The Role of Non-Performing Loans in China: A Public Finance Approach

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I develop a simple model to analyze the impact of subsidies, low interest rate loans, and loan guarantees on social surplus and employment when there is asymmetric information and costly state verification. Rather than arising as a consequence of soft budget constraints or poor project selection, non-performing loans result from an optimal policy to reduce the excess burden of taxation. Extensions show that the conclusions are robust to incentive effects, the structure of the banking sector, and rent seeking. The model suggests that traditional policy prescriptions may have unintended effects.

I. Introduction

Overview

This paper presents a new approach to the question of non-performing loans (NPLs). The traditional approach emphasizes the negative aspects of non-performing loans: how they reduce the efficiency of the financial system, create moral hazard, and trigger financial crises. The new approach, by contrast, sees non-performing loans as a necessary evil. While non-performing loans can have negative effects, they also provide an efficient method to reduce the excess burden of taxation and promote employment. NPLs give targeted subsidies to just those firms that could not have employed workers in the absence of support. In this way, NPLs reduce the revenue requirements of the government, and minimize the deadweight losses to society. Because the new approach shifts the focus to the excess burden of taxation and the efficient provision of subsidies, it is called the public finance approach to non-performing loans.

In the public finance approach, non-performing loans are a form of tagging. The concept of tagging was introduced by Akerlof (1978). It refers to a system that uses various characteristics to identify needy groups. These groups are then given special

treatment in the form of a special tax/subsidy schedule. In the case of NPLs, default serves as a tag to identify needy firms. The government's implicit promise to cover the difference between the lending rate and the firm's return on investment constitutes the special tax/subsidy schedule.

To develop these points more fully, I present a simple model of the banking system and commodity markets and apply it to the case of China. The model shows that in a world of asymmetric information and costly state verification, non-performing loans boost employment at lower cost than either direct subsidies or low interest rate loans. Extensions address questions of moral hazard, the structure of the banking sector, and rent-seeking behavior.

Relevance for China

China provides a useful case study of the issues raised by non-performing loans. It also illustrates how the new approach differs from the old. Currently, China has a large non-performing loans problem. Between 1994 and 2001, the fraction of NPLs at China's four state owned commercial banks (SCBs) increased from 20% to 27% of all loans. Moreover, despite a recapitalization of the banks in 1998 and the sale of 20% of their NPLs to asset management companies in 1999, the Chinese government still has not resolved the problem. Indeed, the OECD estimates it will cost China 29% of GDP just to reduce NPLs in the banking system to 10% of loans outstanding and raise capital adequacy ratios to 8%. The cost could rise to 58% of GDP if, as seems likely, actual NPL ratios turn out to be higher and recovery rates lower.[1]

[1] OECD, p. 466.

Aside from the fiscal cost, non-performing loans are causing a number of serious financial problems. First, the rise in NPLs has reduced the interest income and profits of Chinese banks. For example, in 1999 returns on capital for China's SCBs ranged from only -0.3 to 7.0%.[2] Second, the increase in NPLs has effectively reduced bank capital and made banks technically insolvent. Of China's four state owned commercial banks, only the Bank of China had a capital adequacy ratio above eight percent in 2002. All of the SCBs would have negative capital if NPLs were taken into account. Third, even though the return on assets of state owned enterprises (SOEs) has dropped sharply in recent years, state banks continue to make loans to bankrupt and unprofitable enterprises. As of 1998, 94% of all state bank loans went to state enterprises even though one third were loss-making.

The situation in China naturally raises a number of important questions: Why have NPLs persisted despite repeated attempts to reform the banking system? Why is it that recapitalizations have not prevented the rise of additional NPLs? And why has it been so difficult to impose hard budget constraints on state enterprises even though many are bankrupt and have low returns to capital?

Traditional Approaches & Literature Review

Theories about what causes non-performing loans generally fall into one of four categories: 1) lack of incentives for project selection; 2) principal-agent problems, 3) moral hazard due to low capital; or 4) soft budget constraints due to dynamic commitment problems. Most of the non-performing loan literature is policy oriented. Indeed, with the exception of the soft budget constraint literature, the theoretical literature

[2] *The Banker*, October 2000.

does not explicitly mention non-performing loans. Non-performing loans are implied by many models, however, and the vast policy literature on non-performing loans clearly has certain theoretical models in mind.

The first explanation for China's high level of non-performing loans asserts that bank managers have little incentive to monitor borrowers or select appropriate projects. One reason is that China's financial system evolved out of a central planning system. Prior to 1984, the only bank in China was the People's Bank. It was designed simply as a mechanism to transfer savings from households to state enterprises. In 1984, China established the four state owned commercial banks and since then the government has attempted to increase the efficiency of the financial system by encouraging banks to adopt a more commercial orientation. However, bank managers often lack the skills to engage in effective project selection and pressures to make loans for social purposes remain strong. In addition, China's legal system makes it very difficult to collect non-performing loans. Lau (1999) argues that lenders do not expect their loans to be collectible and borrowers know they will not have to repay. This means there is little incentive for banks to monitor loans.

Political interference is another reason that banks lack incentives to engage in appropriate project selection. For example, the OECD (2002) argues the most important factor in the build up of NPLs is the government's reliance on policy lending to support social projects unable to earn a commercial return. Although direct quotas on bank lending were abolished in 1996, in 1998 the state owned commercial banks were allocated quotas to match lending to favored infrastructure projects financed by special

bond issues. The OECD argues the government has sent mixed messages to bank managers inhibiting the development of a strong credit culture.[3]

A second explanation for the rise in China's NPLs focuses on principal-agent problems. Banks or firms receive different payoffs than the government which induces them to engage in unwanted behavior. In some cases, there is outright corruption. For example, Lau (1999) notes that Chinese firms have diverted loans to third parties and for speculation in the real estate & stock markets. In other cases, banks or firms have incentives to make risky investments because the government will absorb losses. The Asian Development Bank (2004) argues that banks have fewer incentives to monitor loans because of implicit government guarantees while firms may feel they are freed from their obligation to repay. Similarly, Turner and Hawkins (1999) note that loan quality suffers when loan officers are rewarded on the basis of the volume of loans without sufficient attention to risk. The government has attempted to solve these problems by separating loan origination from loan approval. The 1996 bank law also makes lending officers and senior management responsible for new bad loans. However, there still appear to be weaknesses in bank management that allow these practices to continue.

A third explanation for China's high level of non-performing loans is moral hazard due to low capital. Dornbusch and Giavazzi (1999) argue that banks which are technically insolvent lose the incentive to price new loans accurately. It becomes rational to increase lending to bankrupt firms to service old loans. The Asian Development bank argues that NPLs may perpetuate a culture of non-repayment and risk seeking behavior

[3] OECD (2002), pp. 239-240.

on the part of banks.[4] Other papers of particular relevance include Cole (1995) and Cooper and Ross (2002). These papers show that in the presence of an implicit guarantee banks may gamble for resurrection, i.e. invest in risky projects that have low expected return.

Finally, the transition literature suggests that non-performing loans may be evidence of soft-budget constraints (SBCs). Soft budget constraints occur when an organization, such as a firm, cannot meet its financial obligations and would cease operations without support. If the firm is allowed to fail, then it is said to have a hard budget constraint. If some other organization, such as a bank or the government, is willing to pay the financial obligations of the firm, then the firm is said to have a soft budget constraint.[5] Kornai (2001) argues that soft bank credit is now the most common instrument of support for firms in transition countries. He also argues that the proportion of non-performing loans can be used as an indicator of the softness of budget constraints. Higher NPL ratios imply softer budget constraints for the corporate sector.

While soft budget constraints may have different causes, a prominent strand of the SBC literature emphasizes the dynamic commitment problem. An important early contribution to this literature is the model of Dewatripont and Maskin (1995). In this model, banks cannot identify good projects ex ante. After the bank makes an investment, it learns whether a project is good or bad. However, because of sunk costs it becomes ex post optimal to refinance bad projects. As a result, inefficient firms are allowed to continue operations. Although not explicitly stated, this model implies that some fraction

[4] ADB, Asian Development Outlook 2004.
[5] For a survey, see Kornai, Maskin, & Roland (2003).

of loans will be non-performing. Other important contributions to this literature include Schaffer (1989), Bergloff & Roland (1995), and Qian and Roland (1998).

The soft budget constraint literature emphasizes that lending decisions are inefficient. As Kornai, Masskin, & Roland (2003) put it "under the soft budget constraint syndrome too much credit is extended from the standpoint of economic efficiency." As a result, authors of soft budget constraint models often describe methods to harden budget constraints. For example, Dewatripont and Maskin (1995) argue that privatization of banks or the decentralization of credit may harden budget constraints. Qian and Roland (1998) suggest that the devolution of decision making from central to local governments can do the same. Similarly, Berglof and Roland (1998) suggest that larger banks will find project screening more affordable. Policy institutions have also emphasized the importance of hardening budget constraints. For example, the IMF and the Asian Development Bank have urged China to improve corporate governance, enhance bank supervision, and tighten lending requirements.

There are a number of problems with traditional approaches to non-performing loans. First, they tend to downplay the social and economic consequences of economic restructuring and see political motives as lacking legitimacy. For example, the OECD argues that non-economic considerations distort the pricing of credit in China and that public ownership makes it difficult for financial institutions to exercise effective financial discipline and observe prudential norms.[6] As such, traditional approaches do not place sufficient emphasis on employment and social stability as legitimate policy goals. It is important to note that state owned enterprises in China employ approximately half of total non-farm labor and produce about one third of industrial output. The Chinese

[6] OECD, p. 459-460.

government recognizes that many SOEs are inefficient and should be given improved incentives through restructuring. However, massive restructuring would have significant costs in the form of high unemployment.

Beyond the direct cost of joblessness, massive unemployment could also result in serious political unrest. In addition, in China many social services are provided through state owned enterprises. For example, health care, housing, and pensions are all traditionally provided to workers by their employers. Attempts to harden budget constraints without attention to the issue of state enterprises as social service providers would likely reduce productivity and exacerbate the problems associated with unemployment.

Also overlooked in the traditional literature are the deadweight losses associated with transfers to SOEs. It has often been pointed out that loans are actually a form of government subsidy for loss making state enterprises.[7] However, the implications of this observation have not been explored from a public finance perspective. Lardy notes that direct and indirect subsidies to SOEs exceeded 10% of GDP in the 1980s. Although direct subsidies declined in the 1990s, policy loans increasingly took their place. Direct subsidies or policy loans are associated with two significant costs. First, subsidies must be financed by taxes that result in deadweight losses to society (also referred to as the excess burden of taxation). Second, developing countries often have limited capacity to raise revenues. In China, revenues as a percent of GDP declined from 22% in 1985 to 10% in 1995 before rising to 19% in 2003. By comparison, revenues/GDP averaged 35% in OECD countries during this period. To the extent that revenues are used to subsidize SOEs, they are not available to fund other important social goals. For example, the

[7] See Lau (1999), p. 74.

World Bank estimates that China needs to raise an additional 6% of GDP just to eliminate spending gaps in health and education, social insurance, and infrastructure. Obviously, large subsidies reduce the capacity of the government to meet these goals.

The Public Finance Approach

In this paper, I take a fundamentally different approach to the question of why NPLs arise in China. I argue NPLs arise from the government's desire to minimize the excess burden of taxation rather than poor incentives, principal-agent problems, moral hazard, or dynamic commitment problems. Because the traditional approach to NPLs examines the financial market in isolation from the rest of the economy, it is too narrowly focused. The public finance approach, in contrast, emphasizes the interrelatedness of financial and other markets. In this sense, the new approach represents a general equilibrium way of looking at taxation and subsidization in transition economies. It answers the question: How with limited tax capacity do governments ensure basic services and maintain political support? In addition, I shall argue that the traditional approach is likely to results in policy prescriptions that are ineffective and at worst could reduce welfare and raise the cost of transition.

What is the role of non-performing loans in the public finance approach? In the public finance approach the government has two competing policy goals: promoting employment and reducing the excess burden of taxation. The government is in search of a strategy that can support employment at minimum use of scare tax dollars. Ideally, the government would like to implement discriminating taxes/subsides that induce firms to hire labor at minimum cost. But complicating these efforts is the presence of private

information. Firms will, in general, have better information than the government about the quality of their potential investments and likely profits. Moreover, because all firms are better off when they receive government subsidies, firms that do not need subsidies to remain in business have an incentive to report negative profits in order to receive government subsidies. Faced with this situation, the government can provide a subsidy or low interest loan to any firm that agrees to hire labor. This policy minimizes the cost of obtaining information about the firms. Alternatively, the government can require firms to report their profits and then conduct an audit, at some cost, to verify the report. With verification, the government will know which firms to support and exactly how great a subsidy is required to keep a firm in business.

NPLs allow the government to reduce the size of transfers required to boost employment. In the language of Akerlof (1978) default serves as a tag to identify needy firms, i.e. those firms that could not hire labor in the absence of a subsidy. Firms that make positive profits repay their loans and do not receive support. Firms that have negative profits default, are audited, and receive a payment equal to the difference between the lending rate and their return on investment. The identification of needy firms and the tailoring of subsidies to each firm's losses means that non-performing loans require much smaller transfers than either direct subsidies or low interest rate loans.

Another point to note is that the excess burden of state enterprise subsidies is a first order effect. For moderate levels of taxation, additional revenues will significantly increase deadweight losses to society. For example, in China I estimate that for each dollar transferred as a subsidy, approximately 40 cents is lost to society via the excess burden of taxation. Because direct subsidies are given to any firm that agrees to hire labor, the revenue requirements are high and the deadweight losses are first order. NPLs, in contrast, are only given to those firms at the margin and in smaller amounts. As a consequence, the deadweight losses from NPLs are an order of magnitude less than from direct subsidies.

NPLs also address a key concern of governments, the efficient allocation of scarce resources to maintain political support. This is especially true in communist and transition economies such as China that are politically and economically fragile. To maintain political support, they may attempt to extract resources from one section of society for the benefit of a politically more important group. This point has been a central theme in the literature on communist systems. For example, it has been argued that Stalin's plan to collectivize agriculture in the Soviet Union was not driven by a desire to boost agricultural efficiency. Rather it was driven by a desire to extract grain from farmers to: 1) maintain support among urban workers and 2) provide resources for industrialization.[8] Similarly, in China the state provides substantial social services to workers. If unemployed these workers could become a source of political concern, as occurred prior to the Tiananmen Square incident of 1989. Thus, the government is likely to place significant weight on policies - such as the use of NPLs to subsidize employment - that minimize the cost of transferring resources from one sector of the economy to

[8] For a more in depth discussion, see Gregory Grossman p. 101.

another. By contrast, the government may be willing to tolerate some amount of corruption or moral hazard because whose effects are second order.

Finally, the public finance approach to non-performing loans has significant implications for public policy which are at odds with traditional prescriptions. For example, one of the key messages of the transition literature is that countries should harden budget constraints. If non-performing loans represent part of an optimal policy to support state enterprises their reduction is not optimal by definition. Moreover, attempts to harden budget constraints will not be credible given the government's preferences. Instead, the public finance approach suggests the government should focus on lowering the cost of unemployment by taking over the provision of social services from state enterprises. This will reduce the cost of unemployment and harden budget constraints indirectly.

As earlier, traditional models predict that implicit government guarantees and a high level of NPLs encourage banks to invest in risky projects with low expected returns. A common prescription is to recapitalize banks so that incentives to gamble are reduced. However, if NPLs are actually the result of an attempt to boost employment at minimum cost, then recapitalization will not necessarily reduce future accumulation of NPLs. Indeed, to the extent that recapitalization removes a constraint on the resources available to the banking system, NPLs may actually increase.

Lastly, traditional models emphasize the negative effects of rent-seeking behavior and recommend measures to eliminate it. However, since rent-seeking behavior encourages firms to expand and borrow from banks, it may reduce the optimal size of government transfers and lower the excess burden of taxation. Because rent-seeking

behavior is associated with a positive externality, its total elimination may not be optimal. This positive externality may also help to explain why government efforts to limit corruption in China appear to be half-hearted.

The outline of the rest of this paper is as follows. Section II presents the basic model of the capital market and the excess burden of taxation. The model is applied to China and policy implications are examined. Section III considers extensions to the basic model to show that the results are robust to incentive effects, the structure of the banking system, and rent-seeking on the part of firms.

II. The Basic Model

In this section, I introduce the basic public finance model of non-performing loans. The model focuses on the relationship between two types of markets: the banking market which supplies capital to state enterprises and the commodity markets. The government would like to pursue two, sometimes inconsistent, goals. First, it wants to maximize social surplus in the banking and goods markets. Second, it wants to promote employment. To pursue these goals, it can provide state enterprises with direct subsidies, low interest rate loans, or loan guarantees. Under loan guarantees, non-performing loans may accumulate in the banking system. Complicating the picture is the presence of asymmetric information and costly state verification.

A. Firms & the Banking System

First, consider the banking market. To determine the trade off between employment and social surplus, it is important to specify firms' production functions and

demand for capital. I assume that each state enterprise has a potential investment project that requires one unit of capital and one unit of labor. The return on a project is determined by a productivity parameter, A_i, which each firm draws at random from a distribution function, $f(A_i)$. The values of A_i can range from a minimum of 0 to a maximum of A_H, i.e. $A_i \in [0, A_H]$. Each firm observes its own productivity parameter at zero cost. The government and banks do not observe A_i unless they conduct an audit, at cost η per firm audited. The government and the banks do, however, know the overall distribution of A_i in the economy. Note that there is no uncertainty in the sense that once a firm draws A_i, it knows its own potential output even though it has not yet made an investment. There is asymmetric information, however, since neither the government nor the banks know A_i.[9]

I assume that firms have Leontief production functions. Since each project requires one unit of capital and one unit of labor, the output of a project is: $Y_i = A_i \min(K, L) = A_i$. The Leontief production function makes capital and labor complementary so that increases in capital to the state enterprise sector also result in increases in employment. This assumption also underlies standard economic approaches such as the incremental capital output ratio (ICOR) and the Harrod-Domar growth model.[10] This production function may be justified by the observation that developing economies, such as China, are capital constrained.

Each firm's demand for capital is derived from its profit function: $\pi_i = Y_i - w - r_L$ where w is the wage rate and r_L is the lending rate determined by the banking system. I

[9] Models with asymmetric information and costly state verification have been popular in the banking literature beginning with Gale & Hellwig (1985). They show that standard loan contracts are the optimal incentive compatible contracts in this framework.
[10] See Easterly 1999 for a discussion of the advantages and drawbacks to this approach.

assume that the wage rate at state enterprises is fixed by the government. Since the goal of employment is to prevent unrest by unhappy state sector employees, the government sets the wage above the prevailing wage rate. In fact, in China in 1998 a state sector employee was paid an average of 50% more than an employee of a township and village enterprise (TVE).[11]

The banking system is the only source of capital for state enterprises. Again this appears to be a realistic assumption. In China, banks dominate the financial system. For example, at the end of 2003 the stock of bank loans stood at 145 percent of GDP while the capitalization of China's domestic stock markets was only 37 percent of GDP. In 2003, loans made by financial institutions increased by 26 percent of GDP while stock and bond issuance increased less than two percent of GDP.[12] In this model, banks act simply as agents for the government as a mechanism to allocate capital from depositors to enterprises.

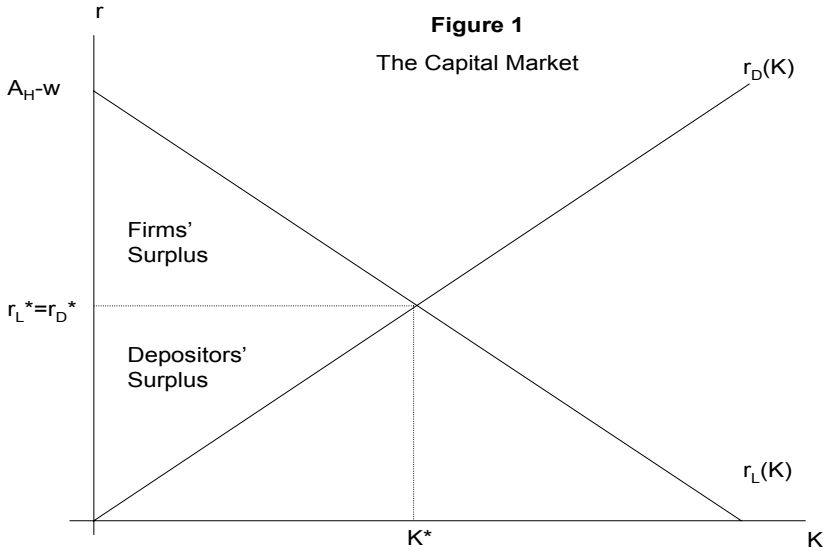
Firms are assumed to maximize profits. This was not a realistic assumption when reforms began in China in 1979. In the past decade, however, many of the reforms of SOEs have been aimed at allowing firms to retain profits and giving managers more control over allocation of scarce resources. With profit maximization, a firm will borrow a unit of capital from a bank and invests in its project when profits are greater than or equal to zero, i.e. when $\pi_i = A_i - \overline{w} - r_L \geq 0$. Thus, a firm will only borrow if the lending rate determined in the banking market is sufficiently low: $r_L \leq A_i - \overline{w}$. (If profits are identically zero, it is assumed the firm borrows and produces.) In this way, the

[11] OECD (2002), p. 88.
[12] IMF (2004), p. 43

distribution of the productivity parameter, A_i, determines a downward sloping inverse demand curve for capital, $r_L(K)$.

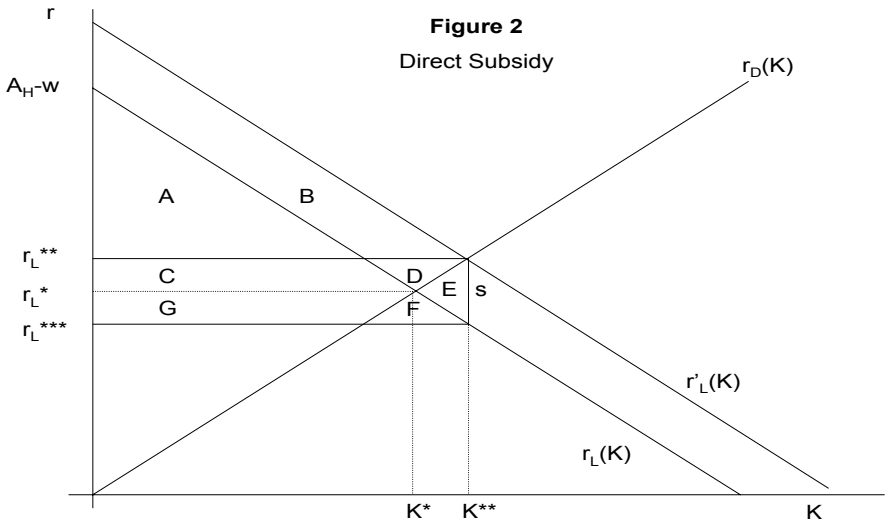
On the supply side, depositors have various alternative uses for their savings. As in the case for demand, the distribution of required returns for depositors generates a supply of capital summarized by an upward sloping inverse supply curve, $r_D(K)$. The banking system acts as an intermediary between firms and depositors and is initially assumed to be perfectly competitive. The assumption of a competitive banking market is made for simplicity and will be relaxed in section III. A similar outcome would occur if the government orders banks to operate at zero profit so that the lending rate equals the deposit rate in equilibrium. In China, interest rates are administratively controlled by the government. I also assume that the quantity of loans is equal to the quantity of deposits, i.e. banks do not have capital but simply act as intermediaries. This assumption could be relaxed with little effect on the results below.

The situation in the capital market is illustrated in Figure 1.



Supply and demand for capital are equilibrated at K* and interest rate r_L*. If firms do not receive support from the government, then a firm with a project whose rate of return is below r_L* will not borrow because the interest rate is too high for it to make positive profits.

Suppose the government offers a direct subsidy in the amount, s, to any firm that agrees to enter production and hire labor (see Figure 2). The demand for capital will shift upward by s to r_L'. As a consequence, the equilibrium interest rate and quantity of loans will increase to r_L** and K**, respectively. Employment will rise by $\Delta L = \Delta K = K^{**}-K^*$ (since one unit of labor is hired for each unit of capital employed) as marginal firms enter production and hire labor.



The subsidy will also have an effect on social surplus in the banking sector. Firms' surplus will increase by area B but fall by area C. Depositors' surplus will increase by areas C+D. The government will have to pay subsidies equal to area B+D+E = sK**. The net result is a loss of social surplus in the banking market equal to

area $E = \int_{K^*}^{K^{**}} [r_D(K) - r_L(K)]dK$. To sum up, a subsidy in the capital market has two effects. Employment will rise but social surplus will fall.

If the banking market is viewed in isolation from other markets, this is the end of the story. However, government subsidies must be financed by taxes on some other sector of the economy. In this model taxes are levied on commodity markets.

B. Commodity Markets & The Excess Burden of Taxation

For simplicity, I assume N identical goods are produced in N commodity markets. A representative market is illustrated in Figure 3.

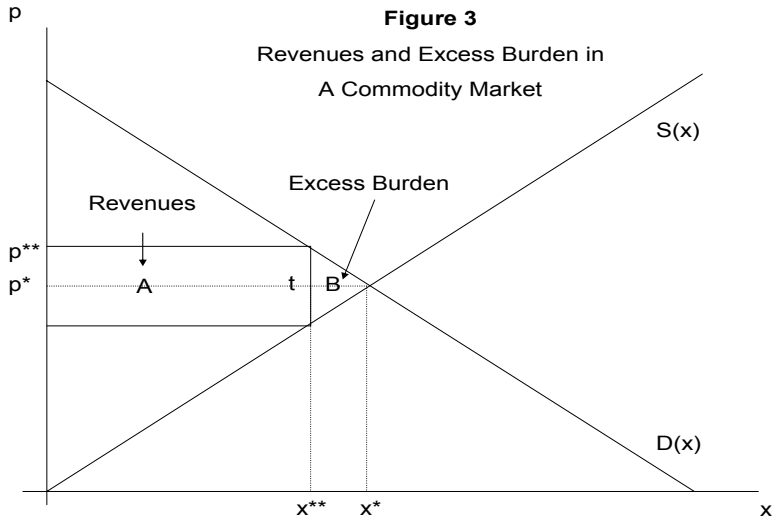


Figure 3

A tax, t, per unit is imposed in each market to raise revenues to fund the subsidy in the banking market. Associated with the tax is a deadweight loss (or excess burden) given by the Harberger triangle: $B = \int_{x^{**}}^{x^*} [D(x) - S(x)]dx$. As can be seen from the figure, the excess burden approximately increases with the square of the tax. For t close to zero, Harberger triangles and deadweight losses are small. However, for high t, marginal

changes in the tax can result in first order losses in welfare. These effects will be made more precise in the linear model examined in part D.

The focus on commodity taxation is meant to capture the situation in China where the value added tax (VAT) is the single most important source of government revenue. Set at 17%, the VAT covers all industrial production, commercial sales, and imports but excludes services. In 1999, the VAT made up 41% of Chinese government revenues making it the single largest source of revenues.[13] In contrast, the VAT makes up an average of only 16% of government revenues in industrial countries.[14] The IMF has encouraged the government to extend the VAT to cover areas that are now excluded.[15]

C. Government Policy and Required Revenues

As noted earlier, the government has two opposing goals. First, it would like to boost employment. Second, it would like to promote economic efficiency by minimizing the excess burden of taxation. These goals are embodied in a loss function similar to that used in monetary economics:

$$Loss = (S^* - S) + \lambda(L^* - L) - \theta(EB - EB^*)$$

Where:

S = social surplus in the banking sector
L = labor employed by firms
EB = excess burden of taxes in commodities markets
* indicates target levels.

According to the loss function, losses increase with a decline in social surplus in the banking sector, a decline in employment, or an increase in excess burden of

[13] OECD, p.
[14] Hofman, p. 29.
[15] See IMF, Article IV Report for China

commodity taxation. The parameters λ and θ indicate the weight placed on employment and tax minimization relative to social surplus.

To minimize its loss function, I assume the government can use one of three alternative policies: provide a direct subsidy, require banks to provide loans at below market interest rates, or agree to cover the defaults of borrowing firms up to a pre-specified limit.

i. direct subsidy

In the case of a direct subsidy, the government provides a payment, s, to firms that are willing to produce. Because there is asymmetric information, the government does not know the returns on an individual firm's investment. Thus, the government cannot target subsidies to the size of a firm's loss. Instead, it must provide the same subsidy to each firm.[16] As discussed earlier, the subsidy shifts the demand curve for loans upward by s. As a consequence, equilibrium lending increases from K* to K** and the equilibrium interest rises to r_L**. The transfer required to finance the subsidy is sK**. Although the equilibrium interest rate has risen, no firms default because the subsidy is sufficient to offset the increase in interest rates. Thus, all firms make non-negative profits and all loans are repaid. In other words, there are no non-performing loans.

ii. low interest rate loans

As an alternative to the subsidy, the government could direct banks to provide low interest loans at interest rate r_L*** (see Figure 2). Equilibrium borrowing would remain at K** and firms will have positive profits if their return on investment exceeds r_L***. Again there are no defaults or non-performing loans. The banks are making losses,

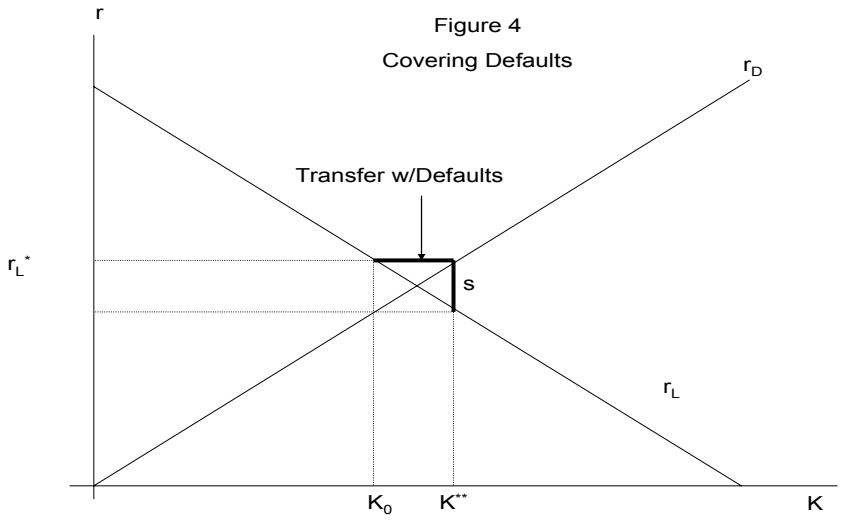
[16] Also note that because the technology is Leontief, a production subsidy and employment subsidy are equivalent in this model.

however, because their cost of funds has risen to r_L**. Bank losses are equivalent to areas C+D+E+F+G. This area represents the revenues that the government will need to raise to fund its low interest rate loan policy.

Inspection of Figure 2 shows that if the difference between the deposit and lending rates equals the amount of the direct subsidy, then the transfers required by low interest loans are the same as required by the direct subsidy (i.e. C+D+E+F+G = B+D+E). Similarly, the increase in employment and loss of surplus will also be identical.

iii. covering defaults

The third policy the government can employ is to cover loan defaults up to a pre-specified limit, $\bar{s}$. This case is shown in Figure 4.



When a firm defaults the government conducts an audit at cost η per unit capital, and learns the true draw of A_i for the defaulting firm. If the firm has lied about its return, A_i, then the government does not provide a subsidy. However, by the Revelation Principle we can assume firms truthfully report their returns. After conducting an audit, the government pays the difference between the lending rate and the project return,

(r_L**-(A_i-w)), up to a maximum of $\bar{s}$. Because the government only pays for the difference between the lending rate and the project return for the subset of firms that default, the transfer required to finance loan guarantees is $\frac{1}{2}\bar{s}(K^{**} - K_0)$ plus the cost of the audit, $\eta(K^{**} - K_0)$. If auditing costs are modest, then the transfer required to finance non-performing loans will be significantly below what would be required in the case of direct subsidies or low interest loans. More generally, there will be a trade off between the cost of audits and the cost of paying a direct subsidy to firms that do not require government support.

If the government covers defaults by making a payment directly to a firm, then it can be viewed as a contingent subsidy and should appear in the government budget. If instead the government orders the bank to absorb the loss, then it appears as a non-performing loan on the books of the bank. In other words, when the government agrees to cover defaults, a large number of firms have zero or negative profits, default on their loans, and non-performing loans in the banking system increase.

D. A Linear Model

To quantify the results from the previous section, we need to adopt a particular model of demand and supply in the capital and commodity markets. I will assume a linear model.[17] A linear demand curve could arise from the Leontief production function if we assume that the productivity parameter, A_i, is distributed uniformly on the interval $[0, A_H]$. The inverse demand curve for capital would then be represented by a curve of the form: $r_L = a - bK$. Similarly, I assume the supply of capital can be represented by

[17] The discussion here implicitly assumes that a linear model is a reasonable approximation to reality. While this is an empirical question, the linear model is commonly used in the public economics literature.

the linear curve: $r_D = c + dK$.[18] In the N identical commodity markets, demand and supply are assumed to be given by: $D = \alpha - \beta x$ and $S = \gamma + \delta x$.

To pay for its chosen policy, the government levies a tax, t, per unit in each commodity market as shown in Figure 3. The revenues generated in an individual commodity market are R = tx** and the excess burden of the tax is given by the triangle= $\frac{1}{2} t(x^* - x^{**}) = \frac{1}{2} \frac{t^2}{(\beta + \delta)}$. Since there are N commodity markets, the total excess burden of the tax is: $EB = \frac{Nt^2}{2(\beta + \delta)}$

E. Loss Function

In considering optimal production, the government wants to balance the competing interests of employment and efficiency. As described earlier, the loss function is given by:

$$Loss = (S^* - S) + \lambda(L^* - L) + \theta(EB - EB^*)$$

In the banking market with a linear model, the relationship between the subsidy and equilibrium demand for capital is given by:

$$s = [c + dK] - [a - bK] \qquad => \qquad K = \frac{(a - c) + s}{(b + d)} \qquad (1)$$

With further work, it can be shown that $S = \frac{(a - c)^2 - s^2}{2(b + d)}$ and the change in social surplus in the banking market is:

[18] In this model, we are using Marshallian demand curves while theory calls for the use of compensated demand curves. The use of Marshallian demand curves leads to an underestimation of the excess burden. However, it does not affect the main point that NPLs will result in a smaller excess burden than providing subsidies.

$$S^* - S = \frac{s^2}{2(b+d)}.$$

Similarly, because one unit of labor is employed for each unit of capital, we have: L = K. Thus, the change in employment is:

$$L^* - L = K^* - K = -\frac{s}{(b+d)}$$

Finally, we need to determine the excess burden as a function of subsidies. It can be shown that the excess burden of taxation in the N commodity markets is proportional to the square of revenues and inversely proportional to the size of the taxed markets[19]:

$$EB \cong \frac{R^2}{4NC} \qquad (2)$$

Where C = value of social surplus in a single commodity market when there are no taxes. Equation (2), in turn gives us a formula for the marginal change in the excess burden with a change in required revenues:

$$\frac{dEB}{dR} \cong \frac{R}{2NC} \qquad (3)$$

Required Revenues under Subsidies and Loan Guarantees

With an approximation for the excess burden of taxation, we can compare the costs of subsidies & low interest loans with loan guarantees. We would like to answer a number of questions:

1) What is the cost advantage of loan guarantees?

2) How does the cost advantage depend on the cost of auditing?

3) What is the optimal size of subsidies or loan guarantees?

[19] See Appendix for a derivation.

To answer these questions, we begin by specifying required revenues, R, under each policy. Let R_0 represent the revenues required to cover operations of the government other than transfers to state enterprises. These revenues are used to pay for social goods such as defense, transfers to the poor and elderly, and operations of the government.

The additional revenues needed to fund subsidies/low interest loans are given by the rectangular region C+D+E+F+G = sK** in Figure 2. From equation (1), we find the additional revenues required for subsidies are:

$$R_s = sK^{**} = \frac{s^2}{(b+d)} + \frac{(a-c)s}{(b+d)} \qquad (4)$$

Similarly, the additional revenues to fund loan guarantees are given by the quantity of subsidies paid to defaulting firms (the triangular region in Figure 3) plus the cost of audits (η times the quantity of defaults). Since the quantity of defaults equals $(K^{**} - K_0) = s/b$, the additional revenues required by loan guarantees given by:

$$R_{LG} = \tfrac{1}{2} s(K^{**} - K_0) + \eta(K^{**} - K_0) = \frac{s^2}{2b} + \frac{\eta s}{b} \qquad (5)$$

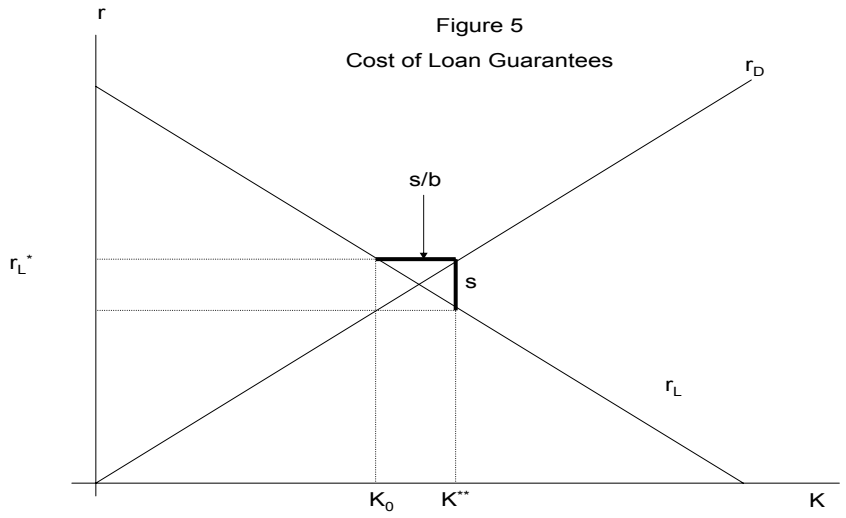
The Cost Advantage of Loan Guarantees

We would like to have a sense of the cost advantage of loan guarantees versus subsidies/low interest loans. I will address auditing costs shortly. For the moment, assume auditing costs are zero, (i.e. η = 0). Assume the government wants to target a specific increase in employment, ΔL. ΔL determines the target subsidy, s, or maximum

loan guarantee, $\bar{s}$, as s = $\bar{s}$ = (b+d) ΔL. The difference in the quantity of transfers and excess burden of taxation is given by the following proposition:

Proposition 1 – Transfers and Excess Burden Under Subsidies and Loan Guarantees: Let f be the fraction of loans that are non-performing under loan guarantees and R_0/NC be the ratio of revenues to GDP in the taxed commodity markets. Also assume auditing costs are zero and that transfers under subsidies are ΔR_s. Then the ratio of transfers required by loan guarantees to the transfers required by subsidies is f/2 and the excess burden of taxation is reduced by approximately: $\left(1-\frac{f}{2}\right)\frac{R_0}{2NC}\Delta R_s$.

[Proof. See Figure 5.



Under loan guarantees, the quantity of non-performing loans is given by s/b. Total loans are given by $K^{**} = \frac{(a-c)+s}{(b+d)}$. Thus, the fraction of loans that are non-performing is:

$$f = \frac{s/b}{K^{**}} = \frac{(b+d)}{b}\frac{s}{(a-c)+s} \qquad (6)$$

The ratio of transfers required by loan guarantees to the transfers required by subsidies when auditing costs are zero is: $\frac{s^2/2b}{sK^{**}} = \frac{s^2/2b}{[(a-c)s+s^2]/(b+d)} = \frac{f}{2}$.

From equation (3), we know the marginal excess burden of taxation starting at R_0 is approximated by: $\left.\frac{dEB}{dR}\right|_{R_0} \cong \frac{R_0}{2NC}$. Using loan guarantees instead of subsidies reduces transfers by $\Delta R_s - \Delta R_{LG} \cong \left(1-\frac{f}{2}\right)\Delta R_s$. Thus the excess burden of taxation is reduced by approximately: $\left(1-\frac{f}{2}\right)\frac{R_0}{2NC}\Delta R_s$.]

How big a difference do loan guarantees make in China? The officially reported percentage of non-performing loans is 25% (i.e. f = ¼). This implies the transfers required by loan guarantees would be only 1/8 the transfers required by subsidies, (i.e. *f*/2=1/8). Lardy (1998) states that direct and indirect subsidies to SOEs were approximately 10% of GDP in the early 1980s. By switching to loan guarantees, transfers would drop to 1% of GDP (i.e. $\Delta R_{LG} \cong \left(f/2\right)\Delta R_s = \left(1/8\right)10\% \cong 1\%$). The Chinese government collects approximately 20% of GDP as tax revenues implying $R_0/NC \cong 1/5$. Thus, the excess burden of taxation would be reduced by approximately 1% of GDP (i.e. $\Delta EB_s - \Delta EB_{LG} = \left(7/8\right)\left(1/10\right)10\% \cong 1\%$.

The Effect of Auditing Costs

In general, auditing costs will not be zero. We would like to have some idea of whether loan guarantees or subsidies require smaller revenues. Obviously, the answer depends on the cost of audits. If audits are expensive enough then auditing costs may outweigh the fact that subsidies must be paid to all firms. The following proposition gives the condition on auditing costs, η, for loan guarantees to require smaller revenues than subsidies.

Proposition 2 – Auditing Costs:

Assume that fraction, f, of loans are non-performing under loan guarantees, then loan guarantees will require smaller revenues than subsidies if and only if:

$$\eta < s\left(\frac{1}{f} - \frac{1}{2}\right).$$

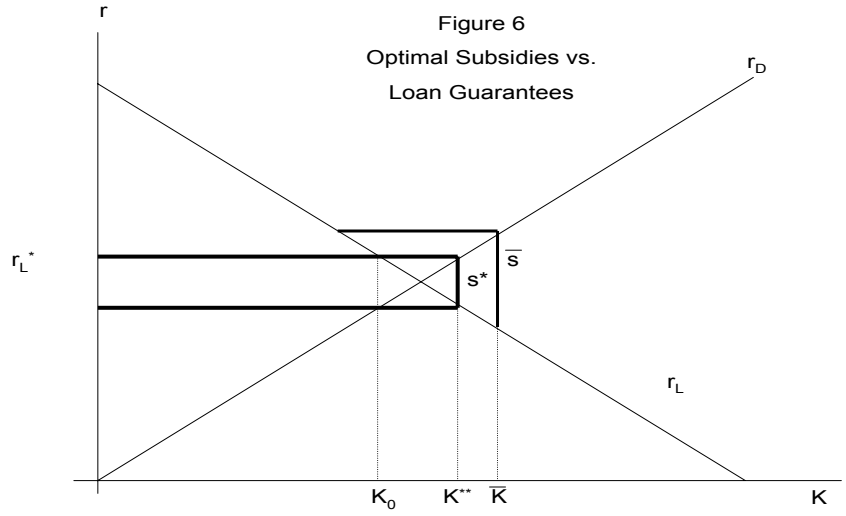
[Proof. See Appendix.]

How do we interpret this condition? If all loans are non-performing, then $f = 1$. Proposition 2 states that loan guarantees will require smaller transfers and have a smaller excess burden if auditing costs are less than half the subsidy: $\eta < \frac{s}{2}$. However, with a lower fraction of non-performing loans, auditing costs can be higher and loan guarantees will still require smaller transfer costs than subsidies.

Optimal Subsidies/Loan Guarantees

The last section assumed that the government had a fixed target for employment. Given the government's loss function, however, the optimal level of employment and

subsidy depend on which policy is chosen. Assuming loan guarantees require smaller transfers than subsidies, the optimal maximum payment, $\bar{s}$ will be larger than the optimal level of subsidies, s*.



The argument is summarized in Figure 6 and the following proposition:

Proposition 3 – Assume s and η are small relative to (a-c) and that auditing costs are zero . Then, the optimal subsidy is given by:

$$s^* = \frac{\lambda - \theta \frac{(a-c)}{2} \frac{R_0}{NC}}{\left[1 + \theta\left(\frac{B}{NC} + \frac{R_0}{NC}\right)\right]} \qquad (7)$$

The optimal maximum payout under loan guarantees is given by:

$$\bar{s} = \lambda \qquad (8)$$

[For a proof, please see the appendix.]

How do we interpret these expressions? First, look at equation (7). s* and λ can be measured with respect to (a-c), which is the social surplus from the best possible investment project. R_0/NC and B/NC are fractions between zero and one that reflect the size of the banking market and required revenues compared to the taxed markets.

- If λ is large relative to the available surplus (a-c), then a subsidy is welfare improving. As expected, greater weight on employment results in a greater subsidy.
- The negative term in the numerator reflects that fact that it may be optimal to introduce some taxation in the banking market to reduce the excess burden of taxation in the commodity markets. If there are no revenues required for other purposes (i.e. R_0=0), then without a subsidy there is no excess burden in the commodity markets. Thus, there is no need to tax the banking market to raise revenues.
- The optimal subsidy declines with an increase in the size of the banking sector, B, and revenues required for other purposes, R_0, relative to the commodity markets, NC. This occurs because for a given subsidy, a larger banking market implies a greater quantity of loans, K**, and higher transfers and excess burden in the commodity markets.

With a loan guarantee, we can make the following observations:

- Since s and η are small, the change in excess burden is effectively zero. Thus, the size of the banking markets, B, and revenues for other purposes, R_0, do not affect the optimal loan guarantee.
- The optimal loan guarantee is greater than the optimal subsidy, $\bar{s} > s^*$.

III. Application to China

The model in this paper is highly stylized. Nonetheless, it helps to explain the evolution of China's tax and financial systems since reforms began in 1978. In pre-reform China, state enterprises' capital expenditures were all financed directly from the budget and all profits were remitted back to the budget. While the socialist economy was severely distorted, there was no excess burden in the goods markets because prices were determined centrally and commodities were not taxed. The reforms that began in 1978 were designed increase SOEs efficiency and improve incentives via retained profits, price reform, and removal of financing from the budget to the banking system. At the same time, the tax system was changed to increase funds raised through commodity taxes and reduce funds raised from enterprise profits. The shift from budget to bank financing had the effect of reducing across the board subsidies to all state enterprises and concentrating remaining subsidies at firms with NPLs. Similarly, the attempts to improve the incentives for state enterprises had the effect of giving firm managers a greater stake in SOE profits. Finally, current efforts to close loss-making SOEs and improve auditing of remaining firms appear consistent with the assumptions of the model presented here.

Pre-Reform China

Prior to 1978, China followed an economic policy designed to promote heavy industry. The main tool to achieve this goal was the state plan. The plan specified what investments and operations a state enterprise could undertake. The government budget was primarily designed to allocate resources in order to fulfill the state plan rather than as a policy tool. All SOE capital expenditures were funded from the government budget. In 1979, capital expenditures were 15% of GNP and 41% of total expenditures, respectively.

Similarly, all SOE profits were returned to the government in the form of profits taxes. In 1979, government income from SOEs amounted to 17.1% of GDP. Since capital expenditures were given to SOEs according to the plan as grants, they amounted to interest free loans. As such they correspond to the case of subsidies/low interest loans in the model in Section II.

Enterprise Reforms

Economic reforms in China began with the fall of the Gang of Four and the rise to power of Deng Xiaoping in 1978. To improve the efficiency of the state enterprise sector, a number of reforms were undertaken. In 1979, the government introduced a profit retention system with the goal of increasing firm profits. However, retention rates had to be negotiated firm by firm and rates often rose with profits, reducing incentives. At the same time, capital expenditures were shifted from the government budget to the banking system. Between 1979 and 1983, capital expenditures in the budget declined from 15 to 7 percent of GNP.

Tax Reforms

Throughout the 1980s and early 1990s the Chinese government attempted to improve incentives of SOEs through changes in the tax system. In 1983-84, the profit retention system was replaced with an enterprise income tax. At the same time, the value added tax was introduced. Then in 1987-88, the tax system was replaced with the contract responsibility system. Under this arrangement, SOEs negotiated individual tax payments to the government. Excess revenues were to be retained to encourage firms to maximize profits and increase their autonomy. However, the contract responsibility system failed to increase tax revenues for the government since renegotiation in the event

of losses was easier than efforts to improve performance.[20] In 1994, the government broadened the VAT, raising its contribution to revenues from 3 to 5% of GNP and reduced the SOE income tax from 55 to 33% of profits.

Reforms to the Financial System

Reforms to China's financial system paralleled those in the tax system. Prior to reform, the People's Bank of China (PBOC) was the only bank in China. It functioned simply to channel funds to fulfill the state plan. The PBOC took all deposits, allocated credits for investment, and issued currency to make up the difference between deposits and loans. From 1979 to 1984, the government established four state banks to take over loans from the PBOC. These banks were the Agricultural Bank of China (ABC), the Industrial and Commercial Bank of China (CBC), the Construction Bank of China (CBC), and the Bank of China (BOC). Overall allocation of credit was still controlled by the PBOC, however, via the annual credit plan. The credit plan became one of the main tools of macroeconomic control.

A series of additional reforms was introduced in the mid-1990s. In 1994, three policy banks were created to take over policy loans of the government and allow the four state banks to become commercial banks. In 1995, the government issued the PBOC and Commercial Bank Laws. These specify the establishment of a commercial banking sector and reorientation of the central bank towards indirect policy tools. Finally, in 1998 the credit plan was abolished. However, borrowing and deposit rates remain controlled by the People's Bank.

Price Reform and Increased Competition

[20] Ma (2000), p. 17.

Along with reforms to the tax and financial systems, China' government made a number of other reforms. This included the introduction of dual track pricing in the early 1980s and the gradual freeing of most prices into the 1990s. As of 2000, however, the IMF estimates that 10-15% of all prices in China are still controlled by the government. Another key reform was the introduction of competition for state enterprises in the form of town and village enterprises (TVEs), private, and foreign firms. As of 1999, the non-state sector accounted for approximately 70 % of industrial production (compared with 30% for SOEs) and % of urban employment (compared with xx% for SOEs).

Recent Reforms

For most of the reform period, loss-making SOEs were not sanctioned or subject to audit. More recently, this situation has changed. The OECD reports that the commercial banks began to audit their customers in 1996 and that in 1997 approximately 2000 large and medium SOEs were audited in Shanghai alone.[21] State enterprises that are not in good shape are not receiving new loans. The result has been that many small and medium state enterprises have been slowly deprived of funds and that local officials can no longer ensure that local firms receive soft loans from the state banks. According to the Chinese government, the number of industrial SOEs fell from 127,000 in 1996 to 61,300 in 1999.[22] Very few have actually gone out of business. Most have been merged with or leased to other enterprises or transformed into joint stock companies.

The Model and Reality

Reforms of the Chinese economy have been broadly consistent with the basic assumptions of the model. SOE reforms have focused on making firms more profit

[21] OECD- China in the World Economy, p. 181.
[22] China Statistical Yearbook 2000.

oriented. In addition, financing of SOEs has been shifted from grants on the government budget to bank financing. This shift has reduced the size of government contributions to SOEs while giving more of the subsidies to loss-making SOEs in the form of non-performing loans. The shift has also accompanied the increasing use of commodity taxation as a method to fund government expenditures. However, unlike in the model, until very recently there has been no serious effort to audit SOEs or sanction the biggest money losers by refusing to renew loans or closures. Still the idea that non-performing loans reduce the excess burden of taxation may help to explain how the Chinese government has targeted financial support for loss-making SOEs and sustained state sector employment despite limited tax resources.

Appendix

Relation between excess burden, EB, and required revenues, R.

Taxes in the commodities markets introduce a wedge between demand and supply (see Figure 3):

$$t = D - S = (\alpha - \gamma) - (\beta + \delta)x$$

which implies :

$$x = \frac{(\alpha - \gamma) - t}{(\beta + \delta)}$$

Revenues, R, raised by the tax in the N commodity markets are:

$$R = Ntx = N\frac{(\alpha - \gamma)t - t^2}{(\beta + \delta)} \qquad (2)$$

Solving for t as a function of R, we get:

$$t = \frac{(\alpha - \gamma) \pm \sqrt{(\alpha - \gamma)^2 - 4(\beta + \delta)R/N}}{2}$$

As a simplification, assume t is small relative to (α-γ) because the subsidy in the financial sector is small relative to the overall economy. In this case, (1) can be simplified to:

$$R \cong N\frac{(\alpha - \gamma)t}{(\beta + \delta)}$$

Which implies: $$t \cong \frac{(\beta + \delta)R}{(\alpha - \gamma)N}$$

Where t is not insignificant relative to (α-γ), this approximation underestimates required taxes and the excess burden. As a result, the derivation that follows will overestimate the optimal subsidy.

Excess Burden

In a linear model, the excess burden in the N commodity markets is given by the N Harberger triangles (see Figure 3):

$$EB = N\frac{1}{2}t(x^*-x) = \frac{Nt^2}{2(\beta+\delta)}$$

which can also be taken as a second order Taylor series approximation when the model is non-linear.[23]

When combined with the approximation for taxes, t, we have:

$$EB \cong \frac{(\beta+\delta)R^2}{2N(\alpha-\gamma)^2}$$

Let $C \equiv \frac{(\alpha-\gamma)^2}{2(\beta+\delta)}$ be the value of social surplus in a single commodity market when there are no taxes. Then:

$$EB \cong \frac{R^2}{4NC}.$$

Proof of Proposition 2

See Figure 5.

Loan guarantees require smaller revenues than subsidies if and only if:

$$R_{LG} < R_s$$

$$<=> \quad \frac{s^2}{2b} + \frac{\eta s}{b} < \frac{s^2}{(b+d)} + \frac{(a-c)s}{(b+d)}$$

$$<=> \quad \frac{2\eta+s}{2b} < \frac{s+(a-c)}{(b+d)}$$

$$<=> \quad \frac{2\eta+s}{2b} < \frac{s}{fb}$$

[23] See the Handbook of Public Economics, Chapter 21, p. 1358.

$$<=> \quad \eta < s\left(\frac{1}{f} - \frac{1}{2}\right).$$

Proof of Proposition 3

Subsidies

The government loss function is given by:

$$Loss = (S^* - S) + \lambda(L^* - L) + \theta(EB - EB^*)$$

In Section IIE, we showed that social surplus in the banking sector is given by:

$$S^* - S = \frac{s^2}{2(b+d)}.$$

Similarly, the change in employment is:

$$L^* - L = K^* - K = -\frac{s}{(b+d)}$$

The excess burden of taxation is approximated by:

$$EB \cong \frac{R^2}{4NC}$$

Under subsidies,

$$R = R_s + R_0 = \frac{s^2}{(b+d)} + \frac{(a-c)s}{(b+d)} + R_0$$

This gives:

$$EB \cong \frac{1}{4NC}\left[\frac{s^4}{(b+d)^2} + \frac{2(a-c)s^3}{(b+d)^2} + \frac{(a-c)^2 s^2}{(b+d)^2} + \frac{2R_0 s^2}{(b+d)} + \frac{2(a-c)R_0}{(b+d)} + R_0^2\right]$$

However, because we assumed s is small relative to (a-c), the first and second terms in the brackets are small relative to the third term and may be dropped.

EB* is the level of excess burden needed to fund revenues required for other purposes, R_0:

$$EB^* = \frac{R_0^2}{4NC}.$$

Let $B \equiv \frac{(a-c)^2}{2(b+d)}$ be the surplus in the banking sector without subsidies, then:

$$(EB - EB^*) \cong \frac{1}{2NC}\left[\frac{Bs^2}{(b+d)} + \frac{R_0 s^2}{(b+d)} + \frac{(a-c)R_0}{(b+d)}\right]$$

The loss function becomes:

$$Loss = (S^* - S) + \lambda(L^* - L) + \theta(EB - EB^*)$$
$$= \frac{s^2}{2(b+d)} - \lambda\frac{s}{(b+d)} + \theta\frac{(B+R_0)s^2 + (a-c)R_0 s}{2(b+d)NC}$$

Maximizing with respect to s, gives the first order condition:

$$s - \lambda + \frac{\theta}{2NC}\left[2(B+R_0) + (a-c)R_0\right] = 0$$

The solution of the first order condition gives the optimal subsidy as:

$$s^* = \frac{\lambda - \theta\frac{(a-c)}{2}\frac{R_0}{NC}}{\left[1 + \theta\frac{(B+R_0)}{NC}\right]}$$

Loan Guarantees

We have assumed that auditing costs are zero. This means: $R_{LG} = \frac{s^2}{2b} + R_0$. In the case of subsidies, we assumed s was small relative to (a-c) and hence s^2 is small relative to R_0. Unless b is small (i.e. demand is very price elastic), this implies:

$R_{LG} = \frac{s^2}{2b} + R_0 \cong R_0$. As a result, the excess burden of loan guarantees is zero: EB-EB*=0. The loss function becomes:

$$Loss = (S^* - S) + \lambda(L^* - L)$$
$$= \frac{s^2}{2(b+d)} - \lambda\frac{s}{(b+d)}$$

In this case, the first order condition becomes:

$$\frac{s}{(b+d)} - \frac{\lambda}{(b+d)} = 0$$

Or

$$\bar{s} = \lambda$$

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