

# Tests of Financial Intermediation and Banking Reform in China<sup>1</sup>

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We develop tests of financial intermediation by national banking systems based on the expectation that, in commercial systems, financial intermediation should not be overly influenced by policy variables; should be greater in richer, faster growing industrial areas; and should direct funds to the best projects regardless of where deposits originate. Using Chinese provincial data from 1991 to 1997, we test whether financial reforms in the mid-1990s increased efficient intermediation by different financial institutions. We find that the importance of policy lending by state banks did not fall during the recent period and that lending by financial institutions did not respond to economic fundamentals. *J. Comp. Econ.*, December 2001, 29(4), pp. 608–644. University of Michigan, Ann Arbor, Michigan 48109; and Department of Government, Dartmouth College, Hanover, New Hampshire 03755. © 2001 Elsevier Science

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## 1. INTRODUCTION

As economies grow, financial institutions play an increasingly important role in directing financial resources to their most productive use. Through their greater size and scope, they are better able than informal institutions to safeguard deposits, diversify portfolio risk, provide liquidity to borrowers and depositors, and achieve economies of scale in evaluating projects and providing financial services. The depth of financial intermediation, measured by loans as a share of GDP, has been shown to be positively associated with both the level of development, measured by GDP per capita, and the rate of economic growth.<sup>2</sup>

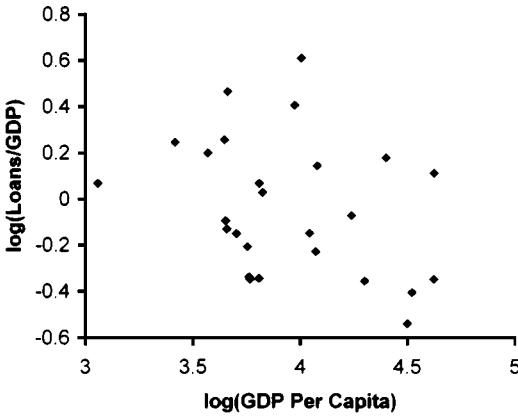
The literature's emphasis on the size of the financial sector overlooks differences in how well available resources are allocated. The recent Asian financial crisis and the experience of banks in transition economies (Bonin and Szekely, 1994), as well as historically poor bank performance in Latin America and Africa (Haggard and Lee, 1995; Nissanke, 1998), highlight the difficulty of establishing successful commercial banking systems that allocate financial resources efficiently. Policy lending, barriers to interregional lending, distorted pricing, poor managerial incentives, and lack of prudential financial regulation can undermine financial performance.

This paper proposes a new approach to assess the effectiveness of financial intermediation by national banking systems. The tests, derived from the optimization problem of bank managers, exploit regional financial and economic data and are based on the expectation that, in efficient systems, financial intermediation should not be overly influenced by policy variables; should be greater where projects are more profitable and require greater financing, which is typically in faster growing, richer, and more industrial areas; and should direct funds to the best projects regardless of where deposits originate.

We apply these tests to China. The Asian financial crisis has heightened scrutiny of China's state banking system, whose fragility stems from the continued use of the financial system to support urban-based, state-owned enterprises (Brandt and Zhu, 2000). Recent estimates suggest that more than one quarter of the loans of China's four major state-owned banks are nonperforming and that these banks are technically insolvent (Lardy, 1998). Provincial data of 1997 reveals a striking inverse relationship between financial intermediation and GDP per capita that is at odds with the empirical regularity of positive correlation found in cross-country studies (Fig. 1). This pattern suggests that the allocation of financial resources across provinces may be highly inefficient, with richer provinces being taxed relative to poorer provinces (Sehrt, 1999; Lardy, 1998).

In recent years, the Chinese leadership has recognized the importance of improving financial intermediation and has made financial reforms a top policy priority.

<sup>2</sup> See Gertler and Rose (1996), Goldsmith (1969), King and Levine (1993), Levine and Zervos (1998), and Rajan and Zingales (1998). Financial intermediation can also occur through equity markets, but in China the stock market is small and tightly regulated.



**FIG. 1.** All bank financial intermediation rate and GDP per capita in Chinese provinces 1997. Note: Excludes Beijing, Tianjin, Shanghai, and Tibet.

The most sweeping changes were implemented in the mid-1990s, i.e., relaxation of binding credit plans following the 1993 antiinflation campaign, centralization of relending by the People's Bank of China (PBC) to reduce excessive local influence on central bank financing of loans, a shift to ratio management of loans that gave more autonomy to state banks to reallocate funds among provincial branch offices, adoption of a new Commercial Bank Law to improve managerial incentives and prudential financial regulation, establishment of policy banks to separate policy from commercial lending, and the establishment of a national, unified interbank market. This paper provides initial empirical evidence on the effect of these reforms on loan allocation decisions. We examine the performance of different Chinese financial institutions before and after the reforms; these consist of all state banks, including specialized and policy banks; the Agricultural Bank of China (ABC), a specialized bank that was relieved of most of its policy lending duties with the establishment of China's largest policy bank, the Agricultural Development Bank of China (ADBC); rural credit cooperatives (RCCs), which are the largest financial institutions other than state banks and which have a branch structure reaching to villages; and other financial institutions (OFIs), including urban cooperatives and Urban Cooperative Banks, national and regional commercial banks, and national trust and investment companies, which constitute a small but dynamic part of the financial sector.

We find a significant effect of policy concerns on lending by state specialized and policy banks, such as to support state-owned enterprises and grain procurement, and, if anything, this has increased since the financial reforms in the mid-1990s. Economic fundamentals have had little effect on total lending by state banks, but there is evidence that separation of policy and commercial lending through the establishment of the ADBC has enabled the ABC to become more commercially

oriented. Among other financial institutions, RCCs and OFIs both seem poorly integrated into financial markets. We conclude that while recent reforms of state banks, including reforms after 1997, and the growth of OFIs hold promise for future performance, remaining restrictions on interbank lending, interest rates, and entry remain serious obstacles to efficient financial intermediation.

The paper is organized as follows. In Section 2, we present a model of financial intermediation that leads to formal tests of efficient financial intermediation. In Section 3, we introduce China’s financial system and describe the main financial reforms. Section 4 outlines the empirical specification and hypotheses to be tested. The empirical analysis is presented in Section 5, including discussions of data, estimation, and results. Section 6 concludes.

## 2. MODELING FINANCIAL INTERMEDIATION

Consider the problem of a bank or bank branch, denoted  $b$ , located in region  $r$  lending to different sectors of the economy, indexed by  $i$ .<sup>3</sup> Bank profits of bank  $b$  in region  $r$  can be expressed as

$$\pi_{rb} = \sum_i \left\{ (1+r) \int_0^{L_{rbi}} R_{rbi}(L) dL \right\} + L_{rbg}(1+r)R_{rbg} - (1+d)D_{rb} - (1+r_T)T_{rb}, \tag{1}$$

where  $r$  is the loan interest rate,  $d$  is the deposit interest rate,  $r_T$  is the interest rate for interbank loans,  $R_{rbi}$  is the expected repayment rate for loans to sector  $i$ ,  $R_{rbg}$  is the expected repayment rate for government policy loans,  $L_{rbi}$  is the amount of loans to sector  $i$ ,  $L_{rbg}$  is the amount of government policy loans,  $D_{rb}$  is the amount of deposits, and  $T_{rb}$  is the net amount of interbank borrowing.

The bank manager’s utility reflects the dual commercial and policy objectives of banks in China. It is a weighted sum of the bank’s profits and the volume of policy lending, denoted  $L_{rbg}$ . The one-period utility-maximization problem of bank  $b$  in region  $r$  can be expressed as

$$\text{Max}_{L_{rbi}, L_{rbg}, T_{rb}} U_{rb} = \pi_{rb} + \lambda_{rb} \log(L_{rbg}) \tag{2}$$

s. t.

$$\sum_i L_{rbi} + L_{rbg} - D_{rb} - T_{rb} = 0, \tag{3}$$

where  $\pi_{rb}$  is bank profits,  $L_{rbg}$  is the volume of policy lending, and  $\lambda_{rb}$  is the relative utility weight on policy lending.

<sup>3</sup> In China, provincial banks, and many lower level banks, are independent accounting units. However, even if all decisions are made by national headquarters, unless severe information asymmetries and moral hazard problems are present, the pattern of predicted lending will be the same as in the decentralized case.

Assuming a free interbank market for funds, the bank can demand (or supply) funds from (or to) the interbank market so that  $T_{rb}$  can be positive or negative. The bank takes all interest rates, the amount of deposits, and the expected repayment rate of policy loans as exogenous. It chooses the amount of lending to each sector, the amount of policy lending, and the amount of net borrowing from the interbank market. A balance condition equates the sources and uses of funds, i.e., Eq. (3).

For commercial lending, the main difference between regions and banks is the quality of loan projects, or the expected repayment rate on loans. We assume that the repayment rate is a linear function of the economic fundamentals including the sector's size, as measured by the share of its output,  $q_{ri}$ , the sector's rate of growth,  $g_{ri}$ , interacted with its size, the overall level of development measured by output per capita, denoted as  $y_r/pop_r$ , and the extent of financial intermediation, or the amount of lending by the bank,  $L_{rbi}$ , and lending by other banks in the sector, denoted  $L_{-rbi}$ , each normalized by sectoral output,  $q_{ri}y_r$ . Hence, we posit

$$R_{rbi} = -\alpha_i^1 \frac{L_{rbi}}{q_{ri}y_r} - \alpha_i^2 \frac{L_{-rbi}}{q_{ri}y_r} + \alpha_i^3 q_{ri} + \alpha_i^4 q_{ri}g_{ri} + \alpha_i^5 \ln\left(\frac{y_r}{pop_r}\right). \quad (4)$$

Here, all the coefficients,  $\alpha_i^n$ , are defined to be positive, and the signs in Eq. (4) are explained as follows. As lending to the sector increases, good projects become harder to find and the expected repayment rate falls as indicated by the first two terms. The larger and faster growing is the sector, the easier it is to find good projects for a given lending volume as represented by the next two terms. Regions with higher levels of development tend to have greater financing requirements because of more input- and capital-intensive production activities as indicated by the last term. Furthermore, if different banks serve different client pools within the sector, the effect of loans from other banks on repayment may be less than that of the bank's own lending, i.e.,  $\alpha_i^1 > \alpha_i^2$ .

With a free interbank market, each bank can borrow or lend as much as it wants at the interbank interest rate. Lending to each sector in each province equates the marginal expected return to the cost of interbank funds, which, if set to clear the market, leads to an efficient allocation across sectors and provinces.

Solving the bank's maximization problem, aggregating lending to different sectors and policy lending, normalizing loan volume by economic output, and solving for the Nash equilibrium for lending by multiple banks, if each bank takes lending by the other banks to be exogenous, yields the following expression for bank intermediation rates:

$$l_{rb}^* = \sum_i \left( \frac{\kappa_i \alpha_i^3}{\alpha_i^1} q_{ri} + \frac{\kappa_i \alpha_i^4}{\alpha_i^1} q_{ri} g_{ri} \right) + \sum_i \frac{\kappa_i \alpha_i^5}{\alpha_i^1} \ln\left(\frac{y_r}{pop_r}\right) - \sum_i \frac{\kappa_i (1 + r_T)}{\alpha_i^1 (1 + r)} + \frac{\lambda_{rb}}{cy_r}. \quad (5)$$

Here,  $\kappa_i$  are constant parameters that measure the substitutability of lending among banks that lend to the same sector and  $c = (1 + r_T) - (1 + r)R_{rbg}$ . Equation (5),  $\kappa_i$ , and  $c$  are derived explicitly in the Appendix.

Note that, with a free interbank market, optimal policy lending and commercial lending are separable (see Appendix for expressions for optimal policy and commercial lending). Optimal levels of commercial lending are the same regardless of the amount of policy lending and vice versa, since in either case, the opportunity cost of funds is  $r_T$ . Consequently, total bank intermediation is a function both of economic fundamentals and policy lending goals.

If the volume of interbank lending is restricted ( $TL_{rb} < T_{rb} < TU_{rb}$ ), where  $TL_{rb}$  and  $TU_{rb}$  are lower and upper bounds, and one of the constraints is binding, i.e., the bank would like to borrow or lend more at the going interest rate, the following identity must hold:

$$l_{rb} = \frac{D_{rb}}{Y_r} + \frac{TL(TU)_{rb}}{y_r}. \quad (6)$$

If interbank constraints are identical for all banks in all provinces, the quality of loan projects still affects lending amounts within the range of the bounds. If, on the other hand, interbank transfers are fully dictated by policy, i.e.,  $TL_{rb} = TU_{rb}$ , the bank has no role in affecting the amount of lending and economic fundamentals become irrelevant.

Of course, it is possible that the bounds themselves are responsive to economic fundamentals if officials internalize the goal of efficient intermediation. In the case of efficient planning, planned transfers would be set equal to the market-determined amounts and the outcome would be indistinguishable from the decentralized case. However, officials may have other policy objectives. Intermediation could even be inversely related to economic fundamentals if prosperous areas are taxed to finance policy lending elsewhere. Absent a free interbank market, intermediation outcomes depend on the specific alternative mechanisms that enable funds to move across regions.

We can model the transfer bounds as a function of economic fundamentals, policy variables, and deposits by writing

$$TL(TU)_{rb} = \delta^0 + \sum_i (\delta_i^1 q_{ri} + \delta_i^2 q_{ri} g_{ri}) + \delta^3 \ln\left(\frac{y_r}{pop_r}\right) + \delta^4 \lambda_{rb} + \delta^5 \lambda_r + \delta^6 \frac{D_{rb}}{y_r}. \quad (7)$$

Inclusion of deposits captures the idea that the government may tax banks with high deposit levels by adjusting transfer bounds. In such cases, more deposits do not necessarily translate into an ability to make more loans. Substituting (7) into

(6) yields the following expression for lending when transfer bounds are binding:

$$l_{rb} = \delta^0 + \sum_i (\delta_i^1 q_{ri} + \delta_i^2 q_{ri} g_{ri}) + \delta^3 \ln\left(\frac{y_r}{pop_r}\right) + \delta^4 \lambda_{rb} + \delta^5 \lambda_r + (1 + \delta^6) \frac{D_{rb}}{y_r} \quad (8)$$

This equation contains two variables that do not appear in the lending equation, Eq. (5), which assumes efficient intermediation. These new variables are provincial policy lending goals,  $\lambda_r$ , which include policy loans not lent by the bank itself, and the amount of deposits in the bank,  $D_{rb}/y_r$ . Thus, measuring the effect of these variables on lending is a natural test for efficient intermediation. For example, lending by a rural bank could be influenced by the size of the state-owned sector even if the rural bank does not lend directly to that sector. Also, with free interbank lending, lending amounts should depend on economic fundamentals and not be influenced by the amount of own deposits. Hence, a strong effect of deposits on lending is indicative of inefficient intermediation. However, the lack of an effect is not evidence of efficient intermediation because it may reflect a government policy of fully taxing surplus deposits, i.e.,  $\delta^6 = -1$ . To the extent that the effect of economic fundamentals on lending may be of opposite sign in (5) and (8), the sign of the coefficients on economic variables become an additional test.

These tests examine financial intermediation across provinces. Even if interprovincial intermediation is inefficient, we may be interested in assessing intermediation within provinces. If there were no financial flows among provinces but unrestricted flows within provinces, provincial policy loans should affect lending volume by all institutions. This also may be true if intraprovincial flows are restricted, so the effect of provincial policy loans on lending cannot be used to test for the efficiency of intraprovincial intermediation. A more promising approach is to test the effect of savings in other provincial banks on bank lending. If the interbank market within the province is free, lending by any one bank should be affected by total deposits in the province rather than the bank's own deposits.

### 3. FINANCIAL INTERMEDIATION IN CHINA

#### 3.1. Description of Financial System

China's financial system is dominated by four state-owned commercial banks and three policy banks.<sup>4</sup> In 1997, these seven banks accounted for two thirds of

<sup>4</sup> The three policy banks are the State Development Bank of China (SDB), which finances large infrastructure projects, the Agricultural Development Bank of China (ADBC), which provides working capital for the procurement of agricultural commodities, and the Export-Import Bank of China, which provides export credit particularly for enterprises in the shipbuilding, machinery and electronics industries. Policy banks do not take deposits but finance their loans via central bank relending or by issuing bonds.

TABLE 1  
Deposits and Loan Shares of China's Financial Institutions, 1997

	Deposits	Loans
State Banks		
Specialized Banks	65%	62%
Industrial and Commercial Bank of China	28%	26%
Agricultural Bank of China	14%	13%
Bank of China	7%	7%
China Construction Bank	16%	15%
Policy Banks	0%	16%
Agricultural Development Bank of China	0%	11%
State Development Bank of China	0%	5%
Export-Import Bank	0%	0%
Other Financial Institutions <sup>a</sup>	35%	22%
Rural Credit Cooperatives	13%	10%
National Commercial Banks <sup>b</sup>	8%	4%
Regional Commercial Banks <sup>c</sup>	2%	1%
Urban Credit Cooperatives/Urban Coop. Banks	7%	5%
Postal Savings	3%	
National Trust-and Investment Companies	1%	1%

Note. Source: Calculated from PBC (China Financial Yearbook 1998) and the banks' annual reports.

<sup>a</sup> Among the excluded institutions are regional trust-and investment companies and finance companies, which are estimated to account for three percent of the national total for both loans and deposits. Also excluded are rural cooperative funds (RCFs), rotating savings and credit associations (ROSCAS), interenterprise finance, and other informal lending institutions.

<sup>b</sup> National commercial banks include the Bank of Communications, CITIC Industrial Bank, Everbright Bank, Huaxia Bank, the China Investment Bank, Zhaoshang Bank and Minsheng Bank.

<sup>c</sup> Regional commercial banks include Guangdong Development Bank, Shenzhen Development Bank, Fujian Xingye Bank, Shanghai Pudong Development Bank and Hainan Development Bank.

total deposits and three fourths of lending, as Table 1 indicates. Established in the early 1980s, the commercial banks, then called specialized banks, took over the lending responsibilities of the socialist monobank. Each focused on a specific sector, namely industry and commerce, agriculture, construction, and foreign currency transactions. Despite reform efforts to commercialize these banks and promote greater competition, policy lending, mainly to state-owned enterprises, still accounts for a significant proportion of their lending. Citing Chinese sources, Lardy (1998) estimates that 42% of specialized bank loans in 1991 were policy loans. The three policy banks were established in 1994 to separate policy lending from commercial lending. However, their share of total loans extended by the banking system was only 16% in 1997, suggesting that substantial policy lending, especially to state-owned enterprises, continues through the commercial banks.

Financial institutions other than state banks include RCCs with 13% of deposits and 10% of loans, national and regional commercial banks with 10% of deposits and 5% of loans, urban credit cooperatives and urban cooperative banks with



7% of deposits and 5% of loans, and national trust and investment companies with insignificant market share.<sup>5</sup> The RCCs are the only financial institutions with a branch network extending to villages. They have received administrative supervision from the PBC since 1996, and before then from the ABC. RCCs lend mainly to farmers and rural enterprises and have no national headquarters to directly intermediate funds across provinces. Other financial institutions (OFIs) are more recently established, dating from the late 1980s, located in richer regions, tend to lend more funds to the nonstate sector, and have grown rapidly in recent years. OFIs are subject to central bank reserve requirements but do not have access to central bank refinancing.

### 3.2. Policy Changes

The efficiency of financial intermediation depends on the specific mechanisms that facilitate financial flows across regions. In China, there are three main channels: central bank fund allocation, mainly through relending by the PBC, reallocation of funds among provincial branches of national banks, or within-bank transfers, and the interbank market. Financial reforms in the 1990s affected all three of these channels.<sup>6</sup> We discuss briefly six policy changes and their anticipated effects on interregional financial flows. The changes are summarized in Table 2.

Although production and distribution plans gradually lost their importance in the mid-1980's, annual national credit plans have continued to be a key determinant of interregional fund allocation. Based on consultation with provincial government leaders and managers of national banks, the State Planning Commission determined credit targets for each bank branch in each province. The plans gave primacy to policy lending goals, which were often linked to specific projects, but also internalized distributional and efficiency considerations. When strictly enforced, the plans left little room for bank managers to adjust total lending amounts, either through within-bank transfers or interbank lending.

During different periods, credit plan targets either have been enforced as binding (*zhilixing*) or have been understood to provide only guidance (*zhidaoxing*). Binding enforcement has occurred during policy retrenchment periods to combat inflation and reduce excessive total lending. These periods have been associated with sharply reduced lending to the nonstate sector (Brandt and Zhu, 2000) and

<sup>5</sup> Our data do not include other financial institutions such as regional trust and investment companies, finance companies, rural cooperative funds (RCFs), rotating savings and credit associations (ROSCAs, or *hui*), interenterprise finance, and other informal financial organizations.

<sup>6</sup> The financial reforms of the mid-1990s were designed to improve the quality of loan portfolios and improve monetary control. They began with what became known as Zhu Rongji's 16 point program in July 1993, which contained emergency measures aimed at reducing inflation. The December 1993 State Council's Decision on Reform of the Financial System was the blueprint for the financial reforms instituted in the following year; these include the establishment of policy banks. This was followed by the promulgation of a new Central Bank Law on March 18, 1995 and a new Commercial Bank Law on May 5, 1995.

TABLE 2  
Financial Reform Summary, 1991 to 1997

Policy reform	1991	1992	1993	1994	1995	1996	1997
1. Guidance, rather than binding credit plans	yes	yes	no (July)	no	yes	yes	yes
2. Centralized PBC relending	no	no	no	yes (June)	yes	yes	yes
3. Ratio loan management	no	no	no	yes (Feb)	yes	yes	yes
4. Commercial Bank Law Improved managerial incentives	no	no	no	no	yes (May)	yes	yes
5. Policy banks established	no	no	no	yes <sup>a</sup> (Dec)	yes	yes	yes
6. Open interbank market	yes	yes	no (July)	no	no	yes	yes

*Note.* Sources for reform dates: 1. Zhu Rongji's 16 point program. 2. Announced May 9, implemented June 21, 1994. Yinfa [PBC Regulation] no. 43 (1994) in PBC ed., *1994 nian xindai zijin guanli wenjian huibian* [Compendium of Documents on Loan Fund Management] (Beijing: Zhongguo jinrong chubanshe), pp. 92–98. 3. Announced February 15, implemented later in the year. Yinfa [PBC Regulation] no. 38 (1994) in PBC, ed., *1994 nian jinrong guizhang zhidu xuanbian*. [Selected Financial Rules and Regulations 1994] (Beijing: Zhongguo jinrong chubanshe), vol. 1: pp. 25–31. 4. "Zhongguo renmin gongheguo shangye yinhangfa." [Commercial Bank Law of the People's Republic of China] in PBC (1996). *1995 nian jinrong guizhang zhidu xuanbian*. [Selected Financial Rules and Regulations 1995] (Beijing: Zhongguo jinrong chubanshe), vol. 1, pp. 8 ff. 5. Policy banks established gradually beginning mid-year. SBD established April 14th, Import-Export Bank established on July 1, and ADABC branches established mostly in late 1994. PBC (1995). *Zhongguo jinrong nianjian 1995*. [China Financial Yearbook] (Beijing: Zhongguo jinrong chubanshe), p. 145. 6. PBC Department for Monetary Policy (1997). 1996 *Quanguo tongyi de yinhang jian tongyi chaijie shichang nianbao* [1996 Annual Report of the National Interbank Market]. Beijing: Zhongguo renmin yinhang huobi zhengcesi.

<sup>a</sup> Policy banks were established gradually throughout the year. Most ADABC branches were established in late 1994.

strong efforts to reduce unlawful diversion of funds from policy to commercial lending. In the 1990s, binding enforcement occurred during the high inflation period beginning in late 1993 and extending through 1994.<sup>7</sup>

In order to help finance shortfalls between loans and deposits the central bank has maintained a system of relending (*zaidaikuan*). Officially these funds are earmarked for specific purposes, such as procurement of agricultural goods, support for large and medium-size SOEs, or disaster relief (Luo, 1991; Xie, 1996).

<sup>7</sup> China experienced three austerity periods between the mid-1980's and the mid-90's corresponding to inflation peaks in 1985, 1988 and 1993/4. The boom-bust cycles of China's reform experience are widely recognized. See Fan and Woo (1992); Yusuf (1994); Naughton (1995); World Bank (1995); and Huang (1996).

Relending supports credit plan targets by providing low-interest loans to bank branches that have a quota but no funds. Throughout the late 1980s and early 1990s, PBC relending refinanced about 30% of the specialized banks' loans, reaching almost 40% in 1993, as calculated from PBC (various years).

Until 1994, the vast majority of PBC relending, up to 70% according to some estimates, was channeled through the PBC's local branches at the provincial level and below (Xie, 1996).<sup>8</sup> Decisions by managers of these branches were often influenced by local government officials who controlled their promotion and other benefits (Sehrt, 1999). This led to excessive lending that contributed to inflationary pressures. To combat this problem, in May 1994, local PBC branches were prohibited from relending to specialized bank branches in their locale (PBC, 1994c). The PBC instead directed refinancing to the national headquarters of specialized or policy banks, which distributed them to local branches based on approved plans. Thus, local branches had to appeal to their headquarters for additional funds, rather than, with the help of local government officials, pressuring local PBC branches to extend more funds. If previously excessive lending supported politically desired projects of local officials primarily, centralized relending should have strengthened the commercial basis of lending.

Reforms in 1994 changed the method for determining approved credit volume of specialized banks. Instead of the previous system of administrative targets (*guimo guanli*), approved credit volume was based on a maximum ratio between loans and deposits (*bili guanli*) (PBC, 1994b).<sup>9</sup> The ratios applied to total national lending by individual banks, but allowed the headquarters to alter the credit allocation for specific provinces. This change should have provided specialized banks with greater flexibility to use within-bank transfers to adjust interregional fund allocation, presumably to pursue commercial lending goals.

The new Commercial Bank Law that came into effect in 1995 contained measures to improve managerial profit incentives and, consequently, the quality of bank loan portfolios. The establishment of capital adequacy ratios should have

<sup>8</sup> Officially, PBC refinancing at the local level was intended only to help banks cover temporary shortages in funds. However, the balance sheets of local PBC branches reflect that, throughout the late 1980s and early 1990s, at least 50% of PBC relending extended at the provincial level and below were loans with a duration of one year or above (HJPBC, 1996; ZPBC, 1997).

<sup>9</sup> In line with Basle international banking standards, the average of total loans at the end of each ten day period cannot exceed 75% of the average of total deposits during that time period. Ratio management applies to all domestic commercial banks as well as to foreign joint venture banks. The four specialized banks, which had much higher loan-deposit ratios, were given two years to conform to these standards. For the four specialized banks, the average total of new loans at the end of ten day period cannot exceed 75% of the average total new deposits during that time period (PBC, 1994b). It is questionable whether the specialized banks are actually conforming with these ratios. Although there is evidence that, since 1994, the ratio of new loans to new deposits of the specialized banks has been below the 75% limit (Xie, 1997), the ratios of outstanding loans to total deposits, remain well above the Basle standards.

improved the responsiveness of lending to economic fundamentals by constraining banks from making unprofitable policy-driven loans.<sup>10</sup>

The state specialized banks began to institute bank director responsibility systems in the late 1980s. Much like the responsibility systems adopted for state-owned enterprise managers, these systems established work contracts that linked wages and/or bonus payments to performance. The content of the evaluation criteria has changed over time. In the early 1990s, performance standards reflected primarily concerns about adherence to the national credit plan. The evaluation criteria were changed significantly during the 1994/95 reforms. A new set of performance standards that took effect for the ABC in 1996 does not mention credit plan targets at all. Instead the ABC branch manager at the provincial level is evaluated on the basis of a combination of profits made by the bank branch, attention to cost control, investment in fixed capital of the branch, deposit increases, and reduction of overdue loans. Moreover, for the first time, market shares attained by the bank branch are taken into consideration and the number of employees was linked to the amount of deposits and profits generated by the branch (ABC, 1992; and ABC, 1996). These reforms are expected to increase the commercial orientation of lending.

The establishment of policy banks, a process completed by the end of 1994, was intended to reduce incentive conflicts associated with mixing policy and commercial objectives. By far the largest policy bank, and the only one established in all provinces and in many counties, was the ADBC. Over 90% of loans made by the ADBC is for procurement of agricultural commodities, mostly grain. It was hoped that separation would prevent the diversion of policy loans to more profitable lending activity, on the one hand, and free specialized banks to focus on commercial lending without being burdened by policy responsibilities, on the other.

In order to increase capital mobility between banks and across regions, and to help decrease the banks' reliance on PBC refinancing, the PBC permitted all banking institutions to lend and borrow funds on local interbank markets beginning in 1986. By the end of 1987, there were 360 interbank markets operating nationwide (PBC, 1988). There is evidence that these markets were quite active in the early 1990s. Many bank branches, even at the county and township levels, loaned funds directly to branches in other provinces. In 1993, at least RMB 100 billion were loaned by the specialized banks to nonbank financial institutions, mainly trust and investment companies, or TICs (PBC, 1994a).<sup>11</sup>

<sup>10</sup> The Commercial Bank Law established capital adequacy ratios in line with international standards. Of total loans, measured as average balance at the end of each month, overdue loans cannot exceed eight percent, nonperforming loans cannot exceed five percent and bad loans cannot exceed two percent. Additional provisions limit the exposure to large customers. Loans to any one customer cannot exceed 15% of the bank's total capital. Loans to the bank's largest ten customers cannot exceed 50% of the bank's total capital. Loans to stockholders cannot exceed 100% of the total amount of the stockholder's paid capital (PBC, 1994b).

<sup>11</sup> We determine this from TIC balance sheets in PBC (various years).

The possibility that large but unmonitored interregional transactions were leading to substantial outflows from the formal banking system, thus undermining the effectiveness of the credit plan, prompted policy-makers in the second half of 1993 to suspend most interbank market activities. With the exception of trading centers run by PBC branches in 35 cities for short-term borrowing and lending, all interbank market centers were shut down.

A new, national unified interbank market was opened in Shanghai in January 1996. The new market is much more tightly controlled than the one that had existed in 1993. Access to the market is reserved for the national headquarters of specialized banks and PBC branches in 35 cities. Interbank lending is limited to short-term transactions, with a maximum period of four months. Thus, bank branches are no longer able to trade independently but must depend on their headquarters to adjust their supply of funds (PBC, 1994b; Wang and Yang, 1996; PBC Department for Monetary Policy, 1997). Other financial institutions, such as the headquarters of national and regional commercial banks and Urban Cooperative Banks, also have access to the national interbank market in principle.

### 3.3. *Reform*

Most of the financial reforms were implemented from mid-1994 to mid-1995; all had the potential to increase the commercial orientation of the banking system. We divide the 1991 to 1997 period into a prereform part from 1991 to 1994 and a postreform part from 1995 to 1997, despite the fact that the timing of a few reforms do not fit well with this division. First, two retrenchment policies began in 1993, with the binding enforcement of credit plans and suspension of interbank trading. These hurt commercialization in the middle of the pre-reform period. Second, the reestablishment of the interbank market did not occur until January 1996, well into the postreform period. The timing of these reforms may qualify our interpretation of the empirical analysis, but broadly speaking the postreform period should have been more commercialized if the intended reforms were implemented successfully. Evidence on the effect of oddly timed reforms also may appear in annual regression results.

The effect of reforms on financial performance may have differed by financial institution. The strongest effects should be seen in the performance of state specialized and policy banks, which were directly affected by all six policy changes. The effect of establishing policy banks should be especially pronounced for the ABC, China's second largest specialized bank in 1993, whose policy lending duties were taken over by the country's largest policy bank, the ADBC. The ADBC's loan portfolio was almost as large as that of the ABC by 1997 (see Table 1). The ABC is also unique as it is the only specialized bank to negotiate a fixed tax contract with the center as early as 1988. This arrangement could have made managerial profit incentives stronger than in other banks.

RCCs and OFIs were not affected by all of the financial reforms. For instance, PBC relending and policy banks had no relevance for the decisions of RCCs and

OFIs. Because of their organizational structure and local lending orientation, RCCs are likely to lend in regionally segmented markets. Hence, they may not be strongly affected by the shift to ratio planning or restrictions on the interbank market. On the other hand, they may have been affected by the shift in oversight from the ABC to the PBC in 1996, which resulted in lower reserve requirements and more hands-off regulatory oversight. This may have reduced the effect of policy lending on fund availability. For OFIs, on the other hand, the interbank market may have been an important source or outlet for funds. Because of their focus on the nonstate sector, OFIs also may have suffered particularly from binding enforcement of credit plans.

#### 4. EMPIRICAL SPECIFICATION AND TESTS

The economy is divided into two sectors, industrial and agricultural, denoted by  $I$  and  $A$ . The main estimating equation corresponds directly to Eq. (8); we have

$$\begin{aligned}
 l_{rbt} = & \beta_1 ISH_{rt} + \beta_2 IG_{rt}^* ISH_{rt} + \beta_3 AG_{rt}^* (1 - ISH_{rt}) + \beta_4 LY \\
 & + \beta_5 GRAIN_{rt} + \beta_6 SOEY_{rt} + \beta_7 SOEP_{rt}^* SOEY_{rt} + \beta_8 BD_{rt} + \beta_9 TD_{rt} \\
 & + \beta_{10} \sum_{i=1}^{t-1} GRAIN_{ri} + \beta_{11} \sum_{i=1}^{t-1} SOEY_{ri} + \beta_{12} \sum_{i=1}^{t-1} SOEP_{ri}^* SOEY_{ri} \\
 & + \lambda_r + \gamma_t + \varepsilon_{rt},
 \end{aligned} \tag{9}$$

where  $ISH$  is the industrial share of output value,  $IG$  is the growth rate of industrial output value,  $AG$  is the growth rate of agricultural output value,  $LY$  is the log of output per capita,  $GRAIN$  is grain production normalized by total output,  $SOEY$  is SOE output value normalized by total output value,  $SOEP$  is SOE profits as a share of assets,  $BD$  is the bank's deposits normalized by total output,  $TD$  is total provincial deposits from all financial institutions,  $\lambda_r$  is a vector of provincial dummy variables, and  $\gamma_t$  is a vector of year dummies.

The first four variables,  $ISH$ ,  $IG$ ,  $AG$ , and  $LY$ , measure economic fundamentals. The sectoral growth rates  $IG$  and  $AG$  are interacted with sectoral shares. The three policy variables are  $GRAIN$ ,  $SOEY$ , and  $SOEP$ .  $SOEP$  is interacted with  $SOEY$  because the effect of SOE profitability in lending should depend on the size of the SOE sector. The provincial dummies capture unobserved regional differences and the year dummy variables control for national changes in policy or economic performance, including restrictions on overall lending to control inflation or to pursue stabilization goals.

The specification in (9) also includes summations of past policy variables to control for potential bias from nonperforming loans being included in our

intermediation measure.<sup>12</sup> Nonperforming loans have been estimated to account for 20% of outstanding loans of state banks (Lardy, 1998), and could be higher if loans are rolled over and not categorized as overdue. Such loans reflect past lending decisions rather than the efficiency of current lending decisions.<sup>13</sup> Overdue loans should decrease with better economic fundamentals, possibly leading us to underestimate the response of new lending to fundamentals. Inclusion of the lagged variables affects, but does not appreciably alter, the main estimation results in comparison with the model without lagged policy variables.

Before discussing the data and estimation, we review briefly the interpretation of the coefficients on different variable groups. The effect of the policy variables, *GRAIN*, *SOEY*, or *SOEP*, on bank lending has two possible implications for efficient financial intermediation. First, if the bank itself is responsible for policy lending, this lending can crowd out commercial lending.<sup>14</sup> However, net of policy lending, intermediation may still be efficient if policy loans act like a fixed tax and lending responds to economic fundamentals. Second, if the bank is not responsible for the policy lending, for example, RCCs do not generally lend to SOEs, the effect of a policy variable on lending is *prima facie* evidence that transfer bounds are affected by policy variables.

In a commercial system, financial intermediation should increase with the level of industrialization, the rate of economic growth in all sectors, and the overall level of development.<sup>15</sup> The extent to which lending by individual banks responds to fundamentals increases with market power. Lending by aggregations of banks should respond to fundamentals even in competitive markets. Even with significant policy lending, if funds are allowed to flow to their most productive use at the margin, lending should respond positively to fundamentals after controlling for policy factors. However, if the government taxes richer, faster growing areas and controls the allocation of resources across regions, intermediation may be inversely related to economic fundamentals.

Higher industrialization should increase commercial financial intermediation because the industrial sector requires a greater amount of financing per unit of

<sup>12</sup> Define outstanding loans,  $L_t$ , to be the sum of nonperforming loans and new loans:  $L_t = NP_t + NL_t$ . Nonperforming loans at year-end equal the sum of the previous period's nonperforming loans plus a fraction of current year policy lending; hence, we have  $NP_t = NP_{t-1} + \phi POLICY_t$ . Recursive substitution of this expression into the definition of outstanding loans yields  $L_t = NP_0 + \phi \sum_{j=1}^t POLICY_j + NL_t$ . Although initial nonperforming loans, denoted  $NP_0$ , differ by province, they are time-invariant for each province and are captured by the provincial dummy variables. Thus, adding variables that measure the cumulative policy obligations of the past can control for the effects of nonperforming loans on intermediation rates.

<sup>13</sup> Outstanding loans may also reflect loans in previous years rather than in the most recent year, if loans have a duration of more than one year. In China, the vast majority of loans are short-term; 70% of new loans in 1997 had a duration of one year or less.

<sup>14</sup> At the national level, central financing still must crowd out commercial lending or become unsustainable.

<sup>15</sup> Firms in rapidly growing areas may be more able to finance activities from retained earnings, but China's low official interest rates make loan financing highly desirable.

output, an effect that Rajan and Zingales (1998) call financial dependence. While agriculture relies primarily on land and labor, industry is much more capital intensive and uses more intermediate inputs. Household surveys in China find that the ratio of purchased inputs to output value is smaller for cropping and livestock than self-employed nonagricultural activities (Park and Wang, 2000). The level of lending should also be associated with the rate of economic growth. In a review article, Levine (1997) considers the extensive literature that finds a strong correlation between the two. Usually, the interpretation is that financial depth increases growth, but Levine acknowledges that the opposite direction of causality is plausible. One explanation is that loans finance working capital associated with the production process, i.e., current output, but loans are also made for new fixed capital investments and these occur in areas of higher expected future growth. Thus, an area with no growth gets only working capital loans, but an area with growth gets both working capital loans and fixed capital loans, as well as more loans proportional to the higher output in the next period.

The difficulty with identifying causal direction in the positive association between financial development and economic growth is well known (Levine and Zervos, 1998; Rajan and Zingales, 1998). A positive effect of financial intermediation on growth may lead to an upward bias in our estimates of the effect of economic fundamentals on lending. However, this possible bias only strengthens our findings that many economic fundamentals do not appear to influence the level of financial intermediation. Nonetheless, we also estimate (9) using instrumental variables as a robustness check.

With a free interbank market, loans should be based on economic fundamentals without regard to the source of deposits. Thus, a greater influence of own deposits on lending implies market segmentation and less efficient intermediation. If the interbank market is free within a province but not across provinces, lending should be affected by total deposits in the province, but not by own deposits.

To summarize our hypotheses for the empirical analysis, in more commercial banking systems, we expect the effect of the policy variables *GRAIN*, *SOEY*, and *SOEP\*SOEY* on intermediation rates to be smaller, the effect of the economic fundamentals *ISH*, *IG\*ISH*, *AG\*(1-ISH)*, and *LY* to be larger, and the effect of deposits, denoted by *BD* and *TD*, to be smaller.

## 5. THE DATA AND ESTIMATION RESULTS

### 5.1. Data and Estimation

Data are from published sources, including various issues of the Statistical Yearbook of China, the China Rural Economics Statistical Yearbook, the China Rural Financial Statistics Yearbook, the Agricultural Yearbook of China, China Almanac of Banking and Finance, and China Provincial Statistics During 20 Years of Economic Reform. For state banks and OFIs, a complete data set is available for 1991 to 1997, and for the ABC/ADBC and RCCs, data are available for 1991 to 1996. For intermediation by state banks and OFIs, output is measured by GDP, where



$I$  refers to industrial GDP and  $A$  to nonindustrial GDP. For intermediation by the ABC/ADBC and the RCC, output is measured by rural social output value, where  $I$  refers to nonagricultural rural social output value and  $A$  refers to agricultural output value. SOE output is measured by SOE industrial output value. Data on rural social output value in 1995 are not available and are interpolated as the mean of the previous and subsequent years for each province. All values are adjusted to 1996 yuan using provincial consumer price indices.

The means for all variables for each year are reported in Table 3. For all bank types except OFIs, there is a pattern of falling intermediation rates through 1995, followed by a recovery in 1996 and 1997. The level of GDP per capita grows steadily, although the growth rate slows sharply in 1994. For rural growth, the sharp drop-off occurs in 1995. The value of SOE output falls starting in 1993, while SOE profits erode significantly beginning in 1995. Mean grain output per capita is fairly consistent over time, showing an increase in 1996 and 1997 in comparison with previous years.

Our data set excludes some financial intermediaries, such as regional trust and investment companies, finance companies, rural cooperative funds (RCFs), rotating savings and credit associations (ROSCAs), interenterprise finance, and other informal lending institutions. We do not expect these unmeasured activities to be very large. Nonetheless, it is possible that other financial intermediaries assume larger roles in more developed areas or that various informal or even illegal mechanisms channel funds to their most valued use. Strictly speaking, our results assess only performance by the institutions for which we have data rather than for the overall financial system. Nonetheless, in a country where formal financial institutions control such a vast amount of resources, we expect their performance to have significant aggregate effects on economic growth.

It is straightforward to estimate the intermediation equation for individual banks or aggregations of banks. We estimate (9) for four categories: state banks, the ABC/ADBC, RCCs, and OFIs. For each category, we include the bank's own deposits as well as total deposits in all financial institutions. Regions are provinces in China, excluding the municipalities of Beijing, Tianjin, and Shanghai, and excluding Tibet and Guangxi provinces.<sup>16</sup>

To describe the changes over time, we first estimate cross-sectional regressions of (9) for each year from 1991 to 1997. By necessity, we exclude the lagged policy variables and the provincial and time dummies. The estimates from these regressions are identified by the regional differences that motivate the paper. However, the coefficient estimates could be biased by unobserved provincial differences. To avoid this potential problem, we exploit the panel nature of the data and estimate (9), which includes provincial fixed effects. This preferred specification

<sup>16</sup> Municipalities are excluded because they are extreme outliers for variables such as output per capita, rural social output value per capita, deposits, and intermediation rates. For example, including municipal provinces in the intermediation-GDP per capita regressions destroys the clear negative trend in the data seen in Fig. 1. Tibet and Guangxi are excluded because of missing data.

TABLE 3  
Summary Statistics by Year, 1991 to 1997

	1991	1992	1993	1994	1995	1996	1997
<b>Intermediation rates</b>							
All financial inst. <sup>a</sup>	0.90	0.90	0.87	0.81	0.79	0.80	0.87
State banks <sup>b</sup>	0.80	0.77	0.70	0.64	0.61	0.63	0.69
ABCs/ADBCs	0.24	0.21	0.16	0.14	0.14	0.16	
RCCs	0.096	0.097	0.082	0.067	0.068	0.070	
OFIs <sup>a</sup>	0.053	0.066	0.074	0.086	0.090	0.088	0.97
<b>Loan–deposit ratios</b>							
All financial inst. <sup>a</sup>	1.21	1.16	1.11	1.03	0.96	0.91	0.93
State banks <sup>b</sup>	1.27	1.17	1.19	1.12	1.04	0.97	1.01
ABCs/ADBCs	1.42	1.36	1.31	1.34	1.62	1.62	1.61
RCCs	0.67	0.71	0.77	0.74	0.73	0.72	0.70
OFIs <sup>a</sup>	1.24	1.34	1.13	0.85	0.80	0.79	0.81
<b>Economic performance</b>							
GDP per capita	3.38	3.81	4.30	4.55	4.77	5.35	5.78
GDP growth	0.105	0.143	0.142	0.071	0.095	0.099	0.090
Ind. share of GDP	0.36	0.38	0.41	0.41	0.40	0.40	0.41
Industrial growth	0.118	0.197	0.230	0.086	0.078	0.103	0.104
RSOV per capita	3.74	4.72	6.47	8.07	8.47	9.29	
RSOV growth	0.113	0.280	0.388	0.257	0.066	0.106	
Nonag. share of	0.55	0.63	0.71	0.73	0.72	0.73	
Nonag RSOV growth	0.180	0.450	0.583	0.295	0.061	0.125	
<b>Policy variables</b>							
SOE output value	2.23	2.46	2.70	2.50	2.44	2.15	2.11
SOE profits	11.9	12.4	12.9	12.6	9.3	7.6	7.3
Grain output p.c.	0.48	0.49	0.50	0.49	0.51	0.55	0.54

*Note.* 1. All means are weighted and exclude the municipal provinces of Beijing, Tianjin, Shanghai, and Tibet. 2. Abbreviations are RSOV = rural social output value, SOE = state-owned enterprise, ABC = Agricultural Bank of China, ADBC = Agricultural Development Bank of China, RCC = Rural Credit Cooperatives, OFI = other financial institutions, excluding RCCs. State banks include commercial and policy banks and exclude cooperatives and non-bank financial institutions. 3. Values are expressed in thousands of 1996 yuan.

<sup>a</sup> OFI loans and deposits are calculated by subtracting state bank and RCC values from all loans and deposits. Data are missing for loans and deposits in three provinces in 1991 and 1992, two provinces in 1993, and one province in 1994. Means for NBFIs loan/deposit rates exclude observations when deposits equal zero, which occurs six times in 1991, once in 1992, three times in 1993, and once in 1994.

<sup>b</sup> Means for state banks intermediation rates and loan–deposit ratios exclude Guangxi due to missing data.

identifies the determinants of changing intermediation rates over time within the same province. To examine changes over time, we divide the 1991 to 1997 period into two subperiods, namely 1991 to 1994 and 1995 to 1997. We include period interaction terms for all of the current period covariates.

Provincial-level unobservables could be estimated using a random, rather than fixed, effects specification, but Hausman tests reject random effects in all cases.

Because we use aggregate data for provinces of different size, we are concerned that the errors will be heteroscedastic, in particular that the error variance will differ by province. We implement the test suggested by Cook and Weisberg (1983) and reject homoscedasticity in all cases. Then we estimate the fixed effects model using feasible generalized least squares, allowing the error variance to differ by province and also allowing for covariances across provinces.

## 5.2. Results

The striking inverse relationship between the rate of financial intermediation and the level of economic development among Chinese provinces suggests that factors other than economic fundamentals play an important role in lending decisions. China's richest and fastest growing coastal provinces, i.e., Zhejiang, Jiangsu, Fujian, and Shandong, had the lowest state bank intermediation rates from 1991 to 1997. Provinces with higher intermediation rates tended to be those with greater SOE output relative to GDP, and with less profitable SOEs; see Tables A1 and A2 in the Appendix. For state banks, the negative intermediation trend becomes statistically significant beginning in 1995 and decreases to a highly negative elasticity of intermediation with respect to GDP per capita of  $-0.42$  in 1997 (Table 4). For the ABC/ADBC, the elasticities are even more negative, perhaps reflecting their rural focus, but, for RCCs, they are only slightly negative and not statistically significant. In contrast, intermediation by OFIs is strongly positively related to the

TABLE 4

Financial Intermediation and Economic Development Elasticities, Chinese Provinces 1991 to 1997

Year	All Banks	State Banks	ABC/ADBC	RCCs	OFIs
1991	0.019	0.021	* $-0.418$	0.169	1.187
1992	$-0.032$	$-0.109$	** $-0.566$	0.132	0.499
1993	$-0.063$	$-0.196$	** $-0.701$	0.013	0.478
1994	$-0.179$	$-0.326$	** $-0.739$	$-0.104$	0.396
1995	$-0.177$	* $-0.353$	** $-0.733$	$-0.108$	0.559
1996	$-0.219$	* $-0.419$	** $-0.685$	$-0.114$	*0.735
1997	$-0.242$	* $-0.411$			0.508

*Note.* 1. \*denotes significant at the 5% significance level, \*\*denotes significant at the 1% significance level. 2. Elasticities are coefficient estimates from annual bivariate regressions of the log of financial intermediation rate (loans/output) on the log of output per capita. 3. State banks include commercial and policy banks and exclude cooperatives or nonbank financial institutions. 4. Abbreviations are ABC = Agricultural Bank of China, ADBC = Agricultural Development Bank of China, RCC = Rural Credit Cooperatives, OFI = other financial institutions, including Urban Credit Cooperatives, national and regional commercial banks, and national trust and investment companies. 5. For all banks, state banks, and OFIs, output is GDP and population is total population. For the ABC and RCCs, output is rural social output value and population is rural population. 6. Excluded provinces are the municipalities of Beijing, Tianjin, and Shanghai, and Tibet. State bank estimates also exclude Guangxi Province due to missing data.

level of development. This suggests that OFIs are helping to meet credit demand in areas where official state banks are underproviding credit.

Tables 5 to 8 report the results of the annual regressions, which describe how the effects of policy variables, economic fundamentals, and deposits on provincial intermediation rates change over time for state banks, the ABC, RCCs, and OFIs. The importance of policy variables increases over time. The effects of SOE output and profits on state bank lending increases over time, reaching their highest levels in 1997 (Table 5). Thus, China's SOE policy lending problem did not abate despite announced reforms. Part of this may be due to the steady erosion of SOE profitability despite declines in SOE output per capita since 1993 (Table 3).<sup>17</sup> The effects of the SOE variables on lending by the ABC/ADBC, RCCs and OFIs are statistically insignificant and small in magnitude in almost all cases.<sup>18</sup> This is not surprising since none of these banks had primary responsibility for lending to SOEs.

The effect of grain production on lending by the ABC/ADBC also increases steadily over time (Table 6). The coefficient on grain output is statistically significant in all years and grows steadily over time, reaching a peak of 1834 in 1997. However, the coefficient is smaller, falls over time, and becomes statistically insignificant after 1994 for all state banks. This may reflect the falling relative importance of grain procurement in total state bank lending or a crowding out of lending by other state banks. Grain does not affect lending by RCCs or OFIs significantly. The grain coefficient can be interpreted as the amount of lending associated with one additional ton of grain production. The size of the coefficients are extremely high when one considers that, in 1996, a ton of grain cost about 1200 yuan<sup>19</sup> and China's grain bureaus only procure about 20 percent of production on average. Two possible explanations for the large grain coefficients are that procurement as a share of output increases with output and that much of the value is unrecoverable debt, which reportedly accounts for 40% of ADBC outstanding loans (Liu, 1998).<sup>20</sup> When the ABC and ADBC are separated for the years 1995 to 1997, grain becomes more significant for the ADBC and less significant for ABC branches over time, as would be expected (Table A3).

The coefficients on the economic fundamentals are mostly insignificant and frequently of the wrong sign, suggesting that the regional allocation of resources does not respond to economic signals, even after controlling for factors affecting policy lending. If anything, responsiveness to economic fundamentals worsens over time. For state banks, the coefficient on industrial share becomes increasingly

<sup>17</sup> We defer the discussion of policy lending for grain to a consideration of the ABC/ADBC.

<sup>18</sup> For ABC lending, SOE profitability is statistically significant in 1991 and 1992 and SOE output value is statistically significant in 1995 (Table 6). For OFIs, SOE profitability is statistically significant in 1993 (Table 8).

<sup>19</sup> Procurement prices in 1996 were 1.06 yuan/kg for maize, 1.31 yuan/kg for wheat, and 1.33 yuan/kg for paddy rice.

<sup>20</sup> Such lending is plausible since the ABC has branch offices in major cities and is the primary lender to agroindustry.

TABLE 5  
Determinants of State Bank Intermediation Rates, Annual Regressions 1991 to 1997

	1991		1992		1993		1994		1995		1996		1997	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
<i>ISH</i>	-0.509	-1.21	0.628	1.23	-0.515	-0.98	-0.512	-0.86	-0.759	-1.62	** -1.410	-3.00	** -1.368	-3.63
<i>IG*ISH</i>	-1.438	-1.34	-1.104	-1.57	0.460	0.51	-0.173	-0.16	-1.029	-1.06	-0.083	-0.08	-2.681	-1.94
<i>AG*(1-ISH)</i>	* -1.220	-2.33	-0.486	-0.88	0.557	1.05	* -1.583	-2.34	0.509	1.54	-0.459	-0.57	-2.041	-1.21
<i>LY</i>	**0.181	2.62	0.036	0.49	0.100	1.10	0.134	1.46	-0.007	-0.08	0.047	0.54	0.072	0.90
<i>GRAIN</i>	**23.79	4.09	**22.16	3.32	**21.55	2.51	*17.02	2.41	6.83	0.58	3.84	0.40	-0.39	-0.04
<i>SOEY</i>	0.330	1.89	0.353	1.72	**0.588	3.09	0.338	1.24	*0.397	1.96	**0.887	2.58	**0.925	3.61
<i>SOEP*SOEY</i>	-0.739	-1.53	** -2.019	-4.48	-0.808	-1.72	** -0.688	-2.92	** -0.934	-2.61	* -1.166	-2.19	* -1.438	-2.19
<i>BDEP</i>	*0.690	2.28	**1.405	4.45	**1.305	3.50	**1.430	3.12	**1.370	3.53	*0.881	2.11	*0.624	2.02
<i>TDEP</i>	0.445	1.73	-0.430	-1.81	-0.401	-1.65	-0.581	-1.88	-0.422	-1.68	-0.263	-1.06	-0.166	-0.78
<i>C</i>	** -0.741	-2.74	-0.320	-1.19	-0.493	-1.35	-0.231	-0.66	0.282	0.68	0.370	1.02	0.613	1.44
<i>N</i>	22		22		23		24		25		25		25	
<i>R-squared</i>	0.919		0.918		0.874		0.903		0.873		0.863		0.894	

Note. 1. \* denotes significant at the 5% significance level, \*\* denotes significant at the 1% significance level. 2. Each equation is estimated jointly with those for other banks (the ABC/ADBC, RCCs, OFIs) using seemingly unrelated regression, except for 1997 which is estimated jointly with OFIs only. 3. Excluded provinces are municipalities (Beijing, Tianjin, and Shanghai) and those with missing data (Tibet and Guangxi). 4. The dependent variable is loans by state banks divided by GDP. Independent variables are defined as follows: *ISH* = industrial share of GDP (including construction), *IG* = growth rate of industrial GDP, *AG* = growth rate of non-industrial GDP, *LY* = log(GDP per capita), *GRAIN* = grain production/GDP, *SOEY* = SOE output value/GDP, *SOEP* = SOE profits per 1000 yuan fixed assets, *BDEP* = bank deposits. 5. State banks include commercial and policy banks and exclude cooperatives or nonbank financial institutions.

TABLE 6  
Determinants of ABC/ADBC Intermediation Rates, Annual Regressions 1991 to 1996

	1991		1992		1993		1994		1995		1996	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
ISH	-0.218	-1.70	0.129	0.75	0.032	0.27	** -0.299	-2.85	** -0.402	-4.08	** -0.428	-3.91
IG*ISH	* -0.709	-2.02	* -0.466	-2.06	-0.091	-1.16	0.051	0.60	0.033	0.82	0.137	1.99
AG*(1-ISH)	* -0.579	-2.05	0.496	0.90	0.720	1.84	0.055	0.29	0.214	0.79	-0.802	-1.66
LY	**0.142	5.18	**0.114	3.79	**0.080	3.67	**0.090	4.83	**0.096	6.87	**0.094	5.73
GRAIN	**670.20	4.31	**1067.19	5.65	**1315.12	7.53	**1356.64	6.65	**1534.94	7.57	**1833.79	3.88
SOEY	0.023	0.38	-0.014	-0.28	-0.010	-0.28	0.014	0.48	*0.063	2.32	0.012	0.16
SOEP*SOEY	** -0.363	-2.55	** -0.446	-3.04	0.008	0.08	-0.066	-1.24	-0.096	-1.28	-0.062	-0.42
ADEP	**0.840	3.84	**1.210	4.96	**1.275	7.11	**0.495	2.55	0.346	1.30	**0.731	2.62
TDEP	-0.082	-1.25	* -0.086	-1.96	** -0.119	-3.12	0.031	0.96	0.048	1.62	0.013	0.31
C	* -0.302	-2.41	** -0.468	-4.09	** -0.415	-4.26	** -0.234	-2.61	** -0.190	-2.50	-0.151	-1.61
N	22		22		23		24		25		25	
R-squared	0.932		0.945		0.969		0.973		0.982		0.975	

Note. 1. See Table 5, notes 1, 2, and 3. The dependent variable is loans by the ABC/ADBC divided by rural social output value (RSOV). Independent variables are defined as follows: ISH = nonagricultural share of RSOV, IG = growth rate of nonagricultural RSOV, AG = growth rate of agricultural RSOV, LY = log(RSOV per capita), GRAIN = grain production/RSOV, SOEY = SOE output value/RSOV, SOEP = SOE profits per 1000 yuan fixed assets, ADEP = deposits in ABC/ADBC, BDEP = bank deposits.

TABLE 7  
Determinants of RCC Intermediation Rates, Annual Regressions 1991 to 1996

	1991		1992		1993		1994		1995		1996	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
<i>ISH</i>	-0.003	-0.10	0.010	0.19	-0.047	-1.11	0.013	0.33	0.017	0.49	0.050	1.25
<i>IG*ISH</i>	*-0.161	-2.01	-0.025	-0.38	0.001	0.02	0.003	0.11	-0.006	-0.43	-0.005	-0.32
<i>AG*(1-ISH)</i>	0.011	0.17	0.189	1.41	-0.052	-0.36	-0.053	-0.85	-0.108	-1.15	-0.138	-1.30
<i>LY</i>	-0.002	-0.32	0.004	0.48	0.010	1.19	0.005	0.79	0.003	0.54	0.000	0.07
<i>GRAIN</i>	-72.98	-1.83	-32.69	-0.63	-79.88	-1.10	4.89	0.08	-36.77	-0.52	106.14	0.83
<i>SOEY</i>	0.006	0.39	0.004	0.26	0.025	1.56	0.006	0.58	0.006	0.60	-0.018	-0.79
<i>SOEP*SOEY</i>	0.002	0.04	0.003	0.07	-0.039	-0.96	-0.016	-0.87	-0.023	-0.95	0.005	0.17
<i>RDEP</i>	**0.715	12.68	**0.763	10.11	**0.987	15.56	**0.821	10.59	**0.815	9.65	**0.753	9.97
<i>TDEP</i>	**0.029	-2.04	-0.019	-1.86	**0.053	-3.67	-0.013	-1.03	-0.009	-0.69	0.005	0.34
<i>C</i>	0.053	1.70	-0.008	-0.27	0.004	0.09	-0.034	-1.22	-0.024	-0.94	-0.042	-1.78
<i>N</i>	22		22		23		24		25		25	
<i>R-squared</i>	0.893		0.837		0.887		0.928		0.932		0.959	

Note. 1. See the notes to Table 6. 2. The dependent variable is loans by RCCs divided by rural social output value (RSOV).

TABLE 8  
Determinants of Other Financial Institution Intermediation Rates, Annual Regressions 1991 to 1997

	1991		1992		1993		1994		1995		1996		1997	
	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>
<i>ISH</i>	*0.333	2.31	0.162	1.47	*0.135	2.04	-0.063	-0.77	-0.147	-1.88	-0.146	-1.72	*-0.247	-2.28
<i>IG*ISH</i>	0.107	0.27	-0.134	-0.82	0.062	0.48	-0.194	-1.10	*0.411	2.29	0.184	0.95	0.504	1.24
<i>AG*(1-ISH)</i>	-0.041	-0.22	-0.079	-0.60	**0.258	-3.34	-0.013	-0.09	-0.030	-0.51	0.119	0.76	0.162	0.33
<i>LY</i>	-0.008	-0.33	**0.043	2.59	0.002	0.17	0.013	0.77	0.019	1.26	0.020	1.19	0.017	0.74
<i>GRAIN</i>	0.97	0.47	**5.18	3.46	0.40	0.30	1.92	1.38	0.71	0.32	0.29	0.15	2.62	0.89
<i>SOEY</i>	0.062	0.99	-0.068	-1.51	-0.003	-0.14	-0.033	-0.80	0.027	0.73	0.036	0.59	0.002	0.03
<i>SOEP*SOEY</i>	-0.302	-1.80	-0.002	-0.02	*-0.159	-2.22	-0.050	-1.07	-0.056	-0.88	-0.037	-0.35	0.118	0.65
<i>ODEP</i>	-0.278	1.89	**0.608	6.26	**0.566	7.20	**0.849	6.95	**0.861	8.33	**0.963	9.97	**0.854	8.88
<i>TDEP</i>	-0.064	-1.24	*0.068	2.21	0.044	1.83	-0.026	-0.73	-0.032	-0.92	-0.053	-1.42	-0.027	-0.70
<i>C</i>	-0.028	-0.29	**0.229	-3.71	-0.038	-0.65	0.009	0.14	-0.023	-0.30	-0.024	-0.33	-0.001	-0.01
<i>N</i>	22		22		23		24		25		25		25	
<i>R</i> -squared	0.607		0.920		0.902		0.919		0.933		0.952		0.933	

Note. 1. See the notes to Table 5. 2. The dependent variable is loans by other financial institutions (OFIs) divided by GDP.



negative over time and is statistically significant in 1996 and 1997. The other fundamentals, industrial growth, agricultural growth, and log of GDP per capita do not affect lending in a consistent and significant way. For the ABC/ADBC, the results are mixed. The coefficient on output level per capita is significantly positive but does not increase over time. As it does for state banks, industrial share has an increasingly negative and statistically significant effect on lending. The coefficients on agricultural and industrial growth have unstable signs and are not statistically significant in most cases. The effects of economic fundamentals on RCC lending is uniformly statistically insignificant. For OFIs, there are also no consistent statistically significant effects. The coefficients for the level of output and for industrial growth do tend to be positive and higher in the reform period, but those for industrial share become negative.

Deposits are a key determinant of intermediation rates in almost all of the regressions. For state banks, very high coefficients on deposits are estimated from 1992 to 1995, but there is a sharp reduction in 1996 and 1997, corresponding to the period when interbank market mechanisms were reintroduced. For the ABC/ADBC, there is a sharp drop in the deposit coefficient in 1994, the year in which the ADBC was established. This may reflect a formal break in deposit financing of policy lending, since ADBC loans are financed almost entirely by PBC relending. For RCCs, annual regressions produce the highest coefficients, averaging 0.81. For OFIs, high deposit coefficients begin after the closure of the interbank market in 1993 but do not return to lower levels after 1995 as they do in other banks. This suggests that OFIs have not had full access to the new national interbank market. In addition, they may have been scrutinized more closely by central bank officials for adherence to the newly established minimum loan-to-deposit ratios.

The coefficient on total provincial deposits is significantly negative in the years when deposit coefficients are large and positive, a pattern also exhibited by the coefficients for the ABC/ADBC. Deposits in other institutions appear to result in more loans from competing institutions that crowd out own lending. This provides additional evidence of poor intermediation across institutions within provinces.

Coefficients from the annual regressions are subject to bias from unobserved provincial characteristics. Cross-sectional regressions also cannot control adequately for the accumulation of nonperforming loans. A more stringent identification strategy is to examine the within-province variation in lending over time to examine the extent to which changes can be explained by time-varying covariates. Tables 9 to 12 report coefficient estimates for each bank for two periods, 1991 to 1994 and 1995 to 1997, from regressions that include provincial fixed effects as well as year dummy variables and controls for past policy lending. Although the size of coefficients tend to be smaller, the results largely confirm the main findings from the cross-sectional regressions.

Policy variables do not fall in importance in the second period. A one yuan increase in the value of SOE output increases state bank lending by 0.26 yuan in the first period, 1991 to 1994, and 0.19 yuan in the second period, 1995 to 1997. The

TABLE 9  
Determinants of State Bank Financial Intermediation Rates, Provincial Fixed Effects

	1991-94		1995-97		Diff. <i>p</i> value
	Coef.	<i>t</i>	Coef.	<i>t</i>	
<i>ISH</i>	-0.012	-0.09	-0.057	-0.36	0.672
<i>IG*ISH</i>	-0.119	-1.30	-0.163	-1.19	0.781
<i>AG*(1-ISH)</i>	** -0.198	-2.96	0.039	0.55	0.017
<i>LY</i>	-0.077	-1.37	** -0.155	-2.88	0.000
<i>GRAIN</i>	** 15.1	6.08	4.6	1.25	0.000
<i>SOEY</i>	** 0.262	3.36	* 0.185	2.09	0.252
<i>SOEP*SOEY</i>	-0.074	-0.73	-0.138	-0.89	0.522
<i>BDEP</i>	0.009	0.09	** 0.400	4.29	0.000
<i>TDEP</i>	0.118	1.35	* -0.157	-2.16	0.000
<i>GRAINP</i>	* 148.3	2.03	* 148.3	2.03	
<i>SOEYP</i>	0.036	1.43	0.036	1.43	
<i>SOEPSOEYP</i>	* 0.083	1.99	* 0.083	1.99	

*Note.* 1. \*denotes significant at the 5% significance level; \*\*denotes significant at the 1% significance level. 2. Equations for within estimates include province and year fixed effects and are estimated using feasible generalized least squares, which allows errors to have different variances by province and to be correlated across provinces. 3. Variables, except those included to control for past bad loans, are interacted with a period dummy for 1995 to 1997, with reported coefficients and *t*-values for that period adjusted to reflect differences from zero. 4. Excluded provinces are municipalities (Beijing, Tianjin, and Shanghai) and those with missing data (Tibet and Guangxi). The sample size is 166. 5. For state banks and other financial institutions, the intermediation rate is defined as loans/GDP and the independent variables are as follows: *NSH* = industrial share of GDP (including construction), *NG* = growth rate of industrial GDP, *AG* = growth rate of non-industrial GDP, *LY* = log (GDP per capita), *GRAIN* = grain production/GDP, *SOEY* = SOE output value/GDP, *SOEP* = SOE profits per 1000 yan of fixed assets, *BDEP* = bank deposits/GDP, *ODEP* = OFI deposits/GDP, *TDEP* = total deposits/GDP, *GRAINP* = total previous grain production from 1991 to period *t*-1/GDP, *SOEYP* = total previous SOE output value from 1991 to period *t*-1/GDP, and *SOEPSOEYP* = sum of interactions from 1991 to period *t*-1/GDP.

difference in the estimates for the two periods is not statistically significant. As in the annual regressions, the policy variables are insignificant for the ABC/ADBC, RCCs, and OFIs, except for a negative coefficient on SOE profitability in the first period for OFIs that suggests the possibility of early government influence over OFI lending.

For the effect of grain production on ABC/ADBC lending, the fixed effect estimates are 193 and 70 for the two periods, which are both smaller than in the cross-sectional regressions. In the second period, the coefficient is not statistically significant. In recent years, ADBC outstanding loans have increased rapidly, e.g., 33 and 38% in 1996 and 1997, despite modest increases in grain output, low grain prices, and reduced procurement quotas (ADBC, 1998). This may help to explain the poor within-province correlation between lending and grain output in the second period, when separation of policy and commercial lending may have weakened the enforcement of policy loan repayment.

TABLE 10  
Determinants of ABC/ADBC Financial Intermediation Rates, Provincial Fixed Effects

	1991-94		1995-97		Diff. <i>p</i> value
	Coef.	<i>t</i>	Coef.	<i>t</i>	
<i>ISH</i>	-0.077	-1.57	-0.073	-1.28	0.939
<i>IG*ISH</i>	-0.003	-0.15	0.035	1.49	0.172
<i>AG*(1-ISH)</i>	** -0.128	-3.20	-0.065	-0.79	0.466
<i>LY</i>	* -0.040	-2.00	* -0.049	-2.36	0.277
<i>GRAIN</i>	**193.3	3.71	70.3	0.54	0.281
<i>SOEY</i>	0.023	1.07	0.020	0.72	0.871
<i>SOEP*SOEY</i>	-0.032	-0.64	-0.066	-0.79	0.449
<i>BDEP</i>	**0.405	3.33	**0.685	3.70	0.049
<i>TDEP</i>	0.003	0.17	-0.012	-0.55	0.396
<i>GRAINP</i>	** -122.7	-2.70	** -122.7	-2.70	
<i>SOEYP</i>	**0.052	5.48	**0.052	5.48	
<i>SOEPSOEYP</i>	0.029	1.32	0.029	1.32	

Note. 1. See Table 6, notes 1 to 4. 2. The sample size is 141. 3. For the ABC/ADBC and RCCs, the intermediation rate is defined as loans/RSOV (rural social output value) and independent variables are as follows: *ISH* = nonagricultural share of RSOV, *IG* = growth rate of nonagricultural RSOV, *AG* = growth rate of agricultural RSOV, *LY* = log (RSOV per capita). *GRAIN* = grain production/RSOV, *SOEY* = SOE output value/RSOV, *SOEP* = SOE profits per 1000 yuan of fixed assets, *ADEP* = ABC/ADBC deposits/RSOV, *RDEP* = RCC deposits/RSOV, *TDEP* = total bank deposits/RSOV. *GRAINP* = total previous grain production from 1991 to period *t-1*/RSOV. *SOEYP* = total previous SOE output value from 1991 to period *t-1*/RSOV, and *SOEPSOEYP* = sum of interactions from 1991 to period *t-1*/RSOV.

TABLE 11  
Determinants of RCC Financial Intermediation Rates, Provincial Fixed Effects

	1991-94		1995-97		Diff. <i>p</i> value
	Coef.	<i>t</i>	Coef.	<i>t</i>	
<i>ISH</i>	**0.039	2.55	0.024	1.24	0.312
<i>IG*ISH</i>	** -0.017	-2.66	* -0.011	-2.11	0.476
<i>AG*(1-ISH)</i>	0.016	1.49	-0.010	-0.38	0.35
<i>LY</i>	** -0.020	-2.82	** -0.019	-2.69	0.94
<i>GRAIN</i>	-24.1	-1.56	-17.5	-0.46	0.835
<i>SOEY</i>	0.005	0.81	-0.004	-0.53	0.111
<i>SOEP*SOEY</i>	0.004	0.24	-0.002	-0.08	0.677
<i>BDEP</i>	**0.491	9.70	**0.486	7.94	0.874
<i>TDEP</i>	-0.011	-1.90	-0.007	-1.00	0.548
<i>GRAINP</i>	** -53.3	-4.69	** -53.3	-4.69	
<i>SOEYP</i>	**0.012	4.98	**0.012	4.98	
<i>SOEPSOEYP</i>	-0.006	-0.82	-0.006	-0.82	

Note. 1. See the notes to Table 10.

TABLE 12  
Determinants of Other Financial Institution (OFI) Intermediation Rates Provincial Fixed Effects

	1991-94		1995-97		Diff. <i>p</i> value
	Coef.	<i>t</i>	Coef.	<i>t</i>	
<i>ISH</i>	-0.052	-0.61	** -0.276	-3.04	0.000
<i>IG*ISH</i>	-0.005	-0.07	* 0.186	1.98	0.084
<i>AG*(1-ISH)</i>	* -0.097	-2.05	-0.022	-0.68	0.185
<i>LY</i>	-0.022	-0.84	-0.021	-0.92	0.935
<i>GRAIN</i>	-0.3	-0.23	-1.3	-0.90	0.402
<i>SOEY</i>	0.023	0.67	0.076	1.80	0.091
<i>SOEP*SOEY</i>	** -0.132	-2.62	-0.089	-1.10	0.391
<i>BDEP</i>	** 0.281	3.69	** 0.593	9.63	0.000
<i>TDEP</i>	** 0.123	3.24	0.051	1.49	0.001
<i>GRAINP</i>	-52.3	-1.42	-52.3	-1.42	
<i>SOEYP</i>	** -0.027	-2.52	** -0.027	-2.52	
<i>SOEPSOEYP</i>	-0.016	-0.72	-0.016	-0.72	

Note. 1. See the notes to Table 9.

The effect of economic fundamentals on lending is the opposite of what was expected. For state banks, higher output is more negatively associated with levels of intermediation during the second period than in the first period (Table 9). The change in magnitude is large and statistically significant. The only other statistically significant coefficient is also of the wrong sign, i.e., a negative coefficient on agricultural growth in the first period. The coefficients on industrial growth are negative in both periods even though they are smaller in magnitude than in the annual regressions. Overall, all indicators suggest that there is a worsening of performance in the post-reform period. The results are equally discouraging for the ABC/ADBC, RCCs, and OFIs (Tables 10, 11, and 12). Beginning in 1994, it is possible to look separately at lending by ABC and ADBC branches (Table A3). Fixed effect estimates for the 1994 to 1996 period reveal that ABC branches responded positively to industrial share and industrial growth, which is consistent with the increasing proportion of loans going to township and village enterprises at almost 20% in 1996. For OFIs, the importance of industrial growth increases significantly in the second period, but the effect of industrial share becomes increasingly negative.

As a robustness check for the possible endogeneity of economic fundamentals, we reestimate the fixed effects specification by instrumenting the economic fundamentals by their lagged values and also by regressing directly on lagged values instead of on contemporaneous values. The former assumes that lagged values do not belong in the intermediation equation, the latter that loans are based on past rather than expected future performance or capture an arguably exogenous part of expected outcomes. For the most part, these alternative estimates do not alter the

main results in terms of the signs of coefficients or the changes between the two periods.<sup>21</sup>

The importance of deposits to lending increases over time. The effect of state bank deposits on lending is near zero and insignificant in the prereform period but 0.40 and significant in the postreform period. This result is the opposite of what would be expected if the intermediation of funds became more free over time. For the ABC, the coefficient on own deposits increases from 0.41 to 0.69 over the two periods; for RCCs, it stays at a relatively high level of 0.49 in both periods. For OFIs, the own deposit coefficient increases from 0.29 to 0.59. The increased importance of deposits to lending volume may reflect the new system of ratio loan management being passed down to regional branches of state banks and reduced access of OFIs to the interbank market. While providing autonomy to local banks, such a trend reduces the effectiveness of interregional financial intermediation.

## 6. CONCLUSION

In this paper, we develop empirical tests of financial intermediation based on a model of profit maximization by banks with restrictions on interbank lending. The tests focus on the effect of policy variables, economic fundamentals, and deposits on rates of financial intermediation using Chinese data. The results indicate that financial intermediation in China is far from efficient and that financial reforms in the mid-1990s have not reversed the trend of worsening bank performance. The responsiveness of lending to policy concerns, such as SOE output and profitability and grain production, is significant and has increased in the recent period. Economic fundamentals have had little effect on total lending and the importance of deposits in determining the volume of local lending has increased. There is evidence that the separation of policy and commercial lending with the creation of the ADBC has allowed the ABC to become more commercially oriented, even though it still responds to policy variables as well. Such separation does not necessarily improve overall performance, with the ADBC incurring increasing losses from policy lending. RCCs, the other large rural financial institution, are poorly integrated into financial markets, suggesting potentially large gains from integrating RCCs into the national banking system. The small but rapidly growing group of OFIs, consisting of Urban Cooperatives and Cooperative Banks, national and regional commercial banks, and national TICs, also do not appear to be well-integrated into national financial markets, although there is some evidence that unlike state banks they are increasingly lending in areas with better economic fundamentals.

<sup>21</sup> These are compared to seemingly unrelated regression (SUR) estimates with the heteroscedasticity correction dropped. Estimates reveal an upward bias on coefficients of many economic fundamentals as expected. The coefficients that change from positive to negative in some cases are those for the industrial share of income and log output per capita; agricultural growth for state banks changes from negative to positive in the first period.

Despite greater rhetoric about the need for financial reform, the performance of banks appears to have worsened in recent years. An examination of national bank balance sheets reveals that the direction of lending changed very little from 1991 to 1998, with loans by state banks to SOEs dropping only slightly from 85 to 83%. While it is still possible for the quality of lending to improve without changes in the structure of lending, it seems unlikely that the previous allocation of funds across sectors was optimal. Although one interpretation of this result is that effective reform will require more drastic measures, perhaps including ownership reform, poor performance does not necessarily mean that reforms have been ineffective or unnecessary. The data may reflect the continued difficulty in dealing with the huge portfolio problems facing Chinese banks so that, despite stronger incentives to improve allocation of new loans, the sharply deteriorating performance of SOEs and the portfolio of older loans is overwhelming these efforts. The challenge was made even more difficult by the government's commitment to restrict credit to avoid inflation in the mid-1990s, leaving few funds for new lending.

Reforms continued after 1997. In 1998, provincial PBC branches were abolished in favor of multiprovince regional branches and the government announced that the national credit plan would be eliminated in 1999. Banks have been allowed to adjust their branch structures based on commercial considerations rather than having a branch at each administrative level. Each specialized bank has established an asset management company to salvage as much value as possible from nonperforming loans. While these changes will continue to move China toward a more commercial banking system, a number of necessary reforms remain for improving the quality of new lending by commercial banks (Bonin, Cheng, and Jaffee, 1999). However, while growth of OFIs and continued reform of specialized banks holds promise for future performance, the limited and highly regulated interbank market, government-set interest rates, the centralization of financial management, and continued difficulty resolving the SOE problem will be major impediments to efficient interregional resource flows.

## APPENDIX

TABLE A1

Provincial Financial Intermediation Rates and Loan-Deposit Ratios, 1991 to 1997 Means  
(Sorted by All Bank Intermediation Rate)

	Financial intermediation rates					Loan/deposit ratios				
	All Banks <sup>a</sup>	State Banks	ABC/ ADBC	RCCs	OFIs <sup>b</sup>	All Banks <sup>a</sup>	State Banks	ABC/ ADBC	RCCs	OFIs <sup>b</sup>
HAINAN	1.51	1.16	0.48	0.09	0.29	0.93	1.03	1.31	0.55	0.66
JILIN	1.47	1.31	0.57	0.07	0.10	1.59	1.78	3.42	0.66	1.15
QINGHAI	1.35	1.31	0.50	0.04	0.02	1.53	1.61	1.53	0.47	0.55

TABLE A1—Continued

	Financial intermediation rates					Loan/deposit ratios				
	All Banks <sup>a</sup>	State Banks	ABC/ ADBC	RCCs	OFIs <sup>b</sup>	All Banks <sup>a</sup>	State Banks	ABC/ ADBC	RCCs	OFIs <sup>b</sup>
TIANJIN	1.33	1.14	0.16	0.08	0.09	1.16	1.26	1.16	0.75	0.78
BEIJING	1.32	1.14	0.25	0.11	0.12	0.54	0.54	0.99	0.49	0.73
NINGXIA	1.28	1.14	0.47	0.08	0.08	1.20	1.26	1.54	0.51	1.62
SHANGHAI	1.23	1.05	0.23	0.07	0.13	0.90	0.94	0.89	0.71	0.73
SHAANXI	1.18	0.99	0.27	0.12	0.07	1.11	1.22	1.57	0.69	0.83
GANSU	1.13	0.99	0.28	0.06	0.07	1.09	1.15	1.49	0.59	1.06
LIAONING	1.09	0.88	0.20	0.09	0.13	1.16	1.28	1.54	0.84	0.85
SHANXI	1.08	0.89	0.19	0.15	0.08	0.90	1.05	1.22	0.71	0.77
GUANGDONG	1.05	0.68	0.17	0.20	0.21	0.78	0.78	0.87	0.82	0.80
XINJIANG	1.03	0.95	0.69	0.04	0.05	1.04	1.08	1.58	0.45	1.67
INNER										
MONGOLIA	1.00	0.93	0.35	0.05	0.03	1.46	1.56	2.49	0.60	3.53
HEILONGJ	0.97	0.90	0.45	0.06	0.03	1.25	1.30	2.40	0.61	37.26
JIANGXI	0.92	0.79	0.25	0.06	0.06	1.20	1.34	1.88	0.62	0.88
GUIZHOU	0.89	0.81	0.31	0.05	0.03	1.20	1.30	1.99	0.73	0.58
HUBEI	0.84	0.80	0.29	0.05	0.05	1.18	1.43	2.06	0.63	0.74
SICHUAN	0.83	0.67	0.18	0.07	0.08	1.16	1.32	1.69	0.75	0.83
HEBEI	0.82	0.61	0.17	0.12	0.07	0.93	0.98	1.22	0.67	2.97
HENAN	0.80	0.64	0.18	0.08	0.05	1.11	1.22	1.86	0.83	0.77
ANHUI	0.74	0.62	0.17	0.04	0.06	1.25	1.37	2.25	0.60	40.28
YUNNAN	0.74	0.65	0.32	0.08	0.03	0.84	0.87	1.21	0.60	1.42
HUNAN	0.72	0.54	0.19	0.07	0.09	1.22	1.22	1.89	0.64	2.94
SHANDONG	0.71	0.54	0.11	0.07	0.07	1.03	1.14	1.33	0.72	1.03
ZHEJIANG	0.66	0.45	0.08	0.06	0.09	0.86	0.86	1.02	0.69	4.81
JIANGSU	0.63	0.51	0.09	0.04	0.04	0.91	0.95	1.16	0.71	1.66
FUJIAN	0.63	0.53	0.11	0.05	0.05	0.86	0.88	1.00	0.68	0.88

Note. 1. Tibet and Guangxi are excluded due to missing data. 2. Abbreviations are ABC/ADBC = Agricultural Bank of China/Agricultural Development Bank of China. RCC = Rural Credit Cooperatives. OFI = Other Financial Institutions (excluding RCCs).

<sup>a</sup> Means for all banks and OFIs have missing data: Shanxi (1991–94), Hubei (1991–93), and Guangdong (1991–92).

<sup>b</sup> Mean OFI loan/deposit ratios also exclude years when deposits are zero, which occurs 11 times, and more than once only for Inner Mongolia (1991, 1994) and Hunan (1991–93).

TABLE A2  
Economic and Policy Variables by Province, 1991 to 1997 Means (Sorted by All Banks  
Intermediation Rate)

	GDP per capita	GDP growth rate	Indust. share of GDP	RSOV per capita	RSOV growth rate	Indust. share of RSOV	SOE output value per capita	SOE profits per 100 Yuan assets	Grain output per capita
HAINAN	5.1	0.10	0.12	5.2	0.12	0.22	1.3	6	0.43
JILIN	4.3	0.09	0.40	6.1	0.16	0.51	3.5	7	1.36
QINGHAI	3.7	0.04	0.31	2.2	0.07	0.26	2.5	3	0.37
TIANJIN	9.9	0.08	0.50	26.5	0.15	0.88	8.6	11	0.51
BEIJING	12.7	0.05	0.37	26.2	0.05	0.82	9.6	14	0.70
NINGXIA	3.4	0.06	0.35	2.7	0.11	0.41	2.6	6	0.60
SHANGHAI	18.4	0.09	0.53	43.5	0.17	0.89	16.4	16	0.57
SHAANXI	3.1	0.07	0.36	3.5	0.10	0.57	2.1	6	0.39
GANSU	2.6	0.06	0.37	3.0	0.16	0.51	2.3	7	0.37
LIAONING	7.3	0.07	0.45	13.3	0.24	0.74	5.7	7	0.67
SHANXI	3.8	0.07	0.46	5.5	0.22	0.76	2.6	7	0.40
GUANGDONG	7.8	0.14	0.41	9.0	0.18	0.70	2.8	15	0.32
XINJIANG	5.3	0.08	0.27	5.7	0.09	0.21	3.3	5	0.86
INNER MONGOLIA	3.8	0.07	0.31	4.9	0.20	0.44	2.2	7	0.83
HEILONGJ	5.5	0.09	0.47	6.8	0.18	0.50	4.1	16	1.41
JIANGXI	3.1	0.10	0.30	4.4	0.13	0.54	1.7	8	0.52
GUIZHOU	2.0	0.05	0.32	1.9	0.09	0.36	1.2	13	0.31
HUBEI	4.2	0.09	0.39	6.0	0.18	0.58	2.7	11	0.60
SICHUAN	3.2	0.09	0.34	4.4	0.17	0.61	1.7	8	0.47
HEBEI	4.4	0.12	0.42	6.1	0.22	0.70	2.2	13	0.47
HENAN	3.3	0.12	0.40	5.1	0.21	0.67	1.7	11	0.45
ANHUI	3.2	0.10	0.41	5.7	0.24	0.65	1.6	12	0.50
YUNNAN	3.3	0.07	0.37	2.6	0.13	0.40	2.0	42	0.35
HUNAN	3.5	0.09	0.32	5.0	0.22	0.58	1.7	12	0.51
SHANDONG	5.7	0.11	0.42	10.2	0.19	0.74	2.8	10	0.56
ZHEJIANG	7.8	0.13	0.45	15.5	0.24	0.83	2.6	14	0.42
JIANGSU	7.1	0.12	0.47	15.5	0.19	0.81	3.4	11	0.62
FUJIAN	6.3	0.17	0.34	8.6	0.28	0.67	1.3	17	0.35

*Note.* 1. The units are thousands of 1996 yuan and thousands of kilograms. Means for variables constructed using RSOV are for 1991 to 1996. 2. Tibet and Guangxi are excluded due to missing data. 3. Abbreviations are GDP = gross domestic product, RSOV = rural social output value, SOE = state-owned enterprises. GDP per capita and SOE output value per capita are based on total population. RSOV per capita and grain output per capita are based on rural population.



TABLE A3  
Determinants of ABC and ADBC Financial Intermediation Rates, 1994 to 1996

ABC	Provincial fixed effects 1994 to 1996		Annual regressions					
	1994		1995		1996			
	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>	Coef.	<i>t</i>
<i>ISH</i>	**0.142	5.08	-0.091	-1.89	** -0.171	-3.46	** -0.219	-3.47
<i>IG*ISH</i>	**0.018	3.34	0.020	0.49	-0.027	-1.20	0.048	1.16
<i>AG*(1-ISH)</i>	-0.017	-0.88	-0.031	-0.34	-0.206	-1.36	-0.058	-0.20
<i>LY</i>	** -0.039	-3.65	0.014	1.53	0.011	1.34	0.006	0.58
<i>GRAIN</i>	**305.9	6.05	**505.6	5.19	**441.2	3.80	185.5	0.66
<i>SOEY</i>	**0.074	11.97	-0.017	-1.21	-0.004	-0.24	0.006	0.13
<i>SOEY*SOEY</i>	** -0.081	-6.89	0.022	0.83	0.077	1.81	0.072	0.82
<i>ADEP</i>	**0.322	6.25	0.137	1.33	-0.013	-0.09	0.164	0.98
<i>TDEP</i>	-0.030	-1.68	**0.109	6.30	**0.109	6.10	**0.081	3.22
<i>GRAINP</i>	**63.6	2.57						
<i>SOEYP</i>	**0.028	6.00						
<i>SOEY*SOEYP</i>	** -0.175	-6.44						
<i>N</i>	74							
<i>R-squared</i>			24		25		25	
<i>ADBC</i>			0.98		0.98		0.97	
<i>ISH</i>	0.090	1.46	** -0.315	-3.12	** -0.323	-4.58	** -0.325	-3.44
<i>IG*ISH</i>	0.009	1.12	0.038	0.39	0.051	1.16	0.123	1.79
<i>AG*(1-ISH)</i>	-0.014	-0.44	0.068	0.31	0.526	1.87	** -1.188	-2.81
<i>LY</i>	**0.058	2.68	**0.084	4.02	**0.095	6.65	**0.102	6.79
<i>GRAIN</i>	-79.2	-0.76	**722.3	3.31	**1009.7	4.49	**1795.2	3.81
<i>SOEY</i>	** -0.037	-2.49	0.056	1.72	**0.085	2.91	0.014	0.18
<i>SOEY*SOEY</i>	* -4.040	-2.04	-0.075	-1.25	-0.129	-1.62	0.006	0.05
<i>TDEP</i>	-0.016	-0.79	-0.036	-1.33	-0.025	-1.12	-0.004	-0.13
<i>GRAINP</i>	**237.1	4.07						
<i>SOEYP</i>	**0.053	4.76						
<i>SOEY*SOEYP</i>	**0.209	3.24						
<i>N</i>	74							
<i>R-squared</i>			24		25		25	
			0.86		0.90		0.92	

Note. 1. See the notes to Table 10.

## Derivation of Equation (5)

Substituting (1), (3), and (4) into (2), dividing through by  $(l + r)$ , defining  $l_{rbi}$  as the sectoral intermediation rate equal to  $L_{rbi}/q_{ri}y_r$ , and solving the integral and the first order conditions of the bank's maximization problem with respect to  $L_{rbi}$  yields

$$l_{rbi}^* = -\frac{\alpha_i^2}{\alpha_i^1} l_{rbi} + \frac{\alpha_i^3}{\alpha_i^1} q_{ri} + \frac{\alpha_i^4}{\alpha_i^1} q_{ri} g_{ri} + \frac{\alpha_i^5}{\alpha_i^1} \ln\left(\frac{y_r}{pop_r}\right) - \frac{(1+r_l)}{\alpha_i^1(1+r)}. \quad (A-1)$$

The maximization problem of other banks can be solved analogously. To simplify, we assume there is only one other bank. Optimal lending by each bank is a function of lending by the other. The two response functions determine a Nash equilibrium that yields a reduced form relationship between  $l_{rbi}$  and the economic fundamentals. The responsiveness of lending will depend on the extent to which lending from the two banks is a substitute for each other, which is expressed by the  $\alpha_i^1$ 's and  $\alpha_i^2$ 's in each bank's repayment function. Adding bank subscripts 1 and 2, the reduced form coefficients for bank 1's lending are

$$\frac{\alpha_{1i}^n \alpha_{2i}^1 - \alpha_{1i}^2 \alpha_{2i}^n}{\alpha_{1i}^1 \alpha_{2i}^1 - \alpha_{1i}^2 \alpha_{2i}^2},$$

where  $n$  is the  $n$ th argument of the repayment function given by Eq. (4).

Assuming that the repayment functions of the two banks have identical coefficients, the reduced form coefficients on fundamentals will equal those in (A-1) multiplied by  $\kappa_i$ , where

$$\kappa_i = \frac{1 - \frac{\alpha_i^2}{\alpha_i^1}}{1 - \left(\frac{\alpha_i^2}{\alpha_i^1}\right)^2}. \quad (A-2)$$

At the extreme of no substitution,  $\alpha_i^2 = 0$ ,  $\kappa_i = 1$  and  $l_{rbi}$  is the same as Eq. (A-1), excluding the first term on the right-hand side. As substitutability increases,  $\alpha_i^2$  approaches  $\alpha_i^1$  and  $\kappa_i$  approaches 0.5. The solution is indeterminate if there is perfect substitutability, i.e., if  $\alpha_i^1 = \alpha_i^2$ . More generally, for  $n > 2$ ,  $\kappa_i$  will converge to  $1/n$ . The responsiveness of lending to economic fundamentals is reduced as the bank anticipates the lending behavior of the other bank and its effect on repayment rates. Thus, measurable responsiveness to fundamentals presumes market power. However, the number of lenders will not affect the aggregate responsiveness of lending to fundamentals, since total lending must equalize expected return across regions in equilibrium.

We can also solve for the optimal amount of policy lending by solving the first order condition for the bank manager's maximization problem with respect to  $L_{rbg}$ .

This yields

$$L_{rbg}^* = \frac{\lambda_{rb}}{(1+r_T) - (1+r)R_{rbg}}. \quad (\text{A-3})$$

The amount of policy lending depends on the importance placed on such loans, which can vary by bank and by region, and the losses from policy lending measured in the denominator.

An equation for region-bank-sector specific lending is estimable, given sector-specific data, and under the assumption of efficient interbank markets. Unfortunately, we often have data only on total lending by the bank, with an unclear mapping between loan categories and economic sectors. Total loans of the bank are the sum of commercial sectoral loans and policy loans, an identity which can be expressed in terms of intermediation rates:

$$l_{rb}^* = \sum_i q_{ri} l_{rbi}^* + l_{rbg}^*. \quad (\text{A-4})$$

Here,  $l_{rbg}$  is policy loans divided by provincial output, i.e.,  $L_{rbg}/y_r$ . Substituting (A-1) and (A-3) into (A-4) yields

$$l_{rb}^* = \sum_i \left( \frac{\kappa_i \alpha_i^3}{\alpha_i^1} q_{ri} + \frac{\kappa_i \alpha_i^4}{\alpha_i^1} q_{ri} g_{ri} \right) + \sum_i \frac{\kappa_i \alpha_i^5}{\alpha_i^1} \ln \left( \frac{y_r}{pop_r} \right) - \sum_i \frac{\kappa_i (1+r_T)}{\alpha_i^1 (1+r)} + \frac{\lambda_{rb}}{c y_r}, \quad (\text{A-5})$$

where  $c$  is the denominator in (A-3). Equation (A-5) is the same as Eq. (5) in the text.

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