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Working Paper

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Preprints of the Max Planck Institute for Research on Collective Goods, No. 2006,11

Provided in Cooperation with:

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Suggested Citation: Hakenes, Hendrik; Schnabel, Isabel (2006) : The threat of capital drain: a rationale for public banks?, Preprints of the Max Planck Institute for Research on Collective Goods, No. 2006,11, Max Planck Institute for Research on Collective Goods, Bonn

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Drain: A Rationale for
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April 2006

The Threat of Capital Drain: A Rationale for Public Banks?*

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April 17, 2006

Abstract

This paper yields a rationale for why subsidized public banks may be desirable from a regional perspective in a financially integrated economy. We present a model with credit rationing and heterogeneous regions in which public banks prevent a capital drain from poorer to richer regions by subsidizing local depositors, for example, through a public guarantee. Under some conditions, cooperative banks can perform the same function without any subsidization; however, they may be crowded out by public banks. We also discuss the impact of the political structure on the emergence of public banks in a political-economy setting and the role of interregional mobility.

Keywords: Public banks, cooperative banks, capital drain, credit rationing, financial integration, privatization.

JEL-classification: G21, F36, H11, L33.

*We thank Philippe Aghion, Felix Bierbrauer, John Boyd, Gianni de Nicoló, Christoph Engel, Thomas Gall, Timothy Guinnane, Frank Heinemann, Carolin Häussler, Martin Hellwig, Christian Ossig, Anne van Aaken, Hans-Joachim Voth, Andrew Winton, and seminar participants at the Universities of Wisconsin-Madison, Mainz, Marburg, Minneapolis, Münster, at the MPI in Bonn, and at the joint International Monetary Fund/World Bank seminar, as well as conference participants at the Sonderforschungsbereich/Transregio 15 Conference in Tutzing, the Workshop on German Banking System Architecture in Frankfurt, and the Midwest Finance Association in Chicago for discussion. We also thank Silvia Grätz for excellent research assistance.

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1 Introduction

In many countries, public banks constitute an important part of the banking sector. There is a long-standing debate on whether this should be considered a blessing or a curse. In the literature, one finds two opposing views of public banks, summarized by La Porta, Lopez De Silanes, and Shleifer (2002): The proponents of the *development view* claim that public banks cure financial market failures and therefore enhance social welfare (see, e.g., Atkinson and Stiglitz (1980)). This view goes back to Gerschenkron (1962) who argued that government intervention may substitute for private activity if private institutions are underdeveloped, and may thereby foster economic growth. In contrast, proponents of the *political view* (see, e.g., Shleifer and Vishny (1994)) argue that public banks are instruments of self-interested politicians, who abuse the banks for the financing of socially undesirable projects.¹

The empirical evidence tends to support the political view. For example, Barth, Caprio, and Levine (2001) and La Porta, Lopez De Silanes, and Shleifer (2002) have shown that government ownership of banks tends to be associated with poorly operating financial systems and slower growth.² Although the issue of causality has not been resolved, such evidence has led to a general dislike of public banks among academics, and this view has been taken up by institutions like the International Monetary Fund (IMF), which tend to favor the privatization of public banks. One notable example is Germany's Financial Sector Assessment Program, where the IMF quite explicitly asked for the privatization of Germany's public banks.

In reality, the spectrum of public banks is larger than suggested by the studies cited above. Some banks have a regional or local orientation, whereas others are national institutions. Some serve special purposes (such as development banks), whereas others conduct the same business as private commercial banks. Some have been nationalized after a banking crisis; others are left-overs of socialist regimes. It is well conceivable that the prescriptions regarding privatization may differ across these different types of public banks.

This paper focusses on regional public banks that conduct their business only within their own region.³ Hence, the public banks in our model most closely resemble savings banks as they are (or were) found in most Continental European countries. We emphasize one particular aspect of regional public banks, namely their promise to invest local funds in local projects. Thereby, they may help to prevent a "capital drain" from poorer to richer regions within a financially integrated economy.

¹Sapienza (2004) argues, based on Banerjee (1997) and Hart, Shleifer, and Vishny (1997), that even if the politician wants to increase welfare when creating a public bank, agency problems between the politician and the banker may entail distortions. She calls this the *agency view*.

²In contrast, there is no clear relationship between the governmental ownership of banks and banking stability. See Caprio and Martinez Peria (2000) and Barth, Caprio, and Levine (2004).

³As a measure of government ownership, La Porta, Lopez De Silanes, and Shleifer (2002) use the share of public banks in the ten largest banks within each country. This measure tends to underestimate government ownership of banks if *regional* public banks are important; it overestimates the share of public banks in countries where public banks are *national*. Therefore, this study is not informative with respect to the effect of regional public banks on economic performance.

The problem of capital drain from poor to rich countries has received a lot of attention in the economic literature. In particular, it has been well established that capital market imperfections may prevent capital from flowing where it can be used most efficiently.⁴ Our model adds to this literature by showing how banking institutions, like regional public banks or cooperative banks, may prevent a capital drain from poorer to richer regions, even if capital flows are unrestricted. Instead of looking at different countries, we focus on different regions within a country.

In our model, we consider two regions where agents have access to investment projects, but are subject to a moral hazard problem. The agents in the two regions differ only in their initial endowments. In both regions, endowments are so low that there is credit rationing à la Stiglitz and Weiss (1981). However, in the richer region, entrepreneurs can promise higher interest rates. Therefore, a capital market directs capital from the poorer to the richer region even if the production technologies are identical. This is what we call a “capital drain.” Compared to autarky, the poorer region suffers a welfare loss, for the benefit of the richer region.

We then discuss what types of banking institutions may help to prevent the capital drain. We first show that private banks cannot improve upon the allocation achieved by integrated capital markets. In contrast, a public bank that obeys a regional principle and is subsidized by the government (for example, through a public guarantee) can prevent the capital drain. Regional taxpayers in the poor region are willing to finance this subsidy because it fosters entrepreneurial activity within their region. In other words, there is a positive intra-regional (pecuniary) externality from providing investment finance within the region.⁵ Through subsidization, a public bank may provide an incentive to deposit funds within the region, with beneficial effects for regional welfare. However, founding a cooperative bank could achieve the same outcome, without any need for subsidization. We show that such a bank endogenously establishes a regional principle. By giving their members privileged access to loans, it sets incentives to invest their endowments in the regional bank rather than the national capital market. However, cooperative banks are crowded out if they have to compete with subsidized public banks.

We then consider a number of model extensions. We first discuss under which conditions either public or cooperative banks are the superior solution from the viewpoint of regional welfare. We show that public banks are better able to mobilize deposits of people who do not have access to investment projects, whereas cooperative banks are superior in the presence of intra-regional wealth differences or heterogeneous industries. Then we put our model into a political-economy context by explicitly considering voting decisions within regions. We show that public banks are more likely to emerge when the voting takes place at the regional level and when the poor regions are relatively large. Finally, we show that interregional mobility destroys the ability of public banks to prevent capital outflows from poor to rich regions. These theoretical predictions may explain why regional savings banks are rather to

⁴See Lucas (1990), Gertler and Rogoff (1990), Boyd and Smith (1997), Morrison and White (2004), and Matsuyama (2005). Ma and Smith (1996) present some empirical evidence.

⁵In practice, such externalities may exist for many reasons (see, e.g., Krugman (1991)). Our results on public banks do not depend on the specific kind of externality.

be found in Europe than in the United States, and why some countries are more likely to abandon their savings banks than others.

In the above categorization of the literature on public banks, our paper is closest to the development view. This is not to say that the political view is unimportant, but to emphasize a potentially beneficial role of public banks that has been understated in current political debates. Hence, our paper also has important policy implications. In spite of the recent privatization wave in many countries, it is still far from clear whether such a privatization is really welfare-enhancing. Our paper argues that the privatization of savings banks comes at a cost, namely a potential capital drain from poorer to richer regions, making the population in poorer regions worse off. Such a capital drain may be undesirable from a regional perspective, and possibly also from a national one, both for efficiency and distributional reasons. This aspect is important for a full assessment of the costs and benefits of a privatization of public banks. Furthermore, our model points towards alternatives to the transformation of savings banks into (or take-over by) commercial banks, namely the transformation into cooperative banks. This may prevent some of the pitfalls of privatization, while preserving its benefits, such as a better governance.

The remainder of the paper is organized as follows. In Section 2, we will provide some evidence for the empirical relevance of regional public banks. In Section 3, we present the setup of our model and the baseline results for an autarkic economy. We then establish the presence of a capital drain under financial integration. Section 4 discusses what types of banking institutions can prevent a capital drain from poorer to richer regions in a financially integrated economy. Section 5 discusses several extensions to the basic setup. Section 6 concludes. The Appendix contains some technical details and the proofs of the propositions and remarks.

2 Regional Public Banks in Different Countries

Regional or local savings banks are a widespread phenomenon, especially in Continental Europe. Before the privatization wave starting in the 1990s, these savings banks were typically owned by the government and subsidized, for example, through tax exemptions or state guarantees. Examples are the “Sparkassen” in Germany, the “Caisses d’Epargne” in France, the “Cajas de Ahorros” in Spain, and the “Casse di Risparmio” in Italy. In contrast, countries like the United Kingdom or the United States never had comparable institutions.

Historically, such banks were founded in the nineteenth century to provide safe investment opportunities for the poor.⁶ However, this objective has gradually been replaced by the goal of advancing regional development. Typically, savings banks obey a regional principle, meaning that they conduct their business only within their region. Behind this stands the idea that regional savings should be reinvested in regional investment projects to prevent capital outflows to other regions and to

⁶Guinnane (2002) presents an interesting analysis of the historical evolution of banking institutions in Germany.

foster regional development. In some countries, such as Germany, this objective is explicitly named in the laws governing the savings banks (“Sparkassengesetze”) as part of their “public mandate” (“öffentlicher Auftrag”).⁷

Since the 1990s, many European countries have privatized their savings banks, following different routes. For example, Italy turned its savings banks into joint-stock companies and abolished the regional principle (Carletti, Hakenes, and Schnabel (2005)). In contrast, France transformed the savings banks into credit cooperatives while maintaining the regional principle (Deutsche Bank (2005)). In most cases, the government maintained a substantial influence on the privatized savings banks. There is little empirical work on the economic consequences of privatization. Recent work on Italy suggests that the privatization (and the accompanying consolidation) has led to gains in cost efficiency, but also to a deposit drain from Southern to Northern Italy (Colombo and Turati (2004)).

The most prominent country where the savings banks are still publicly owned and play a major role in the banking sector is Germany. But even there, the pressure to privatize savings banks has increased. One important step in this direction was the abolition of state guarantees in July 2005, in reaction to a decision by the EU Commission that such guarantees were incompatible with the EC Treaty because they constituted state aid not justified by any public function. Switzerland is another country where regional public banks (“Kantonalbanken”) still play an important role. In contrast to Germany, these banks still enjoy explicit public guarantees.

The savings banks are not the only institutions with a strong regional focus. Many countries have a cooperative banking sector that performs similar functions to the savings banks.⁸ Interestingly, in some countries, such as Germany, cooperative and savings banks even coexist. In contrast to the savings banks, there is typically no state involvement in cooperative banks. One exception is France, where the state itself is a member of the newly founded cooperative banks. Other countries, like the United States and the United Kingdom, have a cooperative banking sector, but no public savings banks. In developing countries, as a rule, there are no institutions comparable to the European savings banks. In contrast, informal micro-finance institutions play a much larger role and have become an important means of ensuring access to finance for the poor (see Armendariz de Aghion and Morduch (2005)).

Some countries have developed alternative solutions for the problem of capital drain from underdeveloped areas. In the United States and the United Kingdom, the government promoted the creation of “Community Development Financial Institutions” (CDFIs), which are non-profit financial intermediaries that specialize in serving particular areas or population groups. Some of those are similar to credit cooperatives, such as the Community Development Credit Unions, but they also come in other legal forms. In addition, the United States passed the “Community Reinvestment

⁷For a detailed analysis of the role of German savings bank in regional development, see Gärtner (2003). Note that the German “Landesbanken,” the savings banks’ regional central institutes, do not obey a regional principle, and therefore do not fall in the category of regional public banks, as defined in this paper.

⁸On credit cooperatives, see Banerjee, Besley, and Guinnane (1994) and Guinnane (2001).

Act” of 1977 to improve the availability of credit in underserved communities (Apar and Duda (2003)). According to the Act, the regulators have to evaluate banks’ lending activities in the areas from which they draw deposits, in particular with regard to the provision of loans to minorities or low-income neighborhoods.⁹ Finally, it has been argued that the U.S. unit banking system historically was founded because of the fear of “deposit siphoning” (see Calomiris (2000) and Guinnane (2002)).

In our paper, we will try to explain some of these empirical observations in a simple theoretical model. Specifically, we will ask why public regional banks are found in some countries, but not in others. We also make an attempt to explain the difference in the speed of privatization in different countries. Finally, we will derive some tentative policy implications regarding the desirability of the privatization of savings banks and the way such privatization should be carried out.

3 Baseline Model

3.1 Setup

Consider an economy with two regions, called North (N) and South (S). In each region, there is a continuum of inhabitants of mass μ_N and μ_S , respectively. All agents are risk neutral, and their discount factors are equal to one. Agents cannot move between regions. Each agent owns an initial endowment of E_N or E_S . Without loss of generality, assume that $E_N > E_S$; Northerners are richer than Southerners. In all other respects, agents are equal.

In both regions, each agent has access to an indivisible, not transferable investment project that requires an investment of $I > E_N$; hence, any agent has to borrow to be able to carry out his investment project. Agents are subject to a moral hazard problem because they can choose between two versions, G (“good,” i. e. safe) and B (“bad,” i. e. risky), of the project. This choice is unobservable to others. Version G yields Y_G with probability p_G , and zero otherwise. The risky version yields Y_B with probability p_B , and zero otherwise. We assume that $p_G Y_G > I > p_B Y_B$, so that the safe version has a positive net present value, whereas the risky version has a negative one. Moreover, $Y_B > Y_G$, hence there is scope for the standard risk-shifting problem, as in Stiglitz and Weiss (1981). Within regions, the returns of the same version of the project are perfectly correlated. Moreover, the failure of the good version implies the failure of the bad version (but not vice versa). Goods can also be stored at zero cost. By assumption, there is only debt finance with limited liability. Hence, a financial contract is characterized by two variables, the principal of the loan and the repayment.

The timing of the model is as follows. First, agents receive their endowments. Also, institutions like public or cooperative banks are formed at this stage. In the next

⁹Curiously, this evaluation refers mainly to the *composition* of loans within the area. Capital flows to other areas are not restricted, and out-of-area loans are subject to a much milder regulation.

stage, agents can either trade in the capital market, or write contracts with financial institutions. Agents that possess at least I can become entrepreneurs and invest in version G or B of the investment project. Finally, project returns are realized and financial obligations are paid according to the concluded financial contracts.

3.2 Autarky

In this section, we consider autarkic regions. Hence, there are no capital flows between regions. Therefore, we can consider a representative region and omit indices.

With $I > E$, agents must borrow to carry out their investment projects. We call agents *lenders* if they lend their endowments to other agents; we call them *entrepreneurs* if they borrow to carry out their investment projects. We assume that agents trade in a capital market, in which the lenders can buy the bonds issued by the entrepreneurs. Later we will also consider intermediated finance. Given the scarcity of capital, only a fraction E/I of agents can become entrepreneurs; the remaining agents become lenders. The expected profit of an entrepreneur is

$$\Pi_G = p_G (Y_G - R(I - E)) \quad (1)$$

if he chooses version G , where R is the gross interest rate (including the repayment of the principal). Analogously, the profit is Π_B if he opts for B . An entrepreneur prefers the safe project if $\Pi_G \geq \Pi_B$, hence if

$$R \leq \bar{R} = \bar{R}(E) = \frac{p_G Y_G - p_B Y_B}{(p_G - p_B)(I - E)}. \quad (2)$$

Consequently, the lending rate can never exceed \bar{R} in equilibrium. Otherwise, lenders would not be willing to provide their funds. They would anticipate that the entrepreneur will choose version B ; this would not allow them to recover their investment. Note that the maximum rate \bar{R} increases in E , i. e., $\partial \bar{R} / \partial E > 0$; the richer an entrepreneur, the higher is the interest rate that he can promise. This will be important for the mechanism of our model.

We will next characterize the equilibrium allocation, using a subgame perfect version of the coalition-proof Nash equilibrium as the equilibrium concept.¹⁰ We focus on those situations where (2) is binding. At an interest rate of \bar{R} , there is an excess demand for loans, such that there is credit rationing. An increase in loan rates is not possible because this would induce entrepreneurs to switch to the risky version of the project. Credit rationing implies that entrepreneurs earn more than lenders in

¹⁰See the Appendix A.1 for technical details. The equilibrium allocation described below is unique, subject to two qualifications. First, groups of agents of measure zero might deviate. Second, equilibria can only be defined up to a renaming of agents. If two agents exchange their positions in an equilibrium, the result must still be an equilibrium because all agents are equal ex ante. When we speak of an equilibrium, we always mean equivalence classes of equilibria, abstracting from sets of measure zero and from permutations of agents.

equilibrium.¹¹ This property is crucial for our model. It could also be obtained with other kinds of market imperfections. For example, Boyd and Smith (1997) achieve the same result by introducing costly state verification as in Gale and Hellwig (1985). In the absence of market imperfections, there would be no role for institutions (such as public banks), as has been suggested by Boyd, Prescott, and Smith (1988).

The expected return of an entrepreneur is given by (1); that of a depositor is equal to $p_G \bar{R} E$. Substituting the maximum interest rate \bar{R} in the expected profits of entrepreneurs and lenders yields the condition under which there is credit rationing,

$$\frac{I}{E} > \frac{Y_G}{Y_B - Y_G} \frac{p_G - p_B}{p_B}. \quad (3)$$

In the remainder of the paper, we assume that (3) holds. Furthermore, we want to rule out situations in which the credit rationing problem is so severe that storing the endowment is more profitable than investing in the capital market. We therefore assume that $p_G \bar{R} > 1$ or, equivalently,

$$\frac{I}{E} < 1 + \frac{p_G}{E} \frac{p_G Y_G - p_B Y_B}{p_G - p_B}. \quad (4)$$

Then the equilibrium under credit rationing can be characterized by the subsequent proposition.

Proposition 1 *In an autarkic economy where conditions (3) and (4) hold, there is a unique coalition-proof Nash equilibrium. There is credit rationing in equilibrium, and the interest rate is $R = \bar{R}$ as given by (2). Total investment is equal to the aggregate endowment μE .*

If (3) does not hold, there is no credit rationing, and the interest rate is $R = Y_G/I$. Again, total investment is equal to the aggregate endowment μE . Public (or cooperative) banks play no role in such a setting. If (3) holds, but (4) does not, credit rationing is so severe that no agent is willing to lend his endowment at the prevailing interest rate; they prefer to store their endowments, and there is no investment.¹²

Welfare In order to discuss welfare implications of different institutional arrangements, we define welfare as the aggregate rents of all agents, i. e., of entrepreneurs and lenders. The aggregate endowment in the region is μE , hence $\mu E/I$ projects can be financed. The return per project is Y_G , with probability p_G . Therefore, aggregate welfare is equal to

$$W = p_G Y_G \mu E / I.$$

This term does not depend on whether (3) holds. The level of interest rates affects only the distribution of rents among entrepreneurs and lenders, not aggregate rents.

¹¹The problem of credit rationing would disappear if entrepreneurs could issue equity rather than debt. In a richer model with costly state verification à la Gale and Hellwig (1985) or a two-dimensional moral hazard problem including a risk and an effort choice, equity would not solve the problem and the results would be similar to those of our model (see Bester and Hellwig (1987)).

¹²This underinvestment problem could be cured by a public or cooperative bank as described in this paper. However, this mechanism is not the focus of our paper.

Example We will now present a numerical example to which we will refer throughout the paper to illustrate the major results. Consider the subsequent parameter constellation:

$$\begin{array}{cccccc} I & E_N & E_S & p_G & Y_G & p_B & Y_B \\ \hline 1 & 0.65 & 0.63 & 0.8 & 1.5 & 0.2 & 4.5 \end{array}$$

Then the expected return from version G is $p_G Y_G = 1.2$; that from version B is $p_B Y_B = 0.9$.¹³ Since $I > E_N$, agents in both regions need to borrow in order to carry out their projects. Moreover, $I/E_N = 1.54 > Y_G/(Y_B - Y_G) (p_G - p_B)/p_B = 1.5$, hence (3) holds and there is credit rationing in the North. Consequently, the Northern interest rate is equal to $R_N = \bar{R}_N = 1.43$. Lenders get an expected return of $p_G \bar{R}_N = 1.14 > 1$ per invested dollar; entrepreneurs earn a return of $\Pi_G/E_N = 1.23 > 1.14$. The market does not clear because agents earn more from borrowing and carrying out the investment project than from lending. Welfare per capita is equal to $W_N/\mu_N = E_N p_G Y_G/I = 0.78$.

In the South, the projects have the same characteristics as in the North, but agents have lower initial endowments, $E_S = 0.63$. There is again credit rationing, but now the maximum interest rate will be lower than in the North, $R_S = \bar{R}_S = 1.35 < R_N$. Consequently, lenders get an expected return of only $p_G \bar{R}_S = 1.08 > 1$, whereas entrepreneurs earn $\Pi_G/E_S = 1.27$ per invested dollar. Hence, entrepreneurs earn more than lenders in both regions. In the South, welfare per capita is $W_S/\mu_S = 0.76 < W_N/\mu_N = 0.78$. Note, however, that welfare *per dollar* is the same in both regions, $0.78/0.65 = 0.76/0.63 = 1.2 = p_G Y_G$.

3.3 Financial Integration

Let us now consider a world with integrated capital markets. Northerners and Southerners trade in the same capital market. We assume that (3) holds in *each* region, hence there is credit rationing. As a consequence, in the absence of financial integration, interest rates would be \bar{R}_N in the North and $\bar{R}_S < \bar{R}_N$ in the South. Interest rates are higher in the North because Northerners have more own resources and need to borrow less, which mitigates the moral hazard problem. Therefore, lenders prefer to invest their endowment in the North at an interest rate of \bar{R}_N . At this rate, lenders will not lend to the South, because Southern entrepreneurs would choose the risky project. As a consequence, capital will flow from the South to the North. Investment in the South will take place only if *all* Northern entrepreneurs have already obtained capital.

At the rate \bar{R}_N , capital demand in the North is equal to $\mu_N (I - E_N)$; capital supply in the South is equal to $\mu_S E_S$. Depending on the relative size of the regions, there are two different regimes. If $\mu_N (I - E_N) > \mu_S E_S$, the potential capital demand in the North exceeds the potential capital supply from the South. Hence, some Northerners

¹³Numbers are always rounded to two decimal places.

will not be able to borrow funds, but will offer their endowments in the capital market. Consequently, the interest rate will be \bar{R}_N in equilibrium. Entrepreneurs in the South will not receive any funds because they cannot credibly promise to choose the safe project at the rate \bar{R}_N . Due to the high interest rates, the Southerners are willing to invest their funds in the capital market. If $\mu_N (I - E_N) < \mu_S E_S$, the potential capital demand from the North is smaller than the potential capital supply from the South. As a result, all Northerners and some Southerners can become entrepreneurs, but only if the interest rate is no larger than \bar{R}_S . Hence, the equilibrium interest rate must be equal to \bar{R}_S .

Proposition 2 *In a financially integrated economy with credit rationing, the capital market transfers funds from poor to rich regions. Investment in the poor region takes place only if all agents from the rich region invest as well. Per capita welfare increases in the rich region and decreases in the poor region. The market rate is*

$$R \begin{cases} = \bar{R}_N & \text{if } \mu_N (I - E_N) > \mu_S E_S, \\ \in [\bar{R}_S; \bar{R}_N] & \text{if } \mu_N (I - E_N) = \mu_S E_S, \\ = \bar{R}_S & \text{if } \mu_N (I - E_N) < \mu_S E_S. \end{cases} \quad (5)$$

The capital transfer from the South to the North increases the rents in the North because more entrepreneurs will be able to finance their investment projects. Because the aggregate number of projects (and hence aggregate welfare) remains unchanged, the rents in the South must, in turn, shrink. The loss is borne entirely by the Southern entrepreneurs who lose the extra rents from borrowing; in contrast, Southern lenders may benefit from financial integration. However, from an *ex-ante* perspective, the expected profits of Southerners drop. The negative effect from the reduced access to funding *always* outweighs the positive effect of increased deposit rates for lenders. These results are due to the credit rationing in both regions. Independent of whether the interest rate is \bar{R}_N or \bar{R}_S , agents earn more as entrepreneurs than they do as lenders. Hence, a region that imports capital experiences an increase in average welfare, whereas a region that exports capital experiences a decrease.¹⁴

Ex ante, Southerners would like to commit to lending only to Southerners. If they could, expected welfare would be the same as under autarky. However, once they know that they are lenders, Southerners will prefer to lend in the capital market. An equilibrium in which Southerners lend only within the region is not time consistent.

Aggregate Welfare One may ask what happens to overall welfare, summed up over the two regions. In our setup, overall welfare is unaffected by financial integration. This is driven by the assumption that investment projects are identical in both regions. In a richer model, the overall welfare effects of financial integration would depend on the relative productivity of investments. If the projects in the South were more efficient (due to lower past investment and decreasing returns to scale),

¹⁴Similar results have been obtained by Gertler and Rogoff (1990), Boyd and Smith (1997), and Matsuyama (2005) using different types of agency problems and capital market imperfections.

aggregate welfare would decrease. If investment in the North were more efficient (for example, due to a better infrastructure), aggregate welfare would increase. Welfare effects would also be different if all agents had equal initial endowments, but different amounts of collateral; then the welfare implications of financial integration would be ambiguous. The important result is that, in a model with financial market imperfections like credit rationing, capital does not necessarily flow to the region with the highest productivity. Hence, financial integration may also be welfare decreasing from an aggregate perspective, and not just from a regional perspective.

Example To illustrate our results, let us come back to the example from above. For $\mu_N = 9$ and $\mu_S = 5$, equilibrium interest rates are undetermined because $\mu_N (I - E_N) = 3.15 = \mu_S E_S$. For illustration, we discuss the cases where μ_S is either infinitesimally lower or higher than 5. First, assume that $\mu_N = 9$ and $\mu_S = 5 - \epsilon$, with ϵ positive, but vanishingly small. This implies that the capital demand from the North (slightly) exceeds the potential capital supply from the South. The interest rate is $R = \bar{R}_N = 1.43$, and only Northerners will borrow and become entrepreneurs. As a consequence, Northerners earn an expected rent of 1.23 per invested dollar, which is more than 1.2, the return earned under autarky. The (vanishingly small) fraction of Northerners who get no funds does not need to be taken into account. All Southerners will end up being lenders, earning a rent of $0.8 \cdot 1.43 = 1.14 < 1.2$. Welfare has increased in the North, but decreased in the South.

Now assume that $\mu_N = 9$ and $\mu_S = 5 + \epsilon$. Then all Northerners and a tiny fraction of Southerners can borrow. Southerners determine the interest rate, $R = \bar{R}_S = 1.35$. Now Northerners earn an expected rent of $1.26 > 1.2$ per invested dollar; Southerners earn only $1.08 < 1.2$. Again, the financial integration leads to a welfare decrease in the South, but to an increase in the North.

4 Banking Institutions

So far, we have assumed that capital is transferred by the capital market. Now we will discuss how certain types of banking institutions may prevent a capital drain.

4.1 Private Banks

Let us first consider private banks operating in the region in addition to the capital market. We assume that private banks have no specific abilities, such as monitoring skills or deposit collection abilities.

Definition 1 (Private bank) *A private bank is a profit-maximizing firm that collects deposits and grants loans.*

Then it is straightforward to show that the equilibrium allocation will be exactly the same as in the model without banks.

Remark 1 *In a financially integrated economy with credit rationing, private banks do not influence the equilibrium allocation.*

Private banks can do no more than to replicate the capital market outcome. In particular, private banks cannot increase the number of Southern entrepreneurs relative to the capital market equilibrium. We stress this point to highlight the particular role played by public and cooperative banks, as will be described in the following sections.

4.2 Regional Public Banks

In this section, we show that public banks can be used by poor regions to prevent capital outflows. Assume that each region has a public bank, run by the regional government, and that the government wants to maximize the welfare within its region. Public banks face competition from the capital market and from private banks. The definition of a public bank is as follows.

Definition 2 (Public bank) *A public bank is a firm that collects deposits and grants loans, and has the following additional properties:*

- *It receives subsidies from the regional government; subsidies are financed by taxes raised within the region.*
- *It obeys a regional principle, i. e., it operates only within its own region.*
- *Within regions, loans are given to those agents who can offer the highest expected returns. If expected returns are identical, loans are distributed randomly.*
- *It makes zero profits.*

The subsidy from the government introduces a wedge between loan rates and (expected) deposit rates. Due to the subsidy, the public bank in the South can pay competitive interest rates, so that lenders will no longer invest their funds in the capital market. At the same time, the bank can demand relatively low loan rates, so that entrepreneurs will stick to the safe project. The subsidy is financed by a tax that must be paid by all Southerners. Nevertheless, expected rents in the South increase because a higher share of regional entrepreneurs are able to carry out their projects. There are several ways to design taxes and subsidies. We discuss two alternatives, direct subsidization with ex-ante taxes, and indirect subsidization by a public guarantee with ex-post taxes.

4.2.1 Direct Subsidization with Ex-ante Taxes

Assume that each Southerner has to pay a lump-sum tax T_S from his initial endowment to finance the subsidy to the Southern public bank. Then only an amount of $E_S - T_S$ remains for investment, either in the project or in deposits. Southern entrepreneurs must now borrow $I + T_S - E_S$. The total tax collected is $\mu_S T_S$. Assume for the moment that a fraction E_S/I of Southerners become entrepreneurs (as under autarky), and that the remaining fraction $(I - E_S)/I$ of Southerners deposit their endowments at the public bank. We will show below that this is true in equilibrium.

The public bank collects $\mu_S (E_S - T_S) (I - E_S)/I$ units of deposits and obtains a subsidy of $\mu_S T_S$, hence the total lending volume is

$$\mu_S [(E_S - T_S) (I - E_S)/I + T_S] = \mu_S E_S [I + T_S - E_S]/I.$$

Entrepreneurs need $I + T_S - E_S$ each, or $\mu_S (I + T_S - E_S) E_S/I$ in the aggregate, which is equal to the bank's total lending volume. This confirms that taxation is irrelevant to the number of projects that can be carried out, as assumed above; the fraction of entrepreneurs remains E_S/I . For an entrepreneur, we can calculate expected profits and the maximal *loan* rate (denoted by \bar{R}^L) as

$$\begin{aligned} \Pi_G &= p_G (Y_G - R(I + T_S - E_S)), \text{ and} \\ \bar{R}^L &= \frac{p_G Y_G - p_B Y_B}{(p_G - p_B) (I + T_S - E_S)} < \bar{R}_S. \end{aligned} \quad (6)$$

The ex-ante tax restricts the entrepreneurs' ability to pay high loan rates. The public bank passes its revenues $\mu_S \bar{R}^L (I + T_S - E_S) E_S/I$ on to its lenders. Lenders have deposited $\mu_S (E_S - T_S) (I - E_S)/I$, hence the nominal *deposit* rate R^D equals the aggregate repayment divided by the aggregate deposited amount,

$$R^D = \frac{\mu_S \bar{R}^L (I + T_S - E_S) E_S/I}{\mu_S (E_S - T_S) (I - E_S)/I} = \frac{\bar{R}^L (I + T_S - E_S) E_S}{(E_S - T_S) (I - E_S)} > \bar{R}_S > \bar{R}^L. \quad (7)$$

For $T_S \rightarrow 0$, there are no subsidies and we get back to the solution $R^D = \bar{R}^L$; the deposit rate equals the loan rate. For $T_S \rightarrow E_S$, $R^D \rightarrow \infty$. This implies that any deposit rate can be obtained by sufficiently high taxes and subsidies. Hence, the public bank can always offer its depositors a competitive interest rate.

To derive the equilibrium deposit rate, we have to distinguish between the two regimes discussed above. If $\mu_N (I - E_N) > \mu_S E_S$, the integrated capital market offers a rate of \bar{R}_N to lenders. If $\mu_N (I - 1) < \mu_S$, the capital market rate is \bar{R}_S in the absence of public banks, but it jumps up to \bar{R}_N if the Southern public bank becomes active and prevents the outflow of capital from the South. Hence, the Southern public bank must offer a rate of at least $R^D = \bar{R}_N$ in both cases; from this and (7), one can calculate the minimum lump-sum tax.¹⁵ The public bank

¹⁵If public banks were allowed to attract deposits from other regions, they might be tempted to set higher interest rates than the capital market rate. This would lead to a "subsidization race" between the public banks from the different regions. Even then, the Southern public bank could prevent a capital drain, but only if the entire endowments were collected as taxes. We exclude such behavior by our definition of public banks.

distributes all subsidies back to the Southerners; welfare in the South rises to the autarkic level. Interestingly, even the expected profits of Southern entrepreneurs and lenders are as under autarky; the tax does not lead to a redistribution.

Example In the presence of a public bank in the South, we do not need to distinguish between the two regimes described above, because the interest rate in the capital market is always determined by the North, $R = \bar{R}_N = 1.43$. Hence, the Southern public bank has to offer a deposit rate of at least 1.43. Therefore, the tax must be at least $T_S = 0.034$. Southern lenders and entrepreneurs earn exactly the same as under autarky, hence welfare per invested dollar is again equal to 1.2. The same is true in the North. Compared to the situation with financial integration, but without public banks, welfare rises in the South and falls in the North.

4.2.2 Subsidization through Public Guarantees with Ex-post Taxes

So far we have assumed that the government subsidizes the public bank directly. Let us now discuss a more subtle instrument of subsidization, which conforms more closely with what we observe in reality: the public guarantee. Under such a guarantee, lenders will always be paid in full; if the bank does not have sufficient funds, the government steps in. Any payments by the government are financed by ex-post taxes; ex-ante taxes do not make sense here because the subsidy is conditional on project failure. By protecting the public bank, the Southern government gives Southern lenders an incentive to deposit locally, even if (nominal) capital market rates are higher. We will now show under which conditions this constitutes an equilibrium. The result will depend on the assumed correlation between projects across regions. For illustration, assume that the projects are uncorrelated across regions.

A Southern lender gets a safe repayment of \bar{R}_S per invested dollar if he deposits his endowment at the Southern public bank. If the projects in the South fail, the government steps in and transfers an amount of \bar{R}_S per dollar, financed by taxes. Entrepreneurs in the South cannot pay taxes; their projects have failed, leaving them with zero returns. Hence, taxes can only be paid by the lenders themselves. The government collects \bar{R}_S per dollar from each lender; this is exactly what they receive from the public bank. Consequently, the expected return of Southern lenders is \bar{R}_S minus the expected tax of $(1 - p_G) \bar{R}_S$, which is $p_G \bar{R}_S$, as under autarky.

If the Southern lender instead decides to invest in the capital market, he gets a return of $\bar{R}_N > \bar{R}_S$ if the project is successful. With probability p_G , Southern projects fail and the Southern government wants to collect \bar{R}_S from the lender. However, if the Northern projects fail at the same time, the lender cannot pay the tax.¹⁶ Hence, the lender pays the tax only with probability $p_G(1 - p_G)$, yielding an expected tax of $p_G(1 - p_G) \bar{R}_S$. The expected return to the lender, net of taxes,

¹⁶In contrast, the lenders at the Southern public bank can always pay the tax because they get money from the state.

is $p_G \bar{R}_N - p_G (1 - p_G) \bar{R}_S$. Consequently, the lender prefers to invest in the public bank with the guarantee if and only if

$$p_G \bar{R}_S \geq p_G [\bar{R}_N - (1 - p_G) \bar{R}_S], \quad \text{or, equivalently,}$$

$$p_G \leq 1 - \frac{E_N - E_S}{I - E_N}. \quad (8)$$

If (8) holds, the subsidization through a public guarantee is feasible. If, however, the probability of success p_G of the good project is too high, the guarantee has little value for lenders and may therefore not be sufficient to prevent capital outflows. (However, it could be supplemented by a direct subsidy.)

The feasibility of subsidization through guarantees is also influenced by the relative importance of aggregate and regional shocks. If projects were perfectly correlated *across* regions, there would only be aggregate shocks. Then Southern lenders who invest in the North never have to pay taxes to finance the bail-out of a failing public bank because the Northern projects fail at the same time. An investment in the capital market would always be superior in the absence of direct subsidies.¹⁷

Note that bail-outs do not redistribute any funds: The interest payments to lenders are financed by taxpayers who, in equilibrium, are identical with the lenders. Nevertheless, this mechanism deters lenders from taking their endowments to the capital market. As a consequence of the subsidy, there is a crowding-out of capital markets and private banks. Welfare is the same as before financial integration. The main results of this section are summarized in the following proposition.

Proposition 3 *In a financially integrated economy with credit rationing, the poor region can stop the capital drain to the rich region by founding a regional public bank and subsidizing it sufficiently. The equilibrium allocation and welfare are the same as under autarky.*

Our discussion of possible taxation and subsidization schemes is far from complete. There are many more ways to collect taxes and subsidize public banks in order to give them a competitive advantage. For example, the government could raise capital yields taxes, income taxes, or corporate taxes. In our framework, these would yield identical allocations. In more elaborate models with other types of frictions, allocations may differ. In any case, our examples suggest that there must be *some* kind of subsidy and taxation to enable public banks to attract savings and invest regionally. In the following, we will assume that public banks are directly subsidized and that the subsidy is financed by an ex-ante tax.

¹⁷This result is, however, driven by the assumption that project returns are zero when the project fails; if returns were always strictly positive, a public bank with public guarantees would still be feasible under certain parameter constellations.

Example We can use (8) to check whether indirect subsidization by a public guarantee works. We have $1 - (0.65 - 0.63)/(1 - 0.65) = 0.94 > 0.8$, hence the Southern public bank provides sufficient incentives for Southern lenders to deposit their endowments at the bank. Specifically, lenders at the Southern public bank earn 1.08 as under autarky. A private bank offers at most a deposit rate of 1.43, yielding an expected return of $0.8 \cdot 1.43 = 1.14$. However, a Southerner who invests at the private bank must still pay taxes if only Southern projects fail, yielding an expected tax of $0.2 \cdot 0.8 \cdot 1.35 = 0.22$ and expected returns per invested dollar of $1.14 - 0.22 = 0.92 < 1.08$. Hence, a Southerner prefers to deposit at the public bank. As a consequence, capital does not flow to the North, and Southern projects can be carried out. Welfare in the South increases to the autarkic level.

4.3 Cooperative Banks

4.3.1 Cooperative Banks in an Economy without Public Banks

In this section, we argue that cooperative banks are an alternative way to prevent a capital drain. However, the mechanism is completely different from that employed by public banks.¹⁸ In contrast to public banks, cooperatives *endogenously* develop a regional principle and do not rely on subsidization. For now we assume that there are no public banks in the economy; below we will also allow for competition between cooperatives and public banks. Let us first define a cooperative bank.

Definition 3 (Cooperative bank) *A cooperative bank is a firm that collects deposits and grants loans, and has the following additional properties:*

- *It lends only to members.*
- *Agents become cooperative members by acquiring a share in the cooperative.*
- *Loans are given to those members who can offer the highest expected returns. If the expected returns are identical, loans are distributed randomly.*

By acquiring shares, agents become members of the cooperative and get privileged access to funds; at the same time, they commit themselves to retaining their funds at the cooperative bank if they do not get access to a loan. In equilibrium, a Southern cooperative bank will endogenously establish a *regional principle*, implying that it will accept only members from the South. A global cooperative would prefer to lend to the rich Northerners at a higher interest rate, just as a private bank or the capital market. Therefore, all Southerners prefer membership in a cooperative *with* a regional principle, and a global cooperative is not feasible.

¹⁸We do not claim that the prevention of capital drain is the only function of credit cooperatives. Most of the literature on cooperative banks instead focuses on informational problems. See, e. g., Banerjee, Besley, and Guinnane (1994), Smith and Stutzer (1995), and Guinnane (2001).

A Southern cooperative bank with regional principle works as follows. In equilibrium, it demands a payment of E_S in exchange for a share in the cooperative; the expected return on this payment will be $p_G \bar{R}_S$ in equilibrium. By demanding the payment of the entire endowment, the cooperative can ensure that a maximum number of projects can be carried out in the South; welfare will be the same as under autarky. If the payment was smaller than E_S , cooperative members that do not become entrepreneurs would invest the difference in the capital market where they can earn the higher return \bar{R}_N . As a result, fewer members in the South could become entrepreneurs, and expected welfare per member would decrease. The membership in a cooperative can be thought of as a lottery ticket: The member gets a higher chance of becoming an entrepreneur; in exchange, he has to forgo the higher return in the international capital market.

In equilibrium, all Southerners will become members of the cooperative. Due to credit rationing, the demand for loans of the members exceeds the funds of the cooperative. Because all loan applications are identical, the cooperative distributes loans randomly. Given own resources of E_S , the entrepreneurs can promise a maximum rate of \bar{R}_S . To be competitive, a cooperative has to pass all revenues on to its members. Hence, the expected return of a member (the expected profit from becoming an entrepreneur plus the expected return from the investment in the share) is $p_G Y_G E_S/I$, just as under autarky. If all Southerners become cooperative members, the interest rate in the integrated capital market is \bar{R}_N . The expected return of Southerners who invest their endowment in the capital market is $p_G \bar{R}_N$. This is always less than the expected return of a cooperative member (this follows directly from Proposition 2). Summing up, we obtain the following proposition.

Proposition 4 *In a financially integrated economy with credit rationing, but without public banks, agents in the poor region can stop the capital drain to the rich region by founding a cooperative bank. In equilibrium, this bank establishes a regional principle, and all Southerners become members of the bank. The equilibrium allocation and welfare are the same as under autarky.*

The most important result is that the capital drain from the poor to the rich region can be prevented both by a public bank and by a cooperative bank. However, the mechanisms are different: Public subsidies enable the public bank to offer competitive deposit rates. In contrast, the members of the cooperative are willing to accept relatively low returns on their investments because, in exchange, they obtain the promise to get privileged access to loans. The mechanism of the public banks depends crucially on the government's power to tax its inhabitants. In contrast, the cooperative bank emerges endogenously without any public intervention.

Example If a Southerner becomes a member of the Southern cooperative, he obtains a loan with probability $E_S/I = 0.63$. The loan rate is $\bar{R}_S = 1.35$. Hence, the expected return of a member per invested dollar is 1.27 if he gets a loan and 1.08 if he does not. Thus, the expected rent from becoming a cooperative member is $0.63 \cdot 1.27 + (1 - 0.63) \cdot 1.08 = 1.2$, exactly like in an autarkic South. Note

that the expected return that the cooperative bank pays its lending members is only $1.08 < 1.14$, the expected return in the capital market. Still, this is beneficial for Southerners *ex ante*. If the lender could quit the cooperative and receive full repayment of his initial investment, it would be optimal for him to do so. However, *ex ante* all Southerners prefer a cooperative that does not allow members to quit.

4.3.2 Competition between Public and Cooperative Banks

We have established the equivalence of public and cooperative banks if only one of the two institutions is present. Assume now that both a public and a cooperative bank are active in the poor region. In order to be able to compete against the capital market, the public bank must be subsidized, for example, by an *ex-ante* tax T_S , as in Section 4.2.1. Consequently, all Southerners (including the lenders and entrepreneurs at the cooperative bank) have to pay taxes.

A Southerner faces the decision whether to deposit at the Southern public bank or become a member of a Southern cooperative bank. If he does the latter, he has to make some initial payment. Therefore, he can no longer get a loan from the public bank, because the bank prefers to extend loans to those agents who still have their entire endowments.¹⁹ Also his probability of getting a loan at the cooperative bank is reduced by the tax payment, and his expected profit is now $p_G Y_G (E_S - T_S)/I$. In contrast, the probability of getting a loan at the public bank is at least as high as in the absence of cooperative banks due to the net tax inflow from cooperative members. As a result, the expected return at the public bank is at least $p_G Y_G E_S/I$. Therefore, it is a dominant strategy for Southerners to deposit at the public bank.

Remark 2 *In a financially integrated economy with credit rationing and both public and cooperative banks, the public bank completely crowds out the cooperative banks.*

Summing up, if *either* a public bank *or* cooperatives are operating in a region, they yield the same outcome. But if both institutions are present, private activity is crowded out completely by public activity.

5 Extensions

We now consider a number of extensions to our model. We first analyze several settings with heterogeneity *within* regions and discuss under which conditions either public banks or cooperative banks yield superior results from the viewpoint of regional welfare. This discussion will show that the two institutions are close, but not perfect substitutes. We then analyze the emergence of public banks in a political-economy context where agents can vote for or against public banks. Finally, we allow for interregional mobility of agents.

¹⁹Using the cooperative share as collateral does not help. Since its return is below market rates, the share is worth less as collateral than when it is invested directly; therefore, cooperative members cannot compete with non-members.

5.1 Public versus Cooperative Banks

Differential Access to Investment Projects Consider an economy with two regions in which not all agents are potential entrepreneurs. Only a fraction λ of agents have access to an investment project in each region and can potentially become entrepreneurs. The remaining fraction $1 - \lambda$ do not have access to projects; we call them *non-entrepreneurs*. Since they have no potential project, they can either store their endowments, or invest them at a bank or in the capital market.

In this situation, public banks will be superior to cooperative banks because only they will be able to attract the deposits of the non-entrepreneurs. The promise by the cooperative bank to give privileged access to lending is of no value to the non-entrepreneurs. Therefore, they will not be willing to accept the cooperatives' low deposit rates. In contrast, all agents in the poor region are willing to bring their money to a public bank if it is sufficiently subsidized. Hence, a public bank increases welfare above what could be achieved by a cooperative bank.

Remark 3 *Public banks are better than cooperative banks in attracting deposits of agents who do not have access to investment projects.*

The difference becomes even more pronounced if we assume that intra-regional investment brings a (non-excludable) positive externality to the non-entrepreneurs in the same region.²⁰ For example, the local firms may employ the non-entrepreneurs, and the employees may earn a positive rent from working, caused by some friction in the labor market.²¹ Due to a free-rider problem, the non-entrepreneurs deposit their money where they earn the highest interest rates, and do not take into account the externality. Since nobody can be excluded from the positive externality, a cooperative cannot solve this problem. In contrast, a public bank can set the subsidy so that the labor market externalities are taken into account. Hence, public banks are better than cooperatives in internalizing non-monetary externalities.

Intra-Regional Wealth Differences Assume now that within each region, only a fraction ν of the population possess an initial endowment E_H , with $\nu_S < \nu_N$; the remaining agents possess only $E_L < E_H$. Hence, there is heterogeneity within and between regions. A public bank must by definition serve all customers from its region and cannot specialize in serving a subset of agents. However, the public bank will grant loans to the poor only after the rich have been supplied with loans because the latter can offer higher loan rates. Given the limited availability of funds, the poor in each region have a lower chance of becoming entrepreneurs.

²⁰Such effects play an important role in the literature on agglomeration effects (Krugman (1991)).

²¹Note that the model of Section 3 can also be reinterpreted as a model with labor market frictions. The “entrepreneurs” can be interpreted as workers of a firm; the “lenders” are then the managers of the firm. Workers are subject to a moral hazard problem; therefore, they earn rents. If they are liable with their private assets when misconduct is detected, the moral hazard problem will be less pronounced in richer regions. As a consequence, capital will flow to richer regions. Then, public banks and cooperatives may help to increase employment within the region.

In this setting, there is scope for cooperative banks even in the presence of public banks because a cooperative bank can specialize in serving a particular customer type. This means that the poor agents can form their own cooperative, which would ensure that at least part of them would get access to capital, in spite of their low initial endowment. Hence, the poor fraction of each region can use cooperative banks as an instrument to prevent a capital drain towards the rich.²² If both a cooperative and a subsidized public bank exist in a region, the poor fraction of the population may still choose to become members of the cooperative. They face the following trade-off: If they acquire shares of the cooperative, the probability of getting a loan is higher; if they deposit their endowments at the public bank, they benefit from the subsidy. Hence, the subsidy to the public bank entails a redistribution from the poor to the rich within the region, and it leads to public banks (partially) crowding out cooperative or private banks by public banks.

Remark 4 *Cooperative banks are better than public banks in giving the poor within a region access to capital.*

Different Industries A similar result can be obtained when there are different industries within each region and when the severity of the moral hazard problem differs across industries. For exposition, assume that each region has two industries with different levels of productivity and that each agent has access to a project in one of the two industries. In general, the maximum loan rate \bar{R} will also differ across industries. Possibly, the less profitable industry can pay higher rates because moral hazard is less pronounced. Without loss of generality, assume that $\bar{R}^1 > \bar{R}^2$. If we maintain the assumption of higher initial endowments in the North, $\bar{R}_N^1 > \bar{R}_S^1$ and $\bar{R}_N^2 > \bar{R}_S^2$. Then, in the absence of public and cooperative banks, an investment in industry 1 in the North will be the most attractive one, and that in industry 2 in the South the least attractive one.

As before, a public bank can prevent a capital drain to the North. However, it cannot ensure access to capital for industry 2 because Southern entrepreneurs in industry 1 can offer higher loan rates. However, agents in industry 2 can join a cooperative bank with both a regional principle and an “industry principle,” and thereby obtain access to capital. This coincides nicely with the empirical observation that, historically, cooperative banks were not just tied to regions, but also to industries, such as farming (see, e. g., Guinnane (2002)). Again, cooperatives are not necessarily crowded out by public banks. The welfare effects of cooperatives are ambiguous; they depend on the relative productivity of industries.

Remark 5 *Cooperative banks are better than public banks in ensuring access to capital for moral-hazard-prone industries within regions.*

²²In this respect, the cooperative banks resemble the Rotating Savings and Credit Associations (RoSCAs) found in many developing countries (Armendariz de Aghion and Morduch (2005)).

5.2 Elections on Public Banks

Up to now, we have assumed that public banks exist for some exogenous reason. Now we will discuss the political economy of the creation of public banks and assume that agents vote in a referendum for or against public banks. For this purpose, we assume the simplest possible voting model, namely majority voting. Since preferences are linearly ordered by individual endowments, equilibrium outcomes under majority voting are well defined and are equal to the preferred outcomes of median voters, i. e., the voters with the median endowments.

Assume first that elections are held at a regional level. Each region is free to decide whether it wants a public bank or not. Then all agents in the poor South will vote for the establishment and subsidization of a Southern public bank. Given that the South establishes a public bank, the rich Northerners are indifferent between having a public bank or not. A public bank in the North does not have to be subsidized; it can offer the capital market rate, and it does not affect the equilibrium allocation. If elections are held at a national level instead, public banks will be established only if the median voter lives in the South. This is the case if the South is more populated than the North. Northerners will always vote against public banks.

Remark 6 *Elections will lead to the establishment of regional public banks if*

1. *elections are held at the regional level, or*
2. *elections are held at the national level and the population in the poor region exceeds that in the rich region.*

In a more complex political system, Northerners may offer side payments to Southerners to influence voting. However, it may be difficult to compensate the Southerners for their losses from voting against public banks: The side payment reduces the initial endowment of Northerners and exacerbates the moral hazard problem. Consequently, Northern entrepreneurs can pay lower loan rates and earn higher rents. In extreme cases, this effect may be so strong that they cannot pay large enough compensations to the Southerners to make them vote against public banks.

5.3 Mobility

So far, we have assumed that capital (i. e., endowments) is mobile, but agents are not. Let us now discuss the implications of mobility. Consider our basic framework of Section 3, but assume that agents are free to move between regions. Assume further that there is a Southern public bank, which is subsidized by a (sufficiently high) tax T_S collected in the South. Then all Northerners will move to the South if the costs of migration are small enough. Because they can offer higher returns than the original Southerners, they will get the loans from the Southern public bank. Hence, migration increases their probability of getting a loan because they can now

tap the Southern funds in addition to the Northern funds. As a consequence, the public bank is of no use for the poor Southerners.

Alternatively, assume that there are elections like those in Section 5.2 and that migration may take place after the election. As above, Northerners will migrate to the region where their access to loans is best. In the absence of public banks, they do not need to migrate; their access to capital markets is the same from anywhere. If public banks are active in the South, Northerners will want to move to the South. There they will obtain loans from the public banks. Consequently, the public bank will no longer need to be subsidized; it can pay a competitive deposit rate even without the subsidy. The outcome is the same as in the situation without public banks or cooperatives. Hence, there is no reason for Southerners to vote for a public bank in the first place; its only effect is the migration of Northerners. In contrast, cooperative banks are not affected by migration because membership can be conditioned on wealth instead of location (exactly as in Remark 4). Therefore, they are not crowded out by public banks.

Remark 7 *If agents can move freely between regions, public banks cannot ensure access to finance for the poor, whereas cooperative banks can still do so.*

6 Conclusion

This paper has formalized the idea that regional public banks may help to prevent a capital drain from poor to rich regions. In the absence of public banks, lenders will transfer their funds to the regions where they obtain the highest interest rates. With credit rationing, these will be the regions with the highest endowments (but not necessarily those with the better projects). A public bank can prevent the capital drain if it is sufficiently subsidized. The subsidy allows the public bank to offer a competitive interest rate, so that it is no longer profitable for agents to transfer their funds to another region. Through this mechanism, the public bank allows agents to internalize the intra-regional externality from investing within the region.

We have shown that the same result can be obtained by a cooperative bank that extends loans to its members only. By acquiring a share in the cooperative, an agent gets privileged access to loans. We have shown that, in spite of the relatively low returns paid by the cooperative, in the absence of public banks, agents in the poor region *ex ante* will always prefer becoming a member of a cooperative with regional principle to depositing in the capital market or at a private bank. Hence, a cooperative can prevent a capital drain to the rich region. However, cooperative banks may be crowded out by public banks. Since a cooperative member has to pay taxes, but will not benefit from the subsidy, agents will prefer to deposit at the public bank if both types of institutions are present.

The equivalence between public and cooperative banks breaks down if one allows for heterogeneity within regions. Public banks are better able to mobilize deposits

from the non-entrepreneur part of the population to whom the membership in a cooperative is of no value. The same is true if there are (non-excludable) positive externalities of production on the non-entrepreneurs (for example, through the creation of new jobs). Due to a free-rider problem, cooperative banks cannot prevent a capital drain, whereas public banks can still do so. In contrast, cooperative banks are better able to serve the poor agents *within* a region because they can specialize in serving particular customer types. Similarly, they can specialize in certain industries to prevent a capital outflow from moral-hazard-prone industries.

Finally, public banks are more likely to emerge endogenously from elections if such elections are held at the regional level or when the median voter is poor. Moreover, interregional mobility destroys the ability of public banks to prevent a capital outflow from poorer to richer regions.

The results of our model are broadly consistent with the evidence presented in Section 2. There we have shown that regional public banks are rather to be found in countries where the mobility of the population is relatively low, as in Continental Europe. In countries like the United Kingdom and the United States with relatively mobile populations, there are no regional public banks. Our model predicts that in such countries, cooperative banks emerge endogenously because they are better able to ensure access to loans for the poor part of the population. Indeed, cooperative banks or similar institutions (such as the Community Development Financial Institutions) are active in both countries. However, it seems that, in spite of such institutions, there still is an underprovision of loans to certain geographical areas or parts of the population. In the light of our model, this may be because cooperatives cannot mobilize deposits from the non-entrepreneurial part of the population and because social returns to investment are not internalized. In addition, neither a regional public bank, nor a cooperative can ensure access to loans in a region if there are too little regional savings. This would require the intervention of a national institution, such as a national development bank.

Another observation concerns the privatization of savings banks in different countries. More centralized countries like France or Italy privatized their savings banks, whereas more federal countries like Germany and Switzerland did not. In Italy, the major privatization laws (especially the Amato Law and the Ciampi Law) were passed at the national level; the same was true in France. In Germany, the privatization of savings banks would have to be enacted by the *Länder*, in Switzerland, by the Cantons. Our model predicts a regional opposition to privatization in the latter countries, as observed in reality.

Most of our paper has taken a regional perspective. We have presented arguments why certain regions, or even subgroups within regions, may prefer one or the other banking structure, without stressing the overall welfare effects of varying banking structures. In fact, financial integration, public banks, and cooperative banks do not affect aggregate welfare in our model. Outside of our model, one may think of arguments why a capital drain from richer to poorer region may be desirable or undesirable from an aggregate perspective, both for efficiency and for distributional reasons. In a richer model, one could, for example, allow for differences in the production technologies. In such a model, the capital market would not automatically

direct the capital towards its best use if there were market frictions, such as credit rationing. Therefore, the prevention of a capital drain may also be welfare increasing from an *aggregate* perspective.

We have focused on the potential role of different types of banking institutions in preventing a capital drain. Our model setup allows for a number of alternative solutions to achieve this end. For example, the South could restrict capital flows to the North.²³ Similarly, a taxation of capital flows or a direct subsidization of firms would lead to the same allocation. Hence, we do not claim that public or cooperative banks are the only ways to stop a capital drain. However, they are a rather subtle mechanism to prevent capital flows even in the presence of integrated financial markets.

We have largely ignored the distortions from government intervention in the banking sector. We have also abstracted from governance problems within public banks. In practice, such issues are important and shift the balance towards the cooperative solution (unless there are other, equally severe distortions in the cooperative sector). There is some anecdotic evidence on governance problems in publicly owned banks (think, for example, of *Crédit Lyonnais* in France, or *Bankgesellschaft Berlin* in Germany). Also, the evidence in La Porta, Lopez De Silanes, and Shleifer (2002) and Barth, Caprio, and Levine (2001) points towards inefficiencies in public banks. It is unclear, however, whether these findings carry over to the type of institutions analyzed in this paper. In fact, there is little evidence so far that public ownership negatively affects the cost efficiency of savings banks (see Carbó, Gardener, and Williams (2002) and Altunbas, Carbó, and Molyneux (2003)).

We believe that our paper contributes to the current policy debate by pointing towards a benefit of regional public banks that has, in our view, received too little attention. Therefore, the policy prescription regarding privatization may not be as clear-cut as suggested by political discussions. Our paper also suggests that a transformation into joint-stock companies, as in Italy, may not be the best way to proceed when privatizing regional public banks. It is well possible that such a privatization induces a capital drain from already structurally weak regions. According to our model, such a capital drain may be prevented if public banks are instead transformed into cooperative banks, as in France. Such an alternative should be taken into consideration in the countries planning the privatization of public banks. It may also help to avoid the distortions from public bank ownership and from taxation.

The scope of our paper is too narrow to conclusively answer the question whether a privatization of regional public banks is desirable or not. However, we want to emphasize that the costs of inefficiencies have to be weighed against the benefits, such as the prevention of a capital drain from poor regions. An empirical quantification of these costs and benefits still awaits to be done. Finally, our paper predicts

²³However, if the Northern production technology was sufficiently more efficient, a general prohibition of capital flows would not be desirable for the South. A public bank with a limited subsidy would not prevent such welfare-increasing capital flows (compare the discussion in Dixit and Norman (1980), p. 165).

a strong regional opposition to the privatization of public banks, especially in federal countries. Therefore, in spite of the widespread critical attitude towards public banks, these are unlikely to disappear in the near future.

A Appendix

A.1 Coalition-Proof Nash Equilibrium

The coalition-proof Nash equilibrium (CPNE) has been introduced by Bernheim, Peleg, and Whinston (1987) for normal form games and a finite number of players, using a recursive definition. For a game with *one* player, a strategy is a CPNE if and only if it maximizes expected utility. For a game with more than one player, a vector of strategies is a CPNE if and only if (a) it is self-enforcing, and (b) there is no other self-enforcing vector of strategies that leads to a *strictly* higher expected utility for all players. Here, self-enforcing means that the strategies must be a CPNE for any *subgroup* of players. This definition does not rely on finiteness, hence it can naturally be extended to an infinite number of players, using transfinite recursion.

Note that the CPNE is a refinement of the Nash equilibrium, allowing for deviations by *coalitions* of agents, and not just individual agents. Thereby, the number of equilibria is reduced. In our context, similarly to Winton's (1995), there is a multitude of (subgame perfect) Nash equilibria. Just to give an example, if $I > 2 E_N$, there is a Nash equilibrium in which no project is carried out; all agents keep their endowments. A unilateral deviation is not beneficial, as no project can be carried out. Our equilibrium concept excludes such equilibria because it allows groups of agents to deviate.

A CPNE is defined for normal form games. However, our game has an explicit time structure, so it is natural to write it in extensive form. First, there are some institutional decisions – whether agents want a regional public bank (in an election), or whether they want to become members of a cooperative. Then the capital market opens. Finally, entrepreneurs decide which version of the project to take. As a result, the notion of a CPNE may still be too broad. However, because our model is characterized by complete information, one can require subgame perfection. Again, the definition is recursive. For games that have no (proper) subgames, a vector of strategies is a subgame perfect CPNE if and only if it is a CPNE. For games that have proper subgames, a vector of strategies is a subgame perfect CPNE if and only if (a) it is a CPNE, and (b) for each subgame, the vector of strategies is a subgame perfect CPNE. This completes our definition of the equilibrium concept.

A.2 Proofs

Proof of Proposition 1: First (i), we reformulate our model in a more formal way than in the main text and characterize the equilibrium allocation. Second (ii), we

show that this allocation is admissible and constitutes a coalition-proof Nash equilibrium. Third (iii), we show that there are no other coalition-proof Nash equilibria.

(i) There is a continuum of agents of measure μ . Without loss of generality, agents are represented by a number $x \in [0; \mu]$. Each agent x can write debt contracts with any other agent. Denote the net amount borrowed by agent x from all other agents by $L(x)$, and the promised repayment by $R(x) L(x)$. For a net lender, $L(x)$ is negative. If an agent is bankrupt, the actual payment may be below $R(x) L(x)$; in our model, it will be 0 in that case.

Denote the expected payoff of agent x by $\Pi(x)$. If an agent does not borrow enough to carry out the project, i. e., $L(x) < I - E$, he becomes a lender, and his expected payoff is $\Pi(x) = E + L(x) - p_G R(x) L(x)$. In equilibrium, storage will never be profitable due to (4). An agent who borrows enough, i. e., $L(x) \geq I - E$, will become an entrepreneur and carry out the project because projects have a positive net present value (the entrepreneur's limited liability increases this value even more). Without loss of generality, reorder the set of agents such that $L(x)$ decreases (weakly) monotonically. Then there is an agent \bar{x} , such that all agents $x \leq \bar{x}$ become entrepreneurs, and all agents $x > \bar{x}$ become lenders.

An admissible allocation is defined by a triple $(\bar{x}, L(x), R(x))$ that satisfies incentive compatibility, individual rationality, and resource constraints. The *incentive compatibility* constraint says that it must be optimal for entrepreneurs to choose the safe version of the project. An entrepreneur's expected payoff is

$$\Pi(x) = \Pi_G(x) = p_G (L(x) + E - I + Y_G - R(x) L(x))$$

if he chooses the safe version, and, analogously, $\Pi(x) = \Pi_B(x)$ if he chooses the risky version.²⁴ The entrepreneur takes the safe project if and only if

$$R(x) \leq 1 - \frac{I - E}{L(x)} + \frac{p_G Y_G - p_B Y_B}{(p_G - p_B) L(x)}.$$

If $R(x)$ were above this threshold, lenders would anticipate the choice of the risky project (with negative NPV) and would not provide finance in the first place. This is where subgame perfection comes into play. Plugging the maximum repayment into the entrepreneur's payoff function, the incentive compatibility constraint can be written as

$$\Pi(x) \geq \underline{\Pi} = \frac{p_G p_B (Y_B - Y_G)}{p_G - p_B} \quad \forall x \leq \bar{x}. \quad (\text{IC})$$

Note that this bound is independent of $L(x)$. An increase in $L(x)$ above the amount necessary to carry out the project increases the minimum repayment by the same amount, but leaves the minimum profit $\underline{\Pi}$ for the entrepreneur unchanged.

In addition to incentive compatibility, an admissible allocation has to be feasible and satisfy the following *resource constraints*,

$$E + L(x) \geq 0, \quad (\text{RC1})$$

²⁴If $R(x)$ were smaller than 1, the entrepreneur's payoff might be positive even if the project fails. However, lending would be dominated by storage.

$$\int_0^\mu \Pi(x) dx \leq \mu E + \bar{x} (p_G Y_G - I). \quad (\text{RC2})$$

(RC1) says that a lender cannot lend more than his endowment. (RC2) implies that aggregate payoffs cannot exceed the sum of aggregate endowments plus the surplus produced by the entrepreneurs. (RC2) considers expected payoffs. More precisely, the condition must hold for each state of nature; however, considering expected payoffs suffices for our argument. Furthermore, the payments among agents must add up to zero, i. e., $\int_0^\mu L(x) dx = 0$ and $\int_0^\mu R(x) L(x) dx = 0$.

Finally, we consider only those allocations that satisfy conditions (3) and (4) from the main text. (4) ensures that storage is dominated by an investment in the capital market (hence, it can be interpreted as an *individual rationality* constraint). Given (3), entrepreneurs' payoffs are higher than lenders' payoffs; hence, the individual rationality constraint of the entrepreneurs is also satisfied.

The equilibrium allocation described in Proposition 1 can be characterized as follows,

$$\bar{x} = \mu E / I, \quad (\text{A1})$$

$$L(x) = \begin{cases} I - E & \text{if } x \leq \bar{x}, \\ -E & \text{if } x > \bar{x}, \end{cases} \quad (\text{A2})$$

$$R(x) = \bar{R}, \quad (\text{A3})$$

with \bar{R} as in (2). (A1) implies that the entire capital in the region of μE is invested in projects. (A2) means that entrepreneurs borrow exactly the amount necessary to carry out the project, and lenders lend their entire endowments. According to (A3), all debt contracts have the maximum incentive compatible interest rate, \bar{R} . The allocation leads to expected payoffs of $\Pi(x) = \underline{\Pi}$ for all $x \leq \bar{x}$, and $\Pi(x) = E \bar{R} = \frac{E}{I-E} p_G \frac{p_G Y_G - p_B Y_B}{p_G - p_B}$ for all $x > \bar{x}$. Because of (3), the payoffs for $x \leq \bar{x}$ (the entrepreneurs) are higher than those for $x > \bar{x}$ (the lenders).

(ii) We first show that the described allocation is admissible. With $R = \bar{R}$, (IC) is satisfied with equality. Moreover, all resource constraints are satisfied (again with equality). Individual rationality is guaranteed by conditions (3) and (4). Hence, the allocation is admissible.

We then confirm that the allocation constitutes a coalition-proof Nash equilibrium by showing that there exists no blocking coalition. Each member x of a blocking coalition must get a strictly higher payoff than $\Pi(x)$. If a group of entrepreneurs forms a coalition, some former entrepreneurs must become lenders. Given that interest rates cannot rise above \bar{R} due to (IC), this would lead to lower expected payoffs for these agents. Hence, entrepreneurs have no incentive to block. If a group of lenders forms a coalition, some of them become entrepreneurs. Again these cannot repay more than \bar{R} . Consequently, those lenders that remain lenders get an unaltered repayment. Because not everyone in the coalition is *strictly* better off, the coalition cannot block. Finally, a coalition among lenders and entrepreneurs is not possible because no entrepreneur will be willing to give up his status and become a lender. Consequently, the given allocation is coalition-proof.

(iii) Finally, we show that the equilibrium allocation is unique, subject to the qualifications mentioned in footnote 10.

A deviation from (A1) would imply that less than the entire capital is invested in projects. Then, due to (RC2), some lenders would get an interest rate below \bar{R} . These lenders could form a blocking coalition, in which all capital is invested: Some of them would become entrepreneurs, and the others would earn \bar{R} on their endowments. The arguments in (ii) show that this coalition is stable.

Consider now deviations from (A2). If the entrepreneurs borrowed less, they could not carry out the projects. Given the positive NPV of projects, all agents are strictly better off if the entrepreneurs borrow enough to carry out projects. If the entrepreneurs borrowed more, they could not pay an interest rate of \bar{R} on their loans. Then lenders could form a blocking coalition: Some agents would become entrepreneurs; payments would be as in (A2) and (A3); and every member of the coalition would be strictly better off. Hence, an allocation for which entrepreneurs borrow more than $I - E$ is not coalition-proof. Lenders cannot lend more than their complete endowment. Also, they will not lend less. Otherwise, they could form a coalition, lend more (and hence increase their own payoffs), and let some agents in the coalition become entrepreneurs (who would earn even more).

Finally, we consider (A3). Interest rates above \bar{R} would violate incentive compatibility. Interest rates below \bar{R} would imply that lenders could form a coalition; some would become entrepreneurs, and the others would lend at a rate \bar{R} , which would strictly increase payoffs. Hence, deviations from (A3) are not coalition-proof. ■

Proof of Proposition 2: We separately discuss the two regimes described in the proposition.

Consider first the case where $\mu_N(I - E_N) > \mu_S E_S$, i. e., the North is relatively large. We show by contradiction that the interest rate is equal to \bar{R}_N and that no Southerners are going to be entrepreneurs. Assume that a strictly positive measure of Northern entrepreneurs offer a rate below \bar{R}_N (a rate above \bar{R}_N is precluded by the moral hazard problem). Then there will be a blocking coalition of Northern lenders (who become entrepreneurs and can offer up to \bar{R}_N) and other lenders (Northerners or Southerners, who remain lenders, but get a higher interest rate than before). Southerners can never become entrepreneurs, because they can pay at most $\bar{R}_S < \bar{R}_N$. Hence, the coalition-proof equilibrium is determined by $R = \bar{R}_N$, and there are no Southern entrepreneurs.

Compared to autarky, welfare increases in the North because some Northerners who were lenders under autarky can become entrepreneurs under financial integration, which increases their rents due to credit rationing; for those who remain lenders or entrepreneurs, the rents are the same as under autarky. In turn, this implies that expected welfare decreases in the South because aggregate welfare remains constant. Note, however, that those Southern lenders who remain lenders benefit from the higher interest rates in the global capital market.

Now discuss the case where $\mu_N(I - E_N) < \mu_S E_S$, i. e., the South is relatively large. Then the interest rate will be equal to \bar{R}_S , and all Northerners plus some Southerners will be entrepreneurs. Assume now that a strictly positive measure of lenders

are promised an interest rate below \bar{R}_S . Then these lenders can form a blocking coalition: Some of them become entrepreneurs and pay the other members of the group \bar{R}_S , and everybody in the group is strictly better off. Assume alternatively that a strictly positive measure of entrepreneurs offer an interest rate \hat{R} above \bar{R}_S . These can only be Northerners because the Southern entrepreneurs can offer no more than \bar{R}_S . Then those Northerners who pay above \bar{R}_S can approach those lenders who are promised only \bar{R}_S and offer them a rate that is higher than \bar{R}_S , but still below \hat{R} . Everybody in this group is strictly better off, hence the group can form a blocking coalition. Finally, assume that a strictly positive measure of Northerners are lenders instead of entrepreneurs. Then these Northerners can approach some Southern lenders (who get a rate of \bar{R}_S) and offer them a slightly higher rate. Again, everybody in this group is strictly better off – the group blocks.

Financial integration decreases welfare in the South because some Southerners who were entrepreneurs under autarky become lenders under financial integration, which decreases rents under credit rationing. For those who stay lenders or entrepreneurs, the rents are the same as under autarky. Analogously to above, this implies that expected welfare increases in the North.

As argued in the text, an equilibrium in which Southerners lend only within the region is not time consistent because this would not be a coalition-proof Nash equilibrium in the second stage of the game. Southerners cannot commit to lending only to Southerners. The subgame perfect coalition-proof equilibrium is unique. This can be shown like in Proposition 1. This also applies to all other propositions and remarks. Summing up, the equilibrium is as described in the proposition. In both regimes, capital has flowed from the South (the poor region) to the North (the rich region), increasing expected welfare in the North, but decreasing welfare in the South. ■

Proof of Remark 1: We first show that a global private bank can do no better than to replicate the capital market outcome. We then analyze whether a private bank can specialize in serving one of the two regions and thereby deviate from the capital market.

If a global private bank sets the same interest rates as the capital market, it will make zero profits because its interest margin is equal to zero. If the bank tried to make a positive profit by offering a lower deposit rate, it would not be able to attract any deposits; this implies zero profits. If the bank instead demanded a higher loan rate from entrepreneurs, the entrepreneurs would take the risky projects. The lenders would anticipate the entrepreneurs' risk-taking and would again not be willing to deposit their funds at the bank. Hence, a bank that deviates from equilibrium loan and deposit rates (or bond prices) will end up with zero volume. In order to stay in business, the bank must offer the same rates as the capital market.

The question is then whether private banks can specialize in serving only one of the two regions. If $\mu_N(I - E_N) > \mu_S E_S$, the capital market offers lenders an interest rate \bar{R}_N . A private bank that finances only Southern entrepreneurs can offer a maximum deposit rate of \bar{R}_S . At this rate, it would not attract any deposits. A bank that invests in the North only replicates the capital market outcome. Only

those Northerners who cannot become entrepreneurs through the capital market would consider depositing at the private bank. Those who become entrepreneurs are indifferent between borrowing from the bank or in the capital market.

If $\mu_N(I - E_N) < \mu_S E_S$, the market rate is \bar{R}_S . A Northern private bank is not possible because it would not attract any deposits. All Northerners who do not receive loans from the bank would access the capital market. A Southern private bank only replicates the capital market outcome. Its loan business is restricted to those Southerners who could also become entrepreneurs through the capital market. If it granted more loans to the South, some Northern entrepreneurs would not be able to get loans. This outcome would not be coalition-proof; the Northerners without loans could approach Southern lenders and offer higher interest rates.

In both cases, regional banks replicate only the function of the capital market. In particular, they cannot help to prevent the capital drain. ■

The *proofs* of Propositions 3 and 4 and Remarks 2 to 7 are given in the main text.

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