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## Are Chinese State-owned Bank Loans Growth-promoting? A Sectoral Analysis

Rachel Forcino  
rachelforcino@gmail.com

*Abstract:* Given the unique development of China's financial sector, the country provides an interesting basis for study of the relationship between bank-based finance and growth. In its sectoral analysis of the relationship between state-owned bank lending and GDP growth, the paper provides evidence of a positive and statistically significant relationship between state-owned bank credit and GDP between 1978 and 2005 in those sectors that receive large quantities of credit funds from state-owned banks. Also based on evidence from those sectors with large accumulations of credit funds from state-owned banks, the study supports a finance-led growth hypothesis based on the results of Granger causality testing. Finally, the study establishes evidence for a stronger link between state-owned bank credit and GDP following the 1995 Commercial Bank Law, indicating that China's bank reform effort was effective in improving the efficiency of its financial sector.

*Key words:* China, state-owned commercial bank, finance, economic growth

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## ACRONYMS

<b>ABC</b> .....	Agricultural Bank of China
<b>ADF</b> .....	Augmented Dickey-Fuller
<b>BOC</b> .....	Bank of China
<b>CCB</b> .....	China Construction Bank
<b>CBRC</b> .....	China Banking Regulatory Commission
<b>GDP</b> .....	Gross domestic product
<b>ICBC</b> .....	Industrial and Commercial Bank of China
<b>NBSC</b> .....	National Bureau of Statistics of China
<b>NPC</b> .....	National People's Congress
<b>NPL</b> .....	Non-performing loan
<b>PRC</b> .....	People's Republic of China
<b>RMB</b> .....	Renminbi
<b>VAR</b> .....	Vector autoregressive (model)
<b>VECM</b> .....	Vector error-correction model

## 1. Introduction

### 1.1 Framing the Question

The economic reforms implemented in China over the past thirty years are remarkable not only due to the resulting unprecedented levels of growth that have been sustained over decades; the fact that the marketization measures that encouraged growth have taken place under an authoritarian regime, socialist in name, in a society that lacks the formal institutions commonly thought necessary for a market economy with a thriving business environment adds to the astounding nature of China's growth in the final decades of the twentieth century.

Chinese finance, particularly in the early stages of the reform period, was largely bank-based due to limitations on investment and the lack of a stock market. Foreign investment was introduced in the mid-1980s, but remained limited to special economic zones and coastal cities. Even with the introduction of stock exchanges at Shanghai and Shenzhen in the early 1990s, China's stock market was underdeveloped, dominated by state interests, and therefore served a small role in the financial sector. Prior to the 1978 opening up that marked the beginning of a move toward today's socialist market economy, the banking sector was limited to the solitary national bank which served to allocate resources according to the economic plan. This system left the legacy of a high level of state involvement in loan decisions that persisted even after the 1995 commercial bank law established state-owned commercial banks.

Since finance is an important and highly debated component of economic growth, it is informative to consider its role in China given that the Chinese financial sector has developed in a relatively unique way. This paper seeks to empirically determine whether state-owned bank loans promote economic growth in each of four industrial sectors.

While numerous authors have sought to determine the long-run relationship between financial development and economic growth in China, most have done so through the examination of financial development and GDP figures by region or province, rather than by sector on a national level (Boyreau-Debray 2003; Hao 2006). Through analysis of the relationship between finance and GDP growth on a sectoral basis using national-level data, I explore the ways in which those industries deemed to be of strategic national interest differ from those that garner less governmental attention with regard to long-run relationships between finance and economic growth, while avoiding the influence that local politics can exert on provincial statistics.

In assessing the relationship between state-owned bank credit and economic growth, one gains insight on whether underdeveloped Chinese financial institutions are helpful to the

country's development experience despite high levels of non-performing loans. Additionally, observations on how the relationship between finance and growth changes following the implementation of bank reform efforts provide valuable information regarding whether attempts at reform can be considered successful, and to what degree they achieve success.

## 1.2 The Chinese Banking Industry: Background Information

The Chinese banking industry, now serving a socialist market economy, has evolved a great deal from the mono-bank structure under which it was intended only to allocate resources according to pre-1978 economic plans (Lin and Zhang 2009). Replacing the administrative hierarchy of the People's Bank of China (PBOC) was a "two-tiered banking system," under which "various banking functions were devolved from the PBOC" in order to replace budgetary allocation with provision of bank credit (Lin and Zhang 2009).

As a result of the additional reform measures, focusing on ownership, instituted in the mid- and late-1980s, the Chinese banking system currently "consists mainly of three tiers of domestic banks, with the Big Four state-owned banks comprising the first tier, 12 national-level domestic joint-equity banks the second tier, and about 100 city-level commercial banks the third tier" (Lin and Zhang 2009). The first tier, however, is largely outperformed by its competitors with regard to profitability, as state-owned banks have proven "7.7 % and 6.2% points less profitable than city banks and domestic joint-equity banks, respectively" (Lin and Zhang 2009).

This lack of profitability by state-owned banks is mainly attributed to a "large volume of policy loans and weak internal controls" (Lin and Zhang 2009). The prevalence of policy loans in the credit decisions of state-owned banks contributes to the fact that a vast majority of state bank loans go to state-owned enterprises suffering from overemployment and inefficiency (Green 2009, 96). In an attempt to deal with "non-performing loans (NPL) and technical insolvency" stemming from the political nature of loan decisions among state-owned banks, "in 1998 the government injected RMB 27 billion of capital into the Big Four state-owned banks and transferred the NPL to four newly established asset management companies" (Lin and Zhang 2009). With the soft budget constraints evidenced by this type of government aid, state-owned banks have few incentives to target profitability over other political goals.

Prior to analysis of the activity and performance of Chinese state-owned banks, it is necessary to review important aspects of the Chinese banking industry and properly define several critical terms.

It is first important to understand what the term ‘state-owned bank’ refers to throughout the paper. China is now home to over one hundred domestic banks; however, it is the country’s Big Four banks that are most relevant to the topic at hand (Wang 2009, 74). While the data considered in the study include all state-owned commercial banks, the dominant position of the Big Four within China’s credit market renders detailed discussion of the remaining players extraneous (Peng 2007, 161).

From the founding of the People’s Republic of China in 1949, the People’s Bank of China existed as the country’s sole financial institution and allocated resources to fulfill the needs of a fully planned economy (Green 2009, 92). Under the PBC were three specialized banks: one dealing with the agricultural sector, one focusing on construction projects, and one managing foreign exchange (Green 2009, 92). At the start of China’s economic reform process in 1979, the three specialized entities were “spun off” from the PBC (Green 2009, 92). The final member of China’s Big Four, the Industrial and Commercial Bank of China, was created in 1984 to take over the PBC’s commercial banking functions (Green 2009, 93). Meanwhile, the PBC became a central bank that, while not independent, lacked commercial responsibilities (Green 2009, 92).

Following their creation, China’s state-owned banks were “long used as quasi-fiscal agents to facilitate reform and development of the real economy in accordance with Plan priorities” (Bottelier 2009, 53). As market reform and the development of the banking sector have taken place concurrently over a period of several decades, it is understandable that the original purpose of banks in the People’s Republic of China was to support the provision of its socialist economic plans. However, while China’s economy has slowly but surely embraced market characteristics, the banking industry maintains an area of continued government entanglement.

It is this government intervention in the affairs of state-owned banks that has induced a non-performing loan rate of over 35 percent in the late twentieth century (Zhou 2009, xiv). Zhou Xiaochuan, who took over as Governor of the People’s Bank of China in late 2002, attributes the excess of NPLs to “the intertwined nature of commercial loans and loans made in response to policy objectives” and “the prevailing credit culture at the time,” where bank loans were mainly “relationship loans” and “there was no clear mandate to run a bank with profit as the key objective; instead, banks were operating under the directives of government institutions” (Zhou 2009, xiv). As a result, “many commercial banks had negative capital adequacy ratios” and “were technically insolvent” (Zhou 2009, xvi).

In an attempt to reverse the pattern of government intervention that had caused the accumulation of over RMB1.4 trillion in non-performing loans, the National People's Congress passed a Law of the People's Republic of China on Commercial Banks in 1995, referred to throughout this paper as the 1995 commercial bank law. In effect beginning July 1, 1995, the law attempts to establish a clear profit-oriented mandate for China's state-owned banks. In addition to the requirement stated in Article 4 that business operations are "governed by efficiency, safety, and liquidity," Article 7 addresses the "credit worthiness of borrowers" in an attempt to steer banks away from the issuance of credit based on social networks or government pressure (NPC 1995).

Another notable effort to generate a profit-oriented atmosphere in state-owned banks was the establishment of new policy banks to take over the policy lending duties of the state-owned commercial banks, thus "free[ing] the Big Four to become more focused on commercial business" (Green 2009, 93). China Development Bank, Agricultural Development Bank, and Export-Import Bank of China, established simultaneously with the new banking law, provided another avenue for the government to channel resources to projects of interest; however, Article 41 of the commercial bank law maintains that wholly state-owned commercial banks must grant loans to "projects that need special loans and are approved by state council" (NPC 1995). While the law was intended to minimize government intervention in loan decisions so that state-owned banks could pursue profit-maximizing strategies, sections such as that contained in Article 41 allow "today's central government...to treat state banks as a 'secondary budget'" in "an implicit transfer of budget deficits" (Peng 2007, 156).

As a corollary to the 1995 legislative effort to minimize the proliferation of NPLs, in 1999 "four newly created state-owned asset management companies (AMCs) absorbed an initial RMB1.4 trillion worth of nominal NPLs from five state banks," including the Big Four and the Bank of Communications (Bottelier 2009, 56). This action removed the threat of NPLs to the stability of the Chinese banking industry and gave the state-owned commercial banks something resembling a fresh start.

The year 2003 saw a resurgence of interest in bank reform, beginning with the establishment of the Banking Regulatory Commission (Zhou 2009, xix). Under the guidance of the new regulatory body, BOC, CCB, and ICBC were selected for "corporatization pilot projects" in September 2003, under the belief that corporatization would help to standardize accounting practices and promote transparency (Wang 2009, 112). Reconfigured financial institutions were required to become shareholding companies "to the extent that [was]

possible,” including “listing on exchanges, implementing control mechanisms, and setting up adequate corporate governance structures” (Zhou 2009, xix).

In response to this ordinance, August 2004 saw BOC become a shareholding company following financial restructuring (Wang 2009, 117). In September 2004 CCB formed as a joint-stock commercial bank, then listed on Hong Kong and Shanghai Stock Exchanges in 2005 and 2007, respectively (CCB History). The corporatization of BOC and CCB was followed by that of ICBC in October 2005 (Wang 2009, 117). As “the weakest part of China’s banking system,” ABC’s 2004 proposal for joint-stock reform was later approved in 2008 (Bottelier 2009, 58).

Despite efforts toward reform, “China’s financial system still gives state-owned enterprises (SOEs) better access to funds than it allocates to more efficient, private companies,” even though “the private sector currently accounts for well over half of China’s GDP and an overwhelming share of its exports” (Green 2009, 96). This tendency toward lending to state-owned and inefficient companies plays a role in whether and how strongly bank lending relates to GDP, particularly in those sectors whose growth is led by private enterprise.

The remainder of the thesis proceeds as follows: the second section provides a theoretical basis for the study; the third section outlines the empirical method used; the fourth section provides the results and discusses their implications, while the fifth and final section concludes.

## 2. Theory

### 2.1 Literature Review

Given that banks serve as the main financial intermediaries in China, this paper adopts a bank-centric focus; however, it is important to consider the theoretical background behind financial intermediation and economic growth more generally before fixating on the role of banks, specifically state-owned banks, in Chinese growth.

In his 1911 work, Schumpeter proposes roles for financial intermediaries in the economic development process, making him an early proponent of the idea that financial sector development is inevitably intertwined with the economic growth process. His five proposed roles for financial intermediaries include mobilizing funds, evaluating and selecting projects, managing risk, monitoring entrepreneurs, and facilitating transactions (Zheng et al. 2010). Of those roles, the idea of monitoring entrepreneurs was not relevant in China until the later stages of reform in which private firms were legalized; however, despite the expectation

that increasing numbers of successful private firms in China would lead state banks to fulfill the task of monitoring entrepreneurs, private enterprises still receive only a very small share of the total credit issued by state banks in China. Furthermore, as the evaluation and election of projects for state-owned commercial banks remains to a great degree the domain of the state, Schumpeter's (1911) proposed roles for financial intermediaries do not necessarily hold in China's unique financial sector.

Additional evidence of a link between finance and economic growth is provided by King and Levine (1992). Despite the tendency of prominent early development economists to neglect to consider the role of finance in economic growth, Levine (1997) is inspired by the seminal finding of Goldsmith (1969) that "a rough parallelism can be observed between economic and financial development," an idea that was tested and proven again, with more convincing evidence, in his paper with Robert King (1992). Levine's (1997) analysis, based largely on the King and Levine (1992) cross-country analysis of the financial and economic development of about 80 countries, concludes that "the preponderance of theoretical reasoning and empirical evidence suggests a positive, first-order relationship between financial development and economic growth" (Levine 1997).

Among those scholars who agree on the presence of a relationship between finance and economic development exists a debate over whether, as Schumpeter (1912) argues, bank finance spurs growth or whether, as Robinson (1952) suggests, "where enterprise leads finance follows" (Levine 1997). Patrick (1996) describes this question of causality between finance and economic growth as a "supply-leading hypothesis" versus a "demand-following hypothesis" (Zheng et al. 2010). While, as noted by Zheng et al. (2010), the supply-leading hypothesis has been supported by the empirical work of, among others, McKinnon (1973) and King and Levine (1993), the demand-following hypothesis "postulates a causal relationship from economic growth to financial development" in which "an increasing demand for financial services might induce an expansion in the financial sector as the real economy grows" (Zheng et al. 2010). These hypotheses have been tested using examples both from China and elsewhere, yielding varying results. These diverse results, outlined below, point to the need for additional research on the question of causality between financial and economic growth.

Driscoll (2004) attributes much of the confusion inherent in the question of causality between finance and growth to the problems of simultaneous equations bias "since the demand for loans presumably depends on the level of output" and reverse causality due to the possibility that "loans may be endogenously rising in response to expected future increases in

output” (Driscoll 2004). Despite these potential modeling issues, Driscoll (2004) finds a small but statistically significant effect of bank lending on income in U.S. states. In this study, a growth rate of lending one percent above the national average was associated with an income growth rate 0.017 percent above the national average (Driscoll 2004). Although there was a statistically significant relationship between bank lending and income, the economic significance of 0.017 percent above the national average income growth rate is questionable. Therefore, despite Driscoll’s (2004) efforts to shed light on the relationship between finance and output, the results indicate only a very small perceived effect.

A study that addresses the relationship between lending and growth in a Chinese context is that of Boyreau-Debray (2003). Inspired by the fact that China does not “follow the expected growth and finance relationship” in its lack of the institutions, including hard budget constraints for central and local governments, previously believed to be a necessary prerequisite to growth, she explores the “coexistence of fast economic development and financial deepening” despite a “massive misallocation of financial resources in China” (Boyreau-Debray 2003). In order to assess the “impact of local banking development on the local economy in China,” Boyreau-Debray (2003) considers the relationship between state-owned bank credit and local economic growth, relying on a sample of 26 Chinese provinces with observations from 1985 to 2000 (Boyreau-Debray 2003). Using an extension of the augmented Solow model, to include a “vector of financial intermediation indicators,” Boyreau-Debray (2003) finds that “state-owned bank credit has a negative and significant impact on local economic growth, supporting the hypothesis that the state-banking sector does not allocate savings efficiently and that provinces with a more developed non-state financial sector may benefit from more efficient resource allocation” (Boyreau-Debray 2003). However, inefficient resource distribution within a locality may not be entirely responsible for the negative relationship; instead, central bank lending itself, regardless of the efficiency of fund distribution, can “affect local growth performance in a negative way by softening the local budget constraint” (Boyreau-Debray 2003).

Hao (2006), using the same general method of moments modeling technique as well as a provincial dataset similar to that of Boyreau-Debray (2003), finds similar results. While Hao (2006) concludes that “the development of financial intermediation exerts a positive, causal and economically large impact on China’s growth,” he shares Boyreau-Debray’s (2003) finding that this impact does not run “through the channel of loan expansion because of the inefficiency of loan distribution” (Hao 2006). The studies by Boyreau-Debray (2003)

and Hao (2006) serve to provide consensus regarding the lack of a relationship between bank lending and economic growth on a provincial level in China.

An additional study focusing on the relationship between Chinese finance and economic growth is that of Zheng et al. (2010), who use a multivariate VAR model to perform cointegration testing along with Granger causality tests to determine how financial development relates to economic growth. Zheng et al. (2010) conclude that there is a positive relationship between credit funds and economic growth, in which credit funds precede GDP in growth, as evidenced by the “unidirectional [Granger causality] relationship between credit funds and GDP” (Zheng et al. 2010). The fact that Zheng et al. (2010) find a positive relationship between bank lending and economic growth that is contrary to the negative relationship between bank credit and local economic growth found by Boyreau-Debray (2003) is likely due to the difference in measurements of economic growth; while Boyreau-Debray (2003) focuses on local economic growth, which is likely to be distorted by the changing budget constraints that result from state bank lending at a local level, Zheng et al. (2010) consider economic growth on a national level.

While Chinese state banks are heavily criticized for their lack of profitability due to large numbers of non-performing loans, Laurenceson and Chai (2001) “offer an alternative view for understanding the behaviour, objectives, and performance” of China’s state banks (Laurenceson and Chai 2001). Although China has implemented state-owned commercial banks over the course of its three-decade reform period, it is “wrong to assume that their objectives conform to those of a typical commercial bank found in most Western countries” (Laurenceson and Chai 2001). Instead, according to Article 34 of the Commercial Banking Law, state-owned banks are directed to make loans that are “in accordance with the need for the development of the national economy and social progress and under the guidance of the state industrial policy” (Laurenceson and Chai 2001). Since these development-based projects are often not very profitable, looking at a balance sheet does not tell the whole story with regard to the success of state banks in China in relation to their stated goals.

If one is to adopt the reasoning of Laurenceson and Chai (2001) and assume that Chinese state banks are not intended to serve first and foremost as profit-making entities, then one must also adopt a new method of evaluating the success of these banks in their developmental roles. Instead of only comparing assets to liabilities, it becomes necessary to assess Chinese state banks by examining output levels in relation to the loans issued. As outlined above, analysis of the effects of financial intermediation on economic growth has been conducted both on a theoretical level and with practical applications in China and

elsewhere; however, few studies address the impact of state bank loans on Chinese economic growth on a sector-by-sector basis. As Chinese state banks make lending decisions in a highly politicized manner, it is informative to differentiate between growth in sectors that receive large amounts of government attention and, in turn, state credit and growth in sectors that receive very few state bank loans.

## 2.2 Hypotheses

The thorough foundation of academic literature on the subject of long-run relationships between financial intermediation and growth as well as the causal effects of finance on GDP and vice versa provides a substantial theoretical basis for several hypotheses when studying the Chinese banking industry and how it relates to and allows for GDP growth.

Despite the findings of Boyreau-Debray (2003) and Hao (2006) that indicate no positive relationship between state-owned bank lending and economic growth on a local level, I expect that, in accordance with the national-level study of Zheng et al. (2010):

Hypothesis 1: There is a positive relationship between state-owned bank lending and economic growth in each of the four sectors under examination.

Also based on the conclusions of Zheng et al. (2010) with regard to their Granger causality testing between credit and growth based on comprehensive Chinese national-level data, I hypothesize that:

Hypothesis 2: Bank loans initiate economic growth, rather than growth leading finance.

Finally, as the aim of the 1995 commercial bank law is to separate government policy from commercial bank decisions to encourage profitability, I hypothesize that:

Hypothesis 3: After the passage of the 1995 law, state-owned commercial bank loans became more reliably linked to economic growth.

While Laurenceson and Chai (2001) suggest that profitability and economic growth are separate and possibly mutually exclusive goals for state-owned banks, market economic theory provides a credible foundation for the assumption that growth should occur where profitability serves as the principal goal of an enterprise or industry.

### 3. Method

#### 3.1 Data

The data used in this study originate from the National Bureau of Statistics of China, and were retrieved both through the organization's print publications and through China Data Online, administered by the China Data Center at the University of Michigan. The time series included were gathered from national statistical yearbooks (1979-2007) and a NBSC print compilation of sources and uses of credit funds between 1949 and 2005. Variables considered include observations on gross domestic product of each sector between 1978 and 2005, state-owned bank loans to each sector between 1978 and 2005, the level of employment between 1978 and 2005 in each sector except for the construction sector where such data was unavailable, and total investment in Chinese fixed assets between 1980 and 2005.

For the purposes of this study, the Chinese economy is divided into four industrial sectors. The agricultural sector refers to primary industry, while data on the industrial sector is composed of statistics pertaining to secondary industry. The commercial sector is labeled both as tertiary industry and commerce in official Chinese data sources, while the construction sector is referred to as such.

Due to the changing nature of state-owned banks beginning in late 2004 with the onset of corporatization reform measures that are not yet complete, empirical analysis included in this study is limited to a period ending in 2005. Once corporatization and listing of China's Big Four state-owned banks is complete, an informative follow-up study would focus on changes in the relationship between state-controlled bank credit and economic growth in response to the latest bank reform measures.

A topic of debate among western researchers is the accuracy of official Chinese statistics. As pointed out by Kahrl and Roland-Holst (2009) in their study using Chinese energy data, "NBS data revisions indeed reflect the difficulties of maintaining data accuracy in a rapidly changing, decentralized economy where information remains highly politicized. That said, there are indications that NBS economic and energy data is not without grounding in reality," as "the dramatic shock to China's energy and commodity markets after 2002...suggests that the country's resource use has indeed greatly accelerated..., a fact that accords with official economic and energy data" (Kahrl and Roland-Holst 2009).

However, the rapidly changing and decentralized nature of the Chinese economy is not the only potential cause of alleged data inaccuracy. Seltzer (2005) addresses ethical issues that exist surrounding the collection and use of official statistics, claiming that "threats to integrity can arise in a number of ways, including, among others, arbitrary political

manipulation of concepts, definitions, and the extent and timing of the release of the data, doctoring the actual data released, using the agency for political analysis or other political work, and politicizing agency technical staff” (Seltzer 2005).

In using official Chinese statistics, one must pay particular attention to the ways in which concepts are defined. While important economic indicators are defined in Chinese statistical yearbooks, these definitions do not always conform to those favored by western researchers; therefore, particular care must be taken to ensure that variables are properly represented in empirical analysis. In addition to the variation in indicator definitions, the sole reliance of the Chinese government on growth figures as a “metric of official performance” is believed to have encouraged the exaggeration of statistics by officials seeking to gain favor with their superiors (China Daily June 2009). For this reason, “measures to assess the accuracy of key statistical indicators were implemented in 1999 at the NBS and provincial statistics bureaus” and updated in 2009 (China Daily July 2009).

While the use of official Chinese data is not without issue, there exists no “alternative set of data with a convincing claim to superiority (Naughton 2007). While political ideology and exaggeration may have affected Chinese official statistics, particularly those reported early in the reform period, “China has gradually developed its survey measures” which has resulted in a lack of evidence suggesting statistical manipulation in recent years (China Daily July 2009; Xu 2010).

### 3.2 Variables

In testing the above hypotheses, I rely on variables representing the gross domestic product output and value of state bank credit, both reported on a 100 million yuan scale, within each of four industrial sectors. With GDP as the dependent variable, state bank loans serve as the independent variable in an effort to detect the nature of the relationship between GDP and lending by state-owned Chinese banks.

Measures of gross domestic product within the agricultural (primary), industrial (secondary), commercial (tertiary), and construction sectors are consistently reported in a straightforward manner; however, in order to obtain figures representing the true value of credit issued by state-owned banks to each industrial sector, one must combine the statistics categorized under “state banks” and “state-owned commercial banks” in publications of the National Bureau of Statistics of China, as figures for state-owned commercial banks are reported beginning only in 1997 despite the history of China’s state-owned banks dating to the early stages of economic reform in 1979 (Green 2009, 92).

In order to employ a growth model in the tradition of Mankiw, Romer, and Weil (1992), I include several control variables that may influence the dependent GDP variable. Despite shortages in available data that preclude the estimation of a complete augmented Solow model, I include measures of labor and investment in fixed assets as control variables. Like the statistics for state-owned bank loans and GDP, labor statistics are reported by sector; therefore, the series used in each sector-specific model represents only the labor force participating in activities related to that particular industrial sector. Employment statistics are reported on a scale of 10,000 persons, except for in the case of the construction sector where employment statistics are not consistently reported over the time period being studied. For this reason, the labor variable is excluded from those models that analyze the construction sector.

Unlike the statistics for bank loans, GDP, and labor, investment in fixed assets is not consistently reported on a sectoral basis. Therefore, for each sector-specific model, I include a series of observations representing the total annual investments in Chinese fixed assets, measured in units of 100 million yuan. While this overstatement of investment figures may cause the coefficients of other independent variables to be diminished in value, the signs and significance of the relationships between other independent variables and the dependent GDP variable are likely to remain, providing important information regarding the proposed hypotheses. In addition, a decision to eliminate the investment in fixed assets control variable rather than include a total figure for all sectors would likely have a very negative impact on resulting estimates, since the omission of key control variables leaves open the possibility of finding statistically significant coefficients for independent variables that, in reality, lack statistical significance. Therefore, it is deemed more prudent to include the total figure and risk slightly affecting coefficient values than to omit the investment in fixed assets control variable and thereby render unreliable the statistical significance of remaining estimates.

In order to interpret estimates with regard to percent change, I use the natural logarithm of all variables. Descriptive statistics for logged variables can be found in the Appendix.

### 3.3 Model Specification

#### 3.3.1 Long-run Relationships: 1978-2005

The first model addresses Hypothesis 1, and therefore seeks to gain insight on the relationship between GDP and state-owned bank loans within each sector. As the data is separated into four databases, each pertaining to one of the four sectors under review, the procedure is repeated for each of the sectors.

As cointegration testing is a way in which long-run relationships can be readily established, I first must prove that each series is not integrated of order zero but that it instead contains a unit root in order to proceed with cointegration testing. This is done through Augmented Dickey-Fuller unit root testing, the results of which are included in the Appendix.

Since Augmented Dickey-Fuller tests indicate that each series is integrated of order one, it is appropriate to proceed to cointegration testing. As in Zheng et al. (2010), I first conduct a Johansen test in order to establish whether there exist any cointegrating vectors among the given series. Given the existence of cointegration in each of the four tested sectors, I estimate a vector error-correction model for each sector in order to retain both the information lost in taking first differences of a series, as well as the information contained in the cointegration vector concerning long-run relationships among the variables. Each error-correction model is estimated with GDP as the dependent variable and state-owned bank credit, labor, and investment in fixed assets as independent variables. In estimation of error-correction models for each sector, the Schwarz information criterion suggests the inclusion of four lags in all models except that of the construction sector, for which three lags are suggested. The inclusion of lags in each error-correction model according to selection order criteria addresses the potential for autocorrelation to negatively impact model estimation. In examining the coefficients of the cointegrating equation for each series, one gains insight on the way in which changes in each variable relate to a one percent change in GDP.

### 3.3.2 Granger Causality

To gain insight on the question of causality between financial development and GDP growth posed by Schumpeter (1912) and Robinson (1953) and further explored by McKinnon (1973) and King and Levine (1993), the second model involves Granger causality testing in order to determine whether, using national-level statistics divided by industrial sector, bank lending precedes GDP growth, or if GDP growth initiates a surge in bank credit.

As Granger causality testing is based on the estimation of a vector autoregressive model, a VAR is estimated as a critical first step in testing Granger causality. Since each series that is included is integrated of order one, as indicated by Augmented Dickey-Fuller unit root testing, the VAR is estimated in first differences to eliminate the potential for inaccurate estimates due to unit roots in the included series. As each of the Schwarz information criteria indicates that it is necessary to include four lags to account for autocorrelation, each VAR model is estimated using four lags. Based on the VAR estimations described above, Granger causality tests are performed and interpreted with regard to the relationship between bank lending and GDP.

### 3.3.3 Commercial Bank Law: Before and After

In order to test the assertion that bank lending should be increasingly related to GDP growth following the implementation of a 1995 commercial bank law stressing the importance of commercially sound lending decisions isolated from the influential pressure of government stakeholders, each time series must be separated into observations prior to 1996 and those from 1996 onward. This leaves two sets of data for each sector: one containing observations on each variable from 1978 to 1995; and another with observations from 1996 to 2005.

For each of these abridged series, the testing procedure outlined in 3.3.1 is repeated. As Augmented Dickey-Fuller tests for each variable reveal unit roots in all series, cointegration testing is an appropriate way to proceed. Johansen tests are performed accordingly for each sector both pre- and post-legislation, followed by error-correction models for each of the eight datasets in order to capitalize on any included cointegration relationships within the model. In comparing the coefficients produced by the error-correction models for each sector before and after the 1995 legislation, it becomes evident whether there is a more pronounced or more statistically significant relationship between bank lending and GDP in each sector following the 1995 law on commercial banking.

While Johansen testing and subsequent error-correction model estimation is a common method of identifying both long-run and short-run elasticities between variables, the reliability of the procedure suffers when the number of observations on each variable is small. Because the period from the enactment of the 1995 commercial bank law until the end of the time series in 2005 consists of only eleven time observations, it is important to do supplementary testing in order to confirm the validity of the conclusions drawn from previously obtained error-correction model estimates.

Since the number of time observations is very low, the most reliable way of testing for cointegration is through the use of panel data analysis methods. While group panel cointegration tests such as that of Pedroni allow for differing cointegration coefficients for each cross-section, the data available does not contain enough observations for the reliable use of this type of test. Instead, a cointegration test that features pooling of panel observations, such as Kao's panel cointegration test, must be employed. While this test does not provide individual coefficients for each sector, it produces enough observations to reliably test whether cointegration is a property of the panel. Given that a result of no cointegration prior to the legislation regarding commercial banking combined with a result indicating cointegration following the enactment of the 1995 commercial bank law would

support Hypothesis 3, the Kao panel cointegration test provides important, albeit undetailed, information required to verify the validity of the conclusions drawn from error-correction models estimated with few observations.

In preparation for cointegration testing, the data is assembled into two panels; one panel contains observations on all variables from all cross-sections during the time period beginning in 1980 and ending in 1995, while the other contains the same information for a time period that starts in 1996 and ends in 2005. A Kao test for panel cointegration is performed for each panel, using the Parzen kernel method and the number of lags selected by the Schwarz information criterion. In the case of the first panel featuring data from 1980 to 1995 three lags are selected, while for the second panel from 1996 to 2005 only one lag is required to account for autocorrelation.

## 4. Results and Discussion

### 4.1 Long-run Relationships: 1978-2005

Upon estimation of four error-correction models each representing an industrial sector in China, it is found that the nature of the relationship between GDP and state-owned bank credit varies significantly by sector. The cointegration coefficients for each error-correction model are detailed below and compiled in Table 4.1.

#### 4.1.1 Agriculture

In the agricultural sector, a coefficient of -0.038 for the loan variable that is statistically significant at a one percent level indicates a negative relationship between GDP and state-owned bank credit, since each one percent increase in GDP is associated with a 0.038 percent drop in state-owned bank lending. One potential explanation for the negative relationship between state-owned bank credit and GDP output in the agricultural sector is that the sector was not a focal point for state-owned bank lending. While the commercial and industrial sectors have received a very large amount of credit from state-owned banks during the economic reform period, as shown in Appendix Figure A.1, the agricultural sector appears to have been largely neglected with regard to bank lending.

This relative disinterest in the agricultural sector is reflected in the national five-year economic plans, where the sixth and seventh plans (1981-1985 and 1986-1990) produce comparatively low growth targets for agricultural industry of around four percent, while beginning with the eighth plan (1991-1995) the emphasis seems to shift to the service sector and the advancement of information technology (Eighth Five-Year Plan). China's relatively poor GDP growth in agriculture is reflected in the fact that over the course of economic

reform, the agricultural sector has been consistently outpaced in annual GDP growth by the secondary industrial sector and gradually yet convincingly overtaken by the tertiary commercial sector (Eighth Five-Year Plan).

Likely a result of official governmental focus shifting away from agricultural growth and toward high technology and energy acquisition, a final possible cause of the negative relationship between state-owned bank lending and GDP growth within the agricultural sector is the weakness of “the rural banking system in general” (Bottelier 2009, 58). As ABC remains “the weakest part of China’s banking system” even a decade into the twenty-first century, it is understandable that the agricultural sector’s GDP growth is negatively associated with bank credit issued by a weak state-owned institution.

#### 4.1.2 Commerce

Contrary to the relationship found between GDP and state-owned bank lending in the agricultural sector, China’s commercial sector features a positive relationship between GDP and state-owned bank loans. At a one-percent significance level, the cointegrating equations of the error-correction model indicate that as GDP rises by one percent, state-owned bank loans also increase by 0.093 percent. This positive relationship between GDP and state-owned bank lending is strikingly different than that found in the agricultural sector, in large part due to the different circumstances surrounding the activities of each sector during China’s economic reform period.

One possible reason for the positive relationship between the commercial sector’s GDP and its state-owned bank credit is the sheer amount of credit received by actors in China’s commercial sector. While the agricultural sector received an annual average of 127,598.4 million yuan in loans from state-owned banks during the period 1978-2005, the commercial sector received nearly ten times that amount at 1,158,307 million yuan annually during the 28-year period examined. This disparity in state-owned bank lending between sectors is a prime example of directed credit, where state-owned banks lend to those sectors that are deemed to be of strategic importance to national economic development and security interests.

The identification of the commercial sector in the ninth five-year plan as critical to economic development due to its role in the promotion and dissemination of information technology and services coincides with a large uptick in state-owned bank lending to commercial entities, from 1,441,712 million yuan in 1996 to 2,725,197 million yuan in 1997 (Ninth Five-Year Plan). While this evidence seems to suggest that a larger quantity of state-owned bank loans is more definitively related to GDP growth, it is also possible that the

TABLE 4.1 Cointegration coefficients, 1978-2005

Sector		Coefficient	
Agriculture	ln_gdp	1.000	
	ln_loans	-0.038	***
	ln_labor	-1.854	***
	ln_investment	-0.493	***
	constant	15.035	
	p>chi <sup>2</sup>	0.000	***
Commerce	ln_gdp	1.000	
	ln_loans	0.093	***
	ln_labor	-2.401	***
	ln_investment	-0.202	***
	constant	14.254	
	p>chi <sup>2</sup>	0.000	***
Industry	ln_gdp	1.000	
	ln_loans	0.709	***
	ln_labor	-2.028	***
	ln_investment	-1.137	***
	constant	13.708	
	p>chi <sup>2</sup>	0.000	***
Construction	ln_gdp	1.000	
	ln_loans	-0.236	***
	ln_labor		
	ln_investment	-0.855	***
	constant	2.186	
	p>chi <sup>2</sup>	0.000	***

Source: NSBC data

\*\*\*significant at 1% level

identification of causes for high GDP growth is confounded by the fact that, as a policy priority outlined in the ninth and tenth five-year plans, the development of the commercial sector is supported by a government-wide effort to boost commercial output that goes beyond solely encouraging state-owned banks to direct credit flows accordingly. Nevertheless, the commercial sector provides strong support for Hypothesis 1, indicating that there is a positive relationship between a sector's receipt of state-owned bank loans and its GDP.

#### 4.1.3 Industry

The industrial sector provides additional support for Hypothesis 1, as every one percent increase in industrial GDP is associated with a 0.709 percent rise in state-owned bank lending that is statistically significant at a one percent significance level. Like in the case of the commercial sector, the industrial sector receives a large amount of state bank credit with the highest annual average of all four sectors at 1,320,863 million yuan. This high level of support lent to the industrial sector is in accordance with the government's priorities for economic growth outlined in the nation's sixth, seventh, and eighth five-year plans, where industrial output was slated to expand 7.5 percent annually between 1986 and 1990 compared to an expected four percent annual growth rate in the agricultural sector (Seventh Five-Year Plan). Large amounts of credit from state-owned banks extended to the industrial sector is also in accordance with the tendency for China's financial system to give "state-owned enterprises (SOEs) better access to funds than it allocates to more efficient, private companies" (Green 2009, 96). Since China's secondary industry is dominated by state-owned enterprises, it is logical that the industrial sector would receive the largest amount of credit from state-owned commercial banks.

In addition to careful economic development planning by government officials in the form of five-year plans, another possible reason for the positive relationship between GDP and state-owned bank loans in the industrial and commercial sectors is the nature of the banks granting credit to these two sectors. While it is impossible to determine using publicly available data the ratio of policy loans to those based on traditional measures of credit-worthiness stemming from each of the Big Four state-owned commercial banks, it is possible to speculate on the role of each bank's history and evolving mission in its issuance of credit. Whereas the Bank of China, Agricultural Bank of China, and China Construction Bank all evolved from their role under the umbrella of the People's Bank of China as specialized institutions intended to carry out the allocation of resources according to economic plan into banks that, while nominally independent and supposedly profit-oriented, maintained their legacy of deference to government wishes, the Industrial and Commercial Bank of China was

independently founded in 1984 (Green 2009, 92). While the ICBC was “founded to take over the PBC’s commercial banking functions,” the fact that it was created independently of the other three big banks presents the possibility that it lacks the same degree of government influence as those three commercial banks that were “spun off from the PBC in 1979” (Green 2009, 92).

#### 4.1.4 Construction

Like the agricultural sector, China’s construction sector features a negative relationship between state-owned bank lending and GDP. Statistically significant at a one percent level, state-owned bank credit falls 0.236 percent for every one percent rise in the construction sector’s GDP output. One possible reason for the negative relationship is the government’s responsibility to maintain needed infrastructure such as roads and railways, despite the fact that such infrastructure projects rarely produce immediate returns. Because of this responsibility, the Chinese government is likely to direct credit funds from state-owned banks toward the construction of public goods regardless of the expected financial return.

When interpreting the relationship between state-owned bank loans and GDP within the construction sector, it is important to note that the small sample length may lend itself to minor inaccuracies in properly estimating coefficients. In addition, the lack of sufficient labor statistics for the construction sector may cause coefficients for the remaining variables to be slightly inflated, with the implication that loans may in fact be less negatively related to GDP than the estimated coefficient indicates.

Given the fact that those sectors that receive the vast majority of state-owned bank loans—commerce and industry—feature a positive and highly statistically significant relationship between state-owned bank credit and GDP output, this study provides qualified yet convincing support in favor of Hypothesis 1. In extending the analysis of Hypothesis 1 to its theoretical basis, the establishment of positive and statistically significant relationships between state-owned bank loans and GDP in the sectors that are most active in the credit market is found to support Laurenceson and Chai’s (2001) analysis regarding the mandate of state-owned commercial banks. While Chinese state-owned commercial banks seem to lack the profit incentives of their western counterparts, as evidenced by a 25 percent non-performing loan ratio for all Chinese commercial banks in 2002, this study provides support for Laurenceson and Chai’s (2001) assertion that Chinese state-owned commercial banks have made loan decisions during the economic reform process beginning in 1978 aimed toward macro-level economic growth rather than basing credit allocation solely on perceived profitability. However, while testing of Hypothesis 1 provides valuable information regarding

the positive relationships between state-owned bank lending and GDP in the commercial and industrial sectors that suggests a positive relationship between loans and GDP, one must allow for the possibility that an overall surplus of governmental funds and attention granted to the commercial and industrial sectors may be a confounding variable in a study otherwise suggesting a link between large quantities of state-owned bank credit and GDP.

In addition to the information provided regarding the relationships between state-owned bank lending and GDP, the cointegration coefficients found in Table 4.1 also provide interesting information regarding the relationship between labor and GDP in each sector. Relatively large and statistically significant negative cointegration coefficients for each of the four tested sectors could suggest that Chinese labor resources are simply not properly allocated. However, as labor has historically been China's most abundant resource, it is possible that each sector simply suffers from overemployment, causing a negative coefficient in relation to growth since the amount of labor in each industrial sector exceeds that which is required to aid in growth promotion.

In interpreting the negative cointegration coefficients for investment in fixed assets, it is important to remember that the investment in fixed assets series represents the total annual investment in fixed assets for all sectors, therefore, it is likely that these coefficients are not completely accurate when used to represent investment in fixed assets by sector in relation to the sector's GDP. Despite a necessary level of skepticism with regard to coefficient reliability, the coefficients representing investment in fixed assets provide a realistic look at the relationship between GDP and investment in fixed assets in each sector. As investments in fixed assets are made up largely of a collection of sunk costs necessary for a company to begin participating in an industrial sector, it is logical that such investments are not immediately reflected in GDP growth figures; instead, it is not until later that the benefits of accumulated fixed assets are reaped. Also logical is the magnitude of each cointegration coefficient in relation to those of the other three sectors. As a company in the industrial sector requires a great deal of fixed assets and therefore sunk costs in order to begin operations, it is appropriate that the negative cointegration coefficient is largest in the industrial sector. Likewise, as much of the commercial sector only requires the accumulation of few fixed assets before a company can contribute to the sector's GDP growth, it is appropriate that the commerce sector has the smallest investment in fixed assets coefficient of the four.

#### 4.2 Which Came First: Finance or Growth?

Upon testing the second hypothesis in an attempt to determine the direction of causality between increases in bank lending and increases in GDP output, the results for each

sector are found to correspond to the results pertaining to the first hypothesis. Those sectors that feature positive relationships between bank lending and GDP also feature a Granger causality relationship where state-owned bank lending initiates GDP growth.

#### 4.2.1 Agriculture

China's agricultural sector from 1978 to 2005 features a bidirectional Granger causality relationship between state-owned bank lending and GDP in which both causality directions are statistically significant at a one percent significance level. As Granger causality implies that "variable X causes another variable Y if the current value of Y can be better predicted by using the past values of X<sup>2</sup>," a bidirectional Granger causality relationship between credit and GDP in the agricultural sector implies a dynamic relationship in which past values of state-owned bank credit can be used to predict values of GDP and vice versa (Wong 2010).

Another possible explanation for the statistical significance of bidirectional causality between state-owned bank lending and GDP is the presence of a third variable that is related to both credit and gross domestic product. In the case of China's agricultural sector, investment in fixed assets is one such variable as it Granger-causes, at a one percent significance level, both state-owned bank lending and GDP, while only bank lending is shown to have a bidirectional Granger causality relationship with the investment in fixed assets variable. Because of the fact that many different factors contribute to GDP value, particularly in a case where bank lending is found to be negatively related to GDP growth, it is informative to explore the ways in which GDP is related to other potential instigators of economic growth, such as investment in fixed assets.

#### 4.2.2 Commerce

In the Chinese commercial sector, past values of state-owned bank loans reliably predict current values of GDP. This Granger causality running from state-owned bank credit to GDP, in combination with the previously described positive relationship between bank lending and GDP growth, suggests that the large quantity of state-owned bank credit directed toward the commercial sector has played a significant role in the sector's growth and success. This Granger causality relationship, in line with the findings of both Zheng et al. (2010) regarding Chinese finance and King and Levine's (1993) broader study, does not fully address Schumpeter's (1911) question of the finance-growth nexus since it involves testing only credit funds while neglecting other aspects of financial development; however, it provides important support for a finance-led growth experience in China's commercial sector. Since the Chinese financial sector is largely bank-based, the examination of credit funds in

relation to GDP provides a solid foundation for inference regarding China's finance-growth nexus.

When considering the evidence that state-owned bank lending has contributed to GDP growth in China's commercial sector, it is important to understand the mechanisms by which state-owned bank lending can influence GDP values. These mechanisms can include increased levels of investment, higher levels of education within the labor force, and technological innovation with the capacity to revolutionize retail and service constituencies within the commercial sector. As both investment in fixed assets and technological innovation are often closely intertwined and in some cases reliant on the availability of bank credit as a means of finance, it is important to consider the role of credit in GDP growth while bearing in mind the multitude of other factors that can contribute to a sector's annual GDP value.

#### 4.2.3 Industry

Like in the commercial sector, Granger causality testing within China's industrial sector reveals that values of GDP can be predicted by past values of state-owned bank lending. The industrial sector, based on annual averages of the total quantities of state-owned bank credit to each sector, was the recipient of more state-owned bank credit than any other sector and appears to make productive use of the credit it receives, as the relationship between state-owned bank loans to the industrial sector and the sector's GDP are positively related over the course of the 28-year period under observation. The evidence for unidirectional Granger causality from state-owned bank lending to GDP is in accordance with the already-established relationship between credit and GDP in China's industrial sector; however, this causal relationship must be understood in the context of other variables in relation to industrial GDP.

While Granger causality testing provides evidence suggesting unidirectional Granger causality from state-owned bank credit to industrial GDP, it is important to also note the way in which investment in fixed assets, itself serving a critical role in industrial capability and growth, relates to both GDP and state-owned bank lending. The fact that at a one percent significance level, investment in fixed assets and GDP display a bidirectional Granger causality relationship while at a five percent significance level there is a bidirectional Granger causality relationship between investment in fixed assets and state-owned bank loans suggests that the three variables, particularly in the realm of China's secondary industrial sector, are inextricably linked. While, due to the high priority given to industrial development by the Chinese government as evidenced by the contents of five-year plans over the course of

TABLE 4.2 Granger causality test results, 1980-2005

Granger causality		Agriculture		Commerce		Industry	
From	To	chi <sup>2</sup>		chi <sup>2</sup>		chi <sup>2</sup>	
Loans	GDP	34.874	***	24.731	***	57.503	***
Labor	GDP	53.412	***	96.464	***	71.714	***
Investment	GDP	87.085	***	46.115	***	133.36	***
GDP	Loans	472.17	***	2.172		5.225	
Labor	Loans	169.04	***	16.394	***	6.926	
Investment	Loans	220.45	***	19.599	***	10.968	**
GDP	Labor	5.0468		3.882		5.167	
Loans	Labor	4.1971		4.968		6.656	
Investment	Labor	25.447	***	27.18	***	8.979	*
GDP	Investment	5.4754		40.896	***	28.507	***
Loans	Investment	44.394	***	8.671	*	12.318	**
Labor	Investment	16.543	***	56.569	***	51.386	***

\*\*\*p>chi<sup>2</sup> less than 0.01\*\*p>chi<sup>2</sup> less than 0.05\*p>chi<sup>2</sup> less than 0.1

Source: NSBC data

the reform period, it is likely that the government provided the industrial sector with incentives and resources for development in excess of solely state-owned bank credit, Granger causality testing provides support for the hypothesis that bank lending plays a significant role in initiating GDP growth in the Chinese industrial sector.

#### 4.2.4 Construction

The construction dataset, as observations begin only in 1988 and end in 2005, is found to cover too short a time period to draw reliable conclusions regarding Granger causality between variables. While one might suspect that given the construction sector's similarity to the agricultural sector with regard to a negative relationship between state-owned bank loans and GDP that it would, like the agricultural sector, feature a bidirectional Granger causality relationship between state-owned bank loans and GDP, support of this assertion relies on future study which will be possible only upon publication of additional data in the coming years.

While the results of one sector prove inconclusive, the three sectors from whose Granger causality tests conclusions can be drawn suggest that state-owned bank credit initiates GDP growth. As the sectors that receive the most state-owned bank credit, commerce and industry, exhibit evidence of Granger causality running unidirectionally from bank credit to GDP, it is reasonable to conclude that, given an adequate quantity of state-owned bank loans, such credit leads to economic development measured by GDP growth. For this reason, my Granger causality study supports the Schumpeterian idea that an active role for financial intermediaries can spur economic growth in China.

#### 4.3 Effect of 1995 Commercial Bank Law

Testing of Hypothesis 1 provides valuable information regarding the relationships between state-owned bank lending and GDP in the agricultural, commercial, industrial, and construction sectors over the course of the Chinese economic reform period; however, it is also important to consider the question of whether attempts to reform state-owned banks into more profitable entities have led to a stronger link between bank credit and macro-level economic growth as measured by GDP. This question is a valuable one since it reflects on the success of recent reform efforts. In comparing the relationship in each sector between state-owned bank credit and GDP from prior to the 1995 commercial bank law to the relationship between the two variables following the enactment of the law, one gains insight on the success of China's most recent legislative banking reform effort.

##### 4.3.1 Agriculture

In considering the Chinese agricultural sector before and after the 1995 law on commercial banks through the estimation of error-correction models, it becomes apparent that the relationship between state-owned bank credit and GDP improves following the enactment of the law. While the cointegration coefficient for the time period beginning in 1980 and ending in 1995 indicates that for every one percent increase in GDP there is a 3.56 percent drop in the value of state-owned bank credit issued, the coefficient for 1996 through 2005 indicates that for every one percent increase in GDP there is a -0.15 percent change in state-owned bank credit.

While the relationship between state-owned bank loans and GDP remains negative in the period following the enactment of the 1995 bank law, the percent decrease in state-owned bank loans is more than 20 times greater prior to the enactment of the bank law than in the period following enactment. As the coefficient representing the change in state-owned bank credit over the entire period 1978-2005 is also negative, the results from all error-correction models of the agricultural sector are found to be consistent.

TABLE 4.3 Cointegration coefficients before and after 1995 commercial bank law

		Pre-1996		Post-1995	
		Coefficient		Coefficient	
Agriculture	ln_gdp	1.000		1.000	
	ln_loans	-3.566	***	-0.150	***
	ln_labor	-11.002	***	0.170	
	ln_investment	3.132	***	-0.414	***
	p>chi2	0.000	***	0.000	***
Commerce	ln_gdp	1.000		1.000	
	ln_loans	-0.120	*	-0.305	***
	ln_labor	-1.897	***	-10.767	***
	ln_investment	-0.280	***	1.270	***
	p>chi2	0.000	***	0.000	***
Industry	ln_gdp	1.000		1.000	
	ln_loans	-1.459		0.256	
	ln_labor	4.172		-2.186	**
	ln_investment	-0.454		-0.689	***
	p>chi2	0.000	***	0.000	***
Construction	ln_gdp	1.000		1.000	
	ln_loans	-1.990		2.967	
	ln_labor				
	ln_investment	2.179		2.461	
	p>chi2	0.832		0.065	*

\*10% significance

\*\*5% significance

\*\*\*1% significance

Source: National Bureau of Statistics of China data

Since the relationship between state-owned bank lending and GDP is shown to improve following the enactment of the commercial bank law, the agricultural sector provides qualified support for Hypothesis 3. As the hypothesis explicitly links state-owned commercial bank loans to economic growth, the negative coefficient for the post-enactment period does not fully satisfy the terms of the hypothesis; however, as there is marked improvement in the relationship between state-owned bank credit and GDP that serves to validate the spirit of the hypothesis, evidence from the agricultural sector can be viewed in support of Hypothesis 3.

#### 4.3.2 Commerce

Unlike the agricultural sector, the commercial sector displays deterioration in the relationship between state-owned bank credit and GDP following the enactment of the 1995 commercial bank law. Compared to a cointegration coefficient prior to the law suggesting a 0.12 percent drop in state-owned bank credit for every one percent increase in GDP (significant at ten percent), the post-enactment coefficient drops to -0.305 and is significant at a one percent significance level. This change indicates that following the enactment of the 1995 bank law intended to link the issuance of state-owned credit funds more solidly with profitable investment opportunities, the link between credit and GDP became nearly three times worse than prior to the law.

An explanation for the lack of improvement in the relationship between state-owned bank loans and GDP in the commercial sector following the 1995 commercial bank law is found in the availability of other means of governmental support to sectors deemed to be of high importance to China's continuing economic development. As the further development of information technology and related services is identified in the ninth and tenth five-year plans as a "strategic industry," it is likely that state-owned bank credit was not the government's only resource dedicated to the development of the IT component of the commercial sector; instead, the state budget likely allocated extensive financial resources to the state-owned commercial entities and national champion private enterprises that were also the recipients of state-owned bank credit (Ninth Five-Year Plan).

As a majority of China's GDP is produced by companies with private ownership status, it becomes evident that the private ownership-dominated commercial sector's lack of improvement in the relationship between state-owned credit and GDP following the 1995 commercial bank law is due more to the lack of dependence of those productive enterprises within the commercial sector on state-owned bank credit in their overall production (Green 2009, 96). However, when analyzing the estimates representing China's commercial sector

before and after bank reform legislation, the negative coefficient values both prior to and following the enactment of the commercial bank law suggest a situation contrary to that implied by the positive cointegration coefficient representing the relationship between state-owned bank lending and GDP in the commercial sector over the course of a time period beginning in 1978 and ending in 2005, one must also consider the possibility that the accuracy of coefficient estimates for the time periods prior to and following enactment of the commercial bank law may be affected by the short sample length available for analysis.

#### 4.3.3 Industry

While the industrial sector's results pertaining to the first and second hypotheses are akin to those produced in analysis of the commercial sector, the industrial sector differs from the commercial sector with regard to its response to the 1995 commercial bank law. A lack of statistical significance for the coefficients related to state-owned bank lending makes drawing definitive conclusions difficult; however, those coefficients estimated in the post-1995 error-correction model indicate significant improvement in the relationship between state-owned bank lending and GDP when compared to the period prior to the bank law's passage and enactment. With the cointegration coefficient for the period beginning in 1978 and ending in 1995 indicating that state-owned bank credit decreases 1.459 percent for every one percent increase in industrial GDP, the equilibrium-restoring relationship between the two variables improves following the enactment of the 1995 commercial bank law. This change is reflected in a positive cointegrating coefficient representing a 0.256 percent change in state-owned bank credit for every one percent change in GDP in the period beginning in 1996 and ending in 2005.

If an accurate representation of the change in China's industrial sector following the 1995 commercial bank law, the increased percent change in state-owned bank credit in relation to a one percent increase in industrial GDP could be attributed to a spike in state-owned bank loans to the industrial sector. This spike, beginning around 1997 and visually represented in Appendix Figure A.1, is a foreseeable response to the calls for further development of high-tech manufacturing capabilities characteristic of the ninth and tenth five-year plans covering the period 1996-2005.

#### 4.3.4 Construction

Like the industrial sector, the construction sector features cointegration coefficients for state-owned bank lending prior to and following the enactment of 1995 commercial bank legislation that, despite a lack of statistical significance, indicate improvement in the relationship linking state-owned bank credit flowing into a sector and that sector's GDP.

This improvement in the relationship between state-owned bank loans and GDP in China's construction sector after 1995 could, like that of the industrial sector, be related to an increase in the total amount of state-owned bank credit issued to the sector following the enactment of bank legislation in mid-1995. As the total amount of state-owned bank credit issued to the construction sector more than tripled between 1996 and 1997 from RMB94,942 million to RMB300,945 million, it is unclear whether the observed improvement in the relationship between state-owned bank loans and GDP, if reliable, is a genuine improvement in the GDP-loan relationship, or whether a large influx of state-owned bank credit has distorted the way in which such a relationship can be interpreted.

While empirical analysis provides limited evidence of improvement in the relationship between state-owned bank lending and GDP in the construction sector following the enactment of the 1995 commercial bank law, strong and recent evidence of corruption in China's Railway Ministry, including the embezzlement of funds by the Railway Minister and other government officials within the Ministry, suggests that the funneling of money into China's construction sector should not necessarily be assumed to relate to a growth in output even after the 1995 law aimed at commercial bank reform given the rampant nature of fund misappropriation (Anderlini 2011).

#### 4.3.5 Kao test for panel cointegration

As the questionable reliability of error-correction models when dealing with short sample lengths and a lack of statistical significance in some cases casts a shadow of doubt upon the accuracy of the cointegration coefficients representing the relationships between state-owned bank credit and GDP before and after the 1995 commercial bank law, it is necessary to confirm the findings of sections 4.3.1 through 4.3.4 with an alternate econometric technique. While the Kao cointegration test for panel data does not estimate individual cointegration coefficients for each cross section, it can confirm the presence of cointegration between variables in an effort to determine whether or not there exists a long-run relationship between state-owned bank lending and GDP in China. As the Kao procedure tests the null hypothesis that at least one included series is not involved in a cointegration relationship, rejection of the null hypothesis implies the existence of cointegration among the tested variables.

The Kao test for cointegration among the variables within the panel from 1980 to 2005 revealed a test statistic of -0.54766 that was insignificant at one, five, and ten percent significance levels, indicating that there is no statistically significant long-run relationship between the tested variables when pooling data from the agricultural, commercial, industrial,

TABLE 4.4 Kao panel cointegration test results, prior to and following 1995 bank law

	t-statistic	observations
1980-1995	-0.54766	64
1996-2005	-7.42174 ***	40

\*\*\*significant at 1% level

Source: National Bureau of Statistics of China data

and construction sectors. However, the null hypothesis of no cointegration is rejected at a one percent significance level for the period beginning in 1996 and ending in 2005, indicating that GDP, state-owned bank lending, labor, and investment in fixed assets variables share a long-run relationship during this time period. The presence of a long-run relationship involving state-owned bank credit and GDP following the enactment of the commercial bank law while there is no such relationship prior to the legislation reinforces the evidence gleaned from error-correction models representing the agricultural, industrial, and construction sectors in that each of these error-correction models suggested improvement in the relationship between state-owned bank lending and GDP following the 1995 commercial bank law.

As three of the four error-correction models, as well as the Kao panel cointegration testing procedure, have indicated a closer relationship between state-owned bank credit and GDP following the implementation of the 1995 commercial bank law intended to transform state-owned banks into profit-making entities, this study provides ample evidence in support of Hypothesis 3 while simultaneously drawing attention to the need for further study upon the dissemination of additional data in future years.

## 5. Conclusion

As shown in the results presented above, it is clear that each of the three tested hypotheses finds at least qualified support in the empirical evidence offered by this study despite data availability and sample length serving as obstacles in the interpretation of results.

In the case of the first hypothesis, which postulates that there is a positive relationship between state-owned bank lending and economic growth, not all sectors featured a positive relationship between state-owned bank credit and GDP. Instead, results from the agricultural and construction sectors indicated that for every one percent increase in GDP, a drop in state-owned bank lending would be required to restore equilibrium. While this finding does not support a positive relationship between state-owned bank lending and GDP, the fact that

these sectors received relatively few resources in the form of state-owned bank credit combined with a positive relationship between state-owned bank lending and GDP in those sectors that do receive a great deal of state-owned bank credit does provide substantial support in favor of the first hypothesis. While this conclusion is contrary to the findings of the provincial-level studies carried out by Boyreau-Debray (2003) and Hao (2006), it provides further support—within those sectors that receive significant state-owned bank-based financial resources—for the conclusions of the Zheng et al. (2010) national-level study.

The assumption that past values of state-owned bank lending can be used to predict current values of GDP, described in Hypothesis 2, is supported in a similar manner to Hypothesis 1, since empirical evidence supports the hypothesis for those sectors in which bank-based finance plays a large role. This, too, lends support to the conclusion of Zheng et al. (2010) regarding the Granger causality relationship between credit funds and GDP in that my study finds that state-owned bank credit in sectors with a great deal of bank attention unidirectionally Granger-causes changes in GDP, while the relationship is more ambiguous in those sectors with little state-owned bank credit.

Although plagued by technical complications relating to the short sample length of available data series, the third hypothesis is supported by evidence of an improvement in the relationship between state-owned bank credit and GDP in three out of the four sets of error-correction model estimates as well as in the Kao panel cointegration testing procedure.

While the first and second hypothesis tests provide their respective broad theoretical debates with additional evidence, it is perhaps the question of whether China's efforts at bank reform have improved the capacity of state-owned banks to promote macro-level economic growth that serves the most practical purpose when considering China's prospects for continued economic growth and financial development.

With the CBRC's initiation of state-owned bank corporatization efforts in the early 21<sup>st</sup> century comes the question of whether this new round of bank reforms will further improve performance and profitability within China's state-owned and state-controlled banking industry. As Peng (2007, 167) cautions, it is inappropriate to fully rely on corporatization and public listing of banks to produce meaningful change in the industry's performance; however, once China's bank corporatization has fully taken place and had several years' chance to affect the way in which business pertaining to the banking industry is done, a study comparing the relationship between state-controlled bank lending and GDP before corporatization to the same relationship after corporatization would provide valuable information regarding the continuing level of success of Chinese bank reforms.

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## Appendix

TABLE A.1 Descriptive statistics, logged variables

		Observations	Mean	Skewness	Kurtosis
Agriculture	ln_gdp	28.0000	8.6516	-0.2008	1.6278
	ln_loans	28.0000	6.6534	-0.1476	1.8410
	ln_labor	28.0000	10.4282	-0.2663	1.8950
	ln_investment	26.0000	9.1362	-0.1343	1.7428
Commerce	ln_gdp	28.0000	9.0101	-0.1138	1.6147
	ln_loans	28.0000	8.8446	-0.1378	1.6081
	ln_labor	28.0000	9.3909	-0.3240	1.7404
	ln_investment	26.0000	9.1362	-0.1343	1.7428
Industry	ln_gdp	28.0000	9.2614	-0.0016	1.5153
	ln_loans	28.0000	8.6683	-0.1245	1.5624
	ln_labor	28.0000	9.4411	-0.7058	2.0640
	ln_investment	26.0000	9.1362	-0.1343	1.7428
Construction	ln_gdp	18.0000	8.0811	-0.5476	1.8937
	ln_loans	18.0000	7.0628	-0.1864	1.3960
	ln_investment	18.0000	9.8799	-0.2860	1.9445

Source: National Bureau of Statistics of China data

FIGURE A.1 Total state-owned bank loans, 1978-2005

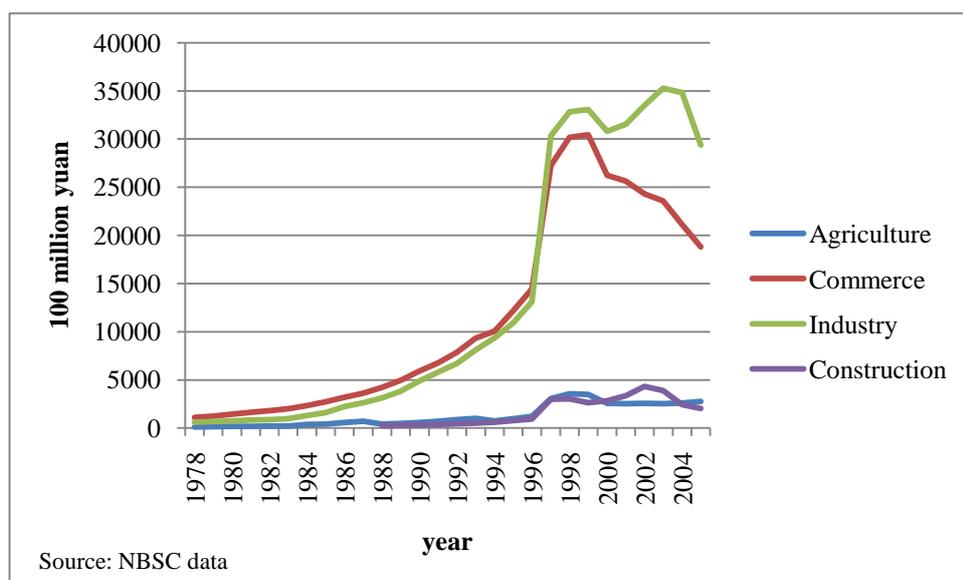


FIGURE A.2 Logged state-owned bank loans, 1978-2005

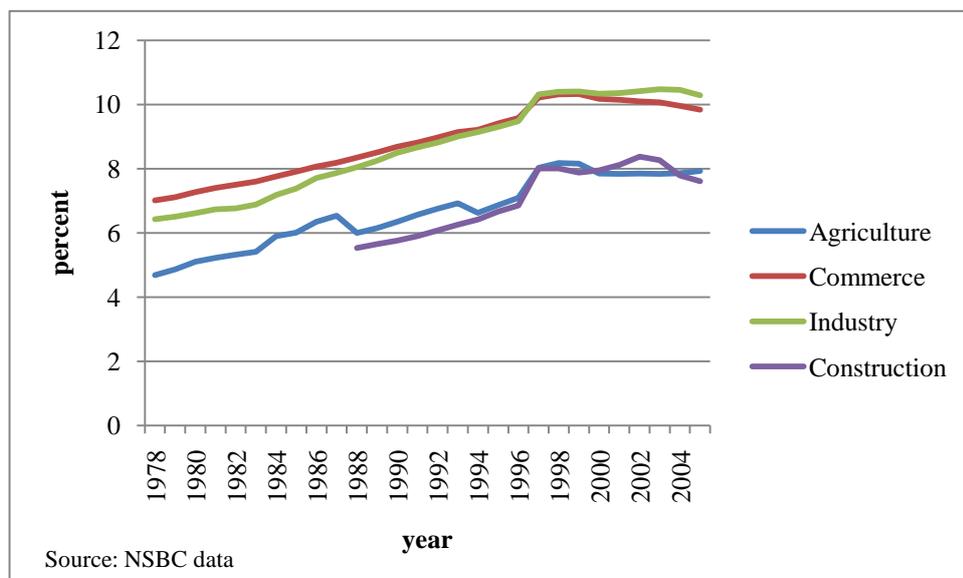


TABLE A.2 Unit root test results, logged variables

		ln(GDP)	ln(loans)	ln(labor)	ln(investment in fixed assets)
Agriculture	t-statistic	-1.748	-2.057	-2.098	-3.547
	5% critical value	-2.994	-3.592	-2.997	-3.6
Commerce	t-statistic	-1.107	1.26	-2.128	-3.547
	5% critical value	-2.997	-1.95	-2.994	-3.6
Industry	t-statistic	-3.288	-1.272	-2.576	-3.547
	5% critical value	-3.596	-2.994	-2.994	-3.6
Construction	t-statistic	-3.413	1.309	-	-3.495
	5% critical value	-3.6	-1.95	-	-3.6

Source: National Bureau of Statistics of China data