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IN CHINA**

Julan Du, Qing He and Oliver M. Rui

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Channels of Interprovincial Risk Sharing in China

Julan Du

The Chinese University of Hong Kong

and

Qing He

Renmin University of China

Hong Kong Institute for Monetary Research

and

Oliver M. Rui*

The Chinese University of Hong Kong

Hong Kong Institute for Monetary Research

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Abstract

This paper decomposes consumption risk sharing among provinces in China over the 1980-2007 period. We find that 9.4 percent of the shocks to gross provincial product are smoothed by the interprovincial fiscal transfer system. This system also cushions a relatively large fraction of the province-specific shocks in the coastal provinces of China. Using a variety of indicators, we explore non-fiscal channels of consumption risk sharing. We find that the migration of rural labor to urban areas and the remittance of migrant wages play important roles in promoting interprovincial consumption risk sharing in the inland provinces of China. In contrast, the extent of risk sharing through financial intermediaries and the capital markets is very limited. These factors have resulted in a low degree of risk sharing among Chinese provinces, especially over the last decade.

Keywords: Consumption Risk Sharing, Chinese Economy, Fiscal System, Credit Markets, Remittance

JEL Classification: O16, O53, R11

* Corresponding author at: The Chinese University of Hong Kong, Faculty of Business Administration, Room 1010, Hong Kong. Email address: oliver@baf.msmail.cuhk.edu.hk

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1. Introduction

The benefits of consumption risk sharing are widely recognized in developing and developed countries. According to Townsend (1995), individuals can potentially raise their levels of income, consumption, and savings by sharing their idiosyncratic consumption risks. Starting with the work of Backus *et al.* (1992), the extent of consumption risk sharing among regions and countries has been a focus of recent research. However, evidence of full consumption risk sharing is either limited or nonexistent, even among developed countries, leaving substantial room for potential welfare gains (see, for example, Backus *et al.*, 1992; Obstfeld, 1994; Asdrubali *et al.*, 1996; Lewis, 1996; Crucini, 1999).

To understand the sources of this incomplete sharing of consumption risk, it is crucial to identify the channels through which regions and countries have achieved their current degree of risk sharing. Asdrubali *et al.* (1996) (henceforth ASY) provide a simple decomposition methodology to determine the channels through which risk is shared. First, by accessing capital markets, households can share risk through the cross-ownership of productive assets in other countries or regions. Second, world and national transfer systems can serve as vehicles for further income and consumption risk sharing. Third, households may also adjust their asset portfolios through borrowing and lending. Several papers have extended this methodology to investigate the scope of, and ability for, risk sharing in various countries and regions.¹ Despite the many studies of risk sharing channels that have been conducted thus far, little is known about these channels in non-industrial economies. Our paper adds to the literature by analyzing the channels of consumption risk sharing in China, a large developing country that is playing an increasingly significant role in the global economy.

The case of China is interesting for several reasons. First, as China exhibits almost all of the notable features of a developing country, an understanding of its risk-sharing channels can help us to understand those of developing countries in general. For example, China's formal financial system is characterized by the repressive financial policies that are prevalent in many developing countries. China's private enterprises rely heavily on informal finance, which is also typical of a developing economy. Moreover, as in many underdeveloped economies, China still has a dual-economy structure in which rural-urban migration plays an essential part in relieving rural poverty.

Second, investigating risk sharing in a developing country such as China offers a number of unique perspectives that are not available in studies of developed economies. For instance, capital and credit markets have long been regarded as crucial for domestic consumption risk sharing in developed countries.² However, the financial markets in most developing and transition economies are

¹ For instance, Asdrubali (1998) distinguishes risk sharing from inter-temporal smoothing, and Athanasoulis and van Wincoop (2001) decompose unpredictable output shocks.

² For example, ASY (1996) find that 62 percent of all shocks to U.S. state products are smoothed by financial markets.

underdeveloped and inefficient, and China's are no exception (Allen *et al.*, 2005; Guariglia and Poncet, 2008). Whether and how financial markets in developing countries promote risk sharing is thus an intriguing issue to explore. In addition, while rural-urban migration is not a prominent issue in industrialized nations, it is very important for developing economies that are in the process of transforming into industrialized economies. It will be interesting to investigate whether rural-urban migration has helped to promote interprovincial consumption risk sharing in China.

Third, studying China may help us to understand the relationship between uneven regional development and interprovincial risk sharing. Economic development is typically uneven over time and across regions in most developing economies. In the past three decades, China's economic growth has been accompanied by increasing regional disparities. Thus, an exploration of the risk-sharing channels in China can further elucidate the effect of uneven regional development on interprovincial consumption risk sharing, which will also have implications for other developing countries.

We find that the degree of consumption risk sharing in China has remained low (approximately 40%) and has not improved since the 1990s. The country's coastal and inland provinces exhibit no striking differences in the extent of risk sharing achieved, although there are salient differences between them in the channels through which risk sharing is conducted. We first estimate the percentages that the fiscal and non-fiscal channels contribute to interprovincial risk sharing, and find the former to have played a much less significant role than the latter. Furthermore, the coastal provinces are found to have engaged in higher levels of risk sharing through the fiscal transfer system than the inland provinces. Next, we compare the relative significance of various potential non-fiscal channels. The development of financial intermediaries and the capital markets has had a moderate impact on risk sharing. In addition, only the coastal provinces have experienced better risk sharing due to the recent development of the capital markets. Although informal finance is instrumental to regional economic growth in China,³ it has depressed the degree of risk sharing. Consistent with the evidence on international risk sharing, foreign direct investment (FDI) has not enhanced overall risk sharing in China, although there is some evidence to suggest it promoted risk sharing in the inland provinces in the 1990s. A rather interesting finding is that industrialization and urbanization, especially in relation to the remittances of migrant laborers, may well play an important part in enhancing consumption risk sharing, particularly in the inland provinces. Although this is a risk-sharing channel with Chinese characteristics, it is one that has implications for other developing countries. In a nutshell, our results suggest that unlike the situation in industrialized economies, the capital markets in China have played a modest role at best in stimulating consumption risk sharing. Instead, cross-province remittances, a product of rural-urban migration, probably constitute the primary channel for such risk sharing in the inland provinces.

³ Allen *et al.* (2005) argue that in spite of the apparent state dominance in China, a sufficient number of alternative, informal financial mechanisms have emerged to allow the overall financial system to function effectively.

Our analysis extends the literature in several dimensions. First, to the best of our knowledge, this study represents the first comprehensive attempt to investigate the patterns of risk sharing through various channels in China.⁴ Second, a wide array of indicators is used to capture the size and quality of the financial system and to assess the impacts of financial development on risk sharing. Finally, we investigate the importance of industrialization and urbanization to interprovincial risk sharing and explore and discuss the possible roles played by rural-urban migration and the remittances of migrant laborers, which helps us to better understand interregional risk sharing in developing economies with underdeveloped financial systems.

The remainder of the paper is organized as follows. Section 2 discusses the various potential risk-sharing channels in China. Section 3 discusses the methodology of the risk-sharing analysis and the econometric issues involved. The data are introduced and the variables presented in Section 4. Section 5 presents an overview of risk sharing through fiscal and non-fiscal channels in China in different areas and periods. Section 6 explores various non-fiscal channels of risk sharing. Further robust evidence of our results is provided in Section 7, and Section 8 concludes the paper.

2. Risk-Sharing Channels in China

2.1 Fiscal Transfer System

Before 1979, the Chinese fiscal system was highly centralized. The central government controlled almost all social resources and implemented a material balance system. With the onset of economic reform at the end of the 1970s, the central government initiated a process of fiscal decentralization and afforded the provinces much more discretionary power over regional budgets. Fiscal decentralization was carried out gradually in several phases. Between 1980 and 1993, a fiscal contract system was established to govern the fiscal relationship between the central and provincial governments. Under this system, fiscal revenue consisted of central and local government revenues. According to the agreement reached in negotiations with the central government, local governments were allowed to retain part of local fiscal revenues, with the remainder handed over to the central government. The fiscal contract system resulted in the central government losing its dominant control over the national budgetary system (Oi, 1992; Lin and Liu, 2000). With dwindling budgetary revenues, the ratio of central government revenue to total revenue declined from 38% in 1985 to 22% in 1993.⁵

⁴ The extant literature includes only a few studies that have investigated the degree of consumption risk sharing in China. Boyreau-Debray and Wei (2005) find that the degree of intra-China consumption risk sharing has declined during the past decade. Xu (2008) provides evidence that less risk sharing takes place across provinces in China than across U.S. states and across Canadian provinces.

⁵ This resulted in an imbalance in the development of regional economies and in such phenomena as local protectionism, tax evasion, expansion of extra-budgetary revenue, and growing regional differences.

This drastic decline in central government revenue placed mounting pressure on the interprovincial fiscal transfer system, which was clearly unfavorable to risk sharing through this channel. To increase the fiscal capacity of the central government, tax system reform was launched in 1994, which separated tax into that collected by the central government, that by local governments, and that by both. Under this new scheme, "local revenue" was redefined as consisting exclusively of local revenue and the local part of shared revenue (Wang, 1997; Zhang, 1999). As this separate tax system allowed the central government to take charge of the main types of tax in China, its revenue share increased to around 55.7% in 1994 (National Statistical Bureau, 2004), an increase likely to have promoted interprovincial fiscal transfer and contributed to risk sharing across provinces.⁶

Furthermore, an extra-budgetary revenue system runs in parallel with the budgetary revenue system. It consists of tax surcharges and user fees levied by the central and local governments, in addition to the earnings of state-owned enterprises (SOEs) (Jin *et al.*, 2005). Because this extra-budgetary revenue does not have to be shared with the central government, it affords local governments with greater autonomy over expenditure, which in turn reduces the power of fiscal transfers for interprovincial risk sharing. Accordingly, the role of the fiscal transfer system in interprovincial risk sharing may not be stable over time due to the extra-budgetary revenue system.

2.2 Formal Financial System

The formal financial system in China mainly consists of financial intermediaries and capital markets.

Financial Intermediary Development

Financial intermediation in China is dominated by the banking system. According to an estimate by the Federal Reserve Bank of San Francisco (2007),⁷ the commercial banks provided 85% of the total capital raised by corporations in China in 2006. The banking system has undergone several phases of reform since the liberalization of the economy. In the 1979-83 period, the Chinese government restored the two-tier banking system, which consists of a central bank and several major state-owned commercial banks. In the 1984-1993 period, it promoted the establishment of shareholding banks and encouraged competition among banks of various types (Bonin, 1999). The 1994-2003 period witnessed the most important reform of the banking sector, whereby the central government set up a market-oriented banking system. Finally, further reforms of the banking sector were introduced in the period from 2004 to the present, following China's accession to the World Trade Organization (WTO). These reforms mainly involved restructuring the state-owned commercial banks into shareholding banks and the introduction of

⁶ Tochkov (2007) shows that net fiscal transfers have reduced the volatility of provincial expenditure.

⁷ Prospects for China's Corporate Bond Market, Federal Reserve Bank of San Francisco Economic Letter, Number 2007-07, March 16, 2007.

overseas strategic investors. As a consequence of these reforms, several state-owned commercial banks were transformed into state-controlled commercial banks that were publicly listed either domestically or overseas (Bai and Holscher, 2009; Berger *et al.*, 2009).

Capital Market Development

China's capital markets mainly comprise the bond and equity markets. Corporate bonds were first issued in China in 1986, but its bond market remains underdeveloped. According to the China Securities Regulatory Commission (CSRC), the value of corporate bond issues in 2007 equated to only 2.05 percent of GDP. In contrast, the equity market has developed rather quickly. Although established after the bond market, the Shanghai and Shenzhen Stock Exchanges have enjoyed rapid expansion since their formation in the early 1990s. The ratio of market capitalization to GDP was only 3.93% in 1992, but had surged to 132.65% by 2007 (CSRC, 2008).

2.3 Informal Financial System

The country's formal financial system has long been characterized by state domination and financial repression, with the banking sector and financial markets primarily serving the funding needs of SOEs and the majority of the non-state sector denied access to formal finance.

Given the rapid growth of the non-state sector, Allen *et al.* (2005) suggest that alternative financing channels and corporate governance mechanisms must be operating in China's private sector. Largely built upon reputational concerns and long-term relationships, informal finance has supported the rapid expansion of the non-state sector and contributed most to the growth of the economy. If informal finance is mobile across provinces and a large proportion of it flows to provinces in which capital is scarce due to the underdevelopment of the formal financial system, then it is expected to promote interprovincial risk sharing. However, if it is mainly locally based due to its relationship-based nature and is also more prevalent in more developed regions, then we cannot expect informal finance to promote interprovincial risk sharing.

2.4 Financial Globalization

Financial globalization could in theory foster risk sharing across countries (Kose *et al.*, 2009). As a central part of the financial globalization process, FDI could potentially affect interprovincial risk sharing within a country. Harrison *et al.* (2004) suggest that firms in countries with larger inflows of FDI are less constrained by external finance limitations. Applying the same logic to China's provinces, we expect that FDI inflow relieves the shortage of capital and generates new employment and income, thus reducing the

impact of negative province-wide shocks on the well-being of the populace.⁸ According to Poncet (2007), China's annual capital inflows have exceeded US\$40 billion since 1996, gradually increasing to around US\$70 billion in 2005 and 2006. As China is the world's largest single recipient of FDI, such investment is expected to smooth consumption by acting as an important source of external finance. However, He *et al.* (2009) find that the allocation of FDI across provinces is rather imbalanced, with the majority going to the coastal provinces. This uneven geographical distribution of FDI may diminish its positive impact on interprovincial risk sharing if FDI inflow is highly correlated with the distribution of domestic capital investment. Thus, the impact of FDI on interprovincial risk sharing may not be uneven across provinces. As FDI has been an important growth engine in China, in certain circumstances the persistence of its uneven distribution may actually contribute to concomitant movements of consumption and output growth, thereby worsening interprovincial risk sharing.

2.5 Industrialization and Urbanization

The problems of surplus labor and land shortages are more serious in China than in most developing countries. The pace of urbanization was fairly slow from 1949 to 1982 because of the rapid growth of the rural population and the tight administrative restrictions on rural-urban migration under the household registration system (*Hukou*).⁹ The proportion of urban dwellers to the total population grew slowly from 13.3% in 1952 to 20.6% in 1982. However, the economic reforms of the later twentieth century led to rapid urbanization and industrialization, such that between 1982 and 1986 the urban population increased dramatically from 20.6% to 37% of the total population. According to National Census figures, there were more than 200 million migrant laborers in 2006. A major cause of this jump was the migration of large numbers of surplus agricultural workers from rural to urban areas following the implementation of a series of liberalization reforms in rural areas, such as the household responsibility system (Zhao, 2003; Wikipedia, 2010). The industrialization and urbanization process has encouraged large numbers of redundant rural laborers to leave farming and the countryside for cities within the same province or in the booming coastal provinces. Because of the *Hukou* system, however, these migrant workers are not officially recognized as urban residents, but are considered merely to be taking up temporary jobs. Typically, they remit large parts of their wages back to their families in the countryside (Chan and Zhang, 1999; Zhang and Song, 2003). Hence, rural-urban migration has substantially altered the sources of household income in rural China, especially in the poorer inland provinces. The remittance of non-farming income by migrant labor has become an increasingly important source of income for rural households (de Brauw and Giles, 2008) and, at the same time, an effective instrument for interprovincial risk sharing.

⁸ Foreign portfolio investment flows into China are rather limited in size because the country's capital account has not been liberalized. Hence, FDI is the primary form of capital inflow. FDI also has the largest potential impact on employment and income in the recipient provinces.

⁹ The *Hukou* system is a social control/administration system that divides the country into rural and urban households, whose members must register at the local public security office to be considered legal residents. After registration, households are issued a *Hukou* certificate that lists all members of the family in detail, allowing them to be more closely controlled by the local street office in urban areas or by the village committee in rural areas (Chen and Ravallion, 1999).

Giles and Yoo (2007) find that households in rural China have engaged in less precautionary saving as the migrant network has increased.

3. Methodology of Risk-Sharing Analysis

3.1 Measuring Risk Sharing

Athanasoulis and Wincoop (2001) developed a variance decomposition method, which they applied to the United States. In essence, the method breaks down the reduction in cross-sectional income and consumption variability into various channels, including capital markets, the fiscal transfer system, credit markets, and the unshared proportion.

To see how the procedure works, let us consider a country with i provinces. Let y_{it} be the per capita provincial output (income before risk sharing) in period t . The growth rate of province i 's output from t to $t+s$ is calculated as $g_{i,t,t+s} = \ln y_{i,t+s} - \ln y_{it}$. Without imposing any structure, we can express the output growth rate as the sum of a predictable component and an unpredictable component:

$$g_{i,t,t+s} = \alpha + \lambda'_s z_{it} + \varepsilon_{i,t,t+s} \quad (1)$$

where α is a constant and vector z_{it} is the information set at time t used to predict future growth.

Even with complete risk sharing, the households in each province remain exposed to the national-level aggregate risk. Thus, what matters for our research is the extent to which a province's growth rate deviates from the national growth rate. Using equation (1), we can write the deviation of the growth rate in province i from the national rate as

$$g_{i,t,t+s} - g_{t,t+s}^N = \lambda'_s (z_{it} - z_t^N) + \mu_{i,t,t+s} \quad (2)$$

where the superscript N represents the corresponding national variable,¹⁰ and $\mu_{i,t,t+s} = \varepsilon_{i,t,t+s} - \varepsilon_{t,t+s}^N$ refers to the residual risk.

¹⁰ Following Athanasoulis and Wincoop (2001), we define the national counterpart as $x^N = \sum_{j=1}^I \theta_j x_j$ for any provincial variable x_i . θ_j is the weight for province j , which is the proportion of province j 's endowment in the national endowment.

When all households are equally risk averse, they are identically exposed to the national risk, and the residual risk $\mu_{i,t,t+s}$ should thus be eliminated. Hence, the risk sharing achieved through a particular channel can be gauged by the extent to which it reduces the uncertainty of the residual risk $\mu_{i,t,t+s}$.¹¹ To obtain the estimation of $\mu_{i,t,t+s}$, we must assume an artificial “representative” province with an “average” residual risk¹² and that the innovations $\mu_{i,t,t+s}$ with non-overlapping intervals $[t, t+s]$ are all independently drawn from the residual risk distribution in this representative province. The residual risk of this representative province is assumed to follow a $N(0, \sigma_s^2)$ distribution.¹³

We employ the representative province’s standard deviation of residual risk σ_s as a measure of the diversifiable risk. The level of risk sharing accomplished through the fiscal transfer channel and non-fiscal channels can then be measured by the extent to which they each reduce the standard deviation of residual risk.

The estimation procedure is as follows. We first choose the variables in vector z_{it} (the information set). For each horizon s , we run a panel regression for Equation (2) using all of the intervals in the sample that do not overlap. Let $\ddot{\mu}$ be the stacked vector of the residual risk for a given horizon. We estimate the average variance in the residual risk over all provinces as that of the representative province $\sigma_s^2 = (\ddot{\mu}'\ddot{\mu})/(IH - \lambda)$, where H is the number of observations in each province and λ is the number of variables in information set z . By comparing the diversifiable risk before and after risk sharing, we can compute the reduction in the standard deviation as the percentage drop in the estimated standard deviation.¹⁴

3.2 Measuring the Contribution of the Fiscal and Non-Fiscal Channels to Risk Sharing

To estimate the degree of risk sharing, we rely on several income measures. We treat GDP as income before risk sharing, as it does not include income sources such as fiscal transfers and asset holdings. Following ASY (1996), we use aggregate provincial income, disposable provincial income, and provincial

¹¹ This methodology is comparable to that of ASY (1996), as both are based on the same measures of income before and after risk sharing.

¹² Because we impose little structure on the endowment process, the variance in residual risk in each region cannot be computed for a sufficiently long horizon. For example, there is only one observation of 20-year growth per region over 20 years of data.

¹³ This is an unconditional distribution. Conditional on each region, the distribution of $\mu_{i,t,t+s}$ is generally different.

¹⁴ For further details, please refer to Athanasoulis and Wincoop (2001).

consumption as measures of income and consumption after risk sharing.¹⁵ Following ASY (1996), we treat the difference between aggregate provincial income and disposable provincial income as representing the risk sharing achieved through the fiscal system, which is the most clear-cut channel of risk sharing. If we follow the approach adopted by ASY (1996), which is based on their observation of the U.S. situation, then we would regard the difference between provincial GDP and aggregate provincial income and that between disposable provincial income and provincial consumption as the risk sharing attained through the capital markets and credit markets, respectively. However, this classification of non-fiscal channels may be inappropriate for China. For instance, China has the world's highest rate of household savings, and consumer credit is far less popular and relevant than it is in the United States. Hence, it may be unreasonable to attribute the difference between disposable provincial income and provincial consumption primarily to the effect of consumption smoothing via the credit markets. Large numbers of migrant workers flock to the coastal areas from the inland provinces and send money back to their families in their home provinces, which could certainly create a large discrepancy between GDP and aggregate provincial income that is not caused by asset investment in the capital markets.

Given the complexity of the risk-sharing channels in China, we classify all potential channels into either the fiscal channel or non-fiscal channels. In our analysis, the difference between aggregate and disposable provincial income represents risk sharing through the fiscal channel, whereas that between GDP and aggregate provincial income and that between disposable provincial income and provincial consumption reflect risk sharing through the non-fiscal channels. In our opinion, the fiscal channel is the most straightforward and least controversial of these channels, whereas the non-fiscal channels serve as a catch-all category for all other potential channels.

In our analysis, we first estimate the percentage of the contributions the fiscal and non-fiscal channels make to risk sharing, i.e., the percentage reduction in the standard deviation of residual risk due to the fiscal and non-fiscal channels. There are numerous potential channels in the non-fiscal category, but we pay particular attention to the most prominent, such as the capital and credit markets, informal finance, globalization, and industrialization and urbanization. It is impossible for us to quantify the percentage that each of these channels contributes to risk sharing because differences in the income associated with them bear no clear one-to-one correspondence with any specific non-fiscal channel. Nonetheless, we try to assess their relevance by using various indicators of the potential non-fiscal channels and extending our regression models to evaluate the statistical and economic significance of their direct effects on the degree of risk sharing.¹⁶

¹⁵ As discussed in Section 4, these income measures are transformed into per capita terms in our analysis.

¹⁶ It should be kept in mind that measurement errors do not result in biased estimates of fiscal smoothing. As our measurements influence provincial aggregate income and disposable provincial income proportionately, the standard error reduction specification is thus an appropriate measure of the fiscal effect.

3.3 Comparing the Importance of Different Non-Fiscal Channels of Risk Sharing

As noted, the non-fiscal channels category is broad and encompasses many dimensions. Here, we explore the development of formal and informal finance, FDI, and urbanization. To capture the role of each channel explicitly, we follow Kose *et al.* (2009) and employ a standard risk-sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . The regressions include province fixed effects and time effects. A negative value of the coefficient vector γ indicates that the greater the value of these non-fiscal channels, the greater the amount of risk sharing that occurs in a province.¹⁷

We conduct our analysis in two steps. First, because each potential channel category often has multiple potential proxy variables, we examine each potential channel separately and test the relevance of each proxy variable individually. This helps us to assess the significance of each potential channel as thoroughly as possible. Based on the sign and statistical significance of the estimated coefficients for γ , we judge whether each potential channel is actually relevant for interprovincial risk sharing, thereby mitigating potential multicollinearity concerns with regard to these non-fiscal channels. Second, to address the concern that examining each potential channel separately may cause estimation bias, we incorporate all of the potential channels simultaneously and carry out multivariate analysis to test the robustness of our results. At the same time, multivariate analysis enables us to conduct a horse race among multiple potential channels to compare their contributions to interprovincial risk sharing.

4. Data and Variables

4.1 Measures of Income

Our sample consists of a panel of 29 provinces and provincial-level cities on the Chinese mainland for which annual data are available.¹⁸ All of the variables are measured in per capita terms and are

¹⁷ This is obvious because the degree of risk sharing attained by region i is equal to $1 - \mu - \gamma' FO_{it}$; see Sorensen *et al.* (2007).

¹⁸ To maintain the consistency of the data on disposable income and consumption we do not include the two provincial-level administrative regions of Tibet and Chongqing.

expressed in 1980 constant prices by deflating them according to the retail price index. To gauge risk sharing accurately, it is essential to obtain data on the following indicators of individual income.

(1) *GDP* data are drawn from the 2008 edition of the *Statistical Yearbook of China*.¹⁹ We obtain the per capita gross product of a province by dividing the aggregate provincial product by the province's population.

(2) Aggregate Provincial Income (*PI*) is defined as the sum of the total income of provincial residents and local government income before taxes and fiscal transfers.²⁰ We approximate provincial income as the sum of disposable household income,²¹ local budgetary fiscal revenue,²² and local extra-budgetary revenue, and then derive per capita provincial income by dividing the provincial aggregate value by the provincial population.

(3) Disposable Provincial Income (*DPI*) consists of household disposable income and local government disposable income. The latter is equal to local budgetary revenue plus central government grants and local extra-budgetary revenue, minus local government remittances to the central government.

(4) Provincial Consumption (*PC*) is defined as the sum of household consumption and government consumption in a province. Provincial household consumption is measured as the average of urban and rural household living expenses. Provincial government consumption is measured as the sum of local budgetary expenditure and extra-budgetary expenditure.²³

To measure local disposable income and consumption, we first use data collected from the *Rural Household Survey Yearbook* and the *Urban Household Survey Yearbook*. These survey yearbooks provide us with data on disposable income and consumption for urban and rural households in each province, respectively. The corresponding figures for government income and consumption are drawn from the provincial yearbooks. As all of the data series are stated in nominal terms, we deflate them by the relevant provincial retail price index (*RPI*).

¹⁹ The 2008 *Statistical Yearbook of China* provides national (provincial) account data adjusted according to the economic census of 2004. This source provides consistent data for the 1980-2007 period.

²⁰ Following ASY (1996), we exclude retained earnings in our measure of provincial income (*PI*). As Athanasoulis and Wincoop (2001) point out, the exclusion of retained earnings is not an issue. Retained earnings are an investment that contributes to dividends in the future, which are captured in pretax provincial income. To provide sensitivity analysis, we include retained earnings in aggregate and disposable provincial income.

²¹ Disposable household income is measured as the average of urban household disposable income and rural household net income.

²² The measurement of local budgetary revenue is inconsistent across years because of the implementation of the separate tax system in 1994. In accordance with the *Finance Yearbook of China*, we estimate local budgetary revenue after 1993 as the sum of local-level revenue plus consumption tax and 75% of value-added tax (VAT) collected.

²³ Budgetary (extra-budgetary) revenue consists of central budgetary (extra-budgetary) and local budgetary (extra-budgetary) revenue.

Table 1 presents the summary statistics for each measure of income and consumption after risk sharing. All of the data are expressed in the first difference in log real per capita terms. Average provincial GDP and average consumption growth are 9% and 7%, respectively. The average standard deviations of provincial GDP and consumption growth are 0.057 and 0.059, respectively, which are much higher than those in industrialized countries.²⁴ A distinct feature is that the volatility of consumption is slightly higher than that of each of the income measures,²⁵ which may imply that there is less risk sharing in China than in other economies.

4.2 Measuring Non-Fiscal Risk-Sharing Channels

Formal finance consists mainly of financial intermediaries and capital markets. We employ the following three ratios to measure the extent of the development of financial intermediation: *Loan*, *Deposit*, and *Saving*. *Loan* is the ratio of total (bank and non-bank) loans to GDP, which measures the overall size of the credit markets. *Deposit* is the ratio of total savings deposited in financial institutions to GDP. *Saving* is the ratio of household savings in financial institutions to GDP.²⁶ These three measures reflect the scale of financial intermediation in terms of assets and liabilities.

We employ two measures, *Issuance* and *Capitalization*, to capture the importance of capital markets. *Issuance* is the ratio of funds raised by issuing equities and non-financial corporate bonds (long- and short-term) to GDP in each province, which is chosen because of the argument that the issuance of equities and corporate bonds is a primary function of capital markets (Hasan *et al.*, 2009). *Capitalization* is the ratio of the stock market capitalization of listed firms registered in each province to the GDP of that province, which captures the depth of its capital markets.

Informal finance refers to alternative sources of finance that are tapped when access to the formal financial system is prohibited or restricted. As a proxy for informal finance, we employ the ratio of private overall investment to fixed asset investment, or the proportion of fixed asset investment accounted for by private investment (*P*). The use of this proxy is motivated by Allen *et al.* (2005), who show that although China's private sector has extremely limited access to formal finance, it is the most vibrant growth engine in the Chinese economy. The implication is that efficient and alternative financing channels must be supporting the rapid expansion of the private sector. We believe that private sector investment reflects the extent of informal finance and adopt this ratio to gauge its importance in each province. In assessing the impact of globalization on interprovincial risk sharing, we adopt the ratio of FDI stock to GDP to proxy for financial globalization (*FDI*).

²⁴ Crucini and Hess (2000) report that consumption volatility for Canadian provinces and Japanese prefectures is about 2%.

²⁵ Boyreau-Debray and Wei (2005) and He *et al.* (2009) also report that consumption is more volatile than output.

²⁶ Chen (2006) suggests that household savings are less likely to be influenced by government policy than are total loans and deposits.

Finally, we employ four ratios to capture the impacts of industrialization, urbanization, and interprovincial rural-urban migration on consumption risk sharing in our analysis. *Urban1* is the ratio of per capita disposable income to the per capita gross output value of farming, forestry, and husbandry in a province, where higher values indicate that non-farming income accounts for a higher proportion of total disposable income. *Urban2* is constructed as 1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP, where a higher value clearly corresponds to a higher proportion of non-farming income. *Urban3* is the ratio of migration outflow to migration inflow based on provincial migration data from the National Census. Census data are available every five years starting from 1995, i.e., we have data for 1995, 2000, and 2005. A higher value indicates a greater extent of labor emigration to other provinces, which makes it more likely that the province in question is a major supplier of migrant workers. To make better use of the data on migration flows, we transform *Urban3* into a yearly variable through simple linear interpolation. *Urban4* is the ratio of migration outflow to migration inflow and is based on linear interpolation to ensure it is available for every year. The first two ratios may well incorporate the impacts of industrialization and urbanization and rural-urban migration on the structure of household income. The last two are proxies for interprovincial rural-urban migration and the importance of migrant workers' remittances back home, respectively.

4.3 Control Variables

The explanatory variables included in information set z_{it} are mainly drawn from the empirical literature on growth. Based on the growth literature (see, for example, Barro and Sala-i-Martin, 1995 for a review) and its application to China, we construct and include the following variables in the base information set.²⁷ Y is the logarithm of initial real GDP per capita. GPO is the five-year lagged population growth rate. G/Y is the ratio of government expenditure to GDP (G/Y). $FERT$ is the ratio of the number of births to the total population ($FERT$). $\Delta_1 Y$ is the one-year lagged growth rate of real GDP per capita. Edu is the secondary school enrollment ratio. I/Y is the ratio of investment to GDP. We include initial GDP per capita to capture the convergence in per capita income across provinces. The population growth and secondary school enrollment variables reflect the growth in labor resources and human capital. Investment and government expenditure are presumed to be growth engines. The summary statistics for our variables are reported in Table 2.

Table 3 provides the estimation results for the GDP growth rate.²⁸ The ordinary least squares (OLS) and general method of moments (GMM) estimation methods are employed. First, we look at the OLS

²⁷ As most of the non-fiscal indicators are available only from 1990, they are excluded from the base information set. One may argue that the problem of omitted variables may influence the estimation of residuals. Nonetheless, it is less of a concern to our estimation of residual risk reduction, as the information set influences the residuals of each income category proportionately. To be precise, various specifications of the information set are used to estimate residual risk reduction. The alternative specifications leave our main results unchanged.

²⁸ The estimation results for other income measures are similar, but are not reported.

estimation results for the one-year, five-year, thirteen-year, and twenty-seven-year horizons. The explanatory power of the model is rather limited over the shorter horizons ($R^2 = 0.053$ and 0.099 for the one- and five-year horizons, respectively), but increases substantially for the longer horizons ($R^2 = 0.263$ and 0.276 for the thirteen- and twenty-seven-year horizons, respectively). Consistent with Barro and Sala-i-Martin (1995), the coefficients of initial per capita GDP are negative for all of the horizons and statistically significant for most of them. Our estimation provides some evidence of a conditional convergence in growth among Chinese provinces. The one-year lagged growth rate of real per capita GDP produces mostly positive and significant estimated coefficients. As expected, the fertility rate and government expenditure exert negative effects on provincial growth, some of which are statistically significant. Most of the other variables in the information set are insignificant. The estimated standard deviation of residual risk (σ) rises substantially with the estimation horizon. With the five-year interval, the standard deviation is 0.115, whereas with the twenty-seven-year horizon, it is 0.330.

Second, we examine the GMM estimation results. A regression model with a lagged dependent variable and other lagged variables may be suspected of producing biased coefficient estimations (e.g., Forbes, 2000; Banerjee and Duflo, 2003). To check whether the model is likely to cause a serious estimation bias of residual risk, we re-estimate the regression model using the SYS-GMM estimator developed by Arellano and Bover (1995). In Table 3, we report the SYS-GMM estimation results for the one- and five-year horizons.²⁹ The results of the residual estimations remain qualitatively similar.

5. Overview of Risk-Sharing Patterns in China

5.1 The Roles of the Fiscal and Non-Fiscal Transfer Channels in Risk Sharing

Figures 1 and 2 show the extent of total risk sharing through the various channels and the extent of risk sharing through the fiscal transfer channel for all of the horizons studied, respectively. Panel A of Table 4 reports the average degree of risk sharing attained through the fiscal and non-fiscal channels and the remaining unsmoothed part over the entire sample period. Approximately 40.5% of the shocks to gross provincial output were insured through the various channels, with the remaining 59.5% being uninsured, which is higher than the level of uninsured shocks in the United States.³⁰ This clearly indicates that there remains substantial scope for potential welfare gains from additional risk sharing in China. Moreover, the fiscal transfer channel insured only 9.4% of the output shocks, a proportion greatly overshadowed by that of the non-fiscal channels, which suggests that government income redistribution measures play a limited role in risk sharing.

²⁹ When the horizon exceeds 10 years, there are only two time observations for each province. As a result, the SYS-GMM cannot be estimated. Therefore, we only report the GMM results for the one- and five-year horizons.

³⁰ ASY (1996) report that only 25% of shocks to gross state output in the U.S. are unsmoothed.

5.2 Results for Sub-Periods

As China is undergoing transformation from a planned to a market economy in which government involvement in the national economy is declining, an interesting question is whether the respective contributions of the fiscal transfer and non-fiscal channels to risk sharing are increasing or decreasing. We assess this issue by determining whether the proportions of risk sharing achieved through the two types of channels vary between different sub-periods. Furthermore, the capital markets in China developed quickly after the stock markets were established in the early 1990s, and how or whether this expansion influenced risk sharing is an interesting issue that remains uninvestigated. We therefore split the entire sample period into two sub-periods, i.e., 1980-1997 and 1990-2007. The estimates for each sub-period are reported in Panel B of Table 4.

The proportion of risk sharing achieved through the government transfer system remained as small as 2.7% in the first sub-period (1980-1997), but increased to 4.6% in the second sub-period (1990-2007).³¹ This increase is a result of the strengthening of the central government's fiscal capacity in the wake of the transition from a contract tax system to a separate tax system in the mid-1990s. The contribution of the non-fiscal channels to risk sharing in the first sub-period was 31.9%, whereas their contribution decreased to 26.1% in the second sub-period. Overall, there was no improvement in risk sharing after 1990, and the total proportion of output shocks that were insured declined slightly in the second sub-period, which is consistent with the evidence of Boyreau-Debray and Wei (2005) and Xu (2008).

5.3 Results for Sub-Groups

China is characterized by a very uneven pattern of regional development. An interesting question is thus whether the benefits arising from risk sharing are also unequally distributed across provinces. To tackle this question, we classify provinces or provincial-level cities into two groups – inland provinces and coastal provinces³² – and compare the patterns and amounts of income and consumption risk sharing between the two. In general, China's economic reforms and opening up policies started in the coastal provinces and gradually spread to the inland provinces. The latter have continued to lag behind the former in terms of their degree of marketization and economic development. The differences in the patterns of interprovincial risk sharing are reported in Panel C of Table 4. Clearly, the fiscal transfer system's contribution to risk sharing is considerably larger in the coastal provinces than in the inland provinces. This finding suggests that the coastal provinces are the major source of tax revenue for the central government and that tax contributions smooth out consumption growth in these provinces, making

³¹ It is doubtful that the risk sharing attained through the fiscal channel in the two sub-periods combined is less than that of the whole period. This result may be due to the estimation results' dependence on the time horizon. Thus, only the results calculated over the same time horizon are comparable.

³² The inland provinces include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal provinces include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang.

it less closely correlated with output growth. What is somewhat surprising is the small contribution that fiscal transfers make to risk sharing in the inland provinces. The implication is that the interprovincial fiscal redistribution carried out by the central government is still small in size and is far from sufficient to provide an adequate degree of risk sharing for residents of the inland provinces.

Interestingly, non-fiscal channels have played a more important role in achieving risk sharing in the inland provinces than in the coastal provinces, which has enabled them to achieve a slightly higher level of overall consumption risk sharing than the coastal provinces. Given the limited development of, and access to, financial markets in the inland provinces and the relative scarcity of FDI inflows, the larger proportion of risk sharing achieved through non-fiscal channels in the interior may reflect the importance of household savings and the remittances of migrant workers. The importance of these potential channels is explored in a subsequent section.

6. Exploring the Non-Fiscal Channels

6.1 Development of Formal Finance and Risk Sharing

In Tables 5 and 6, we report the estimation results on the relationship between the development of formal finance and risk sharing, respectively, for the 1990-2007, 1990-1999, and 1998-2007 periods.³³ For each period, we conduct separate regressions for the whole country, the coastal provinces, and the inland provinces.

Table 5 presents the estimation results for the credit markets. To facilitate comparison with the foregoing analysis and previous studies, in the first column for each period studied, we report panel regressions without the interaction terms between the output and credit market development indicators. The estimation results are broadly consistent with the results reported in the previous section. With respect to the evidence of Kose *et al.* (2009), the extent of interprovincial risk sharing across Chinese provinces is consistent with that across the national boundaries of industrialized countries. By examining the estimated coefficients of the output growth variable,³⁴ we can see that the inland provinces achieved a level of consumption risk sharing comparable to that of the coastal provinces over the entire sample period. Moreover, turning to the two sub-periods, we find that the extent of risk sharing appears, on average, to have declined over time in the whole country and in the coastal provinces, as in these two cases the risk sharing in the past decade is smaller than that in the 1990s. In contrast, risk sharing in the inland provinces increased slightly in the second sub-period in comparison with that in the first.

³³ Because much of the data on the non-fiscal channels in the 1980s is missing, we focus on 1990-2007 in the following regression analysis. In addition, we set the second sub-period as 1998-2007 so that it consists of ten years in common with the first sub-period to facilitate econometric analysis and comparison.

³⁴ A larger value indicates a higher degree of co-movement between output and consumption growth and thus less risk sharing.

Table 5 also presents estimation results that include the interaction terms between each measure of credit market development and output growth. For the full sample period, the interaction coefficients for bank loans and bank deposits are negative but statistically insignificant for the whole country, and positive but insignificant for the coastal provinces. For the inland provinces, both interaction coefficients are negative, although the estimated coefficient for bank deposits is statistically significant. Similarly, household savings in banks are statistically significant with regard to promoting risk sharing in inland provinces, but repress risk sharing in the coastal provinces. Hence, the development of financial intermediaries has played a modest role in promoting risk sharing across provinces in China and has contributed to risk sharing in inland provinces to a much greater extent than in coastal provinces. These results, particularly those associated with bank loans, imply that the capital mobility attained through interprovincial credit allocation among financial intermediaries has remained fairly low in the past two decades. They reflect the lack of any fundamental change in the lending behavior of state-owned banks, which mainly assist provincial and local governments in satisfying the financial needs of the SOEs within a province or locality. This is reinforced by the findings of Park and Seht (2001) and Podpiera (2006). Our finding on the limited role of financial intermediaries in interprovincial risk sharing is also consistent with the evidence of Boyreau-Debray and Wei (2005).³⁵

Looking at the two sub-periods, we find no significant differences between the two for the country as a whole or for the coastal provinces. Bank deposits helped smooth the external shock on consumption in the inland provinces in the 1990-1999 sub-period, but their effect became statistically insignificant between 1998 and 2007. The failure of bank loans to promote risk sharing may reflect the structural characteristics of China's financial system. In past decades, state-owned financial institutions have dominated the financial system, and their main mission has been to provide loans to SOEs. Although the state banks have tended to allocate financial resources from one province to another in accordance with the national government's regional development objectives, the relatively heavy concentration of SOEs in the booming coastal provinces has reduced the amount of credit available in the less productive inland provinces and encouraged loans to flow within the coastal provinces. This pattern has partially weakened the role of bank loans in fostering risk sharing across the inland and coastal provinces. The liberalization of the financial system in the late 1990s has not changed this situation. Bank restructuring and the resultant increased profit incentive has prompted state banks to act like non-state or foreign banks in shunning policy-oriented loan allocations and channeling more credit to the booming coastal provinces, which has not helped to enhance interprovincial risk sharing in the coastal and inland provinces. The well-developed consumer credit market in the coastal provinces has also allowed for the relaxation of individual financing constraints, which has led to a higher level of risk sharing along the eastern seaboard.

It is noteworthy that bank deposits, and household savings in banks in particular, have played a striking

³⁵ We also fit the trend of bank deposits and loans, and use these fitted data to measure financial intermediaries. The results remain unchanged.

role in improving interprovincial risk sharing in the inland provinces. On the one hand, this suggests that the high levels of savings in the formal financial system among enterprises, government entities, and, particularly, households have contributed to the smoothing of consumption for residents in inland provinces. On the other hand, the salient role played by household savings in banks in promoting risk sharing in these provinces may well reflect the importance of the remittances that migrant laborers working in the coastal provinces send back to their families in the inland provinces. As households in the inland areas tend to deposit much of their income in banks, a large proportion of which comes from the remittances of migrant workers, their consumption levels do not move in tandem with their income growth, and the remittances, working through household savings, play a major role in fostering risk sharing. This part of our evidence reinforces our findings in Section 6.4.

Table 6 investigates the impact of capital market development on risk sharing. The interaction coefficients of funds raised through securities issuances and output growth, and those of stock market capitalization and output growth, are negative but insignificant across the country as a whole and in the inland provinces for the different sample periods. This suggests that capital market development has not helped to smooth consumption for the nation as a whole or for the inland provinces. However, many of the estimated coefficients of the interaction terms between the capital market development indicators and output growth are statistically significantly negative for the coastal provinces in the different sample periods, which suggests that capital market development has played an important role in fostering risk sharing in these provinces.

Clearly, only the coastal provinces have obtained risk-sharing benefits from the development of the capital markets since their re-establishment in the 1990s. The inland provinces have largely been denied access to these benefits. Similarly, the development of the capital markets has not generated significant risk-sharing benefits at the national level, largely due to the imbalanced development of these markets across provinces. Du and Xu (2008) argue that the quota system in the Chinese securities market effectively functions as a decentralized regulatory instrument. They find that it has tended to favor the coastal provinces because they are home to the majority of listed firms in China. From the perspective of individual families, average income per family in the inland provinces is substantially lower than that in the coastal provinces. Individual families in inland provinces may lack a local community investment culture or may not have enough extra income or sufficient knowledge about securities to invest in the securities markets. This is manifest in the lower ratio of securities trading accounts opened by individuals in these provinces. It is therefore not surprising that residents in the inland provinces have received few benefits from risk sharing through cross-province asset ownership in the capital market development process.

6.2 Development of Informal Finance and Risk Sharing

Table 7 presents the estimation results for private investment. In general, informal finance has negative effects on risk sharing for all three samples and the three periods under examination. Statistically

significant effects are detected for the 1998-2007 sub-period, during which time informal finance seems to have depressed risk sharing in the inland provinces to a significant extent. This result is not surprising. Allen *et al.* (2005) suggest that the most important governance mechanisms for non-standard financing are based on reputation and relationships. This argument leads to the supposition that these implicit contractual relations result in most of the informal modes of finance being confined to local business communities, which prevents the movement of capital across provinces and depresses risk sharing. As the coastal provinces have better infrastructure and institutions to support the growth of private enterprises and relationship-based informal finance, the interprovincial movement of private capital may be more frequent within these provinces than in their inland counterparts. Hence, the repressive effects of informal finance on interprovincial consumption risk sharing are less salient in the coastal provinces than they are in the inland provinces. Overall, more private investment takes place in the former, where there are stronger supporting institutions than in the latter, which reinforces the provincial disparities in economic growth and worsens interprovincial risk sharing.

6.3 Globalization, FDI, and Risk Sharing

Table 7 also presents the results reflecting the impact of inward FDI on risk sharing. It can be seen that FDI stock has no statistically significant effects on risk sharing across the country as a whole or in the two sub-regions over the entire sample period. Examining the two sub-periods, we find that FDI stock had no significant impact on risk sharing in the 1990-1999 period, although the direction of its effect points to its role in promoting it. However, FDI depressed interprovincial risk sharing in the 1998-2007 period, and this effect is statistically significant across the country as a whole and in the inland provinces.

The failure of FDI to promote interprovincial risk sharing is probably a consequence of its persistently uneven distribution across Chinese provinces. Between the early 1980s and mid-1990s, the central government set up a national-level policy framework to attract FDI, and it exerted substantial influence with regard to which provinces received such investment. Based on its national economic development plan, the central government channeled the majority of the FDI inflow to special economic zones and the major liberalized cities along the east coast, with the inland provinces receiving only a small proportion. In the mid-1990s, the central government largely liberalized the FDI introduction process, allowing local governments to compete directly for FDI (Oman, 2000). As a result, the uneven distribution of FDI continued to persist because the coastal areas had better infrastructure, superior institutions, and more skilled labor to accommodate the inflow of FDI (Du *et al.*, 2008; He *et al.*, 2009). Moreover, as FDI is an important resource for local economic development, local governments prohibited it from moving across provinces, thereby reinforcing its uneven interprovincial distribution. This persistently uneven distribution of FDI appears to have added to the interprovincial disparities in economic growth, contributed to the concomitant growth in output and consumption within each province, and reduced the extent of risk sharing across provinces.

6.4 Industrialization, Urbanization, and Risk Sharing

Our earlier results suggest that non-fiscal channels have made a much greater contribution to risk sharing in the inland provinces than in the coastal provinces. However, our results also demonstrate that the development of financial intermediaries played only a slightly more significant role in promoting risk sharing in the inland provinces than in the coastal provinces in the 1990s, whereas the development of the capital market contributed substantially more to risk sharing in the latter than in the former over the same timeframe. Hence, some alternative channels must have been at work.

We next investigate what else may have affected risk sharing in the interior provinces of China. Presumably, rural-urban migration has made a substantial contribution. A primary indicator of its importance is the sharply rising share of total rural household income represented by non-farming income, particularly after 1990, as can be seen in Figure 3.

Given that informal finance and FDI have worsened risk sharing and that formal finance has made no appreciable contribution to risk sharing in the inland provinces in the past decade, the surge in non-farming income suggests that remittances have played an increasing role in such sharing in recent years.

The estimation results are presented in Table 8. The two indicators of non-farming income are the ratio of household disposable income to the gross output value of farming, forestry, and husbandry (*Urban1*) and 1 minus the ratio of this gross output value to GDP (*Urban2*). A higher value means a higher proportion of non-farming income. For the entire 1990-2007 sample period, neither indicator produces significant effects on consumption risk sharing for the country as a whole. *Urban1* has no appreciable impact in either the coastal or inland provinces. However, we find that *Urban2* enhances risk sharing in the inland provinces and depresses it in the coastal provinces, and both effects are statistically significant. This result makes sense because the inland provinces have, in general, lagged behind their coastal counterparts in the process of industrialization and urbanization. Thus, the rise in non-farming income should have a more significant effect on consumption smoothing in the interior provinces.

In Table 8, we include another indicator, *Urban3*, which is the ratio of migration outflow to migration inflow. A higher value for this indicator suggests a larger number of laborers seeking employment outside the province. In comparison with *Urban1* and *Urban2*, which may incorporate the various effects of industrialization and urbanization and rural-urban migration, *Urban3* is the most direct proxy for the importance of inter-province rural-urban migration. *Urban3* gauges the relative size of the outbound migrant labor flows for different provinces and, thus, the relative importance of the remittances of migrant workers. Owing to data constraints, the sample size is substantially reduced.³⁶ As it could be argued that

³⁶ Based on 1995, 2000, and 2005 census data and Chan (2008), we collect the migrant flows for 1990-1995, 1995-2000, and 2000-2005. Because the number of migrants is calculated every five years, the corresponding GDP and consumption growth rate figures are measured on the basis of non-overlapping five-year periods.

the five-year intervals will produce different results than the one-year intervals for the same variables, we interpolate the migration outflow and inflow observations in our sample period by the linear interpolation method. We also include *Urban4*, which is measured as the ratio of interpolated migration outflow to interpolated migration inflow. The regression results for *Urban3* and *Urban4* are consistent with and reinforce those based on *Urban1* and *Urban2*. The positive effects on interprovincial risk sharing generated by *Urban3* and *Urban4* are primarily concentrated in the inland provinces.

We next look at the results for the two sub-periods. We find that *Urban1* significantly promoted risk sharing in the inland provinces only in the 1990s, probably because rural-urban migration exploded after the launch of the second round of economic reforms in 1992, and thus had a significant impact on risk sharing in that decade. We also find that *Urban2* and *Urban3* significantly enhanced risk sharing in the inland provinces in both sub-periods. Moreover, the positive impact of *Urban4* on risk sharing is statistically significant only in the 1998-2007 sub-period. In 2000, the central government began an experimental reform of the residence registration system in more than 20,000 small towns. Local governments also started to reform their individual *Hukou* systems and made urban residency more easily obtainable for rural migrant laborers. As a consequence, it has become easier for migrant workers to gain *Hukou* in small towns and medium-sized cities. Nonetheless, it is still extremely difficult for them to obtain it in the mega-cities (Fleisher and Yang, 2005). In early 2002, the State Council issued the “No. 2 Document of 2002,” which designated migrant workers as “members of the working class” rather than as peasants, thereby formally acknowledging their contribution to urban development.³⁷ This further reform of the *Hukou* system reduced the discriminatory treatment of migrant workers, thereby accelerating the urbanization process and rural-urban migration. At the same time, as migrant workers still need to support their families in the countryside, remittances have continued to play an important role in interprovincial consumption risk sharing. This may partially explain the effects of *Urban2*, *Urban3*, and *Urban4* in stimulating risk sharing in the inland provinces observed in the later sub-period.

6.5 A Horse Race Based on Multivariate Analysis

Thus far, we have assessed the role of each channel in fostering risk sharing separately. By comparing the results for each candidate channel, we can obtain some understanding of which channels are significant, and which are not. To determine whether our approach causes serious bias and to run a more explicit horse race among the candidate channels, we adopt a multivariate regression model to assess all of the potential risk-sharing channels simultaneously. In Table 9, we use the ratios of total loans to GDP,

³⁷ The State Council Office’s “No. 1 Document,” issued in January 2003, set out four principles underlying the following commitments: (1) to abolish any excessively unfair restrictions on rural laborers seeking either temporary or permanent employment in urban areas; (2) to ensure that employers of migrant laborers act in accordance with the law concerning contracts and the punctual payment of wages; (3) to improve working and living conditions for rural migrant laborers, especially women, including health care and personal safety; (4) to provide legal and skills training for rural migrants, which is to be strictly voluntary and not subject to unreasonable fees; (5) to provide access to education for children of migrant workers equal in quality to that afforded the children of urban residents; and (6) to improve the administration of migrant populations in areas such as family planning, education for children, labor employment, health care, and legal aid.

total equity to GDP, FDI stock to GDP, and private investment to total investment, and *Urban2* (1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP) to represent the roles of the credit market, capital market, globalization, informal finance, and urbanization, respectively.³⁸ Table 9 presents the estimation results for all of these consumption risk-sharing channels. Overall, the results are qualitatively equivalent to those obtained through separate analysis of each channel. We observe that the credit markets played no salient role in consumption risk sharing and that capital market development contributed only to interprovincial risk sharing in the coastal provinces. Informal finance did not enhance interprovincial risk sharing and, at times, even repressed it. Although there is some evidence to suggest that FDI promoted risk sharing in the inland provinces in the 1990s, it contributed little to interprovincial risk sharing and, at times, even depressed it. The most consistent patterns are still associated with industrialization, rural-urban migration, and remittances, which significantly enhanced interprovincial risk sharing in inland provinces in all of the sample periods.

Our analysis demonstrates that industrialization and urbanization and interprovincial rural-urban migration have been the locomotives of consumption risk sharing in the inland provinces. As China's *Hukou* system has prevented rural migrant workers from becoming permanent urban residents, their remittances have led to increases in income and became a viable means of improving living standards in rural households, particularly in the inland provinces, as well as an effective instrument for risk sharing in these provinces.

This finding has general implications for developing countries. Although other countries may not have rigid household registration systems preventing permanent rural-urban migration, remittances have still been found to play an important role in overcoming credit constraints (Katz and Stark, 1986), financing productive investment and other capital expenditure in rural areas (Lucas and Stark, 1985), and enhancing rural household consumption (Banerjee, 1984). These functions certainly contribute, both directly and indirectly, to the smoothing of rural household consumption and, in turn, to interprovincial risk sharing given an uneven distribution of cities across provinces. In this sense, the prominent role played by rural-urban migration in facilitating interprovincial risk sharing is expected to be a common feature of developing countries. Hence, this study contributes to the literature that identifies the importance of rural-urban migration and remittances to interprovincial risk sharing.

7. Further Robustness Checks

7.1 Measures of Variables

One concern about the preceding analysis is the way we constructed the measures of income before and after risk sharing. Thus far, we have used the simple average of rural and urban household living expenses to measure provincial household consumption, because the official data on rural and urban

³⁸ We also use alternative measures for each risk-sharing channel. Our results are robust across a variety of specifications.

populations that are essential to calculating population-weighted provincial household consumption are unavailable for several provinces. To provide a robustness check, we try to get around this data inadequacy problem by constructing a measure of rural and urban population-weighted provincial consumption. We first estimated the ratio of the urban to rural population,³⁹ replacing the missing data with the ratio of the non-agricultural population to the agricultural population. We use this ratio to construct the population-weighted average of household consumption and income. Another concern relates to the role of retained earnings in the calculation of provincial income. We did not include retained earnings because they will be transformed into investments that contribute to dividends in the future, which are captured in the pre-tax provincial income (Asdrubali *et al.*, 1996; Athanasoulis and Wincoop, 2001). To provide a sensitivity test, we further modify our measures of provincial income (PI) and disposable provincial income (DPI) by including retained earnings.⁴⁰ An additional concern relates to our price deflators. Brandt and Holtz (2006) suggest that there are substantial spatial differences in price levels between urban and rural regions across Chinese provinces. Therefore, we also deflate all of the measures of income using the spatial deflators developed by Brandt and Holtz (2006). Panel D of Table 4 reports the average degree of risk sharing attained through the fiscal and non-fiscal channels and the remaining unsmoothed part over the entire sample period based on these new measures. The estimation results are similar to those in Panel A.

7.2 Marketization Progress and Risk-Sharing Measures

Another concern with our approach is that the variations in the deviations of the provincial growth rates from the national growth rate could capture the disparity in institutional changes across provinces induced by China's economic transition over the twenty-seven-year horizon as well as the differences in ex ante market risk.⁴¹ The institutional changes are mainly reflected in the level of marketization. In the preceding analysis, in which we use Equation (2) to measure risk sharing, information set z_{it} contains several control variables that are widely used in the growth literature. Nonetheless, they do not explicitly reflect the progress towards marketization in different provinces. To address this concern, we attempt to control explicitly for the institutional changes arising from the transition towards a market economy.⁴² We use the relative size of the private sector (i.e., the proportion of private investment to total investment in a province) and trade openness (i.e., the ratio of the total value of imports and exports to provincial GDP) as proxy measures of such progress. These two proxy indicators capture the development of the non-state sector and integration with the world economy, which are precisely the themes of the economic reforms and opening up in China. As Cull and Xu (2005) point out, the relative size of the private sector

³⁹ We thank one referee for pointing this out.

⁴⁰ As official data for retained earnings are not available before 1990, we derive the series of data by simple linear interpolation.

⁴¹ We thank one of the referees for pointing this out.

⁴² Some popular cross-province indices of marketization progress such as those constructed by Gang Fan and Xiaolu Wang of the National Economic Research Institute (NERI) include data only from the late 1990s. Using this kind of short time series of data would not generate comparable estimations of interprovincial consumption risk sharing.

and the level of trade openness also reflect the development of market-supporting institutions, such as property rights protection and contract enforcement. Hence, these indicators should reflect progress towards marketization to a large extent. As shown in Panel E of Table 4, after including these two measures, the average degree of risk sharing achieved through the fiscal and non-fiscal channels and the remaining unsmoothed part over the entire sample period remain similar to those in Panel A.

We admit that the foregoing analysis still fails to control fully the impact of institutional changes during China's economic transition. Nonetheless, in the current analysis, we have included province and year fixed effects, which are expected to capture any omitted variables related to provincial differences and time variation. As the interprovincial disparity in institutions changes slowly over time, the province and time dummy variables should account for much of the effects of cross-province variations in institutional change.

7.3 Control Variables

Thus far, we have used Equation (3) to investigate the potential channels of risk sharing. There may be concern that other omitted variables could influence the relationship between each potential channel indicator and consumption risk sharing. To mitigate this concern, we re-estimate Equation (3) by including various control variables used in Section 4.3, such as the logarithm of initial real GDP per capita and the five-year lagged population growth rate. The untabulated results show that these estimations yield qualitatively similar results on the relationship between the channel indicators and the extent of consumption risk sharing.

8. Conclusion

In this study, we examine the patterns of interprovincial risk sharing through various fiscal and non-fiscal channels in China by employing a variety of empirical approaches. First, we examine the evolution of overall risk sharing in the country as a whole and in the coastal and inland provinces in different periods. The results suggest that over the 1980-2007 period, less than 40% of consumption risks were insured, which is a fairly low level. The extent of risk sharing achieved through the fiscal channel (non-fiscal channels) rose (dropped) in the 1990-2007 period compared with that realized in the 1980-1997 period. In terms of regional patterns, there is no significant difference between the inland provinces and the coastal provinces in the extent of risk sharing. However, the two regions display marked differences in the channels through which risk sharing is conducted. The fiscal transfer channel plays a much more important part in the coastal provinces than in the inland provinces, whereas the non-fiscal channels have contributed much more to risk sharing in the latter than they have in the former.

Second, we explore in detail the various components of the non-fiscal channels by directly measuring the impact of the development of financial intermediaries, capital markets, informal finance, FDI, and rural-urban migration on the extent of risk sharing across Chinese provinces. We find that the development of a formal financial system plays a modest role in promoting risk sharing. Although private financing plays an important part in driving regional economic growth, it depresses interprovincial risk sharing because it tends to be locally oriented.

Given the limited and declining role of the development of financial intermediaries in promoting risk sharing in China's inland provinces, the high degree of risk sharing achieved among these provinces is mainly attributable to the surge in non-farming income. We examine the pattern of the share of total rural net income represented by non-farming income over the 1980-2007 period and investigate whether remittances by migrant labor have improved interprovincial risk sharing. We find that non-farming income as a share of total rural net income surged in the 1990s and coincided with an improvement in the level of risk sharing in the same decade. The results of our panel regressions also suggest that the increasing role of remittances has partially alleviated the depressive impact of the financial markets on risk sharing. Our findings suggest that a low level of consumption risk sharing could be one explanation for the high savings rate in China and that urbanization and industrialization could enhance interprovincial risk sharing in provinces with less developed financial markets.

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Table 1. Summary Statistics for the Measures of Risk Sharing

Mean and Volatility are defined as the mean and standard deviation of the first difference in log real per capita terms for each province. *GDP* is the per capita gross provincial product. *PI* is aggregate provincial income, defined as the sum of the total income of provincial residents and local government income before taxes and fiscal transfer. *DPI* is disposable provincial income and consists of household disposable income and local government disposable income. Local government disposable income is equal to local budgetary revenue plus central government grants to the local government and local extra-budgetary revenue minus local government remittances to the central government. *PC* is provincial consumption, defined as the sum of household consumption and government consumption in a province. Provincial household consumption is measured as the average of urban household living expenses and rural household living expenses. Provincial government consumption is measured as the sum of local budgetary expenditure and extra-budgetary expenditure. The time-series variation

$$= \frac{1}{NT-1} \sum_i \sum_t (x_{it} - \bar{x}_i)^2 \quad \text{and} \quad \text{the cross-sectional variation} = \frac{1}{N-1} \sum_i (\bar{x}_i - \bar{x})^2 \quad \text{where}$$

$$\bar{x}_i = 1/T \sum_t x_{it} \quad \text{and} \quad \bar{x} = 1/NT \sum_i \sum_t x_{it}.$$

	GDP	PI	DPI	PC
Mean	0.090	0.072	0.075	0.070
Volatility	0.057	0.055	0.057	0.059
Time series variation	0.0554	0.0542	0.0569	0.0581
Cross-sectional variation	0.0124	0.0090	0.0076	0.0073

Table 2. Summary Statistics for the Explanatory Variables

This table reports the summary statistics for the variables. *Loan* is the ratio of total financial institutional loans to GDP. *Deposit* is the ratio of total savings deposited in financial institutions to GDP. *Saving* is the ratio of total household savings to GDP. *Issuance* is the ratio of funds raised by issuing equities and non-financial corporate bonds (long-term and short-term) to GDP. *Capitalization* is the ratio of stock market capitalization to GDP. *FDI* is the ratio of foreign direct investment stock to total investment. *PI* is the ratio of private investment to total investment. *Urban1* is the ratio of disposable income per capita to the gross output value of farming, forestry, and husbandry per capita in a province. *Urban2* is constructed as 1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP. *Urban3* is the ratio of migration outflow to migration inflow based on provincial migration data from the National Census. *Urban4* is the ratio of migration outflow to migration inflow based on the linear interpolation. *YI* is initial real per capita GDP in log form. *GPO* is the five-year lagged population growth rate. *G/Y* is the ratio of government expenditure to GDP. *I/Y* is the ratio of total investment to GDP. *FERT* is the ratio of the number of births to the total population*1000 in log form. $\Delta_1 Y$ is the one-year lagged real per capita GDP growth rate. *Edu* is the ratio of the number of students enrolled in secondary schools to the number of primary school graduates.

		Mean	S.D.	Min.	Max.	Obs.
Non-fiscal Indicators						
Credit Market:	Loans	0.994	0.269	0.547	2.258	522
	Deposit	1.127	0.496	0.446	4.207	522
	Savings	0.604	0.171	0.234	1.106	513
Capital Market:	Issuance	0.012	0.030	0.000	0.557	521
	Capitalization	0.327	0.878	0.004	16.484	435
Globalization:	FDI	0.082	0.093	0.000	0.594	521
Informal Finance:	PI	0.154	0.072	0.004	0.411	522
Urbanization:	Urban1	1.320	0.889	0.465	7.363	522
	Urban2	0.693	0.134	0.329	0.979	522
	Urban3	2.564	2.896	0.038	12.261	78
	Urban4	2.267	2.618	0.038	12.261	464
Control Variables						
YI		7.163	0.854	5.380	9.813	812
GPO		0.014	0.012	-0.105	0.173	812
G/Y		0.129	0.045	0.039	0.312	812
I/Y		2.710	0.349	1.579	3.389	812
FERT		0.086	0.058	-0.112	0.313	812
$\Delta_1 Y$		0.852	0.140	0.372	1.048	812
Edu		0.345	0.114	0.092	0.826	812

Table 3. Estimation Results for the 29 Provinces

This table reports the estimation results of Equation (2): $g_{i,t,t+s} - g_{t,t+s}^N = \lambda'_s(z_{it} - z_t^N) + \mu_{i,t,t+s}$ where $g_{i,t,t+s} = \ln y_{i,t+s} - \ln y_{it}$ is the growth rate of province i 's output from t to $t+s$. The superscript N represents the corresponding national variable. Vector z_{it} is the information set at time t used to predict future growth, and $\mu_{i,t,t+s} = \varepsilon_{i,t,t+s} - \varepsilon_{t,t+s}^N$ refers to the residual risk. For each horizon, all of the intervals that do not overlap are used. The dependent variable is the extent to which the regional GDP growth rate deviates from the national average growth rate. YI is initial real per capita GDP in log form. GPO is the five-year lagged population growth rate. G/Y is the ratio of government expenditure to GDP. I/Y is the ratio of total investment to GDP. $FERT$ is the ratio of the number of births to the total population*1000 in log form. $\Delta_1 Y$ is the one-year lagged real per capita GDP growth rate. Edu is the ratio of the number of students enrolled in secondary schools to the number of primary school graduates. The standard errors for each point estimate are reported in parentheses. The R^2 for OLS regression and P-value for GMM regression and $\hat{\sigma}_s$ for each horizon are also reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Variables:	1-year Horizon		5-year Horizon		13-year Horizon	27-year Horizon
	OLS	GMM	OLS	GMM	OLS	OLS
YI	-0.010** (-0.004)	-0.0211* (0.0127)	-0.052* (-0.031)	-0.194** (0.0906)	-0.184* (-0.099)	-0.324 (-0.214)
GPO	0.044 (-0.117)	0.115 (0.118)	1.721 (-2.034)	-0.993 (0.986)	-1.79 (-7.019)	-10.1 (-15.311)
G/Y	-0.097** (-0.042)	-0.0261 (0.118)	-0.448 (-0.294)	0.231 (0.318)	-0.147 (-0.869)	-0.62 (-2.202)
I/Y	0.037* (-0.019)	0.0680 (0.0420)	0.14 (-0.13)	-0.149 (0.125)	-0.193 (-0.468)	-0.129 (-1.113)
FERT	-0.01 (-0.006)	-0.0309* (0.0165)	-0.104** (-0.047)	-0.0230 (0.0511)	-0.250* (-0.127)	-0.136 (-0.433)
$\Delta_1 y$	0.183*** (-0.034)	0.136*** (0.0410)	0.473** (-0.228)	0.0751 (0.0944)	1.719*** (-0.618)	1.592 (-1.174)
Edu	0.016 (-0.011)	0.0588** (0.0255)	0.01 (-0.08)	0.296** (0.125)	-0.092 (-0.224)	0.359 (-0.568)
Observation	783	725	145	145	58	29
Province	29	29	29	29	29	29
Non-overlapping intervals	27	25	5	5	2	1
R ² / P-value	0.053	0.0001	0.099	0.0586	0.263	0.276
$\hat{\sigma}$	0.039	0.039	0.115	0.120	0.205	0.331

Table 4. Risk Sharing**Panel A**

This panel reports the average reduction in the standard deviation of residual risk achieved through risk sharing over horizons of 1 to 27 years. Fiscal Transfer Channel refers to risk sharing through the national fiscal system and Non-fiscal Channels refers to risk sharing through other channels. The final row reports the unsmoothed part of consumption.

1980-2007	
Fiscal Transfer Channel	9.4%
Non-fiscal Channels	31.1%
Not smoothed	59.5%

Panel B Sub-periods

This panel reports the average reduction in the standard deviation of residual risk achieved through risk sharing over horizons of 1 to 17 years. To check whether there was an improvement in risk sharing after 1990, we divide the whole sample into two overlapping periods.

	1980-1997	1990-2007
Fiscal Transfer Channel	2.7%	4.6%
Non-Fiscal Channels	31.9%	26.1%
Not Smoothed	55.4%	59.3%

Panel C Sub-regions

This panel reports the average reduction in the standard deviation of residual risk achieved through risk sharing over horizons of 1 to 27 years. To investigate whether the channels of risk sharing vary across provinces, we divide the whole sample into inland provinces and coastal provinces. The inland provinces include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal provinces include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang.

	Inland Provinces	Coastal Provinces
Fiscal Transfer Channel	5%	8%
Non-fiscal Channels	32.1%	26.9%
Not smoothed	63.22.9%	65.1%

Table 4. Risk Sharing (Continued)**Panel D**

To provide a robustness check, we first estimate the ratio of urban population to rural population, and use this ratio to construct the population weighted average of household consumption and income. We further modify our measures of provincial income (*PI*) and disposable provincial income (*DPI*) by including retained earnings. We also deflate all the measures of income by using the spatial deflators developed by Brandt and Holtz (2006). This panel reports the average degrees of risk sharing attained through the fiscal and non-fiscal channels and the remaining unsmoothed part over the whole sample period based on these new measures.

1980-2007	
Fiscal Transfer Channel	8.9%
Non-fiscal Channels	29.4%
Not smoothed	61.7%

Panel E

To provide a robustness check, we use the relative size of the private sector (i.e., the proportion of private investment to total investment in a province) and trade openness (i.e., the ratio of the total value of imports and exports to GDP in a province) as proxies for the progress towards marketization. These two proxy indicators capture the development of the non-state sector and the level of integration with the world economy, which are the themes of the economic reforms and opening up in China. This panel reports the average degrees of risk sharing attained through the fiscal and non-fiscal channels and the remaining unsmoothed part over the whole sample period based on the new control variables

1980-2007	
Fiscal Transfer Channel	9.6%
Non-fiscal Channels	29.4%
Not smoothed	61.0%

Table 5. Risk Sharing and the Credit Market

This table reports the results of panel regressions based on yearly observations. To explicitly capture the role of each channel, we follow Kose *et al.* (2009) and use a standard risk sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (4)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are the national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . *Output*Credit* represents the interaction of each credit market indicator and output growth. *Loan* represents the ratio of total financial institutional loans to GDP. *Deposit* represents the ratio of total savings deposited in financial institutions to GDP. *Saving* represents the ratio of household savings to GDP. The results of regression equation (4) are reported in the column of basic regression without interaction. The regressions include province fixed effects and time effects. The standard errors robust to heteroscedasticity are reported in brackets. The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	1990-2007				1990-1999				1998-2007			
	Basic regression without interaction	Loan	Deposit	Saving	Basic regression without interaction	Loan	Deposit	Saving	Basic regression without interaction	Loan	Deposit	Saving
1. All Provinces												
Output	0.674*** (0.060)	0.744*** (0.178)	0.706*** (0.118)	0.594*** (0.198)	0.627*** (0.064)	0.876** (0.317)	0.636*** (0.216)	0.762** (0.336)	0.709*** (0.093)	0.936*** (0.219)	0.860*** (0.149)	0.519 (0.385)
Output*Credit		-0.057 (0.155)	-0.019 (0.089)	0.142 (0.329)		-0.253 (0.315)	-0.009 (0.224)	-0.266 (0.678)		-0.156 (0.155)	-0.065 (0.069)	0.272 (0.544)
R ²	0.3313	0.34	0.34	0.351	0.285	0.288	0.285	0.343	0.321	0.348	0.348	0.323
N	522	522	522	495	290	290	290	282	290	290	290	271
2. Coastal Provinces												
Output	0.672*** (0.106)	0.622** (0.249)	0.511** (0.170)	-0.013 (0.223)	0.559*** (0.085)	0.485 (0.393)	0.329 (0.237)	0.017 (0.464)	0.810*** (0.113)	1.121*** (0.193)	0.984*** (0.155)	0.31 (0.542)
Output*Credit		0.046 (0.186)	0.12 (0.101)	1.087** (0.323)		0.072 (0.362)	0.202 (0.186)	1.001 (0.878)		-0.262 (0.167)	-0.099 (0.069)	0.642 (0.753)
R ²	0.384	0.384	0.389	0.42	0.289	0.289	0.296	0.332	0.596	0.603	0.6	0.585
N	198	180	180	190	110	110	110	102	110	110	110	110
3. Inland Provinces												
Output	0.698*** (0.087)	0.854*** (0.259)	1.137*** (0.244)	1.127*** (0.227)	0.688*** (0.079)	1.295*** (0.373)	1.392*** (0.339)	1.246*** (0.279)	0.583*** (0.122)	0.499 (0.392)	1.278*** (0.464)	1.236*** (0.471)
Output*Credit		-0.162 (0.246)	-0.473* (0.262)	-0.821* (0.403)		-0.646 (0.421)	-0.870** (0.407)	-1.201** (0.575)		0.084 (0.349)	-0.575 (0.387)	-1.120* (0.658)
R ²	0.302	0.303	0.313	0.318	0.309	0.321	0.328	0.346	0.165	0.165	0.174	0.175
N	324	324	324	305	180	180	180	180	180	180	180	161

Table 6. Risk Sharing and the Capital Market

This table reports the results of panel regressions based on yearly observations. To explicitly capture the role of each channel, we follow Kose *et al.* (2009) and use a standard risk sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are the national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . *Output*CM* represents the interaction between output and each capital market indicator. *Issuance* is the ratio of funds raised by issuing equities and non-financial corporate bonds (long-term and short-term) to GDP and *Capitalization* is the ratio of stock market capitalization to GDP. The regressions include province fixed effects and time effects. The standard errors robust to heteroscedasticity are reported in brackets. The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	1990-2007		1990-1999		1998-2007	
	Issuance	Capitalization	Issuance	Capitalization	Issuance	Capitalization
1. All Provinces						
Output	0.654*** (0.068)	0.693*** (0.074)	0.563*** (0.089)	0.660*** (0.089)	0.755*** (0.099)	0.723*** (0.107)
Output*CM	-1.652 (2.435)	-0.056 (0.074)	-2.39 (6.245)	-0.554 (0.343)	-2.331 (1.835)	-0.031 (0.076)
R ²	0.307	0.333	0.233	0.282	0.331	0.321
N	492	434	261	202	289	290
2. Coastal Provinces						
Output	0.744*** (0.092)	0.753*** (0.103)	0.628*** (0.125)	0.665*** (0.151)	0.874*** (0.127)	0.874*** (0.093)
Output*CM	-5.691* (3.463)	-0.152** (0.068)	-4.279 (6.631)	-0.282 (0.482)	-3.835** (1.863)	-0.104* (0.059)
R ²	0.418	0.421	0.29	0.372	0.602	0.566
N	187	171	99	83	110	110
3. Inland Provinces						
Output	0.636*** (0.123)	0.706*** (0.120)	0.593*** (0.143)	0.812*** (0.186)	0.638*** (0.147)	0.549** (0.216)
Output*CM	-0.423 (11.199)	-0.19 (0.507)	-2.157 (13.877)	-2.562 (1.837)	-3.031 (10.014)	0.11 (0.731)
R ²	0.255	0.257	0.214	0.257	0.177	0.165
N	305	263	162	119	179	180

Table 7. Risk Sharing, FDI and Informal Finance

This table reports the results of panel regressions with yearly observations. To explicitly capture the role of each channel, we follow Kose *et al.* (2009) and use a standard risk sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are the national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . $Output*IF$ represents the interaction between output and each informal financial channel indicator. FDI is the ratio of foreign direct investment stock to total investment and PI is the ratio of private investment to total investment. The regressions include province fixed effects and time effects. The standard errors robust to heteroscedasticity are reported in brackets. The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	1990-2007		1990-1999		1998-2007	
	PI	FDI	PI	FDI	PI	FDI
1. All Provinces						
Output	0.618*** (0.115)	0.636*** (0.072)	0.565*** (0.117)	0.670*** (0.072)	0.492*** (0.165)	0.426*** (0.120)
Output*IF	0.39 (0.651)	0.067 (0.149)	0.449 (0.696)	-0.181 (0.127)	1.492 (1.129)	0.349*** (0.118)
R ²	0.332	0.366	0.286	0.362	0.361	0.358
N	522	522	289	290	290	290
2. Coastal Provinces						
Output	0.616*** (0.137)	0.621*** (0.132)	0.522*** (0.120)	0.689*** (0.154)	0.616** (0.218)	0.700** (0.286)
Output*IF	0.48 (1.033)	0.048 (0.177)	0.071 (1.087)	-0.229 (0.141)	1.533 (1.748)	0.090 (0.217)
R ²	0.385	0.414	0.298	0.310	0.6	0.587
N	198	198	110	110	110	110
3. Inland Provinces						
Output	0.641*** (0.219)	0.739*** (0.146)	0.568*** (0.206)	0.806** (0.152)	0.005 (0.332)	0.092 (0.210)
Output*IF	0.351 (1.083)	-0.920 (0.779)	0.729 (1.065)	-1.977 (1.664)	3.485* (1.868)	1.526* (0.821)
R ²	0.302	0.353	0.311	0.373	0.182	0.265
N	324	324	180	180	180	180

Table 8. Risk Sharing and Urbanization

This table reports the results of panel regressions with yearly observations. To explicitly capture the role of each channel, we follow Kose *et al.* (2009) and use a standard risk sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are the national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . *Output* Urbanization* represents the interaction between output and each indicator of urbanization. *Urban1* is measured as the percentage of per capita household disposable income over the per capita gross output value of farming, forestry, and husbandry at the provincial level. *Urban2* is measured as 1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP. *Urban3* is the ratio of migration outflow to migration inflow based on provincial migration data from the National Census. *Urban4* is the ratio of migration outflow to migration inflow based on the linear interpolation. The regressions include province fixed effects and time effects. The standard errors robust to heteroscedasticity are reported in brackets. The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	1990-2007				1990-1999				1998-2007			
	Urban1	Urban2	Urban3	Urban4	Urban1	Urban2	Urban3	Urban4	Urban1	Urban2	Urban3	Urban4
1. All Provinces												
Output	0.686*** (0.067)	0.629** (0.078)	0.557*** (0.092)	0.477*** (0.069)	0.638*** (0.074)	0.610* (0.071)	0.698*** (0.115)	0.443*** (0.113)	0.647*** (0.161)	0.609 (0.156)	0.764*** (0.116)	0.419*** (0.074)
Output*Urbanization	-0.02 (0.098)	0.043 (0.113)	0.003 (0.006)	-0.041** (0.016)	-0.026 (0.109)	0.029 (0.118)	0.005 (0.009)	-0.036 (0.024)	0.102 (0.251)	0.129 (0.246)	0.003 (0.005)	-0.047** (0.020)
R ²	0.316	0.316	0.378	0.201	0.285	0.285	0.558	0.176	0.322	0.321	0.511	0.175
N	486	486	78	448	270	270	52	280	270	270	52	278
2. Coastal Provinces												
Output	0.611*** (0.159)	0.072 (0.191)	0.537*** (0.174)	0.0616*** (0.114)	0.492*** (0.106)	0.174 (0.225)	1.033*** (0.244)	0.720*** (0.248)	0.885*** (0.205)	858** (0.411)	1.008*** (0.202)	0.446*** (0.164)
Output* Urbanization	0.087 (0.205)	0.814** (0.292)	-0.066 (0.068)	-0.149 (0.175)	0.108 (0.138)	0.573 (0.362)	-0.242** (0.063)	-0.28 (0.353)	-0.092 (0.247)	-0.056 (0.504)	-0.04 (0.044)	0.071 (0.351)
R ²	0.386	0.399	0.281	0.263	0.291	0.295	0.602	0.256	0.597	0.596	0.682	0.206
N	198	198	33	176	110	110	22	110	110	110	22	110
3. Inland Provinces												
Output	0.778*** (0.080)	1.347*** (0.332)	0.657*** (0.119)	0.425*** (0.096)	0.781*** (0.077)	1.644*** (0.515)	0.851*** (0.125)	0.276** (0.105)	0.696*** (0.120)	2.213*** (0.522)	0.625** (0.089)	0.373** (0.166)
Output* Urbanization	-0.075 (0.092)	-0.971* (0.525)	-0.012* (0.006)	-0.030* (0.016)	-0.204* (0.097)	-1.592* (0.832)	-0.026* (0.012)	-0.006 (0.018)	-0.005 (0.197)	-2.148*** (0.694)	-0.011*** (0.004)	-0.050* (0.027)
R ²	0.356	0.362	0.428	0.229	0.361	0.37	0.654	0.167	0.222	0.236	0.487	0.217
N	288	288	45	272	160	160	30	170	160	160	30	168

Table 9. Multivariate Analysis

This table reports the results of panel regressions based on yearly observations. To explicitly capture the role of each channel, we follow Kose *et al.* (2009) and use a standard risk sharing regression model that contains indicators of the various non-fiscal channels:

$$\Delta \log c_{it} - \Delta \log c_t^N = a + \mu (\Delta \log y_{it} - \Delta \log y_t^N) + \gamma' NFC_{it} (\Delta \log y_{it} - \Delta \log y_t^N) + \varepsilon_{it} \quad (3)$$

where a is constant, c_{it} and y_{it} are consumption and output in province i , and c_t^N and y_t^N are the national consumption and output, respectively. NFC_{it} is the set of indicators of non-fiscal channels in province i . *Output*Credit* represents the interaction between output and a credit market indicator, the ratio of total loans to GDP. *Output*Capital* represents the interaction between output and a capital market indicator, the ratio of total equity to GDP. *Output*IF* represents the interaction between output and an informal financial market indicator, the ratio of private investment to total investment. *Output*FDI* represents the interaction between output and a globalization indicator, the ratio of FDI stock to GDP. *Output*Urban2* represents the interaction between output and an urbanization indicator, 1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP. The regressions include province fixed effects and time effects. The standard errors robust to heteroscedasticity are reported in brackets. The symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	All Provinces	1990-2007 Coastal Provinces	Inland Provinces	All Provinces	1990-1999 Coastal Provinces	Inland Provinces	All Provinces	1998-2007 Coastal Provinces	Inland Provinces
Output	0.324 (0.380)	-0.039 (0.396)	1.920*** (0.564)	0.879 (0.694)	0.207 (1.177)	2.942*** (0.658)	-0.337 (0.603)	0.454 (0.545)	1.653 (1.115)
Output*Credit	0.01 (0.200)	0.017 (0.329)	-0.067 (0.180)	-0.179 (0.407)	0.283 (0.546)	-0.43 (0.271)	0.28 (0.298)	-0.347 (0.244)	0.319 (0.462)
Output*Capital	-3.667 (2.791)	-3.883* (2.154)	2.095 (12.014)	-1.339 (7.421)	0.598 (10.162)	-1.655 (15.202)	-1.198 (2.422)	-3.779* (1.954)	4.798 (11.110)
Output*Informal	0.04 (0.031)	0.047 (0.032)	-0.093 (0.167)	-0.083 (0.075)	-0.102 (0.067)	-0.549 (0.385)	0.073*** (0.023)	0.071 (0.063)	0.141 (0.253)
Output*FDI	-0.203 (0.777)	0.481 (1.278)	-1.32 (1.062)	-0.169 (1.121)	0.333 (2.041)	-1.980* (1.091)	3.315* (1.710)	-0.046 (2.545)	4.034 (4.357)
Output*Urban2	0.477 (0.427)	0.812*** (0.243)	-1.380* (0.752)	0.022 (0.599)	0.203 (0.664)	-2.318** (0.855)	0.174 (0.380)	0.751 (0.571)	-2.382** (0.870)
R ²	0.315	0.41	0.356	0.293	0.305	0.377	0.355	0.592	0.239
N	492	198	305	290	110	170	289	110	169

Figure 1. Total Interprovincial Risk Sharing in China

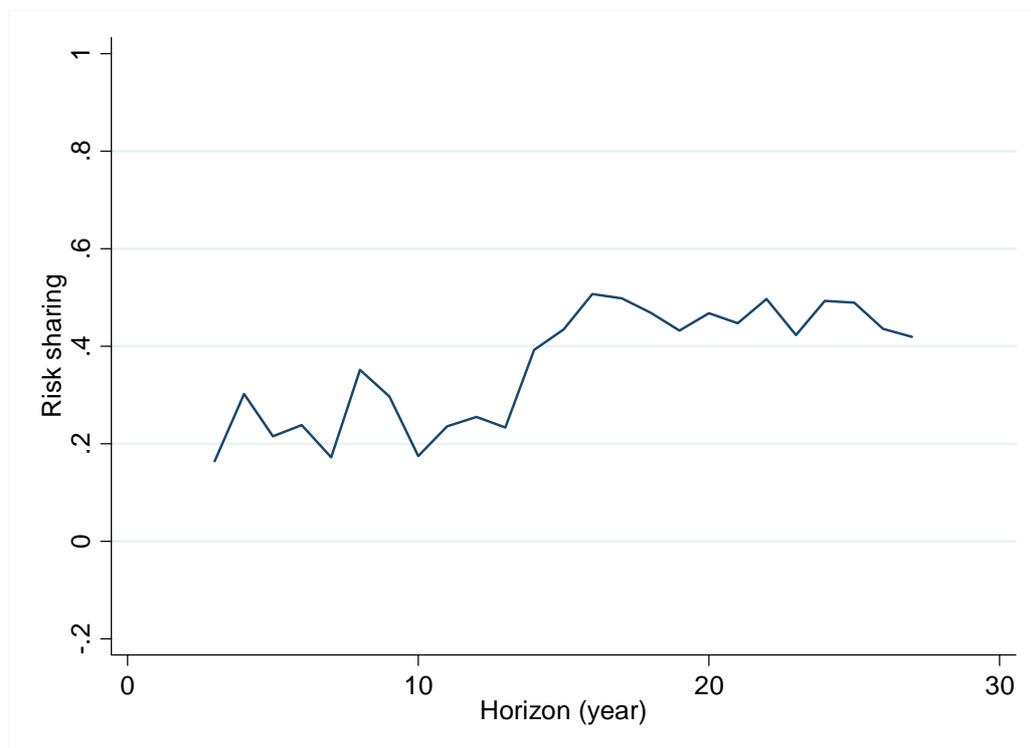
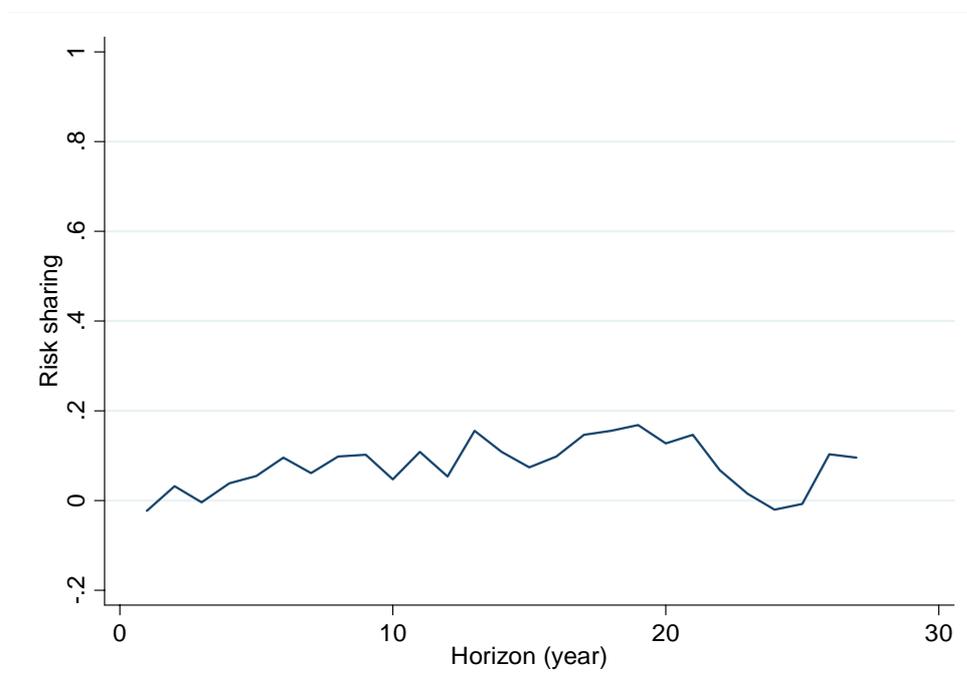
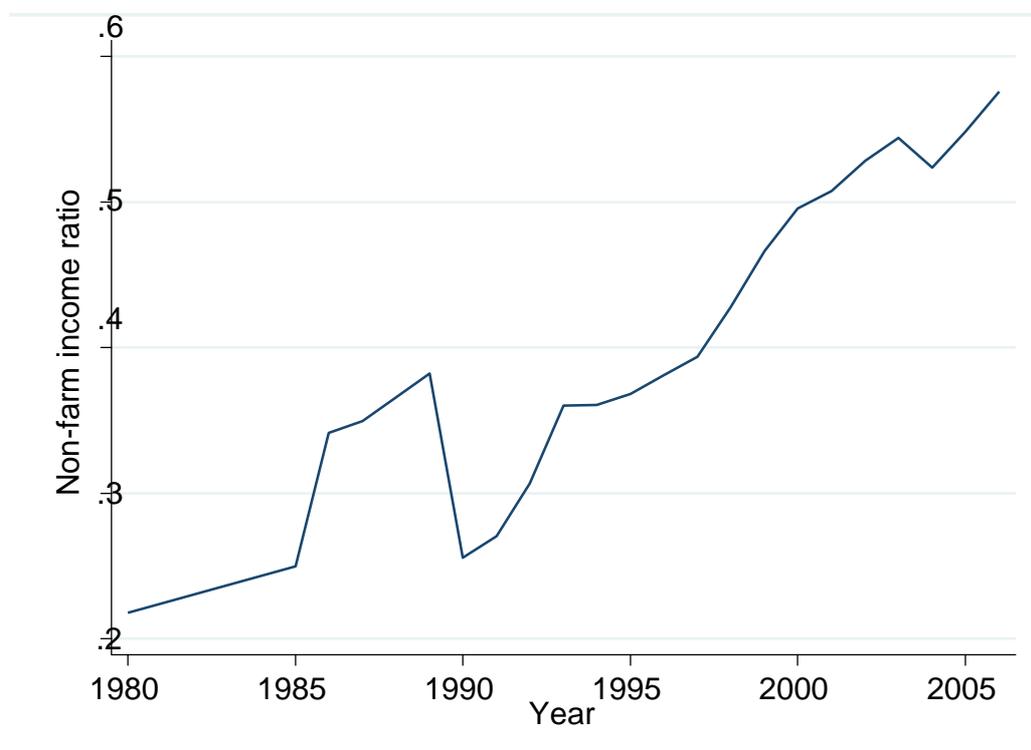


Figure 2. The Extent of Risk Sharing through the Fiscal Channel



Risk sharing is measured as the percentage reduction in the standard deviation of the ratio of provincial income to disposable provincial income.

Figure 3. Share of Non-Farm Income in Total Rural Net Income



Source: National Bureau of Statistics

Appendix

Most of the data on the banking and financial institutional factors are drawn from the annual issues of the *Almanac of China's Finance and Banking* (ACFB). Data on growth and other control variables are taken from annual issues of the China Statistical Yearbook published by the *National Bureau of Statistics* (NBS). We provide a description and data source for each indicator as follows.

Variable	Definition	Source
Non-fiscal variables		
<i>Credit Market</i>		
Loan	the ratio of total financial institutional loans to GDP	ACFB, various years
Deposit	the ratio of total savings deposited in financial institutions to GDP	NBS, various years
Saving	the ratio of total household savings to GDP	Comprehensive Statistical Data and Materials on 55 Years of New China, NBS
<i>Capital Market</i>		
Issuance	the ratio of funds raised by issuing equities and non-financial corporate bonds (long-term and short-term) to GDP	ACFB, various years
Capitalization	the ratio of stock market capitalization to GDP	ACFB, various years
<i>Informal Finance</i>		
FDI	the ratio of foreign direct investment stock to total investment	NBS, various years
PI	the ratio of private investment to total investment	NBS, various years
<i>Urbanization</i>		
Urban1	the ratio of disposable income per capita to the gross output value of farming, forestry, and husbandry per capita	NBS, various years
Urban2	1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP	NBS, various years
Urban3	the ratio of migration outflow over inflow	National census data (1995, 2000, 2005) and Chan (2008)
Urban4	the ratio of migration outflow to migration inflow based on the linear interpolation	National census data (1995, 2000, 2005) and Chan (2008)
Other control variables		
Y ₁	initial real per capita GDP in log form	NBS, various years
GPO	the five-year lagged population growth rate	NBS, various years
G/Y	the ratio of government expenditure to GDP	NBS, various years
I/Y	the ratio of total investment to GDP	NBS, various years
FERT	the ratio of the number of births to the total population*1000 in log form	NBS, various years
$\Delta_1 Y$	the one-year lagged real per capita GDP growth rate	NBS, various years
Edu	the ratio of the number of students enrolled in secondary school to the number of primary school graduates	NBS, various years