Banks as Catalysts for the Big Push

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Abstract

A literature has developed to substantiate Rosenstein-Rodan's intuition that coordination of a critical mass of investments may induce industrialization through a 'big push.' This literature has essentially ignored the question of what economic institutions may overcome the coordination failures which give rise to an 'underdevelopment trap.' In this paper we propose that banks may act as a 'catalyst' for the 'big push.' Our work is motivated by historic evidence that suggest an association between a 'big push' and the emergence of large banks. We develop a model based on Murphy, Shleifer and Vishny (1989) and show that a 'large' bank with sufficient market power can induce the 'big push' by coordinating the investments of a subset of firms in the economy. This creates a critical mass of demand that induces other firms to invest as well. A bank may coordinate firms directly, but more importantly indirectly, that is through the terms of its loans, offering either a low interest rate or investment guarantees. We also show that a government might in principle improve on the private market outcome (by subsidizing a bank's coordination activities), but that problems of incentives, credibility and dynamic efficiency makes this difficult.

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What prevents economies from industrializing and growing? The automatic mechanisms implied by the neoclassical growth model were expected to stabilize development, shifting factors where they are most productive, and inducing investment in modern production techniques. The failure to industrialize of so many economies has proved them wrong, and has called for new approaches. These have come in the form of formalization of older ideas, which pay more attention to the interplay among sectors. The seminal work of Murphy, Shleifer and Vishny (1989) (MVS henceforth) was the first to formalize concepts developed by Nurske (1953) and Rosenstein-Rodan (1943), who noted that economic development may require a critical mass of investments to achieve industrialization through a 'big push.' In this view, the simultaneous investments by several firms become profitable even if no firm would profit from investing alone, whereas if firms fail to coordinate expectations, the economy may get stuck in an 'underdevelopment trap.' MSV modeled the cause of this multiplicity of equilibria as aggregate demand spillovers, a form of pecuniary externality stemming from an income effect. The Marshallian notion of 'external (technological) economies' has also been recently revived. Marshall (1920) noticed that the simultaneous growth of related sectors, especially in the case of intermediated goods, increased the general growth of the economy. An economy where enough 'key' sector take off, will develop smoothly, whereas an uncoordinated start may throw the economy in a vicious circle of poverty. Helpman and Krugman (1985) were the first to formalize this argument, through technological non-pecuniary externalities, which has become popular in regional and international economics.

A number of models have shown that industrialization may fail to occur not for (or not only for) scarcity of resources but for lack of coordination and investors' confidence. Matsuyama (1995) and Rodrìguez-Clare (1996b) give excellent and comprehensive surveys of this literature. Kiyotaki (1988), for instance, derives a model of monopolistic competition and increasing returns with multiple Pareto-rankable equilibria. Just as in MSV, the level of investment of individual firms depends on their expectations of future aggregate demand, which is itself a function of the investment decisions of the individual firms.[1] Matsuyama's (1992) dynamic extension of MSV makes the important point that a critical amount of entrepreneurship (defined as responsiveness to investment opportunities) is necessary to allow for a take-off. When entrepreurship is too scarce any attempt of coordination is doomed to fail. Ciccone and Matsuyama (1996) and Rodríguez-Clare (1996a) both introduce the explicit consideration of of non-tradeable (specialized) intermediate inputs which induce pecuniary externalities.[2] Ciccone and Matsusyama use start-up costs to show that an economy with a poor endowment of intermediate inputs will be

[1] In the same spirit, Fafchamps and Helms (1996) provide another specification of a 'big push' model, now based on pecuniary externalities in local (regional) demand.

[2] Okuno-Fujiwara (1980) also considers non-traded inputs as a source of multiple, Pareto-rankable, equilibria. In his model firms in the intermediate sector compete *à la* Cournot, and the pecuniary externality is the reduction in mark-up due to new entrants.

caught up in a vicious circle of poverty. Rodríguez-Clare, instead, shows that the assumption of a closed economy is not essential for MSV, which can be generalized to the case of a small open economy when there are non-tradeable inputs. Technological externalities without pecuniary externalities have been analyzed, for instance, by Azariadis and Drazen (1990), Durlauf (1993), Fujita (1989), and Matsuyama (1991), though their 'intangible' nature makes them less attractive to many economists. These and other contributions have uncovered the conditions under which an economy would find itself in an 'underdevelopment trap.' Yet, they have said little on how can we remedy the failure to coordinate, so that an economy stuck in the trap can achieve the 'big push.' This question has received surprisingly little attention so far, despite its being of great importance to theorist and policy makers alike.[3] Cooper and John (1988) review several macroeconomic models which propose remedies to coordination failures, whose typical conclusion is simply that there may be a role for government to coordinate investments. As MSV (p.1019) put it: "The inefficiency of the unindustrialized equilibrium raises the possibility of a government role either in encouraging agents to invest or, alternatively, in discouraging current consumption." This argument is clearly incomplete. It fails to address how coordination can be achieved and under what circumstances. It also ignores the possibility that private institutions may play a role in achieving coordination. Our contribution is to construct an argument that looks at how private economic institutions, motivated by profits, may help achieve a 'big push.' We provide a framework that is general enough to encompass both Marshallian (technological) and pecuniary externalities.

To motivate our effort, we take a look at history. Even a cursory look at the past suggests that in many countries banks played a significant role in process of industrialization. In particular, the emergence of private 'industrial' credit banks in 19th century continental Europe is considered to have been a major contribution to the industrialization of these countries. The historical evidence we provide suggests an association between rapid industrialization and the emergence of large and influential banks. This brings up the question of whether there may actually be a causal link between the presence of these large banks and growth. In the main part of this paper we take up this question at the conceptual level, and provide an economic argument that suggests large banks may be instrumental in fostering industrialization. We stress that our argument applies only to the role of banks at the early stages of industrialization. We provide a model which allows for both pecuniary and technological externalities, and where firms nee to finance their investments. We ask if banks can help induce industrialization by coordinating investment decisions. To do so we use a simple bank price leadership model, which allows us

[3] An exception is Ciccone and Matsuyama (1996), who remark that resource constraints, typically ignored by this literature, may impair coordination. In their model, for example, start-up costs may prevent entrepreneurial optimism to induce profitable coordinated investment.

to parameterize the degree of bank market power. Our main finding is that banks can be a 'catalyst' for economic growth. Through the terms of their loans, banks can induce a selective subset of firms in the economy to invest. This changes other firms' expectations, and they decide to invest as well. In order to function as a catalyst, a bank needs to satisfy two requirements. It has to be sufficiently large relative to the economy, so as to be able to finance a critical mass of firms. And it needs a sufficient amount of market power to recoup the costs of inducing coordination.

SAY BANKS PARTICULARLY FITTING.....

We examine alternative ways in which banks can induce industrialization. Banks are particularly suited for coordinating because they can do so through the terms of loan contracts. We show that banks can offer loan contracts at terms that induce firms to invest simultaneously even if they cannot communicate with each other. A large bank can offer loans with low interest rates, or loans which shelter entrepreneurs from the risk of losses ('guarantees'). Such loans induce some firm to invest irrespective of other firms' decisions. Once a critical mass of firms have invested, others follow suit. The bank incurs losses on these loans, but if it is large enough, and with sufficient market power, it can recoup them from the profits it makes on all other firms, once industrialization happens. We show that the cost to the bank of providing incentives is the forgone interest in case of low interests, and the cost of adverse selection in case of risk guarantees. Beyond the terms of contracts, we show that banks can induce coordination also by directly facilitating communication between firms. Again, a 'large' size and 'sufficient' market power are necessary for the bank to engage in coordination.

Our analysis thus shows that private banks may be well suited to achieve coordination. This brings us back to the question of whether a government can do better than private institutions. We show that a benevolent government could in principle correct for externalities by subsidizing a public 'development bank,' and recovering the subsidies with a non-distortionary tax on profits. We also discuss why government intervention, which completely crowds out the private financial market, may in reality be less appealing than suggested by our simple formal analysis.

The remainder of the paper is structured as follows. Section 1 discusses the historical evidence. Section 2 develops the basic model, establishes the multiplicity of equilibria and explains why we need credible coordination for achieving the 'big push.' Section 3 analyzes how a bank can induce industrialization. Section 4 examines a possible role for a public bank, and is followed by a brief conclusion.

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1 Banks and the 'Big Push:' some Historic Evidence

A recurrent theme in the economic history literature is the association between episodes of sudden and sustained industrialization, and the presence of large, powerful, banks. In his seminal work on economic development, Gerschenkron (1962, p.45) wrote that '[t]he focal role in capital provision in a country like Germany must be assigne not to any original capital accumulation but to the role of credit-creation policies on part of the banking system' Rondo Cameron wrote about Belgium: '[S]ubsequently [to 1830] the economy entered a period of explosive growth accompanied by the development of a unique set of banking institutions.'[4] Schumpeter gave German *Kreditbanken* large credit for having taken an entrepreneurial attitude and fostered the rise of large industries.[5] Not only have economic historians noticed the frequent association of 'big banks' with 'big pushes,' they have also documented in detail the active role that banks often undertook in spurring industrialization and coordinating investments.[6]

In this section we motivate our analysis by briefly surveying some suggestive cases. focussing focus on the industrialization of some European countries in the 19th century, For each case we show how the emergence of large banks operating in oligopolistic financial markets corresponded to the attainment of an economic 'big push.' We describe how such banks were coordinating investment activities, and focused their lending to high growth sectors.

Belgium, the first country to follow Britain in the Industrial Revolution achieved its 'big push' over the two decades between 1830 and 1850. Over this period, its GNP grew at an yearly average 2.5%, well above the 1.4% European average.[7] Industrialization transformed the structure of the economy, until then based on small firms engaged in traditional productions, like textiles and handicrafts.[8] Between 1830 and 1860 its industrial capacity grew at an average 4.4%, more than the double of the previous thirty years.[9] Modernization was most intense in the heavy industries. Between 1830 and 1850 coal mining grew at an yearly 5.3%, zinc mining at 20.0%, and steam engines at 7.9%.[10] Critical to this success was the action of two banks. The Société Générale pour favoriser l'industrie nationale was the world's first joint stock investment bank, created in 1822 and active in industrial finance by the early 1830s. The Banque de Belgique was founded in 1835, and engaged in industrial finance from the outset.[11] These two

[4] Cameron (1967), p.129.

[5] Cfr. in particular Schumpeter [1939], ch.VII, section 7.

[6] A literature on financial and history which has by now developed, of which Cameron and Gerschenkron were the forerunners.

[7] Bairoch (1976a), p.281. These two figures in per capita terms are 1.6% and .8%, respectively, p.286.

[8] Chlepner (1930) p.6-8.

[9] Bairoch (1982), p.292.

[10] Cameron (1967), p.148. Railways played a lesser role at this stage of the belgian industrialization, though in these two decades 850 km were built, Mitchell (1980), tab G1.

[11] On the development of the Belgian financial sector cfr. Cameron (1967), Chlepner (1926,1930,1943), Morrison (1967), Société Générale de Belgique (1922), and Wee (1981).

banks dominated the banking sector, their capitalization accounting for about two thirds of that of all industrial banks.[12] They were complemented by several smaller industrial banks, which operated mostly locally.[13] Firms in fast growing industries started quickly adopting corporate form in order to raise large amounts of external finance.[14] Both banks assisted them, and actively encouraged firms to incorporate.[15] This was important because incorporation reduces the risk born by entrepreneurs and makes it easier to raise external finance. Between 1835 and 1838 alone, the Société organized 31 such *sociétés anonymes*, and the Banque 24, for a combined capital of 154 million Francs.[16] As Cameron (1967, p.145) put it: 'banks did not respond passively to demand for credit, but actively sought new firms, underwrote their stock issues, financed potential stockholders, held stock in their own names, placed their officers on the board of directors of the companies they promoted, and ministered to the companies' needs for both working capital and new capital for expansion.'[17]

Banks identified industries with high potential for growth, to which they extended credit and in which bought sizeable equity participations, another way to reduce entrepreneurial risk. Moreover banks carried over an intense activity of coordination of industrial activities. For this purpose they came up with an important innovation: financial trusts.[18] Financial subsidiaries and financial trusts enhanced information circulation, and thus the coordination of investment decisions by otherwise scattered entrepreneurs.[19] Coordination was intense: bank managers consulted their clients on business strategies, and were even dispatched to them as financial managers.[20]

Germany is often cited as the quintessential case of bank driven development. Between 1850 and 1870 the German economy experienced a quick industrialization which allowed it to become the first economic power on the continent. In this period its GNP grew by an yearly average of 2.4%, well above the 1.9% European average, and its own 1.6% in the previous two decades.[21] Between 1860 and 1880 its industrial capacity grew at an yearly 4.6%, up from 1.7% in the

[12] Durviaux (1947), p.56.

[13] Cfr.Cameron (1967), p.134-6, and Chlepner (1930), p.21-24. At least seven such banks appeared in the late 1830s: the Banque Liégeoise, the Banque Commerciale d'Anvers, the Banque d'Industrie, the Banque de Flandre, the Banque Fonciére, the Caisse Hypotécaire, and the Caisse de Propriétaires, Chlepner (1930), p.61-3.

[14] Morrison (1967), p.64, and Chlepner (1943), p.8-9.

[15] Chlepner (1930), p.21. Six industrial *sociétés anonymes* (joint-stock companies) existed in 1830, which became 150 in 1839, and 200 in 1857, Cameron (1967), p.130, Morrison (1967), p.61. Durviaux (1947), p.53, gives a detailed sectoral breakdown.

[16] Cameron (1967), p.145. Of the 1 billion francs of industrial joint stock capital in 1860, the Société Générale controlled about 20%.

[17] Similar concepts are found in Chlepner (1930), p.35.

[18] The Société created one subsidiary and three investment trusts. The Banque created two subsidiaries and two investment trusts, Morrison (1967), p. 64-5. Chlepner (1930), p.10-2 and 36-7, describes their role.

[19] Wee (1981), p.6.

[20] Cfr Chlepner (1926), p.86-7, Chlepner (1943), p.14, and Wee (1981), p.5-6.

[21] Bairoch (1976a), p.281. In per capita terms the growth of GDP was 1.6% in Germany and .9% in Europe, p.286.

previous thirty years,[22] and was concentrated in heavy industries. Between 1858/4 and 1870/74 the industrial production nearly doubled its share of NNP, from 21% to 31%.[23] Its production of coal increased fivefold, and that of pig iron sixfold, spurred by the growth of its railways, which increased more than threefold.[24] The German industrial credit banks, *Kreditbanken*, had a similar role in industrial development as in in Belgium, combining commercial and investment banking activities, and nurturing close personal relations with industry leaders.[25] Of the 40 *Kreditbanken* founded between 1848 and 1870, four accounted for most of the industrial credit activities: the Schaaffhausen Bankverein, the Disconto Gesellschaft, the Bank für Handel und Industrie and the Berliner Handelsgesellschaft. Their capitalization accounted for nearly half of the total, the smaller banks operating locally, and often controlled by these larger ones. Between 1851 and 1870, 259 firms incorporated (up from 102 in the previous 24 years), almost always with the help of an industrial bank.[26] Incorporation was a necessary step to raise funds through securities. Together with *Privatbankiers*, which were their main shareholders, industrial banks dominated the activity of stock exchanges, thus making it easier for their clients to issue bonds and equity.[27] *Kreditbanken* also invested directly in the firms they promoted, obtaining directorships in proportion to their holdings. The capital of the four leading *Kreditbanken* amounted to 68 million Marks at the time of their foundation. By 1872 it had grown to 173 millions, a very large sum, about 1.4% of the net National Product.[28] Deposits represented only about 16% of these banks' capital, as it was their policy to invest and lend mostly from own funds.[29] Direct participations in industrial firms amounted to about 25% of the capital, by 1870.[30]

The activity of Kreditbanken concentrated in the high growth regions and industries: mining, machinery, textiles, construction, and above all railways. These industries were centred in the Rhineland, the Ruhr, Silesia and Saxony. The very personal nature of their business relationships allowed them to elicit and circulate information among industrial leaders very effectively, and to have strong influence on investment decisions.[31] As Richard Tilly (1967, p.181) argued:

[22] Bairoch (1982), p.292.
[23] Hoffmann (1965), p.33.
[24] Mitchell (1980), tables E2,E8,G1.
[25] Cfr. Da Rin (1996), and the references there cited.
[26] Riesser (1911), p.38. In both periods incorporations were subject to the discretionary approval of the government. Firms then often assumed unincorporated limited liability form (*Kommanditgesellschaft auf Aktien*). *Kreditbanken* were also supporting such firms.
[27] Riesser (1911), p. 62-6 details the operations of some banks.
[28] Riesser (1911), appendix III.
[29] Riesser (1911), p.71-7.
[30] pohl (1982), p.146.
[31] Da Rin (1996) provides evidence of such close links and their effect on investing decisions. As the first report of the Bank für Handel und Industrie said: '[the bank] is fitted to assist to the fullest extent of its powers in directing capital and the spirit of enterprise into the channels corresponding to the requirements of the moment,' Riesser (1911), p.49.

'the contribution of German bankers to the mobilization of capital operated not only on the supply side but on the demand side as well; by organizing and allying themselves so closely with industrial enterprises, bankers strengthened and in part represented the demand for investment funds.'

The last case we consider is Italy, which industrialized rapidly between the early 1890s and world war I. Between 1893 and 1913 industrial output grew at an yearly 4.8%, up from .5% in the previous two decades. GDP grew at 2.5%, up from .6%, well above the European average of 1.3%.[32] The average annual growth rate of manufacturing production (1896-1913) ranged from 4.0 to 6.2% according to different estimates. Between 1894 and 1913 the yearly growth rates were 15% in electricity, 12.9% in chemicals, 10.7% in iron and steel, 7.5% in engineering, all higher than in other European countries.[33] The share of producers' goods on total production rose from 28% to 47%.[34] Private industrial banks (*banche di credito ordinario*) played a key role in channeling savings towards industrial high growth sectors and in influencing the direction and timing of investments. For example, they spurred investment in electricity, mechanical engineering, metals, and automobiles, while they overlooked traditional and less promising industries like textiles. Also, they coordinated their effort towards firms in the Northern region (the 'triangle') between Genova, Torino and Milano.[35] The Banca Commerciale was founded in 1894 and the Credito in 1895, both with participation of German banks, whose policies they set to follow.[36] The Banca Commerciale and the Credito dominated a handful of smaller industrial banks. Nearly 60% of the assets of all industrial banks belonged to the two leaders, of which two thirds to the Banca Commerciale.[37]

As in Belgium and Germany, Italian industrial credit banks engaged in both commercial and investment banking activities.[38] Between 1894 and 1906 the Banca Commerciale took part in 145 capital market operations (flotations, mergers and acquisitions, capital increases, debt conversions), and the Credito Italiano in 84.[39] This had a deep impact on firms' attitude towards incorporation. Between 1900 and 1913 Italian joint stock companies grew almost fourfold from

[32] Fuà (1965), tab.1 and 3. Similar data are in Gerschenkron (1962), p.75. Toniolo (1988), p.18, discusses the reliability of different estimates. The European average is for GNP, between 1890 and 1913, Bairoch (1976a), p.281.

[33] Cohen (1967), p.364.

[34] Romeo (1972), p.68.

[35] Aleotti (1990), p.58-60.

[36] Confalonieri (1980), vol. 2 and 3, details the origins of Italian banks, the participations of German banks and the dependence on these, especially for the flotation of new issues. Cfr also Cohen (1967), p.366-8.

[37] The assets of all industrial banks increased by 2.5 times over the two decades, Cohen, (1967), p.78. Confalonieri (1980), vol.3, provides a thorough discussion of the evolution of the Italian financial system.

[38] As we can read in the early reports of the Banca Commerciale, the bank strived to be 'active part ... in all the major and worthy signs of the economic development in our country,' Confalonieri (1980), p.42, our translation.

[39] Confalonieri (1980), vo.2, p.341-5.

848 to 3,069.[40] Even more important was banks' effort in bringing firms to the stock exchange, as this allowed them to raise large funds. Between 1900 and 1907 joint stock companies raised about 2.7 billion lire, most of these on the stock exchange.[41] In 1897 there were 30 listed companies in the Milano Stock Exchange, which grew fivefold to 169 by 1908. Most of these were firms in industry: electricity, transportation, and textiles.[42] Like the Belgian banks with investments trusts, the Banca and the Credito managed their industrial participations through subsidiaries. They usually did so by acquiring control in industrial companies, which they used as holdings companies. They focused on the fast growing industries: electric, chemical, and iron and steel industries.[43] As Gerschenkron (1962, p.88) noticed, '[a]s in Germany, not only capital, but a good deal of entrepreneurial guidance was channeled to the nascent and expanding industrial enterprises. As in Germany, the policy was to maintain an intimate connection with an industrial enterprise and to nurse it for a long time before introducing it to the capital market.'

These examples illustrate the emergence of large and powerful 'industrial banks' at the onset of industrialization, and their intimate connection with the quick f heavy industry. A causal link is hard to establish, whichever way it may go. Our contribution is more simply to provide a first conceptual framework with which to frame the prblem.

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2 A Model of the Big Push

2.1 The Basic Model

Our model is a modification of the 'dynamic model of investment' which MSV develop in their section V, to which we refer the reader for details. We modify that model in two main respects. First, we introduce financial intermediation to account for the need to mobilize funds for industrialization, as entrepreneurs typically have only limited wealth. Second, we assume that the technological efficiency of industrialization is not constant across sectors. This allows us to examine how many sectors industrialize when the Big Push occurs.

Our economy lasts two periods, and its representative consumer has preferences defined over a (time invariant) unit interval of goods indexed by q. Let $x_t(q)$ the quantity of good q she

[40] Aleotti (1990), p.61.

[41] Aleotti (1990), p.67.

[42] Aleotti (1990), p.62.

[43] Some such cases were: Società Edison (BCI), Vizzola (BCI), and Società Industrie Elettro-Chimiche (CI); Unione Italiana Concimi (CI) and Montecatini (CI); Ferriere Italiane (CI), Società Elba and Acciaierie Terni (BCI), and Acciaierie Savona (BCI). Confalonieri (1980), vol.3, chapter 3, details their history, as well as Cohen (1967), p.378-80, and Romeo (1972), p.77-8, and 83 ff. To a lesser extent holding companies were used to coordinate bank activities in the mechanical industry, through Officine Meccaniche (BCI and CI) and Pattison (CI), and in steamship, through the SocietÒGenerale di Navigazione Marittima (BCI), Confalonieri (1980), vol.2, p.355-60.

consumes in period t. Her utility function is:

$$U = \left(\int_0^1 x_1^\gamma(q)\,dq\right)^{1/\gamma} + \beta\left(\int_0^1 x_2^\gamma(q)\,dq\right)^{1/\gamma}$$

where $1/(1-\gamma)$ is the elasticity of substitution between different goods within a period, and β the rate of time preference.[44] At a given deposit rate $(1+r)=1/\beta$ the representative consumer is thus willing to save any part of her income. She is endowed with L units of labor each period, which she offers inelastically at a wage normalized at 1. She also retains any profits in the economy.

There are two technologies available. The 'traditional', constant returns to scale, technology transforms one unit of labor into one unit of output.[45] It can take place each period. The 'industrial', increasing returns to scale, technology transforms one unit of labor into $\alpha(q) > 1$ units of output. We assume that in each sector q the traditional technology is employed by a competitive fringe of firms, and that only one firm can adopt industrial production.[46] We thus use the terms firm and sector interchangeably. To adopt the industrial technology a firm has to invest a sum F in the first period, which allows it to produce in the second period.[47] We assume $\alpha(q)$ to be differentiable, and we index sectors by productivity, so that the higher q the less efficiently goods are produced: $\alpha_q \equiv d\alpha/dq < 0$. We assume that for each firm q is private information.

While traditional producers can self finance, a firm which industrializes needs to borrow. We assume that banks can only issue debt. Each firm is endowed with $F_o < F$ own funds, and needs to borrow $F_b = F - F_o$. We denote the lending rate by i, so that a firm which borrows has to repay $(1+i)F_b$ in the second period. This contrast with MSV, who assume that F can be put aside during the first period without need for external finance. We assume that $\alpha(0) < 1/\gamma$, so that the price the monopolist charges is 1: by charging a higher price it would lose its customers to the competitive fringe, and by charging a lower one, it would not gain enough new clients.[48]

Let y_t be the aggregate income in period t. Each good is equally expensive and has the same expenditure share within a period, so the consumer can be thought of as spending y_t on each

[44] We assume infinite intertemporal elasticity of substitution between the two periods. This fixes the deposit rate and allows us to concentrate on the lending side of banks, as the financial structure does not affect the cost of capital for banks.

[45] Labor can be thought of as working capital at large.

[46] This is a simple way to capture the idea that modernizing firms acquire some degree of market power. Allowing for oligopolistic structures would complicate the analysis without modifying the insights.

[47] There is no uncertainty in the model about the future outcome of the investment. Uncertainty only regards the future level of demand, as determined by the measure of firms which industrialize.

[48] This assumption allows us to concentrate on the spillover effect. With a 'low' elasticity the monopolist makes a profit by producing at low cost, and by selling the 'competitive' quantity at the competitive price. Should the elasticity be 'high' enough, it would produce more and sell at a lower price, thus weakening the spillover effects. For a discussion of the role of demand elasticity, cfr Shleifer and Vishny (1988).

good $x(q)$. In the first period there is no industrial production, and investment absorbs real resources:

$$y_1 = L + F - q^* F = L + (1-q^*)F$$

where q^* is the number of firms which industrialize. In the second period industrialized firms earn (aggregate) profits Π, so that:

$$y_2 = L + \Pi$$

The profit margin, or mark up, of a firms is $a(q) \equiv 1-1/\alpha(q)$. Then the present value of the profits of a firm producing good q, when income is given at level y_2, is:

$$\tilde{\pi}(q, y_2, i) = \beta\,[a(q)y_2 - (1+i)F_b]$$

This function determines the participation constraint of each firm: if $\tilde{\pi}(q, y_2, i) \geq F_o$, firm q industrializes, otherwise it retains the traditional technology. Since $\alpha_q < 0$, it follows that $a_q \equiv da/dq < 0$, and $d\tilde{\pi}(q, y_2, i)/dq < 0$. Therefore, for a given income level, firm q finds it profitable to industrialize only if all $q' < q$ also do. To determine which is the marginal sector to industrialize, we define the profit function of the *marginal* industrialized firm as:

$$\pi(q, i) \equiv \tilde{\pi}(q, y_2(q), i) = \beta\,[a(q)y_2(q) - (1+i)F_b] = \beta\left[\frac{a(q)L}{[1-A(q)]} - (1+i)F_b\right]$$

where we use:

$$y_2(q) = L + \Pi = L + \int_0^q y_2(q)\,a(q')\,dq' = \frac{L}{1-A(q)}$$

and:

$$0 \leq A(q) \equiv \int_0^q a(q')\,dq' \leq 1$$

$A(q)$ is the aggregate savings in labor due to industrialization of q firms. Thus $1/[1-A(q)]$ is an income multiplier: the higher is q, the more labor is freed up, and the higher is aggregate income. Differentiating $\pi(q, i)$ with respect to q we get:

$$\frac{\partial \pi}{\partial q} = \beta\left[\frac{a^2(q)L}{[1-A(q)]^2} + \frac{L}{1-A(q)}\,a_q\right]$$

The (positive) first term accounts for the fact that as q rises, more firms industrialize, shifting income from the first to the second period, and increasing their profits. This is the demand externality effect that MSV stress. If the efficiency of industrialization declines in q, we also have a (negative) second term, which accounts for the decreasing profitability of the marginal firm ($a_q < 0$).

The interest rate charged by banks will depend on the structure of financial markets. We

use a price-leadership model that allows for a simple one-dimensional parameterization. At the two extremes there are a competitive financial market, where the lending rate, i_c, equals the deposit rate, r, and a monopolist bank, which charges a profit maximizing interest rate, i_m. The monopolist charges a uniform price to all borrowers due to asymmetric information: he does not know the value of q for each borrower.[49] As an intermediate case we consider a bank which behaves like a price leader constrained in its behavior by a fringe of competitive (small) banks, and charges an interest i_l.[50] The lead bank has unlimited access to funds. The competitive banks have access to a limited amount Z of funds, with which they can finance $z \equiv Z/F_b$ firms. The cost of funds is r for all banks under any financial structure. The timing of the financing game is as follows. The lead bank offers its contracts. The fringe banks make their offers. All firms can observe these offers. They choose whether to invest, and if so, which contracts to accept. The competitive and monopolistic cases are then simply the extremes for the price leadership model. When $z = 0$ we have the monopoly case, and when $z \geq q^*(i)$ we have the competitive case.[51]

2.2 Multiple Equilibria

We first examine the model with perfect competition in the financial market, so that $z \geq q^*(i)$, and $i = r$. We focus on the case where two equilibria exist. Either industrialization occurs (*Industrialization Equilibrium*, IE), or the economy is stuck with traditional production (*Backward Equilibrium*, BE). Since $\tilde{\pi}$ is decreasing in q and r, the following condition guarantees the existence of a BE:

$$\pi(0, r) = \tilde{\pi}(0, L, r) < F_o \tag{1}$$

To ensure also the existence of the IE, we assume the existence of at least one sector for which industrialization is profitable:

$$\exists\ \hat{q} \in (0, 1)\ \ s.t.\ \pi(\hat{q}, i) > F_o \tag{2}$$

for at least some i.

Proposition 1 *With perfect competition in the financial markets, and under conditions* (1)–(2)*, there exist at least two Nash equilibria in the economy. In the Backward Equilibrium no firm*

[49] A discriminating monopolist can be shown to achieve the social optimum.

[50] We now omit the subscript referring to the financial structure in the interest rate. Unless stated otherwise, i refers to the rate charged by the lead bank.

[51] A model of bank oligopoly would substantially complicate the formal analysis without adding much insight. The main notion that we rely on is that the lead bank has some market power. In an oligopoly one bank may have such market power by itself, or alternatively it may be relatively easy for a small set of oligopolist to coordinate, to jointly achieve a sufficient level of market power.

industrializes: $q=0$. *In the Industrialization Equilibrium* $q^*(r)$ *firms industrialize, where* $q^*(r)=\overline{q}\equiv\max\{q:\pi(q,r)=F_o\}$.

Proof. Conditions (1) and (2) imply the existence of two values, $\underline{q}<\overline{q}$ such that $\pi(\overline{q},i)=\pi(\underline{q},i)=F_o$ for each i, as in Figure 1 below. Consider first the BE. If no firm is industrializing, condition (1) ensures that no firm would deviate to industrialization, thus $q=0$. Consider then the IE. If $\overline{q}$ firms industrialize, none of them profits from deviating to traditional production (which yields zero profits), and no firm with $q>\overline{q}$ would deviate to industrialization, as it would violate its participation constraint. Thus $q^*(r)=\overline{q}$. □

For expositional convenience, we will concentrate on a single peaked shape of $\pi(q,i)$, which becomes negative for q high enough, as depicted in Figure 1: $\pi(q,r)$ first increases (income effect dominant), reaches zero at a value $\underline{q}$, becomes positive, achieves a maximum and then decreases (efficiency effect dominant), reaching zero at a value $\overline{q}$, and eventually becoming negative. The advantage of looking at this particular shape is that there are exactly two equilibria. Multiple equilibria would affect our analysis only insofar as there would be additional uncertainty about the level of industrialization.

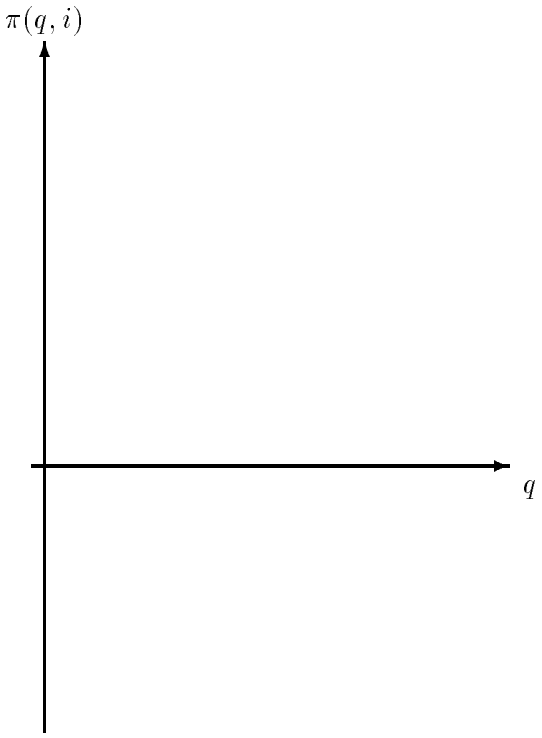

Figure 1

Figure 1 shows that there may exist some sectors q which do not industrialize, even when some $q'<q$ do. This is an implication of $a_q<0$ and of the existence of financial costs. Thus our

framework enables us not only to determine the conditions for IE to arise, but also to measure the intensity of industrialization.

Note that for a *given* number of industrializing firms, aggregate income is unaffected by the interest rate, which merely redistributes it. The interest rate, however, shifts vertically $\pi(q,i)$, and so affects firms' incentives to industrialize. Thus, inasmuch as the financial market structure affects interest rates, it will also affect aggregate income and the extent of industrialization.

2.3 The Social Planner Solution

Before proceeding in the analysis, we consider the benchmark case of a social planning solution to the problem. We take as given the monopolistic structure in the product markets, and use the net present value of total income (as a function of q) as our measure of social welfare (SW):

$$SW(q) = (1+\beta)L + (1-q)F + \beta\int_0^q a(q')y_2(q)\,dq'$$

the social planner maximizes welfare by choosing a value q^*_{SP} determined by the F.O.C.:

$$\frac{dSW}{dq} = \beta a(q)y_2(q) - F + \beta\int_0^q a(q')\frac{dy_2(q)}{dq}\,dq' =$$

$$= \beta\left[a(q)y_2(q) - (1+r)F_b - (1+r)F_o\right] + \beta\left[a(q)\frac{A(q)L}{[1-A(q)]^2}\right] = 0$$

the first term measures the (positive or negative) social benefit of the marginal firm, which takes into account the value of foregone consumption; the second term indicates the (positive) income externality effect generated by the marginal industrialized firm on the level of demand for all industrialized firms. Consequently, we either have a corner solution ($q^*_{SP} = 1$), if dSW/dq is positive for any q, or an interior solution.

Proposition 2 *In the Industrialization Equilibrium a smaller measure of sectors industrializes than socially optimal:* $q^*(i) < q^*_{SP}$.

Proof. The proposition simply follows from observing that the first order condition for the social optimum evaluated at $q^*(i) = \overline{q}$ is positive, as $\pi(\overline{q}, r) = F_o$. Thus $q^*(i) < q^*_{SP}$.

□

Note that this result depends on our assumption that $\pi(q,i)$ becomes negative for q sufficiently large. Should $\pi(q,i)$ remain always positive for large q, the two solutions would coincide at $q = 1$.

2.4 The Need for Credible Coordination

The existence of the BE is a coordination failure. By (1) no firm has an incentive to undertake the costly investment to industrialize if it believes that the others are not industrializing as well. In the IE, on the other hand, it is assumed that coordination occurs spontaneously. In many actual economic situations it is hard to see why firms would independently change their expectations on others' investment decisions.[52] We therefore focus on the cases where the IE does not occur spontaneously, i.e. firms do not invest due to their negative expectations. It is worth stressing that the multiplicity of equilibria is determined by expectations, not by exogenous parameters, or past values of the variables.[53]

To break the expectations that sustain the BE requires that an agent takes an action that is interpreted by firms as a signal that the BE is now replaced by the IE. Whether or not people react to a signal depends on its credibility. We define as a 'credible signal' an action that eliminates the BE as an equilibrium. Firms can no longer have a rational belief that investment is unprofitable because of low demand. We insist on need for a 'credible' signal. Any publicly observable signal, even without content (like a 'sunspot'), could indeed induce coordination. But there is no particular reason to believe it would, since the BE always remains as a possible equilibrium. A 'credible' signal, by contrast, will always induce coordination, since the BE is no longer such.

The question we ask is which economic institutions will be able to provide a credible signals that allows coordination. To send such a signal an agent must take an action that eliminates the BE. Such actions are in general costly. This implies that the coordinating agent not only needs to have the ability but also the appropriate incentives to give a credible signal.

We submit that banks are a natural candidate as coordinating agent.

This for at least two reasons. First, by the nature of their risk-sharing activities, banks are in contact with a large number of firms. And they may have preferential access to sensitive financial and business information, which may lower their cost of identifying the right firms to coordinate. Second, through the provision of funds, banks can influence firms decision to invest.[54]

If banks have the ability to act as a coordinating agent, we need to ask under what condition they also have the right incentives. These incentives depend critically on the financial market structure. To set the stage for the next section it is worth restating an implication of proposition

[52] This would be particularly true in a dynamic interpretation of the model, where the economy has been using the traditional mode of production for a long time.

[53] On the role of history and expectations in models with multiple equilibria, cfr Krugman (1991).

[54] We do not want to suggest that banks are the only possible coordinating agent. We discuss the government as a coordinating agent in section 4. An interesting topic for future research would be to examine the role of conglomerates.

1:

Corollary to Proposition 1 A perfectly competitive financial market, i.e. where $z \geq q^*$ cannot eliminate the Backward Equilibrium.

Proof. In a perfectly competitive financial market no bank can raise the interest rate above $i = r$. The result follows then from condition (1). Even the most efficient firm finds it unprofitable to industrialize under competitive financial conditions, that is when $i = r$. □

The intuition for this result is simple. In a perfectly competitive market banks are small and have no leeway to change the financial incentives of firms, since they can only offer the competitive rate of interest. Notice that this result also applies to a notion of an 'efficient' equity market. The decentralization and anonymity of security markets makes coordination impossible. In the next section we examine what departure from the competitive market will allow banks to become a coordinating agent.

3 Coordination Through Private Banks

We have emphasized that coordination requires actions by some agent able to send a credible signal that the BE is no longer an equilibrium. In this section we examine how a bank may take such actions. The big advantage of banks is that they need not establish an explicit communication channel with each individual firm, in order to coordinate. They can do so through the contractual terms of their loans. They can use two such variables: the interest rate, and the amount of capital risked by the entrepreneur. In both cases a 'favourable' contract induces some firms to invest even with pessimistic expectations on others' decisions. Once a critical mass of firms is so induced to invest, the others will follow suit, and the BE is eliminated. We examine these mechanisms in sections 3.1 and 3.2, and derive conditions for their feasibility. In section 3.3 we also consider a 'direct' coordination mechanism, where the bank sets up a communication channel for agents to communicate with each other to coordinate their expectations. In general we expect such communication to be costly. We examine the conditions under which a bank would be willing to incur the costs of setting up such a communication network.

3.1 Indirect Coordination: Low Interest Rates

A bank has an important advantage as a coordinating agent. Through the terms at which it lends, the bank can influence firms' investment behavior. We now examine how the bank can use financial contracts to achieve coordination indirectly. A bank can offer two types of such incentives. First, it can lower the interest rate i charged on the loan F_b. Second, it can lower the amount of entrepreneurial wealth at stake. If the bank lends $F_b + (1-\theta)F_0$, where $\theta \in (0, 1]$, the firm needs to contribute only θF_o. Offering a cheap loan to some firms is our first type of

indirect coordination. When $\theta = 0$, instead, the bank is providing all the capital. This is our second type of indirect coordination, which gives rise to a problem of adverse selection. We examine it in the next subsection. Without loss of generality, we assume that the bank charges a rate r on the additional funds $(1-\theta)F_o$, while charging i on F_b.[55] When $\theta \in (0,1]$, indirect coordination consist of offering a 'special contract' $\sigma = \{i_s, \theta\}$ to a set of measure x of firms. These receive a low interest rate i_s and a capital contribution $(1-\theta)F_o$. A firm participation constraint for these firms then becomes:

$$\tilde{\pi}(q, L, i) = \beta\left[a(q)L - (1+i_s)(F_b+(1-\theta)F_o\right] \geq \theta F_o$$

We start at the BE with firms holding pessimistic expectations on others' investment decisions. The lead bank publicly offers x special contracts and its standard contract to all the other firms. The banks in the competitive fringe offer their contracts. Finally, firms revise their expectations. If the BE still remains an equilibrium, they retain pessimistic expectations and no investment is made. If the BE is no longer an equilibrium, they take optimistic expectations and invest. The bank maximization problem is then:

$$\max_{i,\sigma,x} \rho(i, i_s, x) = \beta\left[(i-r)(q-z-x) + (i_s-r)x\right]F_b + \beta(1-\theta)(r-r)F_o =$$

$$\beta\left[(i-r)(q-z-x) + (i_s-r)x\right]F_b$$

Since θ does not affect bank profits, we use $\theta = 1$ for simplicity.

Proposition 3 *The Backward Equilibrium can be eliminated by the lead bank offering a low loan rate, i_s, to a set of optimal size x_s, provided the size of the competitive banking fringe is small enough. The interest rate margin charged by the lead bank is decreasing in both z and i_s.*

Proof. We start by assuming that only the lead bank offers coordination, which we will show to be true in equilibrium. The lead bank offers a measure x of special contracts.[56] Define the marginal firm $\hat{q}$ as that which makes no profits when $i = i_s$ in the BE:

$$\tilde{\pi}(\hat{q}, L, i_s) = \beta\left[a(\hat{q})L - (1+i_s)F_b\right] = F_o$$

then all firms with $q \leq \hat{q}$ industrialize. Let $\underline{q}(i)$ be the amount of firms industrializing when i is the interest rate charged on standard loans. Whenever the bank chooses $x \geq \underline{q}(i)$ the BE is broken. Bank profits increase monotonically in i_s. Thus the bank will charge as high a rate as possible, compatibly with firms' participation constraint. Since the special contract is offered

[55] This is equivalent to charging i^* on the entire loan, where $i^* = \frac{iF_b + r(1-\theta)F_o}{F_b + (1-\theta)F_o}$.

[56] Which is equivalent to $x\%$ of all firms.

to x firms in the BE, this implies that: $\tilde{\pi}(x, L, i_s) = \beta\,[a(x)L - (1+i_s)F_b] = F_o$. From Condition (1) it follows that:

$$\beta(1+i_s)F_b + F_o = \beta a(x)L < \beta a(0)L < F_b + F_o$$

Then $i_s < r$. Thus all firms prefer the special contract to the standard one, so that the former is rationed.[57] As it makes a loss on the special contract, the lead bank then chooses $x_s = \underline{q}$. By the definition of $\pi(q, i)$ it follows that $dx_s/di > 0$. The optimal interest rate margin in the standard contract is then determined by the F.O.C. of the lead bank maximization problem:

$$(i-r) = -\frac{q^* - \underline{q} - z}{dq^*/di - dx_s/di} - \frac{(i_s - r)dx_s/di}{dq^*/di - dx_s/di} \tag{3}$$

which decreases in $\underline{q}$ and z, and decreases in i_s. The non-negative profit constraint for the lead bank can then be written as:

$$z \leq (q^* - x_s) + \frac{(i_s - r)}{(i-r)}x_s = q^* - [1 - \beta(i_s - r)]\,\underline{q} \tag{4}$$

the other feasibility constraint being that:

$$z \leq q^*(i) - \underline{q} \tag{5}$$

It follows immediately that the latter constraint is not binding, while the former puts a constraint on the size of the competitive fringe. Finally, the banks in the competitive fringe do not offer low interest rate loans, but free ride on lead bank coordination. □

While the pure financial instrument is not enough to eliminate the BE, as we know from the Corollary to Proposition 1, it is however possible to offer the special contract to a 'small' fraction of firms to ensure a critical mass of investment. Such contract does induce self selection among firms, as no loss making firm ($q > q^*$) finds it profitable to invest. The size of the competitive fringe is again a limit to bank coordination, so that an imperfect capital market is necessary for its feasibility.

3.2 Indirect Coordination: Guarantees

We now turn to the case $\theta = 0$. The lead bank fully finances the investment of x firms. This amounts to offering a guarantee against the risk of other firms not investing. This gives rise to an adverse selection problem.[58] The bank selects randomly a sample of measure x of firms

[57] Note that in the special contract, with $\theta = 1$, firms are prevented from borrowing the whole sum F, as they would prefer.

[58] We continue to assume that a firm invests whenever its profits are non negative, but our results would hold even with (small) private benefits or costs to industrialization. In this case the financing contribution of the bank would simply be adjusted accordingly.

which it buys, and to which contributes the capital for industrialization. Since it retains the profits of these firms, the bank will make negative profits on those with $q > q^*$.

The timing is exactly as with coordination through low interest rates. Coordination consists of the lead bank announcing it will select randomly a measure x of firms to fully finance. The lead bank maximization problem becomes:

$$\max_{i,x} \rho(i,x) = \beta(i-r)[q^*(i)-z]F_b + \beta x \int_{\overline{q}}^{1} [a(q')\hat{y}_2(\overline{q}) - (1+r)F]\, dq'$$

where $\hat{y}_2(\overline{q}) \equiv L + \int_0^{\overline{q}} a(q')\hat{y}_2 dq' + x \int_{\overline{q}}^{1} a(q')\hat{y}_2 dq' = \frac{L}{1-A(\overline{q})-x[A(1)-A(\overline{q})]}$.

Proposition 4 *The Backward Equilibrium can be eliminated by the lead bank extending investment guarantees to a set of optimal size x_o, provided the size of the bank competitive fringe is small enough. The interest rate margin charged by the lead bank is decreasing in z.*

Proof. We assume that only the lead bank offers coordination, which we will show to be true in equilibrium. We start at the BE, and let the lead bank randomly selects a set x of firms.[59] Now all firms in x industrialize, inducing income $y_2(x) = \frac{L}{1-xA(1)}$. Consider now $\tilde{\pi}(q,i,y_2(x))$ We have that $\tilde{\pi}(0,i,y_2(1)) > F_0$, whereas $\tilde{\pi}(0,i,y_2(0)) < F_0$.

The profits of the marginal firm q, outside of x, given that all firms with $q' < q$ outside x, and all firms within x, industrialize, are $\pi(q,i,x) = \beta\,[a(q)\hat{y}_2(q) - (1+i)F_b]$. The monotonicity of $\tilde{\pi}$ in x then ensures the existence of one x s.t. $\tilde{\pi}(0,i,y_2(x)) = F_0$, which we denote by x_o. By the definition of $\tilde{\pi}(q,i,y_2)$, it follows that $dx_o/di > 0$. Since $\pi(0,1,x) = \tilde{\pi}(0,i,y_2(x))$, and $\pi(q,1,x)$ is increasing in q at $q=0$ (which follows from $\partial\pi/\partial q$ being linear in the income term) , the BE breaks down. Finally, the banks in the competitive fringe do not coordinate, and free-ride on the lead bank activity. The profit constraint for the lead bank, $\rho(i,x_f) \geq 0$, can be written as:

$$z \leq q^* + \frac{x_o(i)}{(i-r)F_b} \int_{\overline{q}}^{1} [a(q')\hat{y}_2 - (1+r)F]\, dq' \tag{6}$$

The size of the banking competitive fringe then constrains the feasibility of bank indirect coordination. The other constrain on the size of the lead bank is:

$$z \leq q^*(i)\,[(1-x_o(i)] \tag{7}$$

Finally, the equilibrium interest rate margin is determined by the first order condition of the lead bank maximization problem.

□

[59] Which is equivalent to x% of all firms.

3.3 Direct Coordination

A more general solution to the coordination failure would be for the firms to directly communicate with each other. There needs to be a network where firms can exchange information and opinions and influence each other's expectations. We would argue that in general such communication is costly . An efficient way of organizing direct communication is to create a 'center to periphery' network. By this we mean that firms exchange information through a central agent.[60] Banks can certainly take also this route. They are indeed natural candidates for organizing direct coordination among firms, given their central position in economic activity. There are two equivalent ways of thinking of banks' direct coordination activities. One is for them to intermediate the information flow between firms. Alternatively, banks may invest real resources in discovering firms' private information (q).

To model costly communication, we assume that the bank incurs a small per firm cost δ. This captures the notion that costs are symmetric and proportional to the size of the network.[61] Direct coordination consists of announcing that a measure x of firms will be randomly[62] chosen to form a network through which they can exchange information on their q and on their investment decisions. We assume that the bank can commit ex ante to the interest rate it offers, so that firms are assured they will not be price discriminated once they reveal their private information. The bank, however, cannot force the firms within the network to invest, nor can any of them force the others.[63] Finally, both x and the existence of coordination are public knowledge. Let $\rho(i,x)$ indicate bank profits. The bank maximization problem with direct coordination, subject to eliminating the BE, is then:

$$\max_{i,x} \ \rho(i,x) = \beta[(i-r)(q^*(i)-z)]F_b - \delta x$$

Proposition 5 *The Backward Equilibrium can be eliminated by bank directly coordinating a network of optimal size x_c, provided the communication cost, δ, and the size of the banking competitive fringe, z, are small enough. The interest rate margin charged by the lead bank is decreasing in both δ and z.*

Proof. We first derive the optimal value of x for a given interest rate i. We assume that only

[60] An equivalent way to think about direct communication is a 'common table' where firms can all gather and exchange information under common knowledge.

[61] While we assume δ to be independent of the number of firms coordinated, our results would attain also under a (plausible) increasing return coordination technology, and, to some extent, also for a decreasing return coordination technology.

[62] This is due to q being private information of each firm, unknown to banks.

[63] We exclude side payments among firms within x. Such payments would make coordination easier, as firms profiting from industrialization could 'bribe' loss making firms into investing. Allowing for side payments would not change the basic results.

the lead bank offers coordination, which we will show to be true in equilibrium. We start at the BE, and let the lead bank randomly selects a group of x firms.[64] Firms within x take as given the pessimistic expectations of the other firms. Suppose all firms within x with $q \leq q_0$ decide to industrialize, inducing income $y_2(x) = L + x \int_0^{q_0} a(q')y_2(x)dq' = \frac{L}{1-xA(q_0)}$. Then the profits of firm q_0 are:

$$\pi(q_0, x, i) = \beta \left[\frac{a(q_0)L}{1 - xA(q_0)} - (1+i)F_b \right]$$

Clearly q_0 is a function of x. Whenever there exists some $q_0 > 0$ s.t. $\pi(q_0, x, i) \geq F_o$, then all firms with $q \leq q_0$ within x realize that by investing together they would make a profit, and by coordinating their expectation, rationally decide to invest. But then, by the monotonicity of $\tilde{\pi}(q, i)$, all firms in the economy with $q \leq q_0$ will invest. Since, by construction, $q_0 > \underline{q}$, the BE breaks down, and the IE is the only remaining equilibrium. Define $q_0(x)$ as the smallest q_0 s.t. $\pi(q_0, x, i) = F_o$. Note that $q_0(x)$ may not exist for some x. At $x = 1$ a measure $\underline{q}$ of firms is sufficient to induce industrialization, so $q_0(1) = \underline{q}$. At $x = 0$, $\pi(q_0, x, i) < F_o$ for all q, so $q_0(0)$ does not exist. Since $\pi(q_0, x, i)$ is increasing in x, q_0 is decreasing in x. Similarly, since $\pi(q_0, x, i)$ is decreasing in i, q_0 is increasing in i. Moreover, for each i there exists a critical value x_c s.t. q_0 exists for all $x \geq x_c$ and does not exist for $x < x_c$. From the definition of $\pi(q, i)$, it follows that x_c increases in i. By construction, $x_c \in [\underline{q}, 1]$. The banks in the competitive fringe do not offer to coordinate, but free-ride on the lead bank coordination activities.

The coordination costs and the size of the banking competitive fringe constrain the feasibility of bank direct coordination in two ways. First, from the constraint $\rho(i, x_c) \geq 0$, which can be written as:

$$z \leq q^* - \delta \frac{x_c(i)}{\beta(i-r)F_b}$$

and second from the need of the coordinated network to be smaller than the lead bank's market share: $q^* - z \geq q^* x_c$, which can be written as:

$$z \leq q^* \left[1 - x_c(i)\right]$$

The feasibility condition is depicted in Figure 2 below. Finally, the equilibrium interest rate margin is the solution to the first order condition of the lead bank maximization problem:

$$\beta \left[(q^*(i) - z) + (i-r)\frac{dq^*}{di} \right] F_b - \delta \frac{dx_c(i)}{di} = 0$$

[64] In our setup this is equivalent to choosing x% of all firms. Since firms are drawn from a continuum, we can ignore sampling variance.

which we can write as:

$$(i-r) = \frac{\delta}{\beta F_b} \cdot \frac{dx_c(i)/di}{dq^*(i)/di} - \frac{q^*(i)-z}{dq^*(i)/di}$$

It is easy to check that the F.O.C. satisfies the conditions of Theorem 1 in Milgrom and Roberts (1994), so that $(i-r)$ is decreasing in both δ and z. □

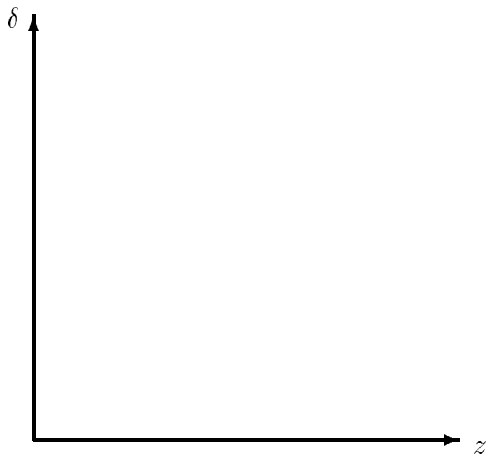

Figure 2

3.4 Discussion

The main argument of this section is that a bank may act as a 'catalysts' to induce industrialization. We have shown that the lead bank may act as a coordinating agent that eliminates the BE. By mobilizing a critical mass of firms to invest, the lead bank triggers off a reaction among the other firms.

One way for the bank to achieve coordination is to actively bring together a critical mass of firms. In this case the lead bank incurs communication cost that no individual firm would be willing to incur. Somewhat surprisingly, however, the bank does not necessarily need to engage in direct communication. By offering a certain amount of favorable loans the bank can make a number of firms willing to invest, irrespective of others' decisions.. This may provide a critical mass on investments that induce the 'big push.'

Two critical conditions to become a coordinating agent are for the bank to have a sufficient size and market power. The bank needs to be large enough to finance a critical mass of firms. Moreover, the bank bears the cost of coordination. It needs to have enough market power to recoup these costs.

Our model suggest that each type of coordination is costly. Direct coordination involves incurring communication costs, indirect coordination with low interest loans involves forgoing

interest, and indirect coordination with guaranteed loans involves costs of adverse selection. The banks choice of coordination mechanism depends on these relative costs.

From a social welfare perspective, it is clear that having a lead bank with market power also involves some inefficiencies. In particular we observe that once industrialization has occurred, the economy has a financial structure that is no longer desirable.[65] Put differently, if there was no coordination problem, a perfectly competitive financial market structure would be preferable, but market power is a necessary price to have the bank become a coordinating agent. As a consequence, it is socially optimal to contain the size (and thus market power) of the lead bank to the smallest size, such that it is still sufficiently large to act as a coordinating agent.

4 The Role of Government in Coordination: Public Banks

We have shown so far that a private bank can act as a catalyst to solve the coordination problem in an 'underdevelopment trap.' As a self interested financial intermediary, a sufficiently large bank is in a position to coordinate investments by dispersed private firms. As in the quotation from MSV we cited in the introduction, most economists would think of the government as the obvious alternative. Indeed, governments often attempt to promote economic development through public ownership of financial intermediaries, and in particular through so-called 'development banks.'

In order to fully compare the differences between a development and a private bank we would need a good theory of the economic role of the government, something still to be achieved in our view. [66]. We therefore take a very simple approach, and focus on governments' ability to tax.

A publicly owned bank may claim a key advantage over a privately owned one, because the government can bear losses in the bank and cover them with tax revenues. In particular, the government can tax the profits of the corporations it has helped to finance in the first place. In the context of our model, this means that a publicly owned ('development') bank is able to offer a wider set of contracts than a private bank. We now examine whether this added flexibility allows a development bank to increase social welfare relative to the private market outcome.

4.1 Indirect Coordination: Low Interest Rates

Suppose the government wants to maximize the social welfare function, $SW(q)$, defined in Section 2. There is an immediate advantage that the development lead bank enjoys over its private counterpart when extending direct coordination. Since it can lose money, it can offer a

[65] This may explain some of the problems that many successful developing countries face at some point with their banking system.

[66] See Stiglitz (1989) for an attempt.

lower interest rate than private banks, and thus increase $q^*(i)$ so as to raise social welfare. This interest rate can be even lower than the cost of funds (r), as the government can tax away part of firms' profits to cover its bank losses. We restrict our analysis to a linear tax on corporate profits, denoted by τ. Such as tax does not modify the incentives for investment, but simply reduce firms profits when these are above F_0. Consequently, such a tax is non-distortionary. We first show how the government can improve on the private solution. The timing of the game is the same as in the case of a private bank.

Let's first consider indirect coordination when $\theta > 0$, in which case the government bank subsidizes the firms to which it grants the special contract σ. We relegate to the appendix the proofs for the rest of this section.

Proposition 6 *By subsidizing a network of optimal size x_s, a government bank can Pareto improve on the private solution by charging a negative interest rate margin. The competitive fringe of banks disappears .*

In this case the objective function for the government is:

$$\max_i \quad SW = (1+\beta)L + (1-q^*)F + \beta \int_0^{q^*} a(q')y_2(\hat{q})\,dq' + I_{i_s>i}\beta x_s \int_{q^*(i)}^{q^*(i_s)} a(q')y_2(\hat{q}) - (1+r)F\,dq'$$

where $q^* = q^*(i)$, $y_2(\hat{q}) = \frac{L}{1-a(q^*)-I_{i_s>i}x[A(q(i_s)-A(q^*)]}$ and $x_s = x_s(i)$ as defined for the private bank case. $I_{i_s>i}$ is the indicator function, which assumes value 1 when $i_s > I$, and 0 otherwise. Because low interest rates only redistribute income, there is no social costs to this type of coordination. Unlike the other two cases, coordination through low interest rates is always feasible.

4.2 Indirect Coordination: Guarantees

We now turn to indirect coordination, when $\theta = 0$.

Proposition 7 *By owning a set of optimal size x_g, a government bank can Pareto improve on the private solution, provided adverse selection is small enough. The competitive fringe of banks disappears.*

The government maximization problem is now:

$$\max_i \quad SW = (1+\beta)L + (1-q^*)F + \beta \int_0^{q^*} a(q')y_2(q^*)\,dq' + \int_{q^*}^1 \left[a(q')\hat{y}_2 - (1+r)F\right] dq'$$

where $q^* = q^*(i)$, and $x_o = x_s(g)$ as defined for the private bank case. The last term in the expression represents the amount of adverse selection which has to be borne. As we show in the appendix, the government can charge the optimal subsidized rate provided $TTP \geq \rho$, or:

$$\beta\left[A(q^*)y_2(q^*) - q^*(1+r)F\right] \geq -\int_{q^*}^{1}\left[a(q')\hat{y}_2 - (1+r)F\right]dq'$$

4.3 Direct Coordination

The potential advantage of government extends to the direct coordination case. Now the government maximization problem is:

$$\max_i \;\; SW = (1+\beta)L + (1-q^*)F + \beta\int_0^{q^*} a(q')y_2(q^*)\,dq' - \delta x_c$$

where $q^* = q^*(i)$, and $x_c = x_c(i)$ is the optimal network size for a given interest rate, as defined in the proof of Proposition 3. The F.O.C. is then:

$$\left[\beta a(q^*)y_2(q^*) - F + \beta\int_0^{q^*} a(q')\frac{dy_2(q^*)}{dq^*}\,dq'\right]\frac{dq^*}{di} - \delta\frac{dx_c}{di} = 0 \tag{8}$$

evaluating the LHS at $i = r$, the term in square brackets is positive, due to the participation constraint for firms. Given $\frac{dq^*}{di} < 0$ and $\frac{dx_c}{di} > 0$, the optimal interest rate is lower than r. We have two possible outcomes. Either, by lowering i, we have $q = 1$ while dSW/di is still negative, so that we reach a corner solution, or at a certain level of i the term in square brackets changes sign, and we have an interior solution. As $i < r$, the banks in the competitive fringe would make a loss if they lent, so they withdraw from the market. With a negative interest rate margins firms would prefer to borrow the whole sum F, so the government bank requires them to put F_0 as collateral. The amount of available taxes may constrain the government decision. The bank losses to be subsidized are:

$$\rho(i, x_c) = \beta q^*\left[(1+r) - (1+i)\right]F_b + \delta x_c$$

so the present value of the taxable profits of firm q, where we take into account the value of F_o to the (owner of) the firm, is:

$$TP(q') = \beta\left[a(q')y_2(q^*) - (1+i)F_b - (1+r)F_o\right]$$

The total taxable profits are then:

$$TTP = \beta\int_0^{q^*} TP(q')\,dq' = \beta\left[A(q^*)y_2(q^*) - q^*(1+i)F_b - q^*(1+r)F_o\right]$$

then the bank can charge the optimal interest rate only if $TTP \geq \rho$, or:

$$\beta\left[A(q^*)y_2(q^*) - q^*(1+r)F\right] \; geq \delta x_c$$

If δ, the cost of coordination, is smaller than the social benefit of industrialization, the government chooses the optimal tax rate, given by $\tau = \frac{\rho}{TTP}$. The government solution Pareto improves on the private one as the level of industrialization is higher. We have thus proved:

Proposition 8 *By directly coordinating a network of optimal size x_c a government bank can Pareto improve on the private solution by charging a negative interest rate margin, provided coordination costs are smaller than the social benefits of industrialization. The competitive fringe of banks disappears.*

4.4 Discussion

In this section we have shown how a government could improve on the private outcome. We have taken a simple stance, allowing the government to take the same actions as a private agent, but also to be able to tax. We have shown that a development bank may increase social welfare, relative to the private market outcome, by lowering lending rates. This means that private banks disappear.

These results indicate an advantage of coordination through public banks. Yet, they do not allow us to advocate government intervention without previously discussing more thoroughly its shortcomings. We identify three major problems.

First, the optimal solution features the development bank making losses on its operations. This actually mirrors the experience of many developing countries, that have experienced sometimes abysmal performances of their development banks. Our model could be interpreted to justify the poor financial results: if the objective of a development bank is to be a catalyst to economic growth, then its true performance should not be judged by its own financial performance, but by its success in stimulating industrialization. The problem with this interpretation, however, is that a contribution to economic growth is inherently difficult to measure. It is very difficult to separate poor performance from a successful provision of a public good such as coordination. This may even give rise to a moral hazard problem. If the development bank does not have a clear performance metric, it is more difficult to discipline its managers.

Second, in the optimal solution the private financial sector disappears. This extreme result depends on the particular specification of our model, but it highlights the problem of crowding out. Complete crowding out of the private sector can be harmful if the development bank is less efficient, for example when its lending practices are opportunistic, or when its incentives to innovate are scant. A straightforward extension of the model would introduce explicitly the

costs of crowding out. One likely solution would then be that to keep the development bank as small as possible.

A final, and broader, concern is whether the government is an appropriate agent to engage in economic coordination. This issue clearly goes beyond the scope of this paper, so we limit ourselves to a few remarks. There may be an issue of the government's credibility. In the process of achieving coordination (especially direct coordination) the government may acquire private information. While firms may be willing to share some information with private banks, they may be less willing to do so with a government institutions. A related issue is whether the government may acquire excessive economic power through the ownership of large banks. The concentration of political and financial power to coordinate industrial activities may raise some eyebrows among those who are concerned with issues of balance of power and the maintenance of checks and balances.[67]

5 Conclusion

A literature has developed to substantiate Rosenstein-Rodan's intuition that coordination of a critical mass of investments may be necessary to achieve industrialization through a 'big push.' This literature has essentially ignored the question of what economic institutions may overcome an 'underdevelopment trap.' In this paper we propose that banks may act as a 'catalyst' for the 'big push.' Our work is motivated by historic evidence that suggest that there may be an association between a big push, and the emergence of large banks. We develop a theoretical model based on Murphy, Shleifer and Vishny (1989). We show that a 'large' bank with sufficient market power can coordinate investments and induce the 'big push.' By coordinating only a subset of firms in the economy, a bank creates a critical mass of demand that induces other firms in the economy to also invest. A bank may coordinate firms directly. Alternatively, it can induce coordination indirectly by offering loans at a low interest rate, or offer investment guarantees. While our results establish that government action is not be necessary to achieve the 'big push,' we also show that a government may improve on the private market outcome by subsidizing the coordination activities of a bank.

This papers suggest a number of interesting areas for further research. On a broad level we would argue that the question of which economic institutions foster economic development is still under-researched. More specifically, the issue of how to solve coordination has received

[67] An interesting case to mention in this context is 19th century Belgium, and the political debates around the control of the Sociètè Gènèrale. While this was a private bank, it had such clout in the economy that it constantly had to guard itself from political pressures. One way to address this issue was to create a board structure, where each of the two main political fractions had a seat. This prevented either political party to exert too much influence over the bank.

relative little attention. An interesting extension of this paper would be to look at the role of conglomerates and industrial cartels in achieving coordination.

HERE we should develop the argument that we explain only one possibile way to achieve coordination for quick growth. Other mechanims might be equally likely. The empirical regularity of finding oligopolistic structure in countries which experienced quick industrialization brings naturally the question of whether banks cannot be supplanted by 'conglomerates,' that is large firms which are likely to internalize the externality. Like banks they would be motivated by profits. Which institutions is likely to fare better? We leave the reader with this curiosity, and will pursue it in future research.....!

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Appendix

A Proof of Proposition 6

The government maximizes social welfare by choosing a special contract σ, and tax rate, subject to the constraints that any bank loss is compensated by tax revenue and that the BE is eliminated. We start considering the government's choice without concern for its ability to finance bank losses with a tax on profits. The maximization problem is:

$$\max_i \quad SW = (1+\beta)L + (1-q^*)F + \beta \int_0^{q^*} a(q')y_2(q^*)\,dq'$$

where $q^* = q^*(i)$, and $x_s = x_s(i)$ as defined for the private bank case. The F.O.C. is then:

$$\left[\beta a(q^*)y_2(q^*) - F + \beta \int_0^{q^*} a(q')\frac{dy_2(q^*)}{dq^*}\,dq'\right]\frac{dq^*}{di} = 0 \tag{9}$$

evaluating this at $i = r$, the term in square brackets is positive, due to the participation constraint for firms. Given $\frac{dq^*}{di} < 0$ and $\frac{dx_c}{di} > 0$, the optimal interest rate is lower than r. We have two possible outcomes. Either, by lowering i, we have $q = 1$ while dSW/di is still negative, so that we reach a corner solution, or at a certain level of i the term in square brackets becomes null, and we have an interior solution. As $i < r$ the banks in the competitive fringe withdraw from the market. We now consider how taxation constrains the government decision. The bank losses to be subsidized are:

$$\rho(i, x_s) = \beta\left\{(q^* - x_s)\left[(1+r) - (1+i)\right] - (i_s - r)x_s\right\}F_b$$

The present value of the taxable profits of firm q, where we take into account the value of F_o to the (owner) of the firm, is:

$$TP(q') = \beta\left[a(q')y_2(q^*) - (1+i)F_b - (1+r)F_o\right]$$

The total taxable profits are then:

$$TTP = \beta\int_0^{q^*} TP(q')\,dq' = \beta\left[A(q^*)y_2(q^*) - q^*(1+i)F_b - q^*(1+r)F_o\right]$$

then the bank can charge the optimal interest rate only if $TTP \geq \rho$, or:

$$\beta\left[A(q^*)y_2(q^*) - q^*(1+r)F\right] \geq 0$$

which is always satisfied. The optimal tax rate is $\tau = \frac{\rho}{TTP}$. The government solution Pareto improves on the private one as the level of industrialization is higher. □

B Proof of Proposition 7

The proof runs as in the previous proposition. The government maximization problem is:

$$\max_i \quad SW = (1+\beta)L + (1-q^*)F + \beta \int_0^{q^*} a(q')y_2(q^*)\,dq' + \int_{q^*}^1 \left[a(q')\hat{y}_2 - (1+r)F\right] dq'$$

where $q^* = q^*(i)$, and $x_g = x_s(g)$ as defined for the private bank case. The last term in the expression represents the amount of adverse selection which has to be borne. The F.O.C. is then:

$$\beta \left[a(q^*)y_2(q^*) - F + \int_0^{q^*} a(q') \frac{dy_2(q^*)}{dq^*}\,dq' \right] \frac{dq^*}{di} + \tag{10}$$

$$\beta \left\{ \frac{dx_f(i)}{di} \int_{\overline{q}}^1 [a(q')\hat{y}_2 - (1+r)F]dq' + x[\int_{\overline{q}}^1 a(q') \frac{d\hat{y}_2}{dq} dq' + a(\overline{q})\hat{y}_2] \frac{dq}{di} \right\} = 0$$

evaluating this at $i = r$, the term in square brackets is positive, due to the participation constraint for firms. Given $\frac{dq^*}{di} < 0$ and $\frac{dx_c}{di} > 0$, the optimal interest rate is lower than r. We have two possible outcomes. Either, by lowering i, we have $q = 1$ while dSW/di is still negative, so that we reach a corner solution, or at a certain level of i the term in square brackets changes sign, and we have an interior solution. As $i < r$ the banks in the competitive fringe withdraw from the market. We now consider how taxation constrains the government decision. The bank losses to be subsidized are:

$$\rho(i, x_s) = \beta(q^* - x_s)\left[(1+r) - (1+i)\right] - \int_{q^*}^1 \left[a(q')\hat{y}_2 - (1+r)F\right] dq'$$

The present value of the taxable profits of firm q, where we take into account the value of F_o to the (owner) of the firm, is:

$$TP(q') = \beta \left[a(q')y_2(q^*) - (1+i)F_b - (1+r)F_o\right]$$

The total taxable profits are then:

$$TTP = \beta \int_0^{q^*} TP(q')\,dq' = \beta \left[A(q^*)y_2(q^*) - q^*(1+i)F_b - q^*(1+r)F_o\right]$$

then the bank can charge the optimal interest rate only if $TTP \geq \rho$, or:

$$\beta \left[A(q^*) y_2(q^*) - q^*(1+r)F \right] \geq - \int_{q^*}^{1} \left[a(q') \hat{y}_2 - (1+r)F \right] dq'$$

and the optimal tax rate is $\tau = \frac{\rho}{TTP}$. If the last condition is violated, the bank is forced to choose a higher interest rate, as it follows directly from $d\rho/di < 0$. The government solution Pareto improves on the private one as the level of industrialization is higher. □

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