 initially. In this case, eq. (42) is unambiguously negative, implying that a reduction in σ increases the profits of both banks.

Effect on taxpayers Differentiating taxpayers' losses (26) with respect to σ gives

$$\frac{\partial T_i}{\partial \sigma} = (1 - k_i) L_i \left[-(1 - \gamma) \frac{\partial q_{ji}}{\partial \sigma} + (q_{ji}^* - q_{ii}^*) \frac{\partial \gamma_i^*}{\partial \sigma} \right]. \quad (43)$$

The first effect in (43) gives the effect on taxpayers' expected losses from the changed monitoring level for foreign loans that is caused by the change in σ . This effect is unambiguously positive, implying that a fall in σ reduces expected losses for taxpayers. The second effect depends again on the sign of $\partial \gamma^* / \partial \sigma$, and hence on whether the fall in information costs raises or lowers the share of loans made in the relatively safer home market.

Effect on consumers Finally, differentiating (30) with respect to σ and assuming symmetry yields the effect on consumer surplus:

$$\frac{\partial CS_i}{\partial \sigma} = b_i (q_{ii}^* L_{ii}^* + q_{ij}^* L_{ij}^*) L_i \left[(1 - \gamma^*) \frac{\partial q_{ij}}{\partial \sigma} + (q_{ii}^* - q_{ij}^*) \frac{\partial \gamma^*}{\partial \sigma} \right]. \quad (44)$$

The first term in the squared bracket of (44) is negative. A fall in σ increases bank j 's level of monitoring the loans to firms in country i , increasing the success rate of these firms and thus consumer surplus in country i . The second term is again ambiguous. It will be negative if the initial levels of σ and τ are sufficiently low, and hence if γ^* is close to 1/2 initially. In this case, banks, taxpayers and consumers in country i will therefore all gain from a fall in the information cost parameter σ . We summarize these results in:

Proposition 2 *If countries are symmetric and the frictions for foreign loans are small in the initial equilibrium, then a reduction in the information costs of cross-border lending, σ , increases banks' profits and consumer surplus and reduces the expected losses of taxpayers in both countries.*

Comparing Propositions 1 and 2 shows that the effects of financial integration can be very different, depending on which type of costs to cross-border lending is reduced. If

transaction costs for foreign loans are reduced, whereas the information costs for these loans are not, then financial integration may well have detrimental effects. This can be the case, for example, in an integrated payments area, as is currently introduced in Europe. A similar effect can arise when the regulation of cross-border loans is reduced, such as the requirement to involve a local bank in the target country of the loan. Our analysis suggests that it is essential for such a liberalization of financial markets to be accompanied by policy measures that reduce asymmetric information and lower information costs in foreign markets. The latter can be achieved, for example, by common banking standards in different countries, or by common standards of bookkeeping for the firms to which the loan is directed.

5 Financial integration and regulatory competition

In this section we determine the effects of (different measures of) financial integration on the nationally optimal regulation policies k_i^* , and hence on regulatory competition between the two countries. (To be written.)

6 Conclusion

In this paper we have analyzed the effects of financial integration on banks, taxpayers and consumers in two symmetric countries that are interlinked through cross-border bank lending. We find that the desirability of financial integration depends crucially on the type of costs for cross-border lending that are reduced. If financial integration is mainly associated with a fall in transaction costs, the monitoring levels of foreign firms cannot be expected to rise. With aggregate loan volumes fixed by capital requirements imposed by the bank's home country, more risky foreign lending may then replace less risky domestic lending in equilibrium, with adverse consequences for banks, consumers and taxpayers. On the other hand, if financial integration is mainly associated with a fall in the information costs for foreign loans, then the optimal monitoring of these loans will rise and banks, consumers and taxpayers can be expected to benefit from financial integration.

Our analysis can be extended in several directions. One possible extension would be to introduce a more complex output sector that is characterized by imperfect com-

petition and some market power vis-a-vis banks in determining the equilibrium loan rate. Another extension is to incorporate a richer set of government policies. For example, it would be possible to consider policy measures that impact upon foreign lenders alone, say through a special levy on the costs of lending by non-domestic institutions. Equally, governments might negotiate reciprocal access to their domestic markets for foreign banks that would have exactly the opposite effect to the special levy. We leave these extensions to further research.

References

- Acharya, V. (2003). Is the international convergence of capital adequacy regulation desirable? *Journal of Finance* 58, 2745-2781.
- Admati, A., DeMarzo, P., Hellwig, M., Pfleiderer, P. (2010). Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is *not* expensive. Stanford GSB Research Paper No. 2063 and Preprint of the Max Planck Institute for Research on Collective Goods, Bonn 2010/42.
- Beltratti, A., Stulz, R.M. (2012). The credit crisis around the globe: Why did some banks perform better? *Journal of Financial Economics* 105, 1-17.
- Brander, J., Krugman, P. (1983). A 'reciprocal dumping' model of international trade. *Journal of International Economics* 15, 313-321.
- Buch, C., Koch, C.T., Koetter, M. (2011). Size, productivity, and international banking. *Journal of International Economics* 85, 329-334.
- Buch, C., Koch, C.T., Koetter, M. (2013). Do banks benefit from internationalization? Revisiting the market power-risk nexus. *Review of Finance* 17, 1401-1435.
- Committee on the Global Financial System (2010). Long-term issues in international banking. CGFS Papers No. 41. Bank for International Settlements, Basel.
- De Blas, B., Russ, K.N. (2013). All banks great, small, and global: Loan pricing and foreign competition. *International Review of Economics and Finance* 26, 4-24.

- De Nicolò, G., Gamba, A., Lucchetta, M. (2012). Capital regulation, liquidity requirements and taxation in a dynamic model of banking. IMF Working Paper 12/72. Washington, D.C.
- Dell’Ariccia, G., Marquez, R. (2006). Competition among regulators and credit market integration. *Journal of Financial Economics* 79, 401-430.
- Eaton, J. (1994). Cross-border banking. NBER Working Paper No. 4686. Washington, D.C.
- Francois, J, Hoekman, B. (2010). Services trade and policy. *Journal of Economic Literature* 48, 642-692.
- Haufler, A., Maier, U. (2013). Regulatory competition in capital standards with selection effects among banks. Mimeo, University of Munich.
- Haufler, A., Wooton, I. (2010). Competition for firms in an oligopolistic industry. The impact of economic integration. *Journal of International Economics* 80, 239-248.
- Hellman, T., Murdock, K., Stiglitz, J. (2000). Liberalization, moral hazard in banking, and prudential regulation: Are capital requirements enough? *American Economic Review* 90, 147-165.
- Jappelli, T., Pagano, M. (2002). Information sharing, lending and defaults: Cross-country evidence. *Journal of Banking and Finance* 26, 2017-2045.
- Kind, H.J., Midelfart, K.H., Schjelderup, G. (2005). Corporate tax systems, multinational enterprises, and economic integration *Journal of International Economics* 65, 507-521.
- Lehner, M., Schnitzer, M. (2008). Entry of foreign banks and their impact on host countries. *Journal of Comparative Economics* 36, 430-452.
- Niepmann, F. (2013). Banking across borders. CESifo Working Paper No. 4120. Munich.
- Ongena, S., Popov, A., Udell, G. (2013). “When the cat’s away the mice will play”: Does regulation at home affect bank risk-taking abroad? *Journal of Financial Economics* 108, 727-750.

- Ottaviano G., van Ypersele, T. (2005). Market size and tax competition. *Journal of International Economics* 67, 25-46.
- Portes, R., Rey, H. (2005). The determinants of cross-border equity flows. *Journal of International Economics* 65, 269-296.
- Portes, R., Rey, H., Oh, Y. (2001). Information and capital flows: The determinants of transactions in financial assets. *European Economic Review* 45, 783-796.
- Rochet, J.-Ch. (1992). Capital requirements and the behaviour of commercial banks. *European Economic Review* 36, 1137-1178.
- Sinn, H.W. (1997). The selection principle and market failure in systems competition. *Journal of Public Economics* 66, 247-274.

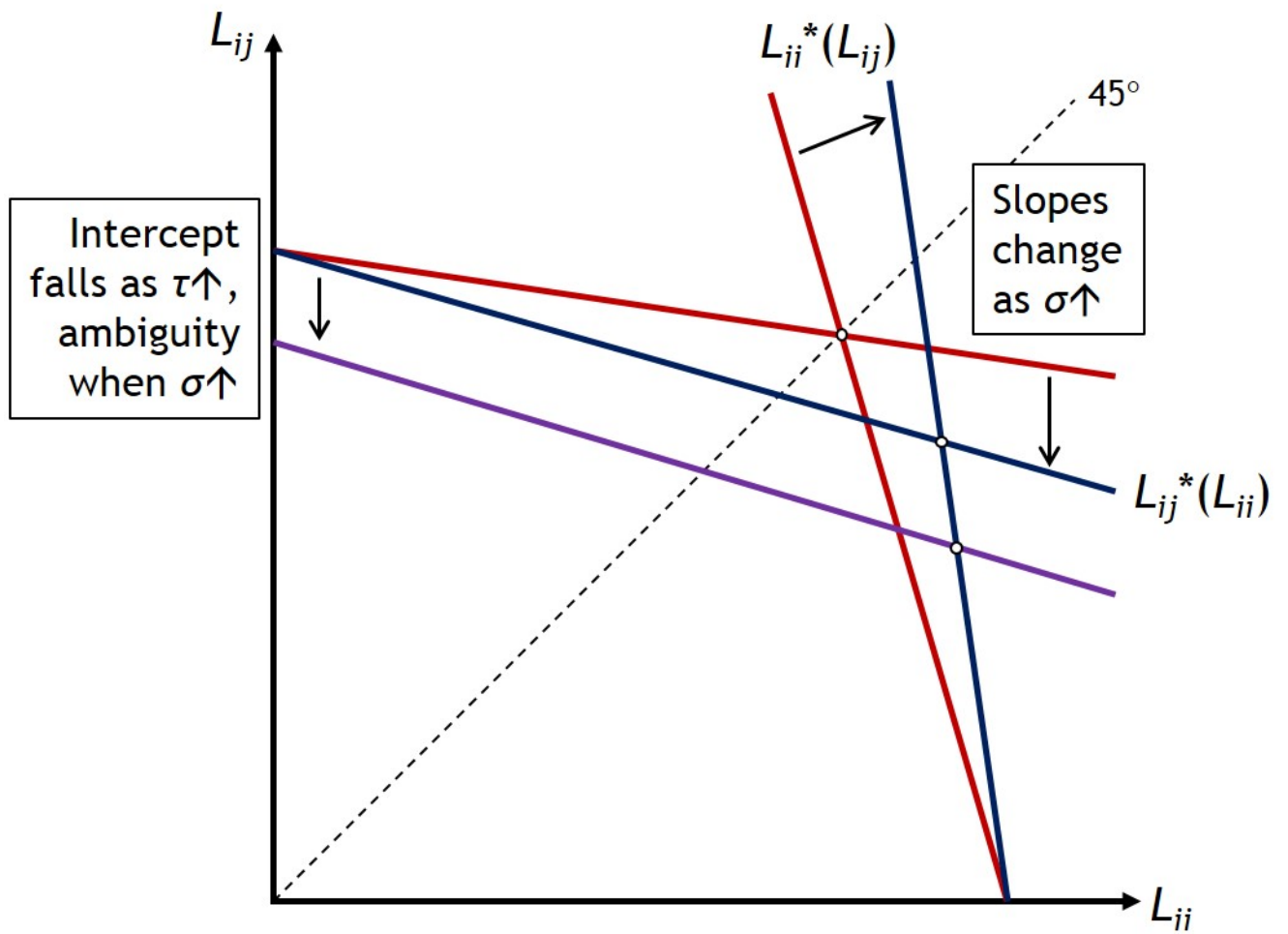


Figure 1. Impact of trade and monitoring costs on volume and shares of lending