

Changes in inter-provincial risk sharing during the COVID-19 pandemic in China

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Abstract

The stringent measures imposed by the Chinese government to deal with COVID restricted labor mobility across the country, impairing the major mechanism for consumption smoothing in China. This paper explores the composition of risk sharing between Chinese provinces before and during the pandemic. Our results indicate that the share of income shocks smoothed by the factor market exhibits a drastic drop, illustrating the adverse effects of lockdowns and other barriers to labor mobility. By contrast, risk sharing via fiscal mechanisms becomes much more prominent but around 37% of income shocks during the pandemic remain unsmoothed.

KEYWORDS

China, consumption smoothing, COVID-19, regional heterogeneity, risk sharing

JEL CLASSIFICATION

E21, E62

1 | INTRODUCTION

The COVID pandemic caused a major shock to China's economy as the government implemented stringent measures to prevent the spread of the virus and economic activity experienced a significant slowdown (Gong et al., 2024). In the first quarter of 2020, the real per-capita disposable income dropped by 3.9% for urban households and by 4.7% for rural ones (National Bureau of Statistics of China, 2020). When facing such transitory shocks to their income, households could smooth their consumption by taking out a loan. However, the credit market in China is not a major channel for sharing risk because it is still relatively underdeveloped and lending for consumption purposes is very limited (Du et al., 2022). An alternative mechanism for mitigating income fluctuations is the migration to another location unaffected or less severely affected by the shock. In fact, the movement of migrant workers from rural areas and the poorer interior provinces to the manufacturing hubs and booming cities of Eastern China has fueled the country's economic growth for more than three decades.

However, one of the key aspects of the pandemic prevention measures was the drastic reduction of mobility within cities, between regions, and across the country via lockdowns, quarantines, mandatory testing, digital health code requirements, and the shutdown of public transportation. Migrant workers were disproportionately more affected by these restrictions as they were unable to return to the cities where they were employed or the companies they worked for did not resume operations (Zhang et al., 2021). The government could also provide risk sharing via fiscal transfers

that dampen the impact of the income shock. In fact, the Chinese government offered various lockdown subsidies and tax relief for households and companies in response to the pandemic (Chen et al., 2022; Li et al., 2023).

This paper explores the composition of risk sharing between Chinese provinces before and during the pandemic with the goal of testing the hypothesis that the relative importance of various channels has shifted. In particular, we anticipate that the contribution of the factor market channel has declined due to the restrictions on labor mobility, while the consumption-smoothing properties of the fiscal channel have been boosted thanks to government policies aimed at relieving the economic impact of the lockdowns. For this purpose, we use province-level data to decompose risk sharing into three components (factor market, fiscal channel, and the credit market) and then compare their respective shares for the pre-pandemic (2017–2019) and pandemic (2020–2022) periods. Furthermore, we conduct a robustness test by employing a time varying parameter approach.

This study contributes to two branches of the literature, one focusing on risk sharing and the other on the impact of the COVID pandemic in China and the Asia-Pacific region. The few publications on inter-regional risk sharing in China indicate that factor market and fiscal channels are more relevant than the credit market (Du et al., 2011, 2022; Tochkov, 2007). However, their analysis is limited to the period before 2015 and thus cannot assess whether the pandemic changed the composition of the various channels. At the same time, a number of studies deal with the effects of COVID on regional income inequality in China (Shen et al., 2021) and the role of the government transfer program during the pandemic in South Korea (Park, 2022), but these have not directly addressed the impact on regional risk sharing.

The rest of the paper is structured as follows. In the next two sections, we describe the methodology and the data. In Section 3, we present the main results and the sensitivity analysis, while Section 4 concludes.

2 | RISK SHARING AND ITS CHANNELS

2.1 | Methodology

We follow the seminal approach by Asdrubali et al. (1996) to decompose risk sharing into its constituent components using the following set of equations:

$$\Delta y_{it} - \Delta p_{it} = \beta_F \Delta y_{it} + v_{F,t} + u_{F,i} + \varepsilon_{F,it} \text{ (Factor market)} \quad (1)$$

$$\Delta p_{it} - \Delta d_{it} = \beta_G \Delta y_{it} + v_{G,t} + u_{G,i} + \varepsilon_{G,it} \text{ (Fiscal channel)} \quad (2)$$

$$\Delta d_{it} - \Delta c_{it} = \beta_C \Delta y_{it} + v_{C,t} + u_{C,i} + \varepsilon_{C,it} \text{ (Credit market)} \quad (3)$$

$$\Delta c_{it} = \beta_U \Delta y_{it} + v_{U,t} + u_{U,i} + \varepsilon_{U,it} \text{ (Unsmoothed)}, \quad (4)$$

where y is the gross domestic product (GDP), p is personal income, d is personal disposable income, and c is personal consumption (all in nominal per-capita terms), v captures time fixed effects, u province fixed effects and ε is the idiosyncratic error. If risk sharing is perfect, $\beta_U = 0$, that is, fluctuations in GDP do not cause any corresponding movements in consumption.

Total risk sharing, that is, $1 - \beta_U$, can be decomposed into its components β_F , β_G , and β_C . Since $1 - \beta_U$ would be the result of a regression of $\Delta y - \Delta c$ on Δy , and the left hand sides of the first three equations add up to $\Delta y - \Delta c$ as well, $1 - \beta_U = \beta_F + \beta_G + \beta_C$, where each equation estimates the share of risk that is shared through the difference represented by the left hand side variable of the respective equation. Since the difference between GDP and personal income is primarily explained by factor income across provincial borders, β_F can be interpreted as the contribution of the factor market channel. The difference between personal and disposable income consists of taxes and transfers, that is, β_G measures the share of the fiscal channel. Finally, the difference between disposable income and consumption is made possible by credit markets through both savings and borrowing, hence β_C describes the amount of risk shared via the credit market channel.

Importantly, all specifications include province fixed effects and year fixed effects, following Asdrubali et al. (1996) and Balli, Kalemli-Ozcan and Sørensen (2012). The inclusion of year fixed effects ensures that identification of the risk-sharing coefficients relies exclusively on cross-provincial deviations from aggregate national growth. In other words, common macroeconomic shocks affecting all provinces in a given year are absorbed by the time dummies, and the

estimated coefficients capture the extent to which province-specific output fluctuations are smoothed through the respective channels. Without time fixed effects, the coefficients would conflate aggregate shocks with idiosyncratic provincial shocks and would therefore not measure risk sharing in the sense defined in the Asdrubali et al. (1996) framework.

2.2 | Data

In our estimation, we use annual data at the province level for all 31 Chinese provinces over the COVID period (2020–2022) and a pre-COVID period. In our preferred specification, we compare to a pre-COVID period of equal length (2017–2019), but we also report results for extended periods for reference. Per-capita GDP at the provincial level is reported on an annual basis by China's National Bureau of Statistics (NBS). Personal disposable income, consumption, and net fiscal transfers are obtained from NBS's annual household survey administered in all provinces separately for urban and rural households. Since personal income is not reported in the data, we construct it by adding net fiscal transfers to personal disposable income. The rural and urban households series are merged at the province level by forming weighted aggregates with the corresponding population shares.

3 | RESULTS

3.1 | Main model

The main results of our estimation presented in Table 1 provide strong evidence in support of our initial hypothesis. First, we observe that the coefficients for the factor market and fiscal channels attain statistical significance, while the credit market does not appear to make a meaningful contribution to risk sharing, which concurs with the existing literature on China (Du et al., 2022). In the immediate pre-COVID period (column 3 in Table 1), the factor market essentially absorbed all shocks to income, even overcompensating for the destabilizing effect of the fiscal channel (signified by the negative sign of the corresponding coefficient). In other words, inter-provincial labor mobility was the main mechanism for consumption smoothing in China before the start of the pandemic, while net fiscal transfers by the government seem to have increased volatility instead of dampening it.

The results are somewhat less pronounced when extending the pre-COVID window, with the factor market coefficient close to unity for 2014–2019 and 0.76 for the sample beginning in 2005 (columns 1 and 2 in Table 1). The longest sample, however, includes missing observations for personal income, notably for Zhejiang (a high-income province and major absorber of migrant labor) and Henan (one of the largest labor-exporting provinces). Because both provinces are central to interprovincial labor mobility, the resulting loss of observations biases the estimated factor market share downward.¹

The pandemic period (column 4 in Table 1) causes a profound shift in the shares of the two channels. The factor market now smooths only 67% of the income shocks, while the coefficient of the fiscal channel turns positive and suggests that the government support absorbs additionally 8% of the shocks. The difference between the coefficients for the pre-COVID and the COVID periods is statistically significant for both channels (fifth column in Table 1). The restrictions on labor mobility during the pandemic are almost certainly responsible for the dramatic drop in the contributions of the factor market. The boost of risk sharing via fiscal mechanisms indicates that the government aimed at mitigating the adverse effects of the stringent measures implemented in the course of the pandemic. While the increase in fiscal risk sharing is considerable (from basically naught to about 8%), the magnitude does not match the decrease in factor market risk sharing. Accordingly, the unsmoothed component of risk increases quite substantially during the COVID period reaching 37% and the corresponding coefficient is statistically significant.

Even during the COVID period, factor market risk sharing remains large, particularly when contrasted with cross-country evidence where the role of the factor market is typically negligible (see e.g., Balli, Kalemli-Ozcan and Sørensen, 2012; Sørensen & Yosha, 1998). In the within-country literature, estimated shares generally range between 30% and 40%. For example, Balli, Basher and Jean Louis (2012) document 29% for Canadian provinces, Méltitz and Zumer (1999) report around 30% for Canada and the UK and about 49% for Italy, and Asdrubali et al. (1996) estimate 39% for the United States (with higher values in later subsamples). Even the upper end of this range remains below our pre-COVID estimate for China.

TABLE 1 Risk sharing coefficients across sample periods.

	Pre-COVID			COVID	$t(\beta^{pre} = \beta^{cov})$
	2005–2019	2014–2019	2017–2019	2020–2022	
Factor	0.76*** (13.45)	1.02*** (22.12)	1.12*** (17.87)	0.67*** (7.93)	3.05***
Fiscal	−0.01 (−0.34)	−0.02 (−0.56)	−0.10** (−1.87)	0.08** (1.74)	−1.80**
Credit	−0.04 (−0.97)	0.01 (0.17)	0.01 (0.13)	−0.13 (−0.76)	0.51
Unsmoothed	0.30*** (5.04)	−0.01 (−0.17)	−0.04 (−0.38)	0.37** (1.85)	−1.33

Note: The fifth column compares the coefficients based on the immediate pre-COVID (third column) and the COVID era (fourth column) using a two-sample *t*-test.

***Significance at the 1% level, **significance at the 5% level. All specifications include province and time fixed effects.

However, the Chinese labor market differs sharply from most other countries. Taking Canada (one of the countries with the highest labor mobility) as an example, a recent research report indicates that about 14% of the labor force in 2021 was “engaged in extended or complex work-related mobility” (Vanier Institute of the Family, 2024). Yet this category includes foreign workers in Canada (about 3 percentage points) and long commutes (about 5 percentage points). Only 0.6% of the Canadian workforce work outside their home province. By contrast, China’s Seventh National Population Census (National Bureau of Statistics of China, 2021) records 375.8 million individuals in the “floating population” in 2020, corresponding to more than 40% of the national labor force. Correspondingly, the contribution of the factor market to risk sharing in China is substantially larger.

3.2 | A time varying parameter approach

As a robustness test, we also employ a kernel-smoothing time varying parameter panel model based on Casas et al. (2021) using province-year panel data from 2015 to 2022.² We include (non time varying) province fixed effects and time fixed effects, and only allow the slope coefficients estimated in Equations (1–4) to vary over time.

Our results in Figure 1 by and large confirm our findings from the previous section. We find a sharp decline in risk sharing via the factor market (Figure 1, panel (a)) and an increase in the smoothing properties of the fiscal channel (Figure 1, panel (b)). The contributions of the credit market (Figure 1, panel (c)) remain insignificant over the entire period. Overall risk sharing declines (i.e., the unsmoothed component increases) after the start of the pandemic (Figure 1, panel (d)) but unlike in the sample split in Table 1, this finding is significant when applying a time varying parameter model. Interestingly, we find that the unsmoothed component declines again at the very end of the sample, which coincides with the gradual rollback of anti-COVID measures in China at the end of 2022.

3.3 | Unknown breakpoint test

In particular in panels (a) and (d) of Figure 1, we notice that the dynamics we interpret as the effect of COVID seem to begin in 2019 rather than in 2020. This is mostly due to the underlying kernel-smoothing approach, which smooths over sudden breaks to some degree. However, we verify that the structural break found in Section 2 is a result of COVID rather than the reflection of an unknown shift in 2019 by estimating the breakpoint using a supF type approach in the spirit of Hansen (1997). That is, we estimate a series of models with different breakpoints (from 2016 to 2022) and see which model produces the best fit (and correspondingly the highest *F*-test statistic). It is important to note that we do not actually need to perform the supF test itself, since we already verified the existence of the break with the theoretically based breakpoint. That is, the multiple testing problem that drives the distribution of the test statistic for supF

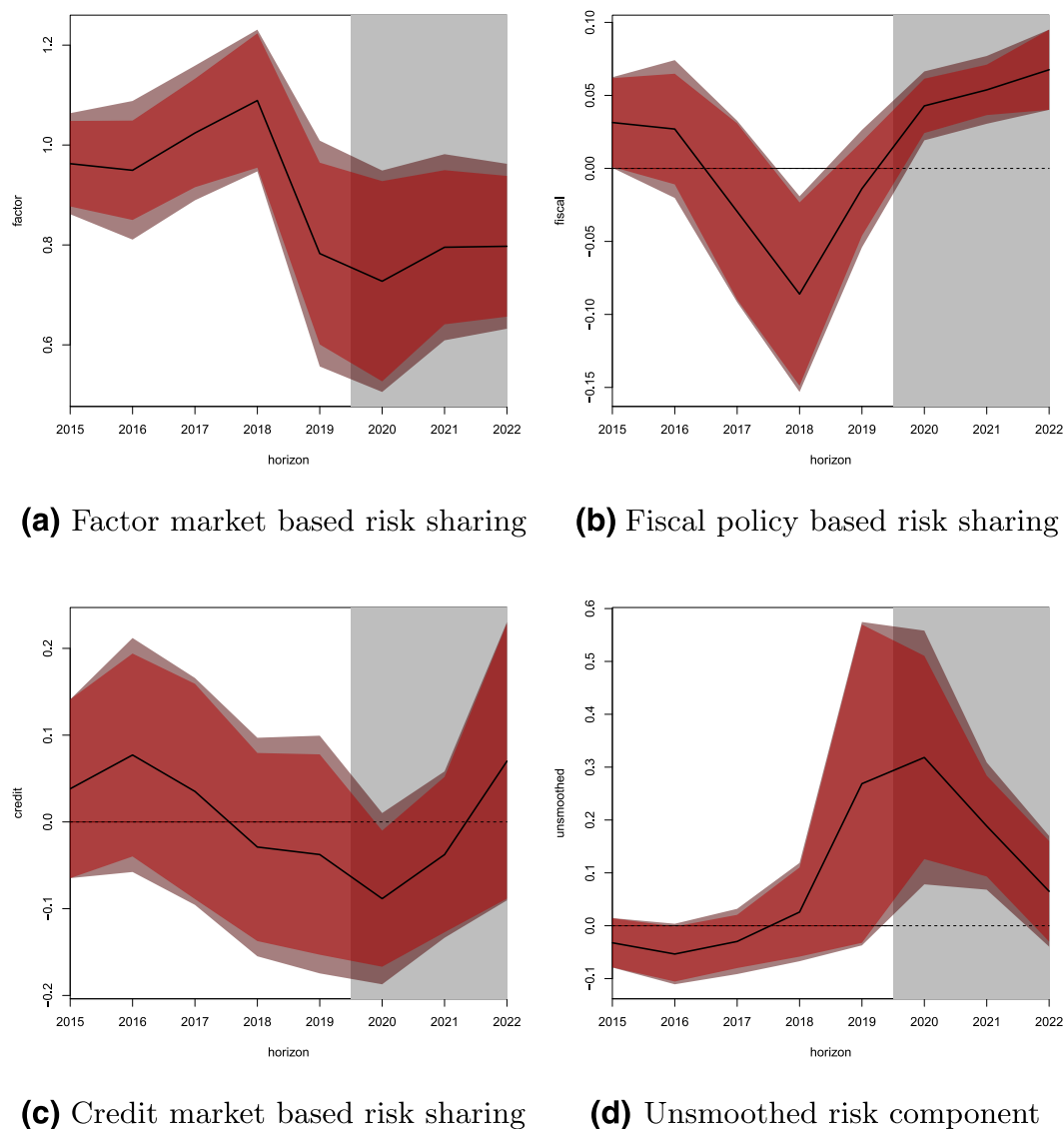


FIGURE 1 Time varying risk sharing by channel. COVID period in gray. Light red denotes 95% confidence bounds, dark red denotes 67% confidence bounds. The bounds are bootstrapped and not normally distributed.

tests does not apply here. We merely aim to double check if the most likely timing of the break determined by the supF approach coincides with our hypothesis.

The results of the supF approach in Table 2 clearly support the COVID-based dating. For all channels—even those where a break cannot be established—the most likely timing of a potential break is the year 2020, which coincides with the start of the pandemic.

4 | CONCLUSIONS

The pandemic has put the Chinese economy to the test by creating an emergency situation that called for prevention measures to stop the spread of the virus. At the same time, these measures severely restricted economic activity in general, and the movement of goods and people across the country in particular, triggering an adverse income shock. This paper explores potential changes in the mechanisms used to smooth such transitory shocks in the context of the pandemic. Our findings identify a major shift from private to public mechanisms that allow Chinese households to share risk at the provincial level. In particular, we show that the factor market experienced a sharp decrease in importance, while the fiscal channel became more prominent compared to pre-pandemic times. Restrictions on the

TABLE 2 supF-type breakpoint test.

	2016	2017	2018	2019	2020	2021	2022
Factor market	243.04	239.76	246.81	263.78	264.89 ^a	239.81	250.17
Fiscal channel	0.49	0.88	0.50	2.02	2.07 ^a	0.79	1.33
Credit market	0.11	0.49	0.37	0.50	0.64 ^a	0.03	0.07
Unsmoothed	0.66	1.81	2.27	3.23	3.60 ^a	0.58	0.77

^aMarks the most likely breakpoint. The year refers to the first year of the second regime (i.e., in column 1 only 2015 is part of regime 1, in the last column only 2022 is in regime 2).

movement of labor across the country severely impaired the main channel of risk sharing in China. The results of our analysis indicate that the government used the fiscal transfer system to compensate for the loss of mobility but more than a third of the income shocks during the pandemic remained unsmoothed.

While the COVID pandemic was a one-in-a-hundred-year event, the sluggish recovery of the Chinese economy in its aftermath indicates that such crises can have long-run economic consequences. The main lessons we can draw from our analysis are twofold. First, the government needs to be ready to step in decisively and mitigate income shocks through fiscal channels when market mechanisms are constrained by public measures. In the Chinese context, this could be achieved by reducing the reliance on stimuli focused on infrastructure investment and expanding means-tested transfers to vulnerable households that typically live in rural areas and rely on labor migration and remittances to share risk. The second policy recommendation is to continue the development of financial markets with the goal of expanding consumer lending in China. This would strengthen the role of capital markets in risk sharing, which is currently insignificant. Coincidentally, the expansion of the consumption-smoothing properties of the fiscal and capital market channels is in line with the objective of the Chinese government to achieve a transition from an investment-based to a consumption-driven economy.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

¹ We confirm this by restricting the 2014–2019 sample to the set of provinces available in the full sample (over the entire time period). In this specification, the estimated factor market contribution declines to 0.88.

² The time-varying parameter specification requires a balanced panel. Extending the sample period would therefore imply excluding provinces with incomplete data, some of which are particularly important for interprovincial labor mobility.

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SUPPORTING INFORMATION

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