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Fiscal Risk Sharing in China: Is It Significant and How to Further Improve It?

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Fiscal Risk Sharing in China: Is It Significant and How to Further Improve It?

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ABSTRACT: The COVID-19 pandemic has weakened the fiscal positions of local governments in China, while the recent stress in the Chinese property market has further compounded this issue, calling for stronger fiscal risk sharing among provinces. This paper examines the existing central to local governmental transfer system and its effect on interprovincial risk sharing and redistribution in China. We show that the fiscal transfers have played an important role in risk sharing although their main purpose is still redistribution. We also propose an alternative transfer mechanism with the size of transfers to each province linked to the shocks that the province is facing to enhance the fiscal risk-sharing effect. Using counterfactual simulations, we show that such an alternative mechanism can significantly enhance risk sharing among all provinces against idiosyncratic shocks while maintaining a comparable level of redistribution effect. Intergovernmental reforms and other structural measures could also be considered to further improve policy efficiency and effectiveness.

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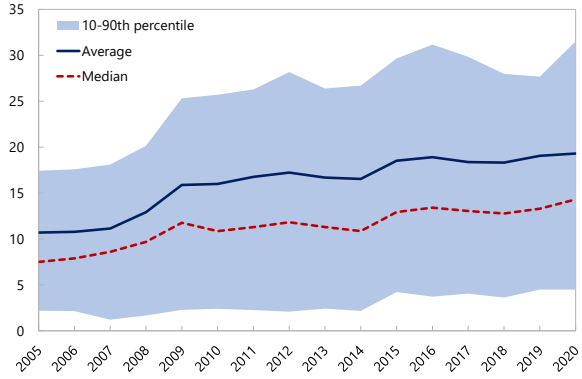
Introduction

The gap between the local revenues and expenditures of China's local governments (LGs) had been on an increasing trend in the last two decades before the COVID-19 pandemic (Figure 1.1). This gap, referred to as LG fiscal gap hereafter, mainly reflects the long-standing misalignment between LGs' limited revenue sources and high expenditure responsibilities. The literature has studied intensively the revenue-expenditure misalignment at the LG level (see, e.g., Wingender, 2018) in the context of China's exceptionally high fiscal decentralization given the five tiers of governments in China (see Box).

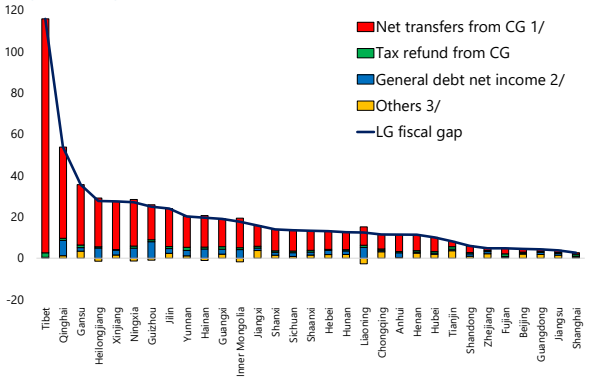
As a result, LGs in most provinces had been relying heavily on funding resources other than local tax and non-tax revenues to cover their own expenditures before the pandemic. In particular, transfers from the central government (CG) are one of the major sources of such funding, particularly for provinces with relatively large fiscal gaps (Figure 1.2). The CG transfers play an important role in redistributing fiscal resources from richer provinces to poorer ones to alleviate poverty and reduce income inequality, while at the same time also serves as a risk-sharing mechanism to channel more fiscal resources to LGs that are more affected by regional shocks from those that are less affected. Other key funding sources for LGs' general budget include tax refund from the shared tax revenues between CG and LGs, LG bond issuance (with quotas set by the CG), revenues from land sales, dividend transfers from local state-owned enterprise (LSOEs), and withdrawals of LG deposits.[1] Following Ma *et al*. (2016), we define the CG transfers in this paper as the net CG transfers excluding the tax refund.

Figure 1. China's LG Fiscal Gaps and Key Funding Sources

1.1. LG fiscal gaps had widened over time before COVID-19 pandemic
(In percent of provincial GDP)



1.2. Key funding sources for LG fiscal gaps: 2019
(In percent of provincial GDP, 2019)



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff calculations.
1/ Excluding tax refund from CG.
2/ Net income from LG general debt issuance deducted by principal repayment.
3/ Including transfers from other government accounts (e.g., specific-purpose bonds, revenues from land sales, LSOE dividend transfers, and deposit withdrawals) and the use of the fiscal balance from last year.

[1] Off-budget financing, such as debt issued by the local government financing vehicles (LGFVs), is excluded here. On dividend transfers from LSOEs to LG budgets, they are unlikely to be a major source for LGs' general budget financing during economic downturns, given that (i) LSOE profits tend to be procyclical and (ii) the transfers are still a self-insurance scheme which is less effective than CG transfers from a risk-sharing perspective (see below).

Box. China's Fiscal Structure and Transfer System

China has five tiers of government, resulting in an exceptionally high degree of fiscal decentralization. Subnational governments are in principle agents of the CG, tasked with carrying out national policy objectives within their own jurisdictions. Historically, subnational governments in China have had *de facto* a high degree of autonomy, partly because of the size and complexity of the country (Wingender, 2018). In addition to the CG, there are four levels of LGs, namely, provincial-level governments (31 in total), prefecture-level governments, county-level governments, and town governments. Out of the five levels, the county-level governments have the largest fiscal expenditure responsibilities and are also more reliant on transfers than the other levels of LGs.

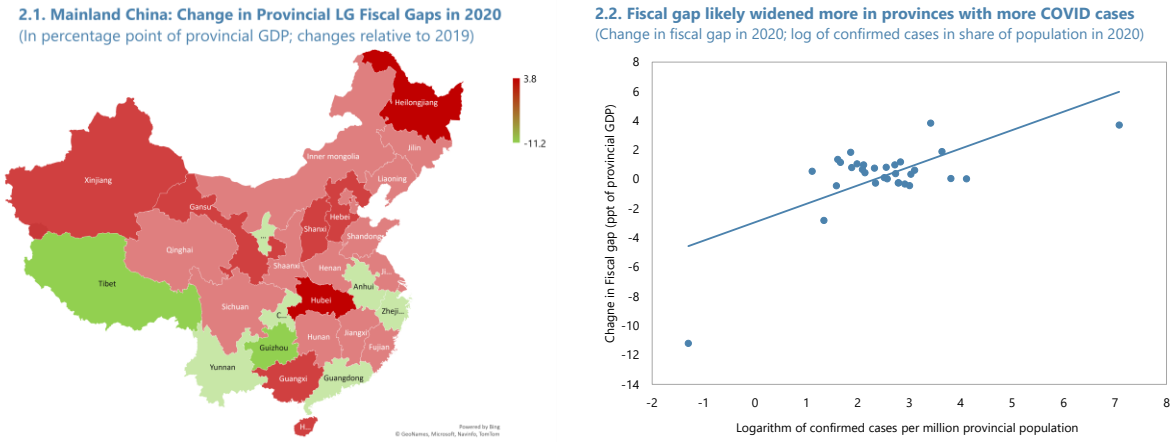
The last major intergovernmental reform was the reform of the "tax-sharing system" in 1994, after which a large misalignment between revenue allocation and spending responsibilities has emerged. The "tax-sharing system" has increased substantially the share of the central fiscal revenue in the national fiscal revenue, while LGs still assume more expenditure responsibilities. In order to fill the fiscal gap, the CG began to implement tax refund and transfers to LGs. The tax refund was large in the early stage of the tax-sharing system, while the initial transfers were small in scale. The situation has reversed as transfers increased over time while tax refund declined, and by 2020, the total tax refund was only about 15 percent of total transfers.

Continuous efforts have been made in recent years to reduce the revenue-expenditure misalignment across levels of governments. In August 2016, the State Council (SC) announced a major intergovernmental reform plan, aiming to i) clarify expenditure responsibilities to minimize overlapping mandates, improve service delivery and increase accountability; ii) recentralize key functions that are ill-suited to local government provision; and iii) consolidate and improve the transfer system, including by increasing the fiscal resources of less-developed regions (SC, 2016). Since then, the SC has announced further reforms to adjust the central-local government responsibilities, improve intergovernmental transfers, and reduce the regional disparity of pensions (SC, 2018a; SC, 2018b; SC, 2019a; SC, 2019b; SC, 2019c). These reforms gave the CG more expenditure responsibilities, especially in education, healthcare, and social security, and should also facilitate budgetary and accounting reforms and enhance the supervision of LG performance. However, despite these efforts, the LG fiscal gap remains large on average.

The COVID-19 pandemic has put more pressure on LG finances. In particular, the LG fiscal gap in percent of GDP widened in 23 out of the total 31 provinces in 2020 compared to their 2019 levels (Figure 2.1).[2] This suggests that most provincial governments needed more fiscal resources to cover their expenditures in 2020 amid shocks from the pandemic. There is also significant heterogeneity among provinces and, more specifically, those with more COVID-19 infections tended to have experienced higher increases in their fiscal gaps (Figure 2.2). For example, both Hubei and Heilongjiang provinces suffered significantly from relatively wider spread of the COVID-19 cases (as a share of their provincial population) in 2020, and their fiscal gaps widened significantly by over 3.5 percent of provincial GDP; while in contrast, Tibet, which was much less affected by the COVID-19 virus during 2020, experienced a significant decline in its fiscal gap in 2020, mostly driven by its continued GDP growth in 2020 despite lower revenues and higher expenditures.

[2] The term "LG fiscal gap" in this paper refers to the LG fiscal gap at the provincial level. It is also worth noting that a positive fiscal gap means a lower revenue than expenditure in this paper. Moreover, the fiscal gap would be largely closed if the transfers and tax refund from the central government are also included in LG revenues.

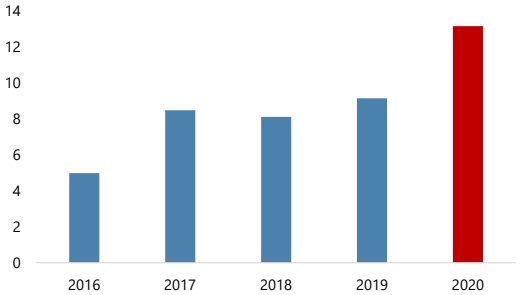
Figure 2. Mainland China: Change in LG Fiscal Gaps in 2020



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff calculations.

Despite increased CG transfers and LG bond issuance, the pandemic seemed to have still curtailed some LGs' ability to conduct countercyclical fiscal policy to support local growth. To mitigate the impact of the pandemic and support the recovery, the CG issued RMB2 trillion anti-epidemic special Treasury bonds with the proceeds fully distributed directly to lower-level LGs earlier than in normal years.[3] Overall, the CG transfers increased significantly in 2020 compared to previous years (see text chart).[4] Moreover, the CG also increased the quota for LGs' own special bond issuance in 2020 by 74 percent (or RMB1.6 trillion). These measures helped LGs address the widened fiscal gaps during the pandemic, but there were still signs that some LGs' ability to increase expenditures countercyclically in response to the pandemic was constrained. For example, as many provinces experienced lower fiscal revenues,[5] the expenditure growth has also declined—indeed, the average expenditure growth among all provinces declined to 3 percent in 2020 from the above-8 percent growth in 2018–19 and 4 provinces even had lower expenditures in 2020 than in 2019. This suggests that fiscal policy at the LG level is less countercyclical in terms of supporting the local economy amid the pandemic. Since CG transfers are a key source for LG financing, more LGs would have been forced to cut their expenditures during the pandemic without such transfers.

Growth of Total CG Fiscal Transfers in China
(Year/year percent change)



Sources: Ministry of Finance, China; CEIC; and IMF staff calculations.

The recent and ongoing property market stress in China has further added to the pressure on LG finances. As discussed above, many LGs have long been facing the structural fiscal gaps and have heavily relied on land sales for revenues and as collateral for off-balance sheet borrowing. The regulatory tightening in the property sector since 2020, which intended to contain the imbalances and risks in the property sector, has led a rapid

[3] To support the economy during the COVID-19 pandemic in 2020, the Chinese authorities introduced a new type of transfer scheme called special transfers, funded by the special Treasury bonds (see http://www.gov.cn/zhengce/2020-06/11/content_5518565.htm). The proceeds were transferred straight to the prefecture- and county-level LGs.

[4] As a result of the higher CG transfers, LGs' total revenues (including such transfers) have largely increased over the same period.

[5] 14 provinces experienced lower fiscal revenues amid the pandemic in 2020, compared to only 6 in 2019, and the average revenue growth among all provinces declined to -1.6 percent from 2.7 percent in 2019.

slowdown in new housing starts and housing investment, together with a sharp decline in LG land revenues (IMF, 2023). Falling land sale revenues have reduced LGs' fiscal capacity at the same time as LGFVs have also significantly increased land purchases. The new funding mechanism introduced by regulators for the completion of troubled unfinished housing projects could further increase the financing pressure for LGs: although the mechanism is funded by the CG, LGs must still backstop housing completion loans and several highly-indebted regions also have large stocks of unfinished housing. As documented in the literature, LG financing stress could also create significant fiscal risks for the CG, not only through affecting service delivery at its root but also by putting continuous pressure on central resources (see an overview of fiscal risks from subnational governments by Saxena, 2022).

Given the heterogeneity of the pandemic shocks and property market stress across provinces, the CG transfers can help channel more funding resources from provinces that are less affected to those that are more affected, thereby serving as a risk-sharing mechanism among provinces. Against this background, this paper examines to what extent the fiscal transfers in China have helped smooth the effects of regional shocks on regional income (income risk sharing) and whether there is room to further enhance the risk-sharing effect among provinces. This paper focuses on income risk sharing through the fiscal transfer channel, though empirical literature on fiscal federalism and risk sharing has also examined all the channels that helped smooth consumption, including fiscal policy and capital and credit markets (see, e.g., Asdrubali *et al*., 1996; Athanasoulis and Wincoop, 2001; Du *et al*., 2011; Furceri and Zdzienicka, 2015).

There has been extensive literature on risk sharing through fiscal transfers in advanced economies (AEs). However, the literature on China's fiscal risk sharing has been relatively limited and mostly relied on data before the intergovernmental framework reforms from 2016 onward. We contribute to the literature by providing updated estimates for the risk-sharing and redistribution effects of China's fiscal transfers using the latest data covering the first year of the pandemic, as well as proposing an alternative transfer mechanism that can achieve full insurance against idiosyncratic regional shocks without significant sacrifice of the redistribution effect. To disentangle the two effects, we use the two-step estimation approach of Bayoumi and Masson (1995) and Poghosyan *et al*. (2016) which features two separate regressions—a cross-sectional regression on average levels of regional variables (for the redistribution effect) and a panel data regression on changes of regional variables (for the risk-sharing effect). We also use the one-step approach proposed by Poghosyan *et al*. (2016) for robustness check, which mirrors the two-step approach but estimates both effects simultaneously in one step.

Using a provincial-level dataset spanning from 2006 to 2020, we find that the fiscal transfers in China have achieved significant redistribution and risk-sharing effects. In particular, we estimate that about 31 percent of permanent provincial shocks have been smoothed on average by the fiscal transfers in China (*redistribution* effect), which is higher than the estimates for many AEs in the literature. For the risk-sharing effect, we find that about 17 percent of idiosyncratic regional shocks have been smoothed by the fiscal transfers, which is broadly comparable with other major economies.[6] Moreover, we find that the fiscal risk-sharing effect in China has remained broadly stable over time, in contrast to the literature's finding for AEs where the effect has been on a

[6] This does not mean that China's existing fiscal transfer scheme is comparable to or as efficient as that in AEs, considering that China's fiscal transfers (relative to the country's total fiscal revenues) are significantly higher than its international peers (see the section on results). It is also worth noting that our estimated fiscal risk-sharing effect is higher than some earlier literature, for example, Du *et al*. (2011), who found that the effect of China's CG transfers on consumption risk sharing is smaller than that in the U.S. or euro area. This difference is likely due to the different focuses of the studies: Du *et al*. (2011) focused on consumption risk sharing while we focus on income risk sharing. The more updated data sample used in this paper (2006-20) could also make a difference.

declining trend. We also find that the fiscal risk-sharing effect is more prominent among the inland provinces, which tend to be less developed, and less significant in the more developed coastal provinces, likely reflecting the higher reliance of inland provinces on fiscal transfers. We also propose an alternative transfer mechanism that is automatic and non-regressive with transfers proportional to the size of the idiosyncratic provincial shocks—similar to the rule proposed by Furceri and Zdzienicka (2015) for euro area—and show that such a mechanism could significantly increase the interprovincial risk sharing while keeping the redistribution effect close to the actual level.

The rest of the paper is organized as follows. Section II discusses why risk sharing via the fiscal channel is important for China. Section III presents the econometric models for estimating both risk-sharing and redistribution effects and the data used in the estimation. Section IV presents the baseline results, with a comparison to the estimated effects in other countries in the literature, as well as the results with subsamples for different time periods and different regions in China. Section V proposes an alternative rule for fiscal transfers and conducts counterfactual simulations to estimate the risk-sharing and redistribution effects under the alternative rule. Section VI concludes the paper and discusses policy implications.

Fiscal Transfers and Risk Sharing

The benefits of risk sharing are widely recognized in developing and developed countries. For example, Townsend (1994) argued that individuals can potentially increase their income and consumption levels by sharing their idiosyncratic risks. However, evidence of full risk sharing is either limited or nonexistent, even among AEs, suggesting significant room for potential welfare gains (see, e.g., Backus *et al*., 1992; Bayoumi and Masson, 1995; Asdrubali *et al*., 1996; Furceri and Zdzienicka, 2015; Poghosyan *et al*., 2016).

A growing literature suggests that a well-functioning intergovernmental risking-sharing mechanism is important for member states or provinces of a fiscal federation. Member states or provinces in a fiscal federation forgo the benefits of flexible exchange rates as argued by Friedman (1953) in response to shocks hitting individual member states or provinces. However, a well-functioning fiscal transfer mechanism among member states or provinces can provide the benefits of pooling risks emanating from idiosyncratic shocks to individual members (Poghosyan *et al*., 2016). Such risk pooling can help smooth consumption paths at the local level, as regions that do better than normal during certain periods of time help insure those that are doing worse than normal. The case for fiscal risk-sharing would be stronger for currency unions like the euro area according to the optimum currency area (OCA) theory. Sharing the key OCA properties, including, in particular, fiscal integration and the mobility of labor and other production factors, could reduce the usefulness of nominal exchange rate adjustments within the currency union, as fiscal policy and mobility of production factors can help respond to idiosyncratic shocks (see, e.g., Mongelli, 2002 and Krugman, 2012).

In principle, fiscal transfers serve both redistribution and risk-sharing functions (see, e.g., Poghosyan *et al*., 2016). Redistribution is the transfer of funds from structurally richer to poorer regions to help convergence of regional living standards to the national average. Risk sharing entails the provision of funds to smooth out (or insure against) the impact of temporary idiosyncratic regional shocks. While self-insurance via unrestricted LG borrowing would also enhance LGs' ability to smooth fiscal spending over time, debt financing will be less effective than a transfer-based mutual insurance system in the presence of Ricardian households and potentially more significant increases in risk premia of fiscally weaker LGs with higher debt burdens when facing idiosyncratic shocks (see, e.g., Farhi and Werning, 2017 and Berger *et al*., 2019). Higher fiscal risk

sharing also implies a more effective fiscal policy at the aggregate level: by spreading the burden of idiosyncratic shocks across the country, CG transfers could provide more fiscal support to the most affected regions to maximize the growth impact of fiscal policy at the national level as multipliers tend to be higher where output gaps are the largest. Therefore, fiscal transfers within a large and economically diverse nation such as China have the potential to increase the effectiveness of fiscal policy as a stabilization tool and enhance risk sharing across regions.

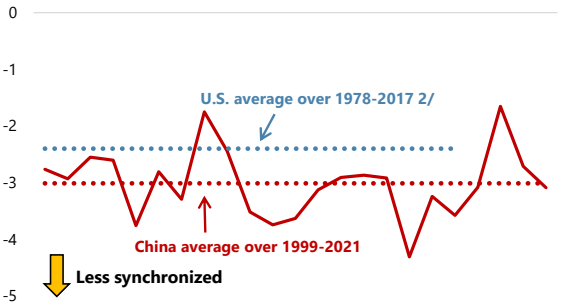
Other ways to provide insurance against idiosyncratic shocks may also help but could be constrained, particularly during periods of stress. Bond issuance or borrowing from credit markets by LGs themselves could provide intertemporal insurance against such shocks, but is essentially an intertemporal re-allocation of regional fiscal spending and hence less desirable than an intergovernmental risk-sharing mechanism, even in a setting with complete financial markets (see, e.g., Farhi and Werning, 2017 and Berger *et al*., 2019). This is partly because, in the presence of Ricardian households, fiscal multipliers could be higher with intergovernmental risk sharing, as these households understand that the transfers are essentially insurance payouts, and hence are not debt financed and do not need to be repaid. In addition, intergovernmental risk sharing could also help lower overall government borrowing costs—as CG can typically borrow at better terms from markets than individual LGs—and lead to potentially positive interregional spillovers from stabilization measures in one region to another and hence better fiscal policy coordination. Moreover, a pre-announced and well-functioning intergovernmental risk-sharing mechanism could limit the increase in the risk premia of the most-affected LGs amid local economic downturns (due to, for example, the flight to safety in periods of stress), as markets understand that these LGs are insured against such shocks through the mechanism. This is particularly important for fiscally weaker LGs that suffer from debt sustainability concerns: without intergovernmental risk sharing, the borrowing costs of fiscally weaker LGs would likely increase more due to the higher risk premia, which will likely constrain the borrowing ability of these provinces and limit the role of LG bond issuance in supporting countercyclical fiscal policy.

Some of the other self-insurance measures such as transfers from LSOEs are likely to be procyclical and hence constrained during local economic downturns. Weaker LGs, local banks and LSOEs hit by idiosyncratic regional shocks could all face higher risk premia and borrowing costs at the same time, leading to a self-fulfilling vicious cycle among these entities (IMF, 2021a). Risk sharing by private sector themselves can also be limited in China: the ability of households and privately-owned corporates to smooth regional shocks would depend on their access to credit markets and the mobility of factor markets (labor and capital). In fact, literature has found that the extent of private sector's risk sharing through financial intermediaries and capital markets is still very limited in China (see, e.g., Du *et al*., 2011). LGs have also increasingly resorted to revenues from land sales to finance their growing deficits (Wingender, 2018), but such land financing is less sustainable and has long been criticized for contributing to the rapid development of LG financing vehicles and higher house prices (see, e.g., Lu and Sun, 2013; Pan *et al*., 2015).

Although the fiscal transfer system is less subject to these concerns, it can come with moral hazard. Some studies have argued that intergovernmental risk sharing provides implicit bailout guarantees to LGs and reduces the incentives for LGs to implement good policies. This could worsen the fiscal position of LGs and, over time, increase their vulnerability to macroeconomic shocks. Other concerns include that it is difficult to design a federal fiscal system that would exclusively minimize the variability of regional income without leading to a systematic redistribution of income from rich to poor regions (Poghosyan *et al*., 2016). In other words, the fiscal risk-sharing effect would have to come together with the redistribution effect.

In China's case, first of all, similar to many other federal countries, China also has a strong need for interprovincial risk sharing. Despite the significant economic development and poverty reduction in China since 1978, unbalanced development among urban, rural, and regional population persists, leading to regional income inequality that may be becoming serious (Chen *et al*., 2016; Lu *et al*., 2019; Li *et al*., 2021). Moreover, given the large size and geographical diversity of the Chinese territory, there could be significant heterogeneity in local business cycles at the provincial level due to the different types of shocks that each province faces, including from natural disasters. In fact, provincial business cycles have been less synchronized in China compared to the U.S. A standard measure of cyclical synchronization used in the literature (see, e.g., Giannone *et al*., 2010 and Furceri *et al*., 2020) is the cross-sectional average of the pairwise difference between provincial GDP growth rates. The calculated measures for China and the U.S. show that the average divergence of provincial GDP growth has been, on average, higher in China during the last two decades, compared to the historical level of the U.S. (see text figure).

China: Business Cycle Synchronization 1/
(In percent)



Sources: National Bureau of Statistics of China; CEIC; and IMF staff calculations.
1/ The figure shows the average provincial business cycle synchronization among all 31 provinces of Mainland China (blue line), measured as the cross-sectional average of pairwise synchronizations. A zero value indicates a complete synchronization.
2/ The average business cycle synchronization measure across the U.S. states averaged over the sample period of 1978-2017 (see Furceri *et al*., 2020).

However, the primary objective of China's existing fiscal transfer system is to reduce the disparities of fiscal resources among provinces—that is, redistribution (Ma *et al*., 2016). The fiscal transfers from the CG budget in China can be classified into two broad types: general and specific-purpose transfers.[7]

- *General transfers* are mainly to support fiscally weak provinces and equalize the fiscal resources among regions. According to the Chinese authorities' definition, this type of transfers include: (i) the tax refund, which was designed to compensate LGs for lost revenues after the 1994 and 2001 tax reforms,[8] (ii) the equalization transfer, which was established in 1995 to reduce the disparities of fiscal resources among provinces, and (iii) other general transfers mainly used to finance pension and social security obligations, government wages, and public education. The general transfers have been increasing over time and accounted for over 80 percent of total transfers in 2020. They have been governed by an automatic rule since 2008, which was designed to take into account both standardized expenditures and revenues of provincial governments (MOF, 2008). However, the rule still aims to equalize fiscal resources among regions and does not explicitly or adequately account for regional business cycles for the risk-sharing purpose.[9] Moreover, although the rule itself is publicly available, it is not fully clear how the rule is used in the calculation of the actual final transfers from the CG to each province.

[7] The new type of transfer scheme introduced in 2020, i.e., the special transfers, is also included in our empirical analysis.

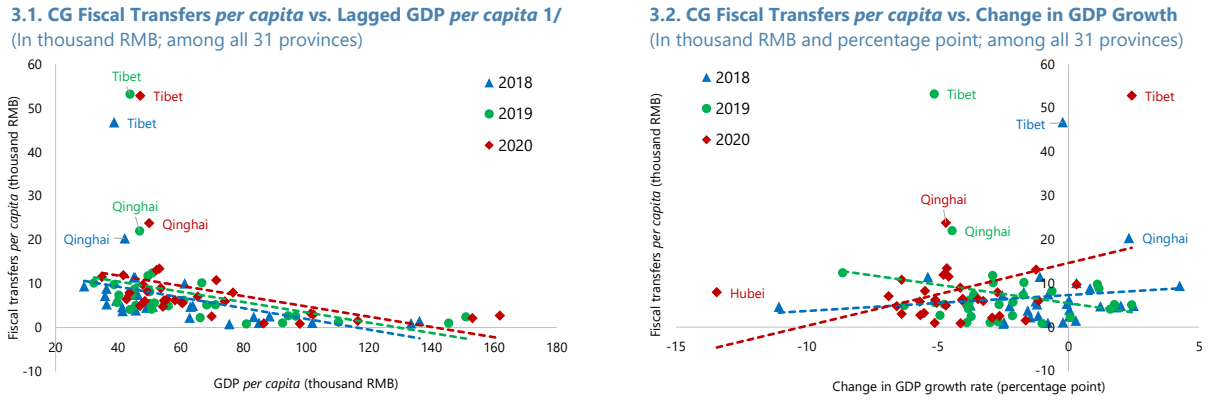
[8] Following Ma *et al*. (2016), the term "fiscal transfers" in this paper refers to the net fiscal transfers that exclude tax refund (as tax refund is shared tax revenues transferred from CG to LGs), unless otherwise specified.

[9] The SC has issued several notices since 2008 to reform and improve the administration of CG transfers (see, e.g., SC, 2014), but risk sharing among provinces was not an explicit objective.

- *Specific-purpose transfers* are also called conditional transfers, mainly to subsidize local programs to achieve specific policy goals, and in certain cases, are subject to matching requirements by recipient LGs. This type of transfers have been governed by the administrative measures issued by the Ministry of Finance (MOF) in 2015 (MOF, 2015), which include some guiding principles: (i) the budgeted size of specific-purpose transfers to each province should be at least 70 percent of last year's specific-purpose transfers to that province, and (ii) the relatively stable part of the budgeted specific-purpose transfers should be at least 90 percent of last year's level while the remaining part should be based on the planned projects for the next year. However, the system is perceived as opaque and overly complex (Wingender, 2018), with the calculation of the budgeted or final transfer amount to each province largely unavailable to the public. Administrative costs are also high both at central and local levels (Shah, 1999; World Bank and DRC, 2014).

Even during the pandemic in 2020, China's fiscal transfers seemed to be still mainly about redistribution. In particular, the fiscal transfers from CG to provinces in *per capita* terms in 2020 continued to be negatively correlated with the development level of each province (measured by the provincial GDP *per capita*), similar to previous years (Figure 3.1). This means that poorer provinces continued to receive higher transfers in 2020, pointing to the redistribution effect. At the same time, the fiscal transfers did not seem to exhibit a strong countercyclical feature. In fact, the fiscal transfers in *per capita* terms in 2020 were weakly positively, rather than negatively, correlated with the change in provincial GDP growth rate in 2020, while the correlation in 2018 was weakly negative (Figure 3.2). This suggests that provinces that experienced larger declines in GDP growth in 2020—due to, for example, larger shocks from the pandemic—received lower fiscal transfers in *per capita* terms, which appears inconsistent with an active countercyclical role and points to a less prominent risk-sharing effect. This suggests room for increasing the risk-sharing effect of fiscal transfers to increase the effectiveness of fiscal policy as a stabilization tool, as fiscal transfers with a more active risk-sharing role could help mitigate the impact of idiosyncratic regional shocks and stabilize local economies (see, e.g., Furceri and Zdzienicka, 2015; Poghosyan *et al*., 2016).

Figure 3. CG Fiscal Transfers and Provincial GDP



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff calculations.
1/ Lagged GDP *per capita* is used in the chart as a measure of the development level of each province to avoid including the impact of fiscal transfers on the current year's GDP *per capita*.

Empirical Strategy & Data

We use the two-step estimation approach, following Bayoumi and Masson (1995) and Poghosyan *et al*. (2016), to estimate the effects of CG transfers on redistribution and risk sharing in China. This approach features two separate regressions: a cross-sectional regression on average levels of regional variables (for the redistribution effect) and a panel data regression on changes of regional variables (for the risk-sharing effect). The regression model can be specified as the following two-step province-level regressions:

$$\left(\frac{\overline{YD_i}}{\overline{\overline{YD}}}\right) = \alpha + \beta_{redist}\left(\frac{\bar{Y}_i}{\bar{\bar{Y}}}\right) + \varepsilon_i \quad (1)$$

$$\Delta\left(\frac{YD_{it}}{\overline{YD_t}}\right) = \alpha_i + \beta_{risk-sharing}\Delta\left(\frac{Y_{it}}{\bar{Y}_t}\right) + u_{it} \quad (2)$$

where i and t indices denote province and year, respectively. α_i is the province-specific fixed effect, and ε_i and u_{it} are the *i.i.d*. error terms of the cross-sectional and panel regressions, respectively. YD_{it} is the post-transfer provincial disposable income after accounting for the net fiscal transfers, and Y_{it} is the pre-transfer aggregate provincial income.[10] Following Du *et al*. (2011), the pre-transfer aggregate provincial income is defined as the sum of the total income of provincial residents and LG income before taxes and fiscal transfers. $\overline{YD}_t$ and $\bar{Y}_t$ are national averages of respective variables in year t, $\overline{YD}_i$ and $\bar{Y}_i$ are averages of respective variables over the sample period in province i, and $\overline{\overline{YD}}$ and $\bar{\bar{Y}}$ are national averages of the respective variables over both the sample period and provinces.[11] All variables are in real *per capita* terms, deflated by provincial CPI. The difference between YD_{it} and Y_{it} captures the fiscal transfers from the CG to province i in year t. The first step (1), which is a cross-sectional regression, estimates the redistribution effect while the fixed-effects panel regression in the second step (2) estimates the risk-sharing effect. As noted by Poghosyan *et al*. (2016), the panel regression (2) uses the changes of province-specific incomes relative to the national average, which filter out the impact of long-run trends in both variables.

The coefficients β_{redist} and $\beta_{risk-sharing}$ are directly linked to the redistribution and risk-sharing effects, respectively. The slope coefficient from the first regression is used to measure the redistribution effect ($1 - \beta_{redist}$). It is obtained from the cross-sectional relationship between province-specific mean values of provincial incomes relative to the national average, which are free from short-term fluctuations driven by idiosyncratic shocks. The slope coefficient from the second regression is used to measure the risk-sharing effect ($1 - \beta_{risk-sharing}$). It is obtained from the fixed-effects panel regression of changes of province-specific incomes relative to the national average, which filters out the impact of long-term trends in both variables.

Since provincial disposable incomes are likely to be correlated across provinces and autocorrelated over time, the usual robust standard errors in the second-step regression could be potentially biased. To address this issue, we also use the two-way cluster robust standard error with clustering by province and year as well as the

[10] Unlike the studies on risk sharing for AEs, we do not use provincial GDP as the measure of Y_{it} due to our interest in the effects of fiscal transfers alone and the potential statistical issues with China's provincial GDP discussed by, for example, Ma *et al*. (2014). Instead, we follow Du *et al*. (2011) and use the aggregate provincial income as the measure of Y_{it}.

[11] As noted by Poghosyan *et al*. (2016), the regressions control for the stabilization effect by demeaning the variables used in the regressions and estimate the impact of fiscal transfers on risk sharing and redistribution.

Driscoll-Kraay standard error developed by Driscoll and Kraay (1998), which is robust to heteroskedasticity, autocorrelation, and cross-sectional dependence.

As a robustness check, we also apply the one-step estimation approach proposed by Poghosyan *et al*. (2016). This one-step approach mirrors the two-step approach but estimates the effects of redistribution and risk sharing jointly using the pooled mean group (PMG) estimator of Pesaran *et al*. (1999). This approach is potentially more efficient because it combines the high and low frequency information in the data, but typically also requires both a large cross-sectional sample size and long time series.[12] The model can be specified by the following fixed-effects panel regression:

$$\Delta\left(\frac{YD_{it}}{\overline{YD}_t}\right) = \phi_i\left(\frac{YD_{i,t-1}}{\overline{YD}_{t-1}} - \alpha - \beta_{redist}\frac{Y_{i,t-1}}{\bar{Y}_{t-1}}\right) + \beta_{risk-sharing}\Delta\left(\frac{Y_{it}}{\bar{Y}_{t-1}}\right) + \mu_i + \varepsilon_{it} \quad (3)$$

where μ_i is the province-specific fixed effect and ε_{it} is an *i.i.d*. error term. The coefficient ϕ_i is the speed of adjustment of the relative post-transfer disposable income to its long-run equilibrium value. In other words, the magnitude of this coefficient illustrates the dynamic effect of fiscal transfers: the larger is the absolute value of this coefficient, the faster is the adjustment of the relative post-transfer disposable income to its long-run equilibrium value facilitated by the fiscal transfers (Poghosyan *et al*., 2016).

We construct a dataset for the regressions using annual provincial fiscal and macroeconomic data spanning from 2006 to 2020, which covers the first year of the COVID-19 pandemic. The key variables in the regressions above are the aggregate provincial income and net CG transfers. Following Du *et al*. (2011), the pre-transfer aggregate provincial income is calculated as the sum of the household disposable income (excluding transfer income from both private and public sources), LG revenue, LG extrabudgetary revenue, and CG tax refund.[13] The post-transfer disposable provincial income is calculated as the sum of the pre-transfer aggregate provincial income and the net CG transfers. Appendix I provides a detailed description of the dataset and data sources. Following Du *et al*. (2011), we approximate the pre-transfer aggregate provincial income by the sum of disposable household income, LG budgetary fiscal revenue, and LG extra-budgetary revenue, and then derive the *per capita* provincial income by dividing the provincial aggregate value by the provincial population. The net CG transfers to each province are calculated by subtracting the tax refund (from the CG to that province) and the transfers turned over (from that province) to the CG from the gross CG transfers. Detailed descriptions of the dataset are available in Annex I.

Results

We take the regression results from the two-step approach as our baseline results. Figure 4 presents the estimated risk-sharing and redistribution effects based on the two-step approach. In particular, the first bars in Figures 4.1 and 4.2 show the baseline estimates of $(1 - \beta_{risk-sharing})$ and $(1 - \beta_{redist})$, respectively, for the full

[12] As the large N and large T assumptions may not be satisfied for all the specifications of our regression model, some of the one-step estimation results in the next section should be interpreted with caution.

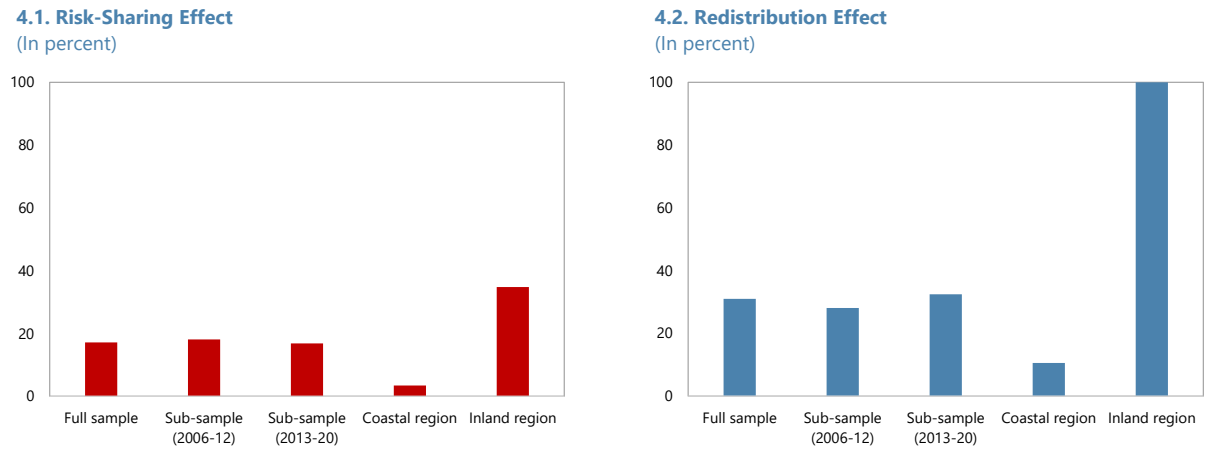
[13] The transfer income is excluded from the household disposable income to avoid double counting, as part of the transfer income comes from the CG fiscal transfers. It is also worth noting that the LG extrabudgetary revenue has been largely brought on LG balance sheet since 2011 (MOF, 2010).

sample of 2006-20. Solid bars indicate that the estimates are statistically significant at the one-percent level.[14] Detailed regression results for the full sample are shown in Annex II – Table 1.

The first bar in Figure 4.1 suggests a significant risk-sharing effect of fiscal transfers in China. In particular, the coefficient for the risk-sharing effect, $\beta_{risk-sharing}$, is estimated to be 0.83 under the two-step approach which is statistically significant at the one-percent level (see Annex II – Table 1), suggesting a risk-sharing effect of 17 percent. This implies that the disposable income of a given province would fall by 83 cents in response to a temporary 1-RMB decline in its aggregate pre-transfer income relative to the national average. The remaining 17 cents are smoothed out by the fiscal transfers. The results using the two-way cluster robust and Driscoll-Kraay standard errors (see Annex II – Table 1) suggest the same findings as the baseline results with the robust standard errors.

The estimated risk-sharing effect appears higher than some earlier literature that examined China's fiscal risk-sharing effect: for example, Du *et al*. (2011) found that the effect of fiscal transfers on consumption risk sharing was only about 9 percent using a data sample of 1980-2007 (see Table). Our higher estimate was likely due to—apart from the more updated data sample used in this paper (2006-20)—the fact that our main interest is the fiscal effects on both income risk sharing and redistribution given the important role of China's fiscal transfers in income redistribution, while Du *et al*. (2011) was mostly interested in understanding the fiscal and non-fiscal channels for consumption risk sharing.

Figure 4. Estimated Risk-Sharing and Redistribution Effects of Fiscal Transfers 1/



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff estimates.
1/ The estimates shown in the figure are the average estimates from the two-step estimation approach. Solid bars denote statistical significance at the 1-percent confidence level. A 100-percent redistribution effect means that the estimated redistribution coefficient in the second step is statistically insignificant at the 10-percent confidence level.

For the redistribution effect, the first bar in Figure 4.2 shows a larger effect than the risk-sharing effect. More specifically, the coefficient for the redistribution effect, β_{redist}, is estimated to be 0.69 (statistically significant at the one-percent level) under the two-step approach, suggesting that the redistribution effect is 31 percent. This implies that a province with a 1-RMB permanently lower aggregate pre-transfer income relative to the national

[14] It is worth noting that, as shown in Annex II – Tables 1-3, the three different standard errors (i.e., robust, two-way clustering robust, and Driscoll-Kraay standard errors) all produce the same level of statistical significance for the estimates shown in Figure 4.

average (as a result of a permanent provincial shock) would have a disposable income that is only 69 cents below the national average, with the remaining 31 cents smoothed out by the fiscal transfers.

Results for sub-periods

As China has gone through a series of fiscal reforms including the introduction of the new budget law in 2014 and the guidance from the SC to improve the administration of fiscal transfers, an interesting question is whether the respective effects of the fiscal transfers on risk sharing and redistribution are increasing or decreasing. We assess this issue by examining whether the two effects vary between two different sub-periods. More specifically, we split the full sample into two non-overlapping sub-periods with a similar number of years: 2006-12 and 2013-20. The estimated effects using the two-step approach are shown in Figure 4 (the second and third bars) and the detailed estimates are reported in Annex II – Table 2.

The estimates suggest that the fiscal risk-sharing effect has remained broadly stable over time: 18 percent during 2006-12 and 17 percent during 2012-20. Meanwhile, the redistribution effect has increased from 28 percent in the first sub-period to 32 percent in the second sub-period. This likely reflects the increased emphasis of fiscal transfers on equalizing fiscal resources across regions (redistribution) rather than stabilizing regional business cycles (risk sharing).

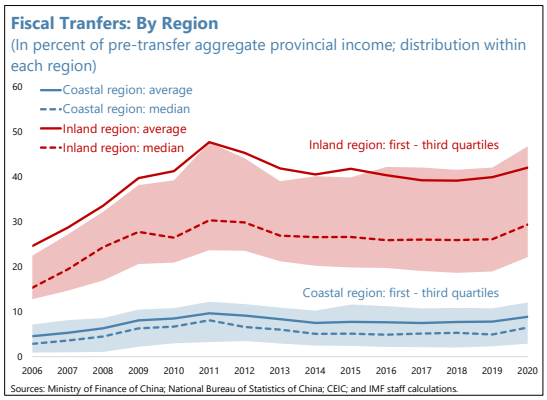
The finding that the risk-sharing effect has remained broadly stable across the two sub-periods is different from the finding in IMF (2021b), which used the same approach but a less updated dataset for 2006-18 and found that the fiscal risk-sharing effect increased during the second half of the sample period (2012-18). This difference likely reflects the fact that our more updated dataset also covers 2020, the first year of the pandemic, when the fiscal transfers seemed to be mainly about redistribution of fiscal resources and provinces with larger declines in GDP growth in 2020 tended to receive lower fiscal transfers in *per capita* terms as shown in Figure 3. This confirms our earlier observation that there could be room to increase the fiscal risk-sharing effect during the pandemic.

Results for sub-groups

China is characterized by an uneven pattern of regional development (see, e.g., Ma *et al*., 2016). An interesting question is thus whether the benefits from fiscal risk sharing are also unequally distributed across provinces. To tackle this question, we split the 31 provinces in our sample into two groups (i.e., the more developed coastal region and less developed inland region) and compare the amount of income risk sharing between the two. Following Du *et al*. (2011), we include 11 provinces (Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang) in the coastal region and the remaining 20 provinces are included in the inland region. The latter region has continued to lag behind the former in terms of its degree of marketization and economic development. The estimated risk-sharing and redistribution effects using the two-step approach are shown in Figure 4 and the detailed estimates are reported in Annex II – Table 3.

Clearly, the fiscal transfers' risk-sharing and redistribution effects are both considerably larger in the inland region than in the coastal region. More specifically, the risk-sharing effects are estimated at about 35 and 3 percent for the inland and coastal regions, respectively. For the redistribution effect, the inland region has 100 percent, meaning that permanent provincial shocks are completely smoothed out by the fiscal transfers, while the effect is only 11 percent in the coastal region. It is worth noting that these estimates are obtained by using the averages within each group or region for $\overline{YD_t}$, $\overline{Y_t}$, $\overline{\overline{YD}}$, and $\overline{\overline{Y}}$ in the two-step regressions. If we instead use

the national averages for each group, the qualitative result that the risk-sharing and redistribution effects are larger in the inland region than in the coastal region still holds, but with much smaller differences: 25 percent risk-sharing effect in the inland region vs. 15 percent in the coastal region and 100 percent redistribution effect in the inland region vs. 21 percent in the coastal region.



This finding is in line with the observation that the less developed inland provinces are more dependent on the fiscal transfers for both risk sharing and redistribution. For the coastal provinces, they have better-functioning non-fiscal channels (e.g., more developed financial intermediaries and markets) for risk sharing as well as better self-insurance capacity on average (reflecting their more developed local economies), which may suggest less need for risk sharing through the fiscal channel. Fiscal redistribution is also less needed in these more developed coastal provinces, which are in fact the major source of tax revenues for the CG (Du *et al*., 2011). That said, our finding contrasts with some earlier results in the literature: Du *et al*. (2011) found that the consumption risk sharing through fiscal transfers was larger in the coastal region vis-à-vis the inland region during 1980-2007. They attributed the smaller risk-sharing effect of fiscal transfers in the inland region primarily to the small size of fiscal transfers during their sample period, which are far from sufficient to provide an adequate degree of risk sharing for residents of the inland provinces. However, this was no longer the case during our more recent sample period, as the *per capita* fiscal transfers in percent of the *per capita* pre-transfer provincial income have increased rapidly in the inland region and remained much higher than in the coastal region, with the median rising from 15 percent in 2006 to 29 percent in 2020 (see text figure).

Comparison with other countries

The estimates for the fiscal risk-sharing and redistribution effects in the literature also vary considerably, even for AEs (see Table).[15] For example, for the U.S., the estimated risk-sharing effect in the literature ranges from 4 percent to 30 percent, while the redistribution effect is between 16 and 22 percent. Broadly speaking, our estimates for China's fiscal risk-sharing effect of 17 percent is within the range for AEs, although the redistribution effect of 31 percent is on the high end. However, this does not mean that China's existing fiscal transfer scheme is comparable to or as efficient as that in AEs, given that the fiscal transfers in China (relative to the country's total fiscal revenues) are significantly higher than its international peers. Indeed, according to Zhang (2012) and Joumard and Kongsrud (2003), China's fiscal transfers (including tax refund) accounted for 36 percent of the total fiscal revenues of the whole country in 2010, while the number was only roughly 10 percent for OECD countries in 2001 and 17, 3, and 4 percent for India, Argentina, and Brazil, respectively, in 1997. This suggests that, despite having a similar overall fiscal risk-sharing effect, the efficiency of the risk-sharing effect in China could be lower than that in many AEs.

The large variation in the estimated fiscal risk-sharing effect for AEs could be due to the different sample periods and methodologies used in estimation. In fact, there is consensus that the fiscal risk-sharing effect has

[15] It is worth noting that some of the literature cited in the table, e.g., Athanasoulis and Wincoop (2001) and Du et al. (2011), examined consumption risk sharing through all channels including fiscal transfers as mentioned above.

generally declined over time in the U.S., likely due to an increased harmonization of regional business cycles and better functioning interregional financial markets (Poghosyan *et al*., 2016). Interestingly, in contrast to the observation that the effect has broadly declined in these advanced economies over time, likely due to an increased harmonization of regional business cycles and better functioning interregional financial markets (Poghosyan *et al*., 2016). In contrast, our estimates for the fiscal risk-sharing effect in China have remained stable between the two sub-periods of 2006-12 and 2013-20, which is in line with the continued divergence in China's regional business cycles (see the text figure on China's business cycle synchronization).

Table. Comparison with Estimated Fiscal Risk-Sharing Effects in AEs

Country	Sample period	Risk-sharing effect	Redistribution effect
China: two-step approach (this paper)	2006–2020	17%	31%
China: Du *et al* . (2011)	1980–2007	9%	
U.S.: Bayoumi and Masson (1995)	1969–86	30%	22%
U.S.: Athanasoulis and Wincoop (2001)	1963–90	10-20%	
U.S.: Melitz and Zumer (2002)	1977–92	20%	16%
U.S.: Poghosyan *et al* . (2016) (average of two-step and one-step approaches)	1998–2010	8%	21%
U.S.: Furceri *et al* . (2020)	1998–2017	4%	
Canada: Bayoumi and Masson (1995)	1965–88	17%	39%
Canada: Obstfeld and Peri (1998)	1971–95	13%	53%
Canada: Melitz and Zumer (2002)	1965–88	10-15%	16%
Canada: Poghosyan *et al* . (2016) (average of two-step and one-step approaches)	1992–2009	6%	25%
U.K.: Goodhart and Smith (1993)	1966–88	21%	21%
U.K.: Melitz and Zumer (2002)	1971–93	20%	26%

Source: Authors, based on the literature search.

Robustness

As a robustness check, we also apply the one-step estimation approach to the full sample and the two-step approach to the pre-COVID sample (2006-19). The detailed estimation results are reported in Annex II – Table 4.[16] For the one-step approach following Poghosyan *et al*. (2016), we run two regressions, i.e., one without a trend term and one with a trend term, to capture the possibly different long-run relationships. Similar to the baseline results from the two-step approach, the one-step approach also produces a significant fiscal risk-sharing effect, with the coefficient $\beta_{risk-sharing}$ estimated to be 0.82 in both regressions (without and with trend), which is statistically significant and close to the estimate of 0.83 in the baseline regressions. For the redistribution effect, the two-step approach produces a smaller effect: 28 percent in the regression without trend and 23 percent in the regression with trend, with an average of 26 percent, slightly below the estimate of 31 percent in the baseline regressions. That said, our baseline results remain unchanged qualitatively. Moreover, the results for the pre-COVID sample are close to those for the full sample, with the risk-sharing effect at 14 percent—slightly below the 17 percent in the full sample—and the redistribution effect the same as in the full sample (31 percent).

[16] The one-step approach is not applied to the sub-samples given the large N and large T assumptions of the PMG estimator.

An Alternative Transfer Mechanism & Counterfactual Simulations

As shown in literature, a well-designed fiscal transfer mechanism could achieve higher, even full fiscal risk sharing. For example, Furceri and Zdzienicka (2015) constructed a supranational fiscal risk-sharing mechanism based on a non-regressive and automatic transfer rule for the euro area and showed that such a mechanism could achieve higher risk sharing. In a similar vein, we propose the following alternative transfer rule for China:

$$T_{it} = 0, \qquad if\ \varepsilon_{it} \geq 0$$
$$T_{it} = |\varepsilon_{it}| * \frac{GDP_{it}}{\sum_i GDP_{it}} * \tau * T_t^{Total}, \qquad if\ \varepsilon_{it} < 0$$

where ε_{it} are the shocks for province i in year t, τ is a parameter which is constant for all provinces, and T_t^{Total} is the total transfers in year t. In other words, the transfers to province i in year t (T_{it}) are a function of three factors: (i) the size of the provincial shock, (ii) the relative size of the provincial economy measured by the provincial GDP,[17] (iii) the size of the total transfers, and (iv) a constant parameter (τ) to calibrate the total size of the alternative transfers. For provinces with positive shocks in year t, they do not receive any transfers in that year.[18] It may seem impractical that the size of transfers in year t would depend on the GDP outturn in the same year; however, the transfers can be settled in the next year when provincial GDP data are released, as long as the rule itself is explicitly and publicly available. That said, implementing the alternative rule could be still challenging given that the existing transfer system in China still largely focuses on redistribution (see above). Following Furceri and Zdzienicka (2015), the provincial shocks are derived from the following simple regression, estimated province by province:[19]

$$\Delta log(GDP_{it}) = \alpha_i + \sum_{j=1}^{2} \beta_{ij} \Delta log\left(GDP_{i,t-j}\right) + \varepsilon_{it} \qquad (4)$$

In order to examine how this alternative transfer mechanism would perform relative to the actual transfers, we simulate two counterfactual scenarios and estimate the associated risk-sharing and redistribution effects of this alternative rule:

- *The first scenario* assumes that the CG cannot borrow additional funds intertemporally (relative to the total actual transfers) for any year in our sample period, so that the total transfers based on the alternative rule in any year cannot exceed the total actual transfers in that year. In other words, the total size of the alternative transfers is constrained to be less than or equal to the total size of the actual transfers for each year during our sample period of 2006-20. In this scenario, the CG is allowed

[17] One caveat of using provincial GDP in the alternative transfer rule is that provincial GDP could be potentially subject to statistical issues as discussed by, e.g., Ma *et al*. (2014). Therefore, we also use aggregate provincial income instead of the provincial GDP in the alternative transfer rule, which does not change the results qualitatively.

[18] It is worth noting that the definition of full risk sharing in this paper follows earlier literature such as Poghosyan *et al*. (2016) and Furceri and Zdzienicka (2015) and only refers to full insurance against negative idiosyncratic shocks. In other words, a transfer mechanism that can achieve full risk sharing would smooth all negative idiosyncratic shocks but not positive shocks. As a result, there is no need to make transfers to provinces that experience positive shocks in any given year.

[19] As argued by Furceri and Zdzienicka (2015), two alternative measures of shocks, i.e., local output gap and growth deviations from historical averages, tend to be serially correlated and generate redistributive effects.

to choose a different parameter τ for each year to maximize the transfers that it can deploy, which implies that the total transfers under the alternative rule in each year would be equal to the total actual transfers in that year. Although this could potentially achieve higher risk-sharing and redistribution effects than the case where the CG has to choose the same τ for all the years, this would make the alternative transfer rule less stable and predictable over time.[20]

- *The second scenario* assumes that the CG could borrow additional funds (i.e., common borrowing) or save part of the actual transfers intertemporally over the years in our sample period.[21] This implies that only the total size of the alternative transfers over the entire sample period 2006-20 (rather than each year) is constrained by the total actual transfers over the same period.[22] In other words, the total transfers under the alternative mechanism in each year can be higher or lower than the actual transfers in that year. In this case, the CG can choose the same τ for all the years, making the alternative transfer rule more stable and predictable over time.

Clearly, these two scenarios would imply different fiscal transfers for the same province in the same year. In the first scenario (Scenario 1), the total fiscal transfers in any given year would be the same as the total actual transfers in that year. For each year of our sample period, we can compute the year-specific parameter τ that makes the total alternative transfers equal to the total actual transfers, based on each province's GDP share, the total actual transfers, and the estimated shocks for each province from equation (4). In the second scenario (Scenario 2), we would need to find a time-invariant parameter τ that makes the total alternative transfers over the entire sample period equal to the total actual transfers during the same period (both in real terms).

Figure 5.1 shows the calculated total alternative transfers for each year in both scenarios, expressed in percent of the total GDP of all provinces in that year. As mentioned above, the total alternative transfers in the first simulation scenario are the same as the total actual transfers. Interestingly, the total alternative transfers in the second simulation scenario exhibit more volatility over time, reflecting the flexibility that the CG can borrow intertemporally to smooth regional shocks. In particular, since the outbreak of the COVID-19 pandemic, many provinces were hit hard, leading to a significant increase in the total transfers in 2020 under the alternative transfer rule. The amount of the total transfers in both scenarios is the same as that of the total actual transfers, equivalent to about 6½ percent of GDP over the entire sample period.

The estimated fiscal risk-sharing and redistribution effects of the alternative transfers are presented in Figure 5.2. The blue bars are the actual effects as shown in Figure 4. The yellow and red bars show the effects from the two simulation scenarios. As expected, the alternative transfers in both scenarios can completely smooth out the idiosyncratic regional shocks and achieve full insurance, with only slightly smaller redistribution effects: 25 and 27 percent in simulations 1 and 2, respectively (vis-à-vis the actual effect of 31 percent). Interestingly, the additional intertemporal borrowing in the second simulation, which is essentially an intertemporal redistribution of total transfer, does not seem to be as important as one would expect, since the risk-sharing effect has already reached 100 percent even without such intertemporal borrowing. This means that, even

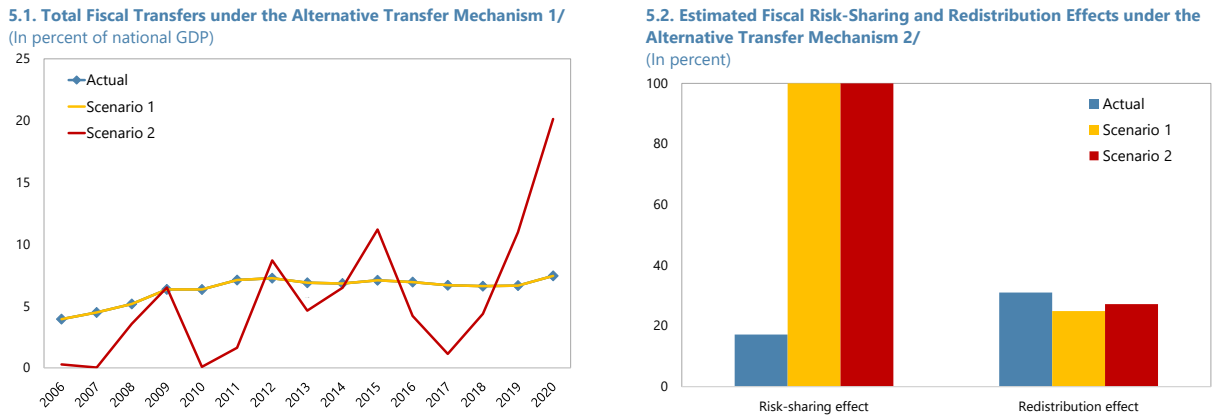
[20] If we instead assume that the CG has to choose the same τ for all the years of our sample period, then the size of the total transfers under the alternative rule in "bad" years would be constrained by that in the "good" years, which would mechanically reduce the risk sharing and redistribution effects.

[21] The common borrowing actually happened during the COVID-19 pandemic in 2020 when the CG issued the special Treasury bonds to support the economy and transferred the proceeds to LGs through a new transfer scheme called special transfers.

[22] For simplicity, we do not consider the impact of higher-than-actual transfers on the CG's borrowing costs in the simulations.

without the intertemporal redistribution of total transfers, the alternative transfer rule can still achieve full insurance against idiosyncratic provincial shocks. This is because the risk-sharing effect is in fact mainly achieved through a "horizontal redistribution" of the transfers among provinces. In other words, for fiscal risk sharing, redistributing the total transfers over time is less important than getting the "horizontal redistribution" right—which should be linked to the size of the shocks that the province is facing as in the alternative transfer rule. Moreover, in practice, fiscal transfers funded by the higher common borrowing by the CG may be less effective in the presence of Ricardian households as the debt is eventually borne by all.

Figure 5. Counterfactual Simulations: Fiscal Transfers under the Alternative Transfer Mechanism



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff estimates.
1/ The actual total transfers are the same as those in Scenario 1.
2/ The estimates shown in the figure are the average estimates from the two-step estimation approach. Solid bars denote statistical significance at the 1-percent confidence level. A 100-percent risk-sharing effect means that the estimated risk-sharing coefficient in the second step is statistically insignificant at the 10-percent confidence level.

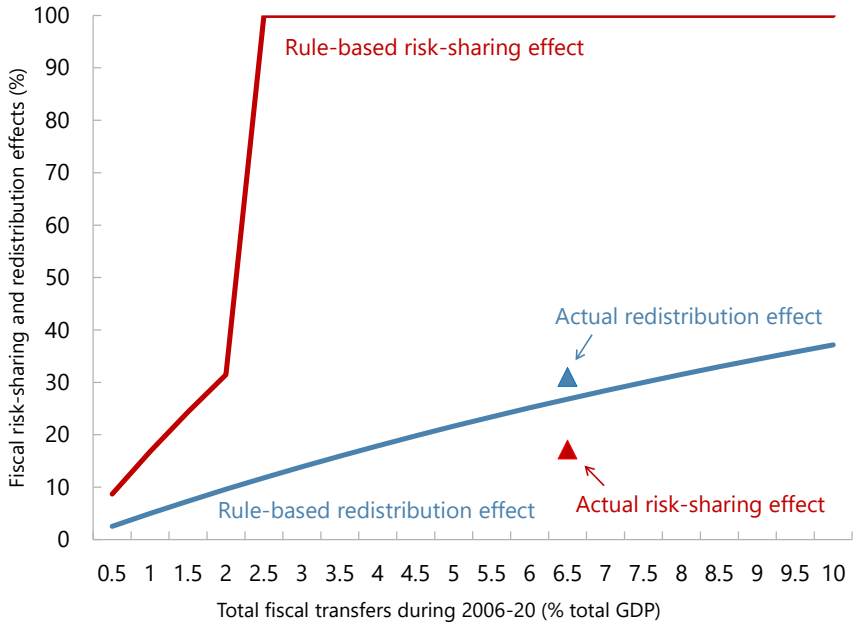
So far, we have shown in the second scenario that the alternative transfer mechanism with the same amount of total transfers (as the actual transfers) can smooth out all idiosyncratic shocks. A related question is how much total transfers would be needed to achieve the full insurance and, relatedly, what would be the associated redistribution effect. If a much smaller amount of total transfers (than the actual transfers) under the alternative mechanism can also achieve the full insurance while producing a similar redistribution effect, then this would suggest that the alternative transfer mechanism could have significantly improved the efficiency of fiscal transfers compared to the existing system. We can address this question by simulating an extended version of the second scenario where the parameter τ is assumed to be constant over the entire sample period. More specifically, we first vary the amount of total transfers over the entire sample period under the alternative transfer mechanism by changing the parameter τ and then estimate the associated risk-sharing and redistribution effects. We can also calculate the total transfers in percent of the total GDP over the entire sample period for any given parameter τ based on the definition of the alternative transfer rule, and vice versa. This means that we can estimate the risk-sharing and redistribution effects for any amount of total alternative transfers (in percent of total GDP).

Figure 6 presents the simulation results, with the amount of total transfers over the entire sample period on the horizontal axis and the estimated effects on the vertical axis. The red and blue lines show the risk-sharing and redistribution effects, respectively, for any amount of total transfers (under the alternative transfer rule) ranging

from 0.5 to 20 percent of total GDP. The red and blue triangles denote the previously estimated risk-sharing and redistribution effects of the actual transfers (with the total equivalent to about 6½ percent of total GDP), respectively. Clearly, under the alternative transfer rule, the redistribution effect increases as the total amount of transfers increases following an almost linear relationship. The relationship is however different for the risk-sharing effect, which also increases with the total amount of transfers but only when such total amount is small, i.e., below 2 percent of total GDP. When the total amount exceeds the threshold of 2 percent of GDP, the risk-sharing effect would reach 100 percent, suggesting that all idiosyncratic shocks can be smoothed. A special case is when the total amount of transfers is equal to that of the actual transfers, i.e., 6½ percent of total GDP. This is the same as the second scenario simulated in Figure 5.2, where the risk-sharing and redistribution effects are estimated to be 100 and 27 percent, respectively.

These results suggest that the rule-based transfers could have delivered a significantly higher risk-sharing effect—more specifically, full insurance against idiosyncratic shocks—than the realized effect of about 17 percent, while keeping the redistribution effect close to the realized level of 31 percent. These results are also consistent with the observation that the existing fiscal transfer system has been focusing primarily on the redistribution function of fiscal transfers, despite that a more efficient rule could help achieve higher risk sharing at lower fiscal costs without sacrificing too much on redistribution.

Figure 6. Simulated Fiscal Risk-Sharing and Redistribution Effects vs. Total Transfers
(In percent of total GDP over 2006-20)



Sources: Ministry of Finance of China; National Bureau of Statistics of China; CEIC; and IMF staff estimates.

One question is, how to adapt the existing transfer system to the proposed alternative rule. As mentioned above, this is not an easy task as the existing transfer system in China still largely focuses on redistribution rather than risk sharing. One possible approach is to start with incorporating the provincial cyclical position into the existing automatic rule for general transfers in a more explicit and systematic way. More specifically, as described above, an automatic rule has been adopted for general transfers since 2008 that takes into account both standardized expenditures and revenues of provincial governments (MOF, 2008):

$$T_{it} = \left(Exp_{it}^{standard} - Rev_{it}^{standard}\right) * \rho_{it},$$

where ρ_{it} is the transfer coefficient for each province in year t, determined by factors including the total amount of general transfers, the difference between the standardized fiscal revenue and expenditure of each province, and the degree of financial difficulties in each province. To better capture the cyclical position of each province in this existing rule, the authorities can consider, for example, including the size of the shocks to provincial GDP or local output gap as an additional driving factor of the transfer coefficient ρ_{it}.[23]

Concluding Remarks & Policy Considerations

Like in many other countries, fiscal transfers in China also serve two important functions: (i) transferring funds from richer to poorer regions to help convergence of regional living standards to the national average (*redistribution*), and (ii) providing insurance for LGs to smooth out the impact of idiosyncratic regional shocks (*risk sharing*). This paper examines to what extent the fiscal transfers in China have performed these functions and whether there is room to further enhance the risk-sharing effect among provinces. To disentangle the risk-sharing and redistribution effects of fiscal transfers, we use the two-step estimation approach developed by Bayoumi and Masson (1995). A one-step approach proposed by Poghosyan *et al*. (2016), which mirrors the two-step approach but estimates both effects simultaneously, is also used for robustness check.

Using a provincial-level dataset spanning from 2006 to 2020, we find that the fiscal transfers in China have achieved significant redistribution and risk-sharing effects. For the redistribution effect, we estimate that about 31 percent of permanent provincial shocks have been smoothed on average by the fiscal transfers in China, which is higher than the estimates for many AEs in the literature. For the risk-sharing effect, we find that about 17 percent of idiosyncratic regional shocks have been smoothed by the fiscal transfers, which is broadly comparable with other major economies. Moreover, we find that the fiscal risk-sharing effect in China has remained broadly stable over time, in contrast to the literature's finding for AEs where the effect has been on a declining trend. We also find that the fiscal risk-sharing effect is more prominent among the inland provinces, which tend to be less developed, and less significant in the more developed coastal provinces. This likely reflects the higher reliance of inland provinces on fiscal transfers while the coastal provinces have better-functioning non-fiscal channels (e.g., more developed financial intermediaries and markets) for risk sharing. Finally, the much higher redistribution effect (compared to the risk-sharing effect) is consistent with the observation that the existing fiscal transfer system in China has been mainly focusing on the redistribution function so far.

Facing the shocks from the COVID-19 pandemic and recent property market stress, most provinces' LG fiscal gaps could widen further, which would likely constrain LGs' ability to respond to these shocks and increase their reliance on fiscal transfers from the CG. It is therefore useful to consider measures to further enhance the risk-sharing effect of fiscal transfers in China. Against this background, we propose an automatic and non-regressive transfer mechanism for China, similar to the one proposed by Furceri and Zdzienicka (2015) for the euro area. Under the alternative mechanism, the amount of transfers to each province is linked to both the province's share of GDP in national GDP and the size of the idiosyncratic shocks that the province is facing,

[23] This is just one potential approach to adapt the existing transfer rule to the proposed alternative rule, and there are other ways including, for example, making the standardized revenue and expenditure more reflective of provincial cyclical positions.

with the latter to strengthen the risk-sharing function. Using counterfactual simulations, we show that such a mechanism could have significantly increased the fiscal risk-sharing effect and achieved full insurance against idiosyncratic shocks, while keeping the redistribution effect close to the actual level during our sample period, assuming that the same amount of total transfers (as the actual transfers of about 6½ percent of total GDP) were distributed over that period.

By further enhancing the risk-sharing effect of fiscal transfers, the alternative transfer mechanism could also increase the effectiveness of overall fiscal policies in stabilizing local economies amid the difficult period for LG finances. Moreover, establishing such a transfer mechanism in a transparent and well-communicated manner would assure households and investors that LGs have and will have access to the fiscal resources needed to mitigate the effects of local shocks and avoid a sharp tightening of financial conditions even if temporary borrowing is required. That said, there is a trade-off between the fiscal risk-sharing and redistribution effects under the alternative mechanism. A smaller amount of total transfers (e.g., 2.5 percent of total GDP) could achieve a higher risk-sharing effect or even full insurance, but would also come with a smaller redistribution effect. In other words, the two effects would need to be carefully balanced and aligned with the authorities' objective function. It is also worth noting that important caveats apply when interpreting these results, as the simulated estimates are from a "partial equilibrium" exercise and do not take into account, for example, the behavioral responses of households and LGs as well as the potential aggregate price impact on CG borrowing costs.

When the CG's funding for fiscal transfers is constrained during periods of stress, for example, the pandemic in 2020, common borrowing by the CG (e.g., in the form of CG-issued bonds) could be used. This is better than self-insurance by LGs themselves due to the vicious cycle between weaker LG fiscal health and higher borrowing costs (IMF, 2020). Moreover, as shown in the counterfactual simulations, the alternative transfer mechanism under the intertemporal common borrowing scenario could also bring a higher fiscal risk-sharing effect than the existing transfer system. That said, the overall fiscal impact would likely be lower, compared to non-debt-funded transfers, in the presence of Ricardian households as the debt is eventually borne by all.

While these results highlight the potential to achieve higher stabilization under the proposed alternative transfer mechanism, it is important to note that the analysis is subject to the *Lucas' Critique*—an irresolvable weakness as called by Furceri and Zdzienicka (2015). The implementation of the alternative mechanism would inevitably change the structure of the economic system, undermining the robustness of our results. Also, the sample size in the analysis is relatively small and hence the estimates could be subject to the small sample bias; as a result, the usual definition of full risk sharing as the lack of a statistically significant coefficient in the regression could end up with misleading results. In addition, higher fiscal risk sharing, even if can be achieved through the proposed alternative mechanism, may also bring moral hazard—by providing bailout guarantees to LGs, which reduces the incentives for LGs to implement good policies. This could worsen the fiscal position of LGs over time and eventually increase their vulnerability to macroeconomic shocks. Moreover, the alternative mechanism could also bring moral hazard for LSOEs and local state-owned banks, as the bailout guarantees by the CG reduces the borrowing costs of LGs and LSOEs and encourages higher risk-taking behaviors during normal periods (IMF, 2020). In this context, removing explicit and implicit government guarantees for LSOEs could help break the interlinkages and contain the increase in moral hazard. This would also call for stronger governance rules guiding LG fiscal decisions, including preventing LGs from using the transfers to protect weak LSOEs.

From a broader perspective, how to manage fiscal risks from subnational governments is an important and common issue for many countries (Saxena, 2022). In this context, further reforming China's intergovernmental framework based on international best practices to address the long-standing misalignment between LGs' own revenues and expenditures is critical. This could further improve policy efficiency and effectiveness and reduce the need for fiscal risk sharing, as the structural underfinancing weakened LGs' ability to respond to idiosyncratic shocks and increased their dependence on fiscal transfers. On the expenditure side, the assignment of expenditures to the appropriate level of governments (laid out in the SC reform plan) should be decided on assessments of the economies of scale, equity considerations, and externalities. Centralized pension and unemployment insurance systems should also be considered. On the revenue side, tax reforms to provide LGs with more authority over some tax rates and bases (e.g., personal income and property taxes) could strengthen LGs' fiscal accountability (Wingender, 2018; Ahmad 2011). It is also critically important to align LGs' borrowing limits with their expenditure responsibilities and contain investment financed off-budget, including by ensuring realistic LG financing arrangements, carefully assessing and removing implicit guarantees on remaining off-budget investments, and bringing non-commercial investment on budget.

Other measures can also be considered to increase interregional risk sharing through other channels, therefore reducing the dependence on the fiscal channel. After the tax decentralization reform in 1994, LGs—in pursuit of their objectives of social and economic stability and fiscal revenue maximization—have introduced widespread local protectionism, including barriers in capital, labor, goods, and services (see, e.g., Zhao and Ni, 2018; Poncet, 2005; Zhu, 2004). Economic reforms aiming to increase the interregional mobility of production factors (capital and labor) and promote domestic market integration, for example, by phasing out local protectionism and LG interventions in the product and factor markets, could increase households' and private firms' capacity to smooth idiosyncratic shocks via market and financial channels, thereby limiting the need for fiscal risk sharing.

Annex I. Data Description

We construct a dataset consisting of annual provincial panel data for the 31 provinces of China covering 2006-18. The key set of variables are: i) fiscal transfers from CG to each province, ii) fiscal revenues and expenditures of each province, iii) provincial macroeconomic variables including nominal GDP and inflation, and iv) aggregate provincial income per capita including both pre- and post-transfer income per capita. The main data sources are the Ministry of Finance (MOF) of China, the National Bureau of Statistics (NBS) of China, and the CEIC database.

- *Fiscal transfers from CG to each province* are calculated by taking out the tax refund and the transfers from LGs back to CG from the gross transfer data. The gross transfer data include three components, namely, transfers from CG to LGs, tax refund from CG to LGs on shared taxes, and transfers from LGs back to CG. The first two components are removed from the gross transfer data to calculate the net transfers from CG to LGs. One issue is that the tax refund data are only available at the provincial level since 2015. Since the total tax refund for all provinces are available since 2006, we estimate the provincial tax refund for 2006-14 by assuming that the share of each province's tax refund remained the same during 2006-14 as in 2015.

- *Provincial fiscal revenue and expenditure data*, including both LG revenue and LG extrabudgetary revenue (before 2011), are obtained from the MOF and CEIC database.

- *Provincial macroeconomic and demographic variables* including nominal GDP, inflation, and urban and rural population are obtained from the CEIC database.

- *Provincial income per capita data* include both pre- and post-transfer income per capita. All the income variables are calculated in *per capita* terms using the provincial population. The breakdown of disposable income between regular and transfer income is available and collected from NBS' yearbooks during 2006-20. The transfer income includes both transfer income from fiscal transfers to individuals and transfer income from remittances from migrant workers. Given the lack of the breakdown between the two types of transfer incomes, we calculate the pre-transfer household disposable income by removing the total transfer income from the disposable income, which may however underestimate the true value.[24] Following Du *et al*. (2011), we then calculate the pre-transfer aggregate provincial income by adding the LG revenue, LG extrabudgetary revenue (before 2011), and CG tax refund to the pre-transfer household disposable income, and the post-transfer aggregate provincial income as the sum of the pre-transfer aggregate provincial income and the net fiscal transfers from CG to LGs.

[24] One other complication is the provincial-level data for household disposable income, which is only available from 2013 onwards. That said, the household disposable income is available for urban and rural households separately for years before 2013. Therefore, we estimate the household disposable income as a weighted average of the urban and rural household disposable incomes using the share of urban and rural population as the weights, following Hao and Wei (2009).

Annex II. Regression Results

Annex II – Table 1. Regression Results from Two-Step Approach

	(1) Robust standard error	(2) Two-way clustering	(3) Driscoll-Kraay standard error
Step 1. Cross-sectional regression			
β_{redist}	0.69*** (0.05)	–	–
constant	0.31*** (0.07)	–	–
# of observations	31	–	–
R-squared	0.80	–	–
Step 2. Fixed-effects panel regressions			
$\beta_{risk-sharing}$	0.83*** (0.02)	0.83*** (0.04)	0.83*** (0.03)
constant	0.00 (0.004)	–	0.00 (0.00)
# of observations	434	434	434
# of provinces	31	31	31
Time fixed effects	Yes	–	–
Province fixed effects	Yes	Yes	Yes
R-squared	0.62	0.60	0.60

Note: Estimations in step 1 are performed using a cross-sectional OLS, while estimations in step 2 are performed using the fixed-effects OLS estimator. Standard errors are shown in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent confidence level, respectively.

Annex II – Table 2. Regression Results for Sub-Period Samples

	2006-12		2013-20	
	(1) Robust standard error	(2) Two-way clustering	(1) Robust standard error	(2) Two-way clustering
Step 1. Cross-sectional regressions				
β_{redist}	0.72*** (0.04)	–	0.68*** (0.05)	–
constant	0.28*** (0.06)	–	0.32*** (0.08)	–
# of observations	31	–	31	–
R-squared	0.87	–	0.69	–
Step 2. Fixed-effects panel regressions				
$\beta_{risk-sharing}$	0.82*** (0.04)	0.82*** (0.08)	0.83*** (0.03)	0.83*** (0.03)
constant	0.00 (0.003)	–	-0.00 (0.002)	–
# of observations	186	186	217	217
# of provinces	31	31	31	31
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
R-squared	0.59	0.52	0.64	0.60

Note: Estimations in step 1 are performed using a cross-sectional OLS, while estimations in step 2 are performed using the fixed-effects OLS estimator. Standard errors are shown in parentheses. Results with the Driscoll-Kraay standard error are similar to those with the two-way clustering and hence omitted here. ***, **, and * denote significance at 1, 5, and 10 percent confidence level, respectively.

Annex II – Table 3. Regression Results for Regional Sub-samples

	Coastal region		Inland Region	
	(1) Robust standard error	(2) Two-way clustering	(1) Robust standard error	(2) Two-way clustering
Step 1. Cross-sectional regressions				
β_{redist}	0.89*** (0.02)	–	0.42 (0.28)	–
constant	0.11*** (0.03)	–	0.58 (0.32)	–
# of observations	11	–	20	–
R-squared	0.99	–	0.06	–
Step 2. Fixed-effects panel regressions				
$\beta_{risk-sharing}$	0.97*** (0.01)	0.97*** (0.02)	0.65*** (0.05)	0.65*** (0.09)
constant	-0.00 (0.001)	–	-0.00 (0.01)	–
# of observations	154	154	280	280
# of provinces	11	11	20	20
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
R-squared	0.94	0.94	0.31	0.28

Note: Estimations in step 1 are performed using a cross-sectional OLS, while estimations in step 2 are performed using the fixed-effects OLS estimator. Standard errors are shown in parentheses. Results with the Driscoll-Kraay standard error are similar to those with the two-way clustering and hence omitted here. ***, **, and * denote significance at 1, 5, and 10 percent confidence level, respectively.

Annex II – Table 4. Robustness: Regression Results for One-Step Approach and Pre-COVID Sample

	(1) Without trend	(2) With trend	(3) Pre-COVID (2006-19) *Robust standard error*	(4) Pre-COVID (2006-19) *Two-way clustering*
	Long-run coefficients		***Step 1. Cross-sectional regressions***	
β_{redist}	0.72*** (0.02)	0.77*** (0.02)	0.69*** (0.05)	–
Trend	–	-0.001*** (0.0001)	–	–
constant			0.31*** (0.07)	–
	Short-run coefficients		***Step 2. Fixed-effects panel regressions***	
$\beta_{risk-sharing}$	0.82*** (0.05)	0.82*** (0.05)	0.86*** (0.02)	0.86*** (0.03)
Speed of adjustment	-0.34*** (0.03)	-0.37*** (0.03)	–	–
constant	0.10*** (0.01)	0.10*** (0.01)	0.00 (0.004)	–
# of observations	434	434	403	403
Time fixed effects	–	–	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
# of provinces	31	31	31	31

Note: Robust standard errors are shown in parentheses. Reported short-term and speed of adjustment coefficients represent averages of province-specific estimates. ***, **, and * denote significance at 1, 5, and 10 percent confidence level, respectively.

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