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# Channels of Interprovincial Consumption Risk Sharing in the People's Republic of China

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**Abstract**

This paper analyzes consumption risk sharing among provinces in the People's Republic of China (PRC) during 1980–2007. The analysis finds that 9.4% of shocks to gross provincial product are smoothed by the interprovincial fiscal transfer system. This system also cushions a relatively large percentage of province-specific shocks in coastal areas. Using a variety of indicators, we explored nonfiscal channels of consumption risk sharing. We found that the migration of rural labor to urban areas and the remittance of migrant wages play an important role in promoting interprovincial consumption risk sharing in inland PRC provinces. In contrast, the extent of risk sharing through financial intermediation and capital markets is very limited. These factors have resulted in a low degree of risk sharing among provinces, especially during the last decade.

**JEL Classification:** O16; O53; R11

# Contents

# 1. INTRODUCTION

The benefits of consumption risk sharing are widely recognized in developing and developed countries. According to Townsend (1994, individuals can potentially raise their 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 the 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 adjust their asset portfolios through borrowing and lending. Several authors[1] have extended this methodology to investigate the scope and ability for risk sharing in various countries and regions. The empirical literature on risk-sharing channels provides evidence that is largely consistent with earlier findings—that international risk sharing is relatively uncommon. Due to the prevalence of home asset bias, international risk sharing usually takes place through domestic savings. Intranational risk sharing, in which the role of capital markets is dominant, is much more prevalent.

Despite the many studies of risk-sharing channels, little is known about them in nonindustrial economies. Our paper adds to the literature by analyzing the channels of consumption risk sharing in the People's Republic of China (PRC), a large developing country that is playing an increasingly significant role in the global economy.

The case of the PRC is interesting for several reasons. Since the PRC exhibits almost all of the notable features that characterize developing countries, understanding the PRC could help us understand the risk-sharing channels of developing countries in general. For example, the PRC's formal financial system is characterized by repressive financial policies that are prevalent in many developing countries. Its private enterprises rely heavily on informal finance—dependence typical for developing economies. The PRC still has a dual-economy structure in which rural–urban migration plays an essential part in relieving rural poverty, a feature common to underdeveloped economies.

Studying risk sharing in a developing country such as the PRC offers 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, financial markets in most developing and transition economies are underdeveloped and inefficient, and the PRC is 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

[1] For instance, Asdrubali (1998) distinguishes risk sharing from intertemporal smoothing, Dedola et al. (1999) apply a different setup to each country, and Athanasoulis and van Wincoop (2001) decompose unpredictable output shocks.

[2] For example, Asdrubali et al. (1996) find that 62% of all shocks to state products in the United States are smoothed by financial markets.

issue in industrialized nations, it is very important for a developing economy that is being transformed from a dual economy to an industrialized one. It will thus be interesting to investigate whether rural–urban migration has helped to achieve interprovincial consumption risk sharing.

Studying the PRC may help us 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, the PRC's economic growth has been accompanied by increasing regional disparity. Thus, studying risk-sharing channels in the PRC could further clarify the effect of unequal regional development on interprovincial consumption risk sharing; this could have implications for other developing countries.

In this study, we find that consumption risk sharing in the PRC has remained low and not improved since the 1990s. Coastal and inland areas do not exhibit striking differences in the extent of risk sharing achieved. However, they do display salient differences in the channels through which risk sharing is consummated. Coastal areas have engaged in higher risk sharing through the fiscal transfer system than have inland areas. The development of financial intermediaries and capital markets play a modest role in risk sharing. In addition, only coastal areas have experienced better risk sharing due to recent development of capital markets. Although informal finance is instrumental to regional economic growth,[3] it has depressed the degree of risk sharing. A possible reason for this is that informal finance is sustained by reputational concerns and long-term relationships. Hence, cross-regional private capital flows are more likely to be dominated by business transactions within the local business community. This means that informal finance makes less of a contribution to interprovincial risk sharing. Consistent with the evidence of international risk sharing, foreign direct investment (FDI) does not enhance risk sharing overall. A rather interesting finding is that the remittances of migrant laborers may play an important part in enhancing consumption risk sharing, especially for inland provinces. Although this is a risk-sharing channel with Chinese characteristics, it has implications for other developing countries. Our results suggest that unlike the situation in industrialized economies, the PRC capital markets have played at most a modest role in achieving consumption risk sharing. In contrast, cross-regional remittances as a product of rural–urban migration probably constitute the primary channel for consumption risk sharing in inland areas of the PRC.

Only a few studies have investigated the degree of consumption risk sharing in the PRC. Boyreau-Debray and Wei (2005) found that the degree of intra-PRC consumption risk sharing declined during the past decade. Xu (2008) provides evidence that less risk sharing takes place between provinces in the PRC than for states in the United States (US) and Canadian provinces. Our analysis extends the existing literature in several dimensions. First, to the best of our knowledge, this study represents the first attempt to comprehensively investigate the patterns of risk sharing through various channels in the PRC. Second, a wide array of indicators is used to capture the size and quality of the financial system and its role in risk sharing. We conducted a careful investigation of the consumption risk-sharing patterns and related them to the progress of financial market development across time and regions. Finally, we investigated the importance of industrialization and urbanization to interprovincial risk sharing, and explored and discussed the possible roles played by rural–urban migration and remittances by migrant laborers in risk sharing.

[3] Allen, Qian, and Qian (2005) argue that in spite of apparent state dominance, a sufficient number of alternative informal financial mechanisms have emerged to allow the overall financial system to function effectively.

This study is also related to the literature on consumption behavior in response to risks and the impact of rural–urban migration in the PRC. Park (2005) finds that uncertainty about future consumption prices for grain contributes to a significant proportion of grain storage in the PRC's poor areas. Giles (2006 demonstrates that households in villages with stronger connections to migrant markets have better insurance against shocks to farm production and have less variable income and consumption. Giles and Yoo (2007) tested the precautionary behavior of rural households in consumption decisions and found that an increased village migrant network allows households to engage in less precautionary saving. This study differs from these earlier studies in several dimensions. Rather than focusing on household behavior, we frame our discussion in the context of interprovincial risk sharing. We treat cross-regional rural–urban migration as one potential channel for interprovincial risk sharing. The study examines its significance in achieving interprovincial risk sharing in conjunction with other potential channels, constructing a prism through which we can understand its relative importance in promoting interprovincial consumption risk sharing. It also compares the significance of cross-regional migration in attaining interprovincial risk sharing between inland and coastal areas over time.

Section 2 of this paper discusses various potential risk-sharing channels in the PRC. Section 3 discusses the measurement of risk sharing and econometric issues involved. The data are introduced and the variables are presented in Section 4. Section 5 presents an overview of risk sharing through fiscal and nonfiscal channels in the PRC in different areas and periods. Section 6 explores the financial channel of risk sharing, the impact of FDI on risk sharing, and the effects of rural–urban migration and wage remittance on risk sharing. Some further robust evidence of our results is provided in Section 7. Our conclusions are discussed in Section 8.

# 2. RISK-SHARING CHANNELS IN THE PRC

## 2.1 Fiscal Transfer System

Until 1979, the PRC fiscal system was highly centralized. Under the central planning system, the central government controlled almost all social resources and implemented a material balance system. It assigned production resources and output targets to each region, but at the same time took away most of the revenues generated from local production activities. The provincial governments had no control over their budgets.

With the onset of economic reform at the end of the 1970s, the central government initiated waves of fiscal decentralization and gave provinces much more discretionary power over regional budgets. Fiscal decentralization was carried out gradually in several phases. From 1980 to 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 revenue. According to the agreement reached in negotiations with the central government, local governments were allowed to keep part of the local fiscal revenue and pass over the remainder to the central government. The contractual arrangement varied across provinces and over time depending on local revenue-generating capacity and actual budgetary expenditure needs. Although the statutory tax rates and tax bases were still controlled by the central government, provincial governments could alter the effective tax revenues collected. They often provided a variety of tax concessions to local enterprises or shifted funds to their extrabudgetary revenue accounts, thereby minimizing the budgetary revenues that they were obliged to remit to the central government.[4] The fiscal contract system resulted in the central government losing its dominant control over the national budgetary system. With dwindling

[4] Almost all revenues were collected by the local tax bureaus (Ma and Norregaard 1998).

budgetary revenues, the ratio of central revenue to total revenue declined from 38% in 1985 to 22% in 1993.[5]

The drastic decline in central government revenue put the interprovincial fiscal transfer system under mounting pressure; this was unfavorable to risk sharing through this channel. To increase the fiscal capacity of the central government, a reform of the tax system was launched in 1994 to separate tax into that collected by the central government, by local governments, and by both. Under this new scheme, local revenue was redefined as consisting of exclusively local revenue and the local part of shared revenue.[6] As this separate tax system allowed the central government to take charge of the main types of tax in the PRC, the share of central government revenue increased to around 55.7% in 1994 (National Bureau of Statistical 2004). This increase in central budgetary revenue is likely to have promoted interprovincial fiscal transfers and contributed to risk sharing across regions.

An extrabudgetary revenue system runs in parallel with the budgetary revenue system and comprises tax surcharges and user fees levied by the central and local governments, in addition to earnings of state-owned enterprises (SOEs) (Jin et al. 2005). Because this extrabudgetary revenue does not have to be shared with the central government, it provides local governments with greater autonomy over expenditure. This then reduces the power of fiscal transfers to achieve interprovincial risk sharing. The role of the fiscal transfer system in interprovincial risk sharing may not be stable over time due to the extrabudgetary revenue system.

## 2.2 Formal Financial System

Formal finance mainly consists of formal systems of indirect and direct finance. The extent of indirect finance is reflected in the development of financial intermediaries. Direct finance refers to growth in the capital market.

### 2.2.1 Financial Intermediary Development

Financial intermediation in the PRC is dominated by the banking system. According to a Federal Reserve Bank of San Francisco (2007) estimate,[7] commercial banks provided 85% of the total capital raised by corporations in the PRC in 2006. The ratio of bank deposits to GDP is extremely high and is far in excess of that in any other country **(**Kuijs 2005**)**. Most bank credit is controlled by state-owned banks and is directed to SOEs.

In the era of the centrally planned economy, banks were not independent business entities, but simply served as cashiers for the fiscal system. The banking system has undergone several phases of reform since the economy was liberalized. During 1979–1983, the government restored the two-tier banking system comprising a central bank and several major state-owned commercial banks. During 1984–1993, the government promoted the establishment of shareholding banks and encouraged competition among various types of banks. The most important banking reform period took place from 1994 to 2003, with the central government setting up a market-oriented banking system. A series of measures were implemented to achieve this. Policy banks were established to focus on policy-dictated loan extensions and commercial banks were pushed to become market-oriented business entities. Standard

[5] This resulted in an imbalance in the development of regional economies and phenomena such as local protectionism, tax evasion, expansion of extrabudgetary revenue, and growth of regional differences.

[6] For example, based on this new tax-sharing formula, all provinces are required to remit 75% of their revenue collected from the value-added tax, the most important tax source in the PRC.

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

accounting principles and prudential norms were created to support the financial sector reforms, and licenses were granted to foreign banks and non-state-owned commercial banks to promote competition in banking. From 2004 to the present, further banking reforms were introduced, following the PRC's accession to the World Trade Organization. These reforms mainly involved restructuring state-owned commercial banks into shareholding banks and introducing overseas strategic investors. As a consequence, several state-owned commercial banks were transformed into state-controlled commercial banks that were publicly listed either domestically or overseas (Berger et al. 2009).

### 2.2.2 Capital Market Development

Capital markets mainly refer to the bond and equity markets. Corporate bonds were first issued in the PRC in 1986, yet the bond market has remained underdeveloped. According to the China Securities Regulatory Commission, the value of corporate bond issues in 2007 equated to only 2.05% of GDP.

In contrast, the equity market has developed rather quickly. Although set up later than the bond market, the newly established Shanghai Stock Exchange and Shenzhen Stock Exchange have expanded rapidly since their formation in the early 1990s. The ratio of market capitalization to GDP was only 3.93% in 1992, but surged to 132.65% by 2007. The introduction of stock markets was initially aimed at generating fresh capital for the ailing SOEs. However, since the late 1990s, the central government has promoted the partial privatization of SOEs and encouraged private enterprises to go public. The amount of equity funds channeled to the private sector has continued to rise.

## 2.3 Informal Financial System

The formal financial system in the PRC has long been characterized by state domination and financial repression. In this system, banking and the financial markets have mainly served the funding needs of SOEs and the majority of the non-state sector has been denied access to formal finance.

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

## 2.4 Financial Globalization

After summarizing theoretical models in open economy macroeconomics and international finance, Kose et al. (2009) posit that financial globalization could in theory foster risk sharing across countries because it provides increased opportunities for countries to smooth consumption growth in the face of idiosyncratic fluctuations in income growth. As a central part of the process of financial globalization, FDI could potentially affect interprovincial risk sharing

within a country.[8] Harrison et al. (2004) suggest that firms in countries with larger FDI inflows are less constrained by external finance limitations. Applying the same logic to different provinces in the PRC, we expect FDI inflow to relieve the shortage of capital and generate new employment and income, thus reducing the impact of negative regionwide shocks on the well-being of regional residents. According to Poncet (2007), the PRC's annual capital inflows have exceeded US$40 billion since 1996, gradually increasing to around US$70 billion in 2005 and 2006. As the PRC is the world's largest single recipient of FDI, FDI is expected to smooth consumption by acting as an important source of external finance. However, He et al. (2009) find that FDI allocation across regions is rather imbalanced, with the coastal regions receiving the majority. This uneven geographical distribution may diminish the positive impact of FDI on interprovincial risk sharing if FDI inflow is highly correlated with domestic capital investment distribution. Thus, the impact of FDI on interprovincial risk sharing may not be even across regions in the PRC. Under some circumstances, as FDI has been an important growth engine in the PRC, the persistence of uneven FDI inflow distribution may actually contribute to the concerted movement of consumption and output growth and worsen interprovincial risk sharing.

## 2.5 Industrialization and Urbanization

The problems of surplus labor and a shortage of land are more serious in the PRC than in most other developing countries. The pace of urbanization was fairly slow from 1949 to 1982 because of the rapid growth of the rural population and tight administrative restrictions on rural–urban migration under the household registration system. The proportion of urban dwellers in the total population grew slowly from 13.3% in 1952 to 20.6% in 1982. However, the economic reforms of the latter twentieth century led to urbanization and industrialization, such that between 1982 and 1986 the urban population increased dramatically to account for 37% of the total population. National census figures show that the country had more than 200 million migrant laborers in 2006. A major cause of this large jump was the migration of large numbers of surplus agricultural workers from rural to urban areas following a series of liberalization reforms in rural areas, such as the household responsibility system (Zhao 2003). The industrialization and urbanization process has encouraged large numbers of redundant rural laborers to leave farming and the countryside to move either to cities within the same province or to the booming coastal provinces and cities (this form of migration is called *litu lixiang*). However, because of the household registration system (*Hukou*),[9] these migrant workers do not officially migrate to cities, but only take temporary jobs there. Typically, they remit a large part of their wages to their families in the countryside. Hence, rural–urban migration has substantially altered the sources of household income in rural areas, especially in poorer inland provinces. The remittance of nonfarming 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.

In the early stage of rural–urban migration in the reform era, redundant rural laborers usually moved to work in rural enterprises in nearby villages or townships. However, rural enterprises were not able to keep absorbing surplus labor and, in the late 1980s, job creation in rural

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

[9] The *Hukou* system is one of the social control and administration systems set up for households in rural and urban areas. Members must register at the local public security office as legal residents. After registration, households are issued a *Hukou* certificate on which all members of the family are listed in detail as legal residents. This means that they can be more closely controlled by the local street office in urban areas or by the village committee in rural areas (Chen and Ravallion 1999).

enterprises started to decline. Meanwhile, the big cities were starting to attract an increasing number of rural laborers due to the acceleration of industrialization and relaxation of regulations on the employment of migrant workers. Increasing numbers of rural laborers moved to the big urban centers, initially to those in their own province (Garcia 2004). While this type of movement increased rural household incomes, its contribution to interprovincial risk sharing was rather limited from the provincial perspective. We thus expect that rural migration to urban areas did not cause a large increase in risk sharing in the 1980s.

The large-scale movement of labor across provinces began after Deng Xiaoping's tour of southern PRC in early 1992 to launch a new round of economic reforms that further promoted industrialization and urbanization. Since then, increasing numbers of migrant workers have flowed from rural areas—especially those in the inland provinces—to large urban areas, particularly those lying along the east coast. As a consequence, the share of total rural net income accounted for by nonfarming income increased substantially from 26% in 1990 to 58% in 2006 **(**National Bureau of Statistics 2007**)**. This not only reflects the industrialization process, but more importantly is evidence of the increasing value of remittances made by migrant workers to their families. Giles and Yoo (2007) suggest that households in rural areas engage in less precautionary saving as the migrant network increases. This wave of interprovincial rural–urban migration is likely to have improved risk sharing in the inland provinces.

# 3. MEASURING RISK SHARING

Athanasoulis and van Wincoop (2001) developed a variance decomposition method to measure risk sharing and applied it to the US. The basic idea of this method is to break 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 this procedure works, let us consider a country with $I$ regions. Let $y_{it}$ be per capita regional output (income before risk sharing) in period $t$. The growth rate of region $i's$ 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:

$$g_{i,t,t+s} = \alpha + \lambda_s' z_{it} + \varepsilon_{i,t,t+s}, \qquad (1)$$

where $\alpha$ 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 region remain exposed to the national aggregate risks. 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 region *i* from the national rate as

$$g_{i,t,t+s} - g^N_{t,t+s} = \lambda_s'(z_{it} - z^N_t) + \mu_{i,t,t+s}, \qquad (2)$$

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

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 region with an average residual risk [12] and that the innovations $\mu_{i,t,t+s}$ with nonoverlapping intervals $[t, t+s]$ are all independently drawn from the residual risk distribution in this representative region. The residual risk of the representative region is assumed to follow a $N(0, \sigma_s^2)$ distribution.[13]

We use the representative region's standard deviation of residual risk $\sigma_s$ as a measure of the diversifiable risk. The amount of risk sharing accomplished through the fiscal transfer channel and the nonfiscal 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 $\hat{\mu}$ be the stacked vector of the residual risk for a given horizon. We estimate the average variance in the residual risk over all regions as that of the representative region $\sigma_s^2 = (\hat{\mu}'\hat{\mu})/(IH - \lambda)$, where $H$ is the number of observations in each region and $\lambda$ 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]

[10] Following Athanasoulis and van Wincoop (2001), we define the national counterpart as $x^N = \sum_{j=1}^{I} \theta_j x_j$ for any regional variable $x_i$. $\theta_j$ is the weight for region *j*, which is the proportion region $j$'s endowment represents of the national endowment.

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

[12] Because we do not impose much structure on the endowment process, the variance in residual risk in each region cannot be computed for a sufficiently long horizon. For example, more than 20 years of data have only one observation of 20-year growth per region.

[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 van Wincoop (2000).

# 4. DATA AND VARIABLES

## 4.1 Measures of Income

Our sample consisted of a panel of 29 provinces and provincial-level cities on the PRC mainland for which annual data were available.[15] All of the variables were measured in per capita terms and expressed in 1980 constant prices by deflating them with the retail price index. To accurately gauge risk sharing, data were obtained on the following various indicators of individual income.

(1) *GDP* data were drawn from the 2008 edition of the *Statistical Yearbook of China*.[16] We obtained the per capita gross product of a province by dividing the aggregate regional product by the population in the province. We treated this as income before risk sharing as it does not include income sources such as fiscal transfers and asset holdings. Following ASY (1996), we used provincial income, disposable provincial income, and provincial consumption as measures of income and consumption after risk sharing.

(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.[17] We approximated provincial income as the sum of disposable household income,[18] local budgetary fiscal revenue,[19] and local extrabudgetary revenue, and then derived provincial income per capita by dividing the regional aggregate value by the regional population.

(3) Disposable provincial income (*DPI*) 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 extrabudgetary revenue, minus local government remittances to the central government.

(4) Provincial consumption (*PC*) is defined as the sum of household 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 extrabudgetary expenditure.[20]

Following ASY (1996), we treated the difference between *PI* and *DPI* as representing the risk sharing achieved through the fiscal system. This is the most clear-cut channel of risk sharing. Based on their observation of the situation in the US, ASY (1996) regarded the differences between *GDP* and *PI* as the risk sharing attained through capital markets, and between *DPI* and

[15] To maintain the consistency of the data on disposable income and consumption, we do not include Tibet and Chongqing, two provincial administrative regions.

[16] The Statistical Yearbook of China 2008 provides national (provincial) account data adjusted according to the economic census of 2004. This source gives consistent data for 1980–2007.

[17] Following Asdrubali et al. (1996), we excluded the retained earnings in our measure of provincial income (PI). As Athanasoulis and van Wincoop (2001) point out, not including 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 a sensitive analysis, we included retained earnings in both provincial income and disposable provincial income.

[18] Household disposable income is measured as the average of urban household disposable income and rural household net income.

[19] The measurement of local budgetary revenue is inconsistent because of the implementation of the separate tax system in 1994. In accordance with the *Finance Yearbook of China*, we estimated local budgetary revenue after 1993 as the sum of local revenue plus consumption tax and 75% of value-added tax collected.

[20] Budgetary (extrabudgetary) revenue consists of central budgetary (extrabudgetary) and local budgetary (extrabudgetary) revenue.

*PC* as the risk sharing attained from credit markets. However, this classification of nonfiscal channels may not be appropriate for the PRC. For instance, the PRC has the world's highest household savings rate and consumer credit is far less popular and relevant than it is in the US. This suggests that it may not be reasonable to attribute the difference between *DPI* and *PC* primarily to the effect of consumption smoothing via the credit markets. For example, 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. This could certainly create a large discrepancy between *GDP* and *PI* that is not caused by asset investment in capital markets.

Given the complexity of the risk-sharing channels in the PRC, we adopted the approach of classifying all of the potential channels into either fiscal or nonfiscal channels. In our opinion, the fiscal channel is the most straightforward and least controversial, whereas the nonfiscal channels are a catch-all category for all other potential channels.

In our analysis, we first estimated the contribution of the fiscal and nonfiscal channels to risk sharing. We then explored the various potential channels in the nonfiscal channels category including capital markets, credit markets, informal finance, globalization, and industrialization and urbanization. By using various indicators of these nonfiscal channels, we extended our regression models to evaluate their direct effects on the degree of risk sharing.[21]

To measure local disposable income and consumption, we first used data collected from the rural and urban household survey yearbooks, which provide data on disposable income and consumption for urban and rural households in each province. 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 deflated them by the relevant provincial retail price index (*RPI*).

**Table 1: Summary Statistics for the Measures of Risk Sharing**

| Item | GDP | PI | DPI | PC |
|---|---|---|---|---|
| Mean | 0.090 | 0.072 | 0.075 | 0.070 |
| Volatility | 0.057 | 0.055 | 0.057 | 0.059 |

Note: 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 the 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 extrabudgetary 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 extrabudgetary expenditure.

Source: Authors

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 logarithm real per capita terms. Average regional GDP growth is 9% and average consumption growth 7%. The average standard deviation of regional GDP is 0.057 and consumption growth is 0.059; these are much

[21] It should be kept in mind that measurement errors do not result in biased estimates of fiscal smoothing. As our measurements influence PI and DPI proportionately, the standard error reduction specification is thus an appropriate measure of fiscal effect. However, since some nonfiscal channels are controlled by the government such as financial intermediary, capital market, and FDI, the impact of fiscal transfer on interprovincial risk sharing could be underestimated.

higher than in industrial countries.[22] A distinct feature is that the volatility of consumption is slightly higher than that of each of the income measures.[23] This may imply less risk sharing in the PRC than in other economies.

## 4.2 Measuring Nonfiscal Risk-Sharing Channels

Formal finance mainly consists of financial intermediaries and capital markets. We use the following three ratios to measure the extent of financial intermediation development: loan, deposit, and saving. Loan is the ratio of total (bank and nonbank) loans to GDP and 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.[24] These three measures reflect the scale of financial intermediation from the perspective 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 nonfinancial corporate bonds (long-term and short-term) to GDP in each province. This ratio is chosen because the issuance of equities and corporate bonds is argued to be 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; it captures the depth of 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 (PI). The use of this proxy is motivated by Allen et al. (2005), who show that the private sector in the PRC is extremely limited in its ability to gain access to formal finance, but at the same time is the most vibrant growth engine in the economy. This indicates the need for efficient and alternative financing channels to support rapid expansion of the private sector. We believe that private sector investment reflects the size of informal finance and adopted this ratio to gauge its importance in each province. We used the ratio of FDI stock to GDP to proxy for financial globalization (FDI).

Finally, we employed 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 disposable income per capita to the gross output value of farming, forestry, and husbandry per capita in a province, where higher values indicate that nonfarming 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 nonfarming income. Urban3 is the ratio of migration outflow to migration inflow based on provincial migration data from the national census. A higher value indicates labor emigration to other provinces on a larger scale and makes it more likely that the province in question is a major supplier of migrant workers. Urban4 is the ratio of migration outflow to migration inflow based on the linear interpolation. The first two ratios may well incorporate the impacts of industrialization, urbanization, and rural–urban migration on the structure of household income. The last two ratios are the proxies for

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

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

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

interprovincial rural–urban migration and the importance of migrant workers' remittances back home.

## 4.3 Control Variables

The explanatory variables included in the 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 the PRC, we constructed and included the following variables in the base information set.[25] YI is the logarithm of initial real GDP per capita. GPO is the 5-year lagged population growth rate. G/Y is the ratio of government expenditure to GDP. FERT is the ratio of the number of births to the total population. $\Delta_1 Y$ is the 1-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.

[25] As most of the nonfiscal indicators are available only from 1990, they were 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.

**Table 2: Summary Statistics for the Explanatory Variables**

| Item | | Mean | SD | Minimum | Maximum | Obs |
|---|---|---|---|---|---|---|
| **Nonfiscal 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 |
| Informal Finance: | FDI | 0.082 | 0.093 | 0.000 | 0.594 | 521 |
| | 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 |
| **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 |

( ) = negative number, Obs = , SD = ,

Note: 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 nonfinancial 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 1minus Urban1. Urban3 is the ratio of migration outflow over inflow. YI is initial real per capita GDP in log form. GPO is the 5-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 multiplied by 1,000 in log form. $\Delta_1 Y$ is the 1-year lagged real per capita GDP growth rate. Edu is the ratio of the number of students enrolled in secondary school to the number of primary school graduates.

Source: Authors

**Table 3: Estimation Results for the 29 Provinces**

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

Note: This table reports the estimation results of Equation (2). 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 5-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*1,000 in log form. $\Delta_1 Y$ is the 1-year lagged real per capita GDP growth rate. Edu is the ratio of the number of students enrolled in secondary school to the number of primary school graduates. The standard errors for each point estimation 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.

Source: Authors

Table 3 provides the estimation results for the GDP growth rate.[26] The explanatory power of the model is rather limited over shorter horizons ($R^2 = 0.053$ for 1 year and 0.099 for 5 years), but increases substantially for longer horizons ($R^2 = 0.263$ for 13 years and 0.276 for 27 years). Consistent with Barro and Sala-i-Martin (1995), the coefficients of initial GDP per capita are negative for all horizons and statistically significant for most horizons. Our estimation provides some evidence of a conditional convergence in growth among PRC provinces. The 1-year lagged growth rate of real GDP per capita produces mostly positive and significant estimated coefficients. As expected, the fertility rate and government expenditure exert negative effects on regional 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 **(**$\hat{\sigma}$**)** rises substantially with the estimation horizon. With a 5-year interval, the standard deviation is 0.115, whereas with a horizon of 27 years, the standard deviation is 0.330. One may suspect that a regression model with a lagged

[26] The estimation results for other income measures are similar, but are not reported.

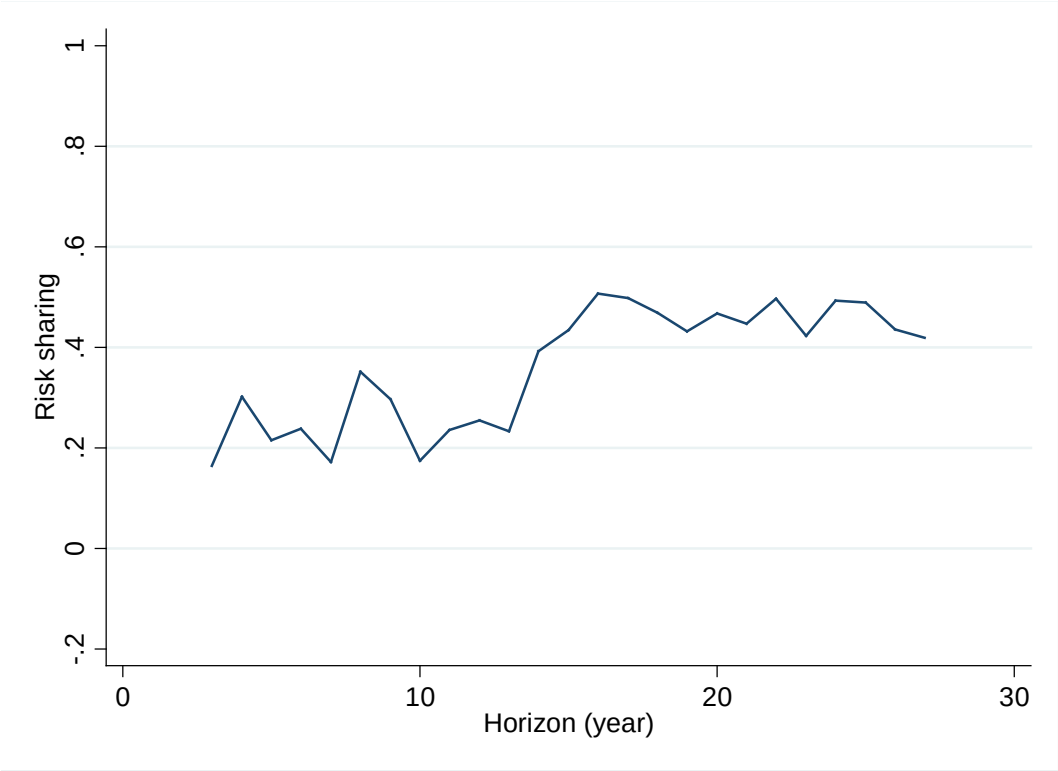
dependent variable and other lagged variables tends to produce a biased estimation of coefficients (e.g., Forbes 2000, Banerjee and Duflo 2003). To check whether it may cause serious estimation bias of residual risk, we reestimated the regression model using an SYS-GMM estimator developed by Arellano and Bover (1995).[27] The results remain qualitatively similar.

# 5. OVERVIEW OF RISK-SHARING PATTERNS IN THE PRC

## 5.1 The Roles of Fiscal and Nonfiscal 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 under study. Table 4, panel A reports the average degree of risk sharing attained through fiscal and nonfiscal channels and the remaining unsmoothed part over the sample period. Approximately 40.5% of the shocks to gross provincial output were insured through various channels, with the remaining 59.5 % being uninsured, a higher level of uninsured shocks than in the United States.[28] This clearly indicates that substantial scope remains for potential welfare gains from additional risk sharing in the PRC. Moreover, the fiscal transfer channel insured 9.4% of the output shocks, a proportion much overshadowed by that of the nonfiscal channels, which suggests that government income redistribution measures play a limited part in risk sharing.

**Figure 1: Total Interprovincial Risk Sharing in the PRC**



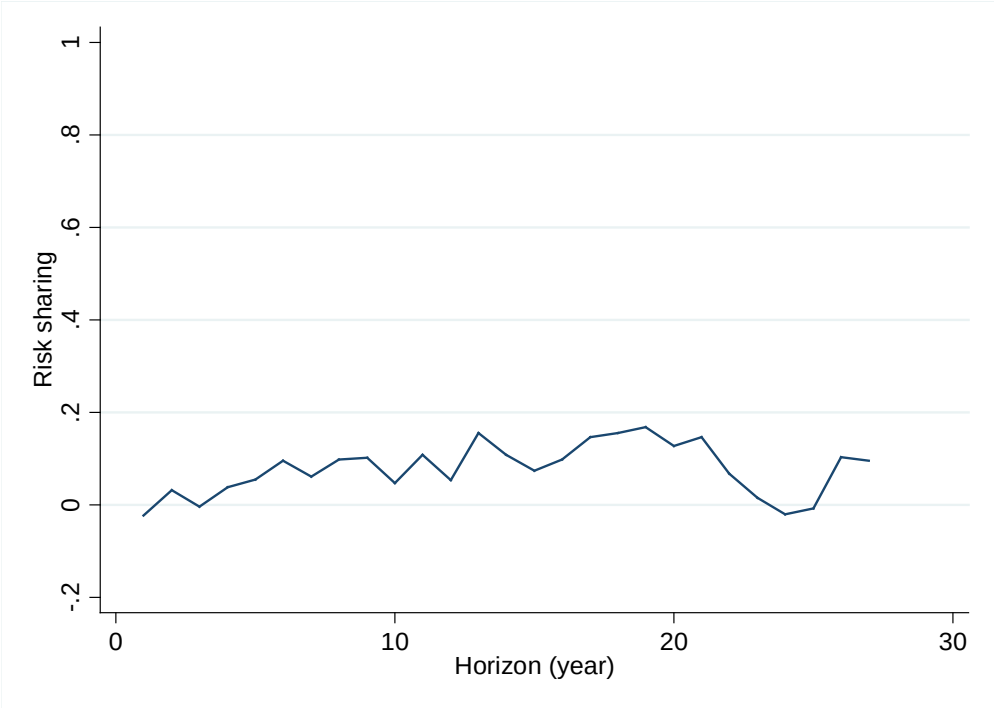

Note: Risk sharing is measured as the percentage reduction in the standard deviation of the ratio of gross provincial product to provincial consumption.

[27] When the horizon exceeds 10 years, the panel regression reduces to two time periods. The SYS-GMM cannot be estimated. As a result, we only report the GMM results for horizons 1 and 5. The estimation results for other income measures or other horizons are similar, but are not reported.

[28] ASY (1996) reported that only 25% of shocks to gross state output are not smoothed.

Source: Authors' estimation

**Figure 2: The Extent of Risk Sharing through the Fiscal Channel**




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

Source: Authors' estimation

## 5.2 Results for Subperiods

As the PRC is transforming itself from a planned economy into 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 channel and the nonfiscal channels to risk sharing are increasing or decreasing. We assessed this by determining whether the proportions of risk sharing achieved through the fiscal and nonfiscal channels varied over subperiods. Meanwhile, the capital markets developed rather quickly after the introduction of stock markets in the early 1990s. How or whether this expansion has influenced risk sharing is an interesting issue that remains uninvestigated. We therefore split the whole sample period into two subperiods, i.e., 1980–1997 and 1990–2007.[29] The estimates for each subperiod are reported in Table 4, panel B.

[29] As the estimation results may hinge on the time horizon, we set each subperiod at 18 years.

## Table 4: Risk Sharing, 1980-2007

**Panel A**

Note:This panel reports the average, over horizons of 1 to 27 years, of the reduction in the standard deviation of residual risk achieved through risk sharing. The fiscal transfer channel refers to risk sharing through the national fiscal system and nonfiscal channel refers to risk sharing through other channels. The final row reports the unsmoothed part of consumption.

:

| Item | |
|---|---|
| Fiscal Transfer Channel | 9.4% |
| Nonfiscal Channels | 31.1% |
| Not Smoothed | 59.5% |

**Panel B Subperiods**

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

| **Item** | **1980–1997** | **1990–2007** |
|---|---|---|
| Fiscal Transfer Channel | 2.7% | 4.6% |
| Nonfiscal Channels | 31.9% | 26.1% |
| Not Smoothed | 55.4% | 59.3% |

**Panel C Subregions**

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

| **Item** | **Inland Regions** | **Coastal Regions** |
|---|---|---|
| Fiscal Transfer Channel | 5.0% | 8.0% |
| Nonfiscal Channels | 32.1% | 26.9% |
| Not Smoothed | 63.9% | 65.1% |

**Panel D**

To check for robustness, we first estimated the ratio of the urban population over the rural population, and used this ratio to construct the population weighted average of household consumption and income. We further modified our measure of both provincial income (PI) and disposable provincial income (DPI) by including retained earnings. We also deflated all the measure of income by using the spatial deflators developed by Brandt and Holtz (2006). This panel reports the average degree of risk sharing attained through fiscal and nonfiscal channels and the remaining unsmoothed part over the whole sample period based on these new measures.

| Item | **1980–2007** |
|---|---|
| Fiscal Transfer Channel | 8.9% |
| Nonfiscal Channels | 29.4% |
| Not Smoothed | 61.7% |

The proportion of risk sharing achieved through the government transfer system remained as small as 2.7% in the first subperiod (1980–1997). However, it increased to 4.6% in the second (1990–2007),[30] reflecting the increased contribution of the fiscal transfer system to risk sharing resulting from 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 made by the nonfiscal channels to risk sharing in the first subperiod was 31.9%, their contribution decreased to 26.1% in the second. Given the rapid expansion of the capital markets after 1990, the diminishing role of nonfiscal channels implies that the development of the capital markets did not improve the degree of risk sharing. Overall, risk sharing did not improve after 1990 and the total proportion of output shocks that were insured declined slightly in the second subperiod, a result that agrees with the evidence of Boyreau-Debray and Wei (2005) and Xu (2008).

## 5.3 Results for Subgroups

The PRC is characterized by very uneven regional development. An interesting question is thus whether the benefits arising from risk sharing are unequally distributed across regions. To answer this question, we classified provinces or provincial-level cities into two groups—inland areas and coastal areas [31] —and compared the patterns and amounts of income and consumption risk sharing between the two. In general, the PRC's economic reforms and opening up started in the coastal areas and gradually spread to the inland areas. In terms of the degree of marketization and economic development, the inland areas are still lagging coastal areas. The results on the regional differential in risk-sharing patterns are reported in Table 4, panel C. The contribution of the fiscal transfer system to risk sharing is considerably larger in coastal areas. This suggests that coastal areas are the major source of tax revenue for the central government and that tax contributions smooth out consumption growth in coastal areas and make it less closely correlated with output growth. What is somewhat surprising is the low contribution of fiscal transfers to risk sharing in inland areas. This implies that the interprovincial fiscal redistribution carried out by the central government is still small and far from sufficient to provide an adequate degree of risk sharing for residents in inland areas.

Interestingly, the nonfiscal channels have played a more important role in achieving risk sharing in inland areas than in coastal areas. This has enabled inland areas to achieve slightly higher overall consumption risk sharing. Given the limited development of and access to financial markets in inland areas and the relative scarcity of FDI inflows, the larger proportion of risk sharing achieved through nonfiscal channels in the interior may reflect the importance of household savings and remittances made by migrant workers.

[30] It is doubtful that fiscal channel risk sharing in each subperiod combined is less than that of the whole period. This result may be due to the fact that the estimation depends on the time horizon. Thus, only results calculated over the same time horizon are comparable.

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

# 6. EXPLORING NONFISCAL CHANNELS

The nonfiscal channels category is broad and encompasses many dimensions. To explicitly capture the role of each channel, we followed Kose et al. (2009) and used a standard risk-sharing regression model that contains indicators of the various nonfiscal channels.

$$\Delta \log c_{it} - \Delta \log c_{it}^{N} = a + \mu_t(\Delta \log y_{it} - \Delta \log y_{it}^{N}) + \gamma_t' NFC_{it}(\Delta \log y_{it} - \Delta \log y_{it}^{N}) + \varepsilon_{it} \text{ , (3)}$$

where $a$ is constant and $NFC_{it}$ is the set of indicators of nonfiscal channels in region $i$. A negative value of the coefficient vector $\gamma$ indicates that the greater the value of these nonfiscal channels in a region, the greater the amount of risk sharing that occurs.[32]

## 6.1 Development of Formal Finance and Risk Sharing

In Tables 5 to 8, we report the estimation results on the relationship between the development of formal finance and risk sharing for 1990–2007, 1990–1999, and 1998–2007.[33] For each period, we conducted regressions for the whole country, coastal areas, and inland areas.

[32] This is obvious because the degree of risk sharing attained by region $i$ is equal to $1 - \mu_t - \gamma_t' FO_{it}$. See Sorensen et al. 2007.

[33] Because many observations are missing for nonfiscal data in the 1980s, we focus on 1990–2007 in the following regression analysis. In addition, we set the second subperiod as 1998–2007 so that it consists of 10 years in common with the first subperiod to facilitate econometric analysis and comparison.

**Table 5: Risk Sharing and the Credit Market**

| | 1990-2007 | | | | 1990-1999 | | | | 1998-2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Item** | | **Loan** | **Deposit** | **Saving** | | **Loan** | **Deposit** | **Saving** | | **Loan** | **Deposit** | **Saving** |
| **All Regions** | | | | | | | | | | | | |
| Output | 0.674*** | 0.744*** | 0.706*** | 0.594*** | 0.627*** | 0.876** | 0.636*** | 0.762** | 0.709*** | 0.936*** | 0.860*** | 0.519 |
| | (0.060) | (0.178) | (0.118) | (0.198) | (0.064) | (0.317) | (0.216) | (0.336) | (0.093) | (0.219) | (0.149) | (0.385) |
| Output*Credit | | -0.057 | -0.019 | 0.142 | | -0.253 | -0.009 | -0.266 | | -0.156 | -0.065 | 0.272 |
| | | (0.155) | (0.089) | (0.329) | | (0.315) | (0.224) | (0.678) | | (0.155) | (0.069) | (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 |
| **Coastal Regions** | | | | | | | | | | | | |
| Output | 0.672*** | 0.622** | 0.511** | -0.013 | 0.559*** | 0.485 | 0.329 | 0.017 | 0.810*** | 1.121*** | 0.984*** | 0.31 |
| | (0.106) | (0.249) | (0.170) | (0.223) | (0.085) | (0.393) | (0.237) | (0.464) | (0.113) | (0.193) | (0.155) | (0.542) |
| Output*Credit | | 0.046 | 0.12 | 1.087** | | 0.072 | 0.202 | 1.001 | | -0.262 | -0.099 | 0.642 |
| | | (0.186) | (0.101) | (0.323) | | (0.362) | (0.186) | (0.878) | | (0.167) | (0.069) | (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 |
| **Inland Regions** | | | | | | | | | | | | |
| Output | 0.698*** | 0.854*** | 1.137*** | 1.127*** | 0.688*** | 1.295*** | 1.392*** | 1.246*** | 0.583*** | 0.499 | 1.278*** | 1.236*** |
| | (0.087) | (0.259) | (0.244) | (0.227) | (0.079) | (0.373) | (0.339) | (0.279) | (0.122) | (0.392) | (0.464) | (0.471) |
| Output*Credit | | -0.162 | -0.473* | -0.821* | | -0.646 | -0.870** | -1.201** | | 0.084 | -0.575 | -1.120* |
| | | (0.246) | (0.262) | (0.403) | | (0.421) | (0.407) | (0.575) | | (0.349) | (0.387) | (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 |

Note: This table reports the results of panel regressions based on yearly observations. 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 inland regions include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal regions include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. The regressions include both 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.

Source: Authors

Table 5 presents the estimation results for credit markets. To facilitate comparison with earlier analysis and previous studies, in the first column for each subperiod we report panel regressions without the interaction terms between the output and credit market development indicators. The estimation results are broadly consistent with results reported in the previous section. Compared with the evidence of Kose et al. (2009), the extent of regional risk sharing across PRC provinces is consistent with that across the national boundaries of industrial countries. By examining the estimated coefficients of the output growth variable,[34] we can see that the inland areas achieved a level of consumption risk sharing comparable with that of the coastal areas over the whole sample period. Moreover, turning to the two subperiods, we find that the extent of risk sharing appears to have declined over time in the whole country on average and in coastal areas, with risk sharing in the last decade being smaller than that in the 1990s. In contrast, risk sharing in the inland areas increased slightly in the second subperiod in comparison with that in the first subperiod.

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, positive but insignificant for the coastal areas, and negative for inland areas. The estimated coefficient for bank deposits is statistically significant for inland areas. Similarly, household savings in banks are statistically significant in promoting risk sharing in inland areas, but repress it in coastal areas. Hence, financial intermediary development has played a modest role in risk sharing across regions in the PRC and contributed to risk sharing in inland areas to a much greater extent than in coastal areas. These results, particularly those associated with bank loans, imply that the capital mobility attained by interprovincial credit allocation among financial intermediaries remained fairly low in the last two decades, which is consistent with the evidence of Boyreau-Debray and Wei (2005).

Looking at the two subperiods, we found no significant differences between them for the country as a whole and for coastal areas. Bank deposits significantly enhanced consumption risk sharing in the inland areas during 1990–1999, but their stimulant effect became statistically insignificant during 1998–2007. Nonetheless, household savings in banks exerted a statistically significant stimulant effect on risk sharing in inland areas in both subperiods.

The failure of bank loans to promote risk sharing may reflect the structural characteristics of the PRC's financial system. In past decades, state-owned financial institutions dominated the financial system and their main mission was to provide loans to SOEs. Although state banks tended to allocate financial resources from one region to another in accordance with the national government's regional development objectives, the relatively heavy concentration of SOEs in the booming coastal areas reduced the amount of credit made available in less productive inland areas and encouraged loans to flow within coastal areas, a pattern that partially weakened the role of bank loans in fostering risk sharing across inland and coastal areas. The liberalization of the financial system in the late 1990s did not change this situation. Bank restructuring and the resultant increasing profit incentive prompted state banks to act like nonstate or foreign banks in shunning policy-oriented loan allocations and channeling more credit to the booming coastal areas. This did not help to enhance interprovincial risk sharing in coastal and inland areas. The well-developed consumer credit market in coastal areas also allowed for the relaxation of individual financing constraints, which led to higher risk sharing along the eastern seaboard.

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

It is noteworthy that bank deposits and household savings in banks in particular played a striking role in improving interprovincial risk sharing in inland areas. On the one hand, this suggests that the high savings of enterprises, government entities, and households in particular in the formal financial system have contributed to the smoothing of consumption for residents in inland areas. On the other hand, the salient role played by household savings in banks in achieving risk sharing in inland areas may well reflect the importance of the remittances of migrant laborers in coastal areas made to their families in inland areas in promoting risk sharing in inland areas. As households in inland areas tend to deposit much of their income in banks, a large proportion of which comes from remittances, their consumption does not move in tandem with their income growth. Remittances, working through household savings, play a major role in fostering risk sharing. This part of our evidence reinforces what we find in Section 8.

**Table 6: Risk Sharing and the Capital Market**

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

Note: This table reports the results of panel regressions based on yearly observations. Output*CM represents the interaction between output and each capital market indicator. Issuance is the ratio of funds raised by issuing equities and nonfinancial corporate bonds (long-term and short-term) to GDP and Capitalization is the ratio of stock market capitalization to GDP. The inland regions include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal regions include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. The regressions include both 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.

Source: Authors

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

Only the coastal provinces have obtained risk-sharing benefits from the development of capital markets since their reestablishment in the 1990s. The inland provinces have largely been denied access to these benefits. Capital market development has not generated significant risk-sharing benefits nationally. This is largely due to the imbalanced development of capital markets across regions. Du and Xu (2008) argue that the quota system in the PRC securities market effectively functions as a decentralized regulatory instrument and find that it has tended to favor coastal areas as they are home to the majority of listed firms in the PRC. From the perspective of individual families, average income per family in the inland provinces is substantially lower than in coastal areas. Individual families in inland provinces may not have enough extra income, sufficient knowledge about securities, or a local community investment culture to invest in the securities markets, which is manifested in the lower ratio of securities trading accounts opened by people in inland areas. It is therefore not surprising that residents in inland areas have received few benefits from risk sharing through cross-regional 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 1998–2007, when informal finance seems to have depressed risk sharing in inland areas to a significant extent. This result is not surprising. Allen et al. (2005) suggest that the most important governance mechanism of nonstandard financing is based on reputation and relationships. This argument leads to the supposition that implicit contractual relations cause the use of most informal finance modes to be confined to local business communities. This prevents the movement of capital across regions and depresses risk sharing. As coastal areas 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 in coastal areas than in inland areas. Hence, the repressive effects of informal finance on interprovincial consumption risk sharing are less salient in coastal areas than in inland areas. Overall, more private investment takes place in coastal areas with stronger supporting institutions than in inland areas; this reinforces regional disparities in economic growth and worsens interprovincial risk sharing.

**Table 7: Risk Sharing, Foreign Direct Investment, and Informal Finance**

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

Note: This table reports the results of panel regressions with yearly observations. 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 inland regions include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal regions include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. The regressions include both 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.

Source: Authors.

## 6.3 Globalization, Foreign Direct Investment, and Risk Sharing

Table 7 presents the results reflecting the impact of inward FDI stock on risk sharing. FDI stock does not have statistically significant effects on risk sharing across the country as a whole or in the two subregions for the whole sample period. Examining the two subperiods, we found that FDI stock did not have a significant impact on risk sharing during 1990–1999, although the direction of its effect points to its role in promoting risk sharing. However, FDI depressed interprovincial risk sharing during 1998–2007; this effect is statistically significant across the country as a whole and in inland areas. The results are consistent with the Kose et al. (2009 assessment that FDI does not contribute to consumption risk sharing in emerging markets.

The failure of FDI to promote interprovincial risk sharing is probably a consequence of the persistently uneven distribution of FDI across PRC provinces. From the early 1980s to the mid-1990s, the central government set up a national policy framework to attract FDI and exerted substantial influence over which provinces received FDI. Based on its national economic development plan, the central government channeled the majority of FDI inflow to special economic zones and major liberalized cities lying along the east coast. Inland areas received only a small proportion of FDI inflow. In the mid-1990s, the central government largely

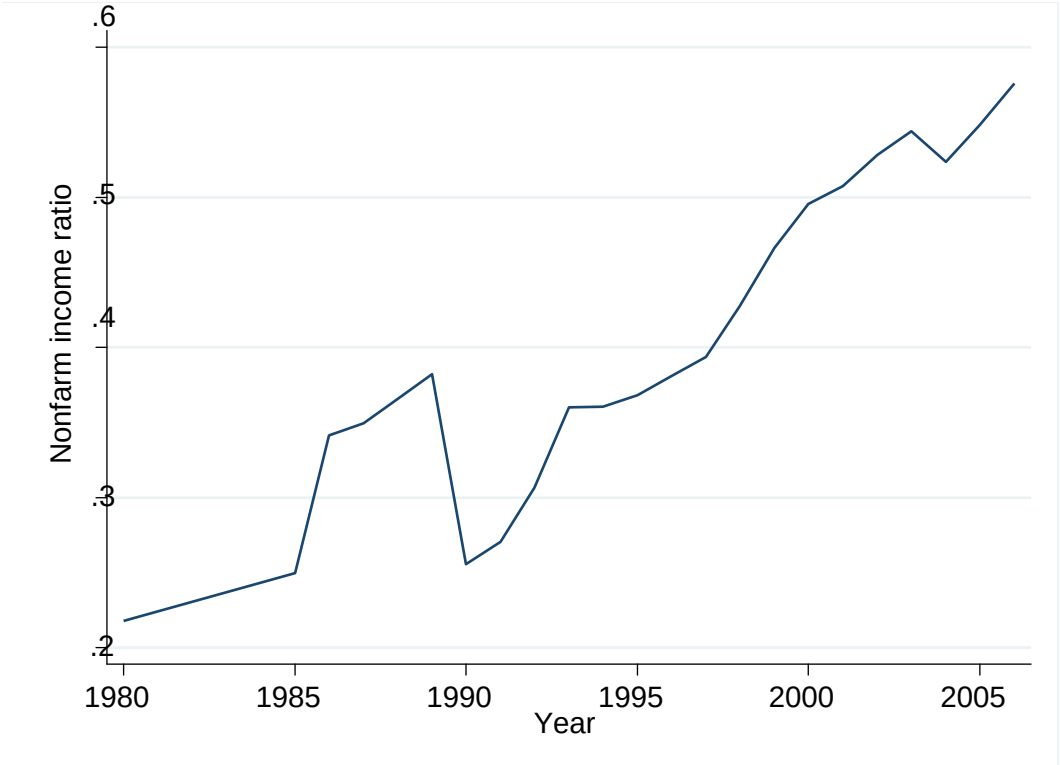
liberalized the FDI introduction process by allowing local governments to compete directly for FDI inflow (Oman 2000). As a result, the uneven distribution of FDI inflow persisted because coastal areas had better infrastructure, superior institutions, and more skilled labor to accommodate FDI (Du et al. 2009 He et al. 2009. Moreover, Since FDI is an important resource for local economic development, local governments did not allow FDI to move across regions, reinforcing the uneven interprovincial distribution of FDI. The persistently uneven distribution of FDI appears to have added to interprovincial disparities in economic growth, contributed to the correlation of output and consumption growth within each province, and reduced the extent of risk sharing across regions.

## 6.4 Industrialization, Urbanization, and Risk Sharing

Our earlier results suggest that nonfiscal channels have made a much greater contribution to risk sharing in inland areas than in coastal areas. However, our results also demonstrate that financial intermediary development played only a slightly more significant role in achieving risk sharing in inland areas than it did in coastal areas in the 1990s, whereas capital market development contributed substantially more to risk sharing in coastal areas than in inland areas over the same time frame. Hence, some alternative channels must have been at work.

We next investigated what else may have affected risk sharing in the interior provinces. Presumably, rural–urban migration has contributed substantially to risk sharing. A primary indicator of its importance is the rising share of total rural household income represented by nonfarming income, particularly after 1990. Figure 3 exhibits the sharply increasing trend after 1990.

**Figure 3: Share of Nonfarm Income in Total Rural Net Income**




Source: National Bureau of Statistics

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

**Table 8: Risk Sharing and Urbanization**

| | 1990–2007 | | | | 1990–1999 | | | | 1998–2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Urban1** | **Urban2** | **Urban3** | **Urban4** | **Urban1** | **Urban2** | **Urban3** | **Urban4** | **Urban1** | **Urban2** | **Urban3** | **Urban4** |
| **All Regions** | | | | | | | | | | | | |
| Output | 0.686*** | 0.629** | 0.557*** | 0.477*** | 0.638*** | 0.610* | 0.698*** | 0.443*** | 0.647*** | 0.609 | 0.764*** | 0.419*** |
| | (0.067) | (0.078) | (0.092) | (0.069) | (0.074) | (0.071) | (0.115) | (0.113) | (0.161) | (0.156) | (0.116) | (0.074) |
| Output*Urbanization | -0.02 | 0.043 | 0.003 | -0.041** | -0.026 | 0.029 | 0.005 | -0.036 | 0.102 | 0.129 | 0.003 | -0.047** |
| | (0.098) | (0.113) | (0.006) | (0.016) | (0.109) | (0.118) | (0.009) | (0.024) | (0.251) | (0.246) | (0.005) | (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 |
| **Coastal Regions** | | | | | | | | | | | | |
| Output | 0.611*** | 0.072 | 0.537*** | 0.0616*** | 0.492*** | 0.174 | 1.033*** | 0.720*** | 0.885*** | 858** | 1.008*** | 0.446*** |
| | (0.159) | (0.191) | (0.174) | (0.114) | (0.106) | (0.225) | (0.244) | (0.248) | (0.205) | (0.411) | (0.202) | (0.164) |
| Output* Urbanization | 0.087 | 0.814** | -0.066 | -0.149 | 0.108 | 0.573 | -0.242** | -0.28 | -0.092 | -0.056 | -0.04 | 0.071 |
| | (0.205) | (0.292) | (0.068) | (0.175) | (0.138) | (0.362) | (0.063) | (0.353) | (0.247) | (0.504) | (0.044) | (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 |
| **Inland Regions** | | | | | | | | | | | | |
| Output | 0.778*** | 1.347*** | 0.657*** | 0.425*** | 0.781*** | 1.644*** | 0.851*** | 0.276** | 0.696*** | 2.213*** | 0.625** | 0.373** |
| | (0.080) | (0.332) | (0.119) | (0.096) | (0.077) | (0.515) | (0.125) | (0.105) | (0.120) | (0.522) | (0.089) | (0.166) |
| Output* Urbanization | -0.075 | -0.971* | -0.012* | -0.030* | -0.204* | -1.592* | -0.026* | -0.006 | -0.005 | -2.148*** | -0.011*** | -0.050* |
| | (0.092) | (0.525) | (0.006) | (0.016) | (0.097) | (0.832) | (0.012) | (0.018) | (0.197) | (0.694) | (0.004) | (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 |

Note: This table reports the results of panel regressions with yearly observations. Output* Urbanization represents the interaction between output and each nonfarm income indicator. 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. A higher value indicates a larger degree of interprovincial migration. The inland regions include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal regions include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. The regressions include both 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.
Source:

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

Looking at the two subperiods, we found that the stimulant effect of *Urban1* on risk sharing in inland provinces was statistically significant only in the 1990s. This is probably because this was when rural–urban migration exploded after the launch of the second round of economic reforms in 1992; it thus had the greatest impact on risk sharing in that decade. We also found that the stimulant effect of *Urban2* on risk sharing in the inland provinces was significant in both subperiods. However, neither indicator had significant effects for the whole country or coastal areas. 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 labors. 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 peasants, thereby formally acknowledging their contribution to urban development.[35] Further reform of the *Hukou* system could partially explain the stimulant effect of *Urban2* on risk sharing in inland provinces observed in the later subperiod.

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, urbanization, and rural–urban migration, *Urban3* is the most direct proxy for the importance of interprovincial rural–urban migration. It gauges the relative size of 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 someone may suspect that 5-year intervals will produce different results for the same variables that 1-year intervals found, we interpolated both migration outflow and inflow observations in our sample period. We include *Urban4*, which is measured as the ratio of interpolated migration outflow to the interpolated migration inflow. The regression results for *Urban3* and *Urban4* are consistent with and reinforce those based on

[35] In January 2003, the State Council Office's No. 1 Document set out four principles underlying the following commitments: abolish any excessively unfair restrictions on rural laborers seeking either temporary or permanent employment in urban areas; ensure that employers of migrant laborers act in accordance with the law concerning contracts and the punctual payment of wages; improve working and living conditions for rural migrant laborers, especially women, including health care and personal safety; provide legal and skills training for rural migrants (training is strictly voluntary and no unreasonable fees should be charged); provide access to education for children of migrant workers equal in quality to that afforded the children of urban residents; improve the administration of migrant populations including in areas of family planning, education for children, labor employment, heath care, and legal aid.

[36] Based on (1995, 2000, 2005) census data and Chan (2008), we collected the migrant flows for 1990–1995, 1995–2000, and 2000–2005. Because the number of migrants is calculated every 5 years, the corresponding GDP and consumption growth rate figures were measured on the basis of 5-year periods that do not overlap.

*Urban1* and *Urban2*. *Urban3* had no significant effect on risk sharing across the whole country in the sample periods. It had a significant stimulant effect on risk sharing in coastal areas only during 1990–1999. Nonetheless, *Urban3* significantly enhanced risk sharing in inland areas for all sample periods.

Our analysis demonstrates that industrialization, urbanization, and interprovincial rural–urban migration have been the locomotives of consumption risk sharing in inland areas. As the PRC's *Hukou* system prevented rural migrant workers from becoming permanent urban residents, the remittances of migrant workers lead to increases in income and become a viable means of improving living standards in rural households, especially in inland areas, as well as an effective instrument for risk sharing in inland areas.[37]

This finding has general implications for developing countries. Although other countries may not have a rigid household registration system preventing permanent rural–urban migration, remittances have still been found to play an important part 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 directly and indirectly to the smoothing of rural household consumption and, in turn, to interprovincial risk sharing given an uneven distribution of cities across regions. 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 literature that identifies the importance of rural–urban migration and remittances to interprovincial risk sharing.

# 7. ADDITION CHECKS OF ROBUSTNESS

## 7.1 Measures of Variables

A major concern of the preceding analysis is the measures of income before and after risk sharing. To provide a robustness check, we first estimated the ratio of urban population over rural population,[38] and used this ratio to construct the population weighted average of household consumption and income. Retained earnings may also influence the measure of income. As a result, we modified our measure of provincial income (PI) and disposable provincial income (DPI) by including retained earnings.[39] As Brandt and Holtz (2006) suggest that spatial differences in prices between urban and rural regions cross PRC provinces are substantial, we deflated all the measure of income by using the spatial deflators developed by them. Figures 5 and 6 show that the pattern of total risk sharing through the various channels and the extent of risk sharing through the fiscal transfer channel for all of the horizons, based our new measures, are similar to those of Figures 1 and 2. Table 4, panel D reports the average degree of risk sharing attained through fiscal and nonfiscal channels and the remaining unsmoothed part over the whole sample period based on these new measures. The estimation results are similar to those of Table 5, panel A.

[37] Giles and Yoo (2007) found that migration facilitates risk coping and risk management, which lead to lower savings and higher consumption.

[38] As official data are unavailable for several provinces, we replaced the missing data with the nonagriculture population over the agriculture population.

[39] As official data for retained earnings before 1990 is not available before 1990, we derived the series of data by interpolation.

## 7.2 Control Variables

So far, we had been using equation (3) to investigate the potential channels of risk sharing. There may be a concern that other omitted variables could influence the relationship between each potential channel indicator and consumption risk sharing. To mitigate this concern, we reestimated equation (3) by including various control variables used in Section 4.3, such as the logarithm of initial real GDP per capita and the 5-year lagged population growth rate. The untabulated results show that these estimations yield qualitatively similar results on the relationship between the channel indicator and the extent of consumption risk sharing.

## 7.3 Multivariate Analysis

Another potential concern about the preceding analysis is related to the univariate regression models we used to assess the separate role of each channel in fostering risk sharing. To see whether our approach causes serious bias, we adopted a multivariate regression model to assess all potential risk-sharing channels simultaneously. We chose the ratio of total loans to GDP, the ratio of total equity to GDP, the ratio of FDI stock to GDP, the ratio of 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, the capital market, globalization, informal finance, and urbanization, respectively.[40] Table 9 presents the estimation results for all these measures of consumption risk sharing. The results are qualitatively equivalent to those we obtained earlier by conducting univariate regression analysis for each channel separately, which reinforces the robustness of our conclusions. We also compared the different roles played by the domestic channels (formal finance, informal finance, and urbanization) and international channel (globalization) on the interprovincial consumption risk sharing. We found that the effect of domestic channels dominate that of international channel. This implies that financial globalization is not conducive to risk sharing because foreign portfolio flows into the PRC are rather limited in size because the PRC's capital account has not been liberalized and the persistently uneven distribution of FDI increases the correlation of output and consumption growth within each province.

[40] We also used alternative measures for each risk-sharing channel. Our results are robust across a variety of specifications.

**Table 9: Multivariate Analysis**

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

Note: This table reports the results of panel regressions based on yearly observations. 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 urbanization indicator, 1 minus the ratio of the gross output value of farming, forestry, and husbandry to GDP. The inland regions include Anhui, Gansu, Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, and Yunnan. The coastal regions include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. The regressions include both 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.

Source: Authors.

# 8. CONCLUSION

In this study, we examined the patterns of interprovincial risk sharing through various fiscal and nonfiscal channels in the PRC by employing a variety of empirical approaches. First, we examined the evolution of overall risk sharing achieved by the country as a whole and by the coastal and inland areas in different periods. The results suggest that during 1980–2007, not even 40% of consumption risks were insured, which is fairly low. The extent of risk sharing achieved through the fiscal channel rose (nonfiscal channels dropped) during 1990–2007 compared with that realized during 1980–1997. In terms of regional patterns, no significant difference in the extent of risk sharing was found between inland and coastal areas. However, the two areas display marked differences in the channels through which risk sharing is achieved. The fiscal transfer channel plays a much more important part in coastal areas than in

inland areas, whereas the nonfiscal channels have contributed much more to risk sharing in inland areas than in coastal areas.

Second, we explored in detail the various components of the nonfiscal channels by directly measuring the impacts of the development of financial intermediaries, capital markets, informal finance, FDI, and rural–urban migration on the extent of risk sharing across PRC provinces. We found that the development of a formal financial system plays a modest role in promoting risk sharing. Although the private financing channel plays an important part in driving regional economic growth, it depresses interprovincial risk sharing because of its local financing orientation.

Given the limited and declining role of financial intermediary development in achieving risk sharing in the inland regions, the high degree of risk sharing achieved by the PRC's inland provinces is mainly attributable to the surge in nonfarming income. We examined the pattern of the share of total rural net income represented by nonfarming income during 1980–2007 and investigated whether remittances by migrant labor improved interprovincial risk sharing. We found that nonfarming income as a share of total rural net income surged in the 1990s and coincided with an improvement in 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 financial markets on risk sharing. Our findings imply that low consumption risk sharing could be one explanation for the high savings rate in the PRC, and that urbanization and industrialization could enhance interprovincial risk sharing in regions with less-developed financial markets.

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