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capital misallocation: Evidence from China**

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**International Center for Public Policy
Working Paper 18-16**

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**September
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Fiscal decentralization and interregional capital misallocation:

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September 2018

Abstract: Misallocation of factors of production has been recently viewed as a promising explanation accounting for the large difference in total factor productivity (TFP) across countries. This paper differs from previous studies by concentrating on interregional capital misallocation and by focusing on the role of fiscal decentralization in shaping misallocation. Using a municipal level panel data set, we measure intra-provincial and inter-municipal capital misallocation in China over 2003-2015. The empirical results based on provincial level panel data suggest that revenue decentralization mitigates interregional misallocation while expenditure decentralization fails to exert a significant impact. We further find that this positive effect is more significant and much larger when it is the market rather than government intervention that is driving the flow of capital. The results are robust to different specifications, IV estimations and alternative measurement of interregional misallocation. Our study complements the literature on the causes of misallocation and enriches the understanding of the consequences of fiscal decentralization, especially in terms of economic growth and interregional inequality.

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Key Words: Fiscal decentralization; Interregional misallocation; China

JEL Classification: H11; H23;H70.....

1 Introduction

Misallocation has been viewed as a promising explanation accounting for the large TFP (total factor productivity) differences across countries (Restuccia and Rogerson, 2008). The essence of this insight is that when resources are misallocated, the marginal products of capital or labor will disperse across producers, and therefore the economy will operate inside its production possibilities frontier, with the result that a given quantity of inputs produces less total output (Jones, 2016).

This paper explores the source of one dimension of misallocation, that is, interregional capital misallocation by focusing on the potential role played by fiscal decentralization in the context of China. The motivation is that fiscal decentralization may be naturally linked to interregional factor (mis)allocation, as the essence of fiscal decentralization is a process of devolution of fiscal, and other economic and political powers from a larger jurisdiction--the central government-- to several smaller jurisdictions administered by subnational governments. As a result, decentralization endows subnational governments with significant power and capacity to allocate resources. For example, in the Chinese context, the share of subnational government expenditures reaches even over 80% of the consolidated public sector.

In this paper, we first document the relationship between fiscal decentralization and (interregional) misallocation. The theoretical analysis suggests that the effect of fiscal decentralization on interregional misallocation is ambiguous. Next, we measure intra-provincial and inter-municipal capital misallocation based on municipal level data for China over 2003-2015. Our empirical results show that revenue decentralization mitigates interregional misallocation while expenditure decentralization does not have any significant effects. We further identify that the potential alleviation effects of revenue decentralization on misallocation are significantly stronger when it is market forces rather than government intervention that is driving the flow of capital. Our results are robust to different specifications, IV estimation and alternative measurement of interregional misallocation.

Our study is closely related to two threads of the literature. First, this paper adds to literature on misallocation. Restuccia and Rogerson (2017) divide this literature into two categories according to the different approaches they adopt, that is, the direct approach and the indirect approach. The

former concentrates on measuring misallocation, attempting to investigate to what extent misallocation affects TFP without considering the source of misallocation. One important and representative paper is Hsieh and Klenow (2009), who measure misallocation with the variance of TFP while TFP is proportional to the geometric average of the marginal products of capital and labor. Based on micro data on manufacturing firms, they find that TFP in China and India would increase by 30%-50% and 40%-60% respectively if their resources were reallocated to the US level. A series of papers extended this approach to other countries and other sectors, including Busso et al. (2013) for ten Latin American countries, Kalemli-Ozcan and Sorensen (2016) for ten African countries, De Vries (2014) for the retail sector in Brazil, and Brandt et al. (2013) for non-agricultural sector in China. In addition, there are some studies aiming to improve the measurement methodology to overcome the potential measurement error and adjustment cost problem (Song and Wu, 2015; Bils et al., 2017). The second category of papers in this literature, labeled as using the direct approach, focuses on the causes of misallocation and documents a variety of sources from which misallocation may arise from, such as financial frictions (Midrigan & Xu, 2014; Moll, 2014), imperfect information (David et al., 2016) and government regulation (Hsieh & Moretti, 2015; Fajelbaum et al., 2015).

This paper differs from and contributes to the previous literature on misallocation in the following two aspects. First, given that the majority of studies presented above are focused on the misuse of resources among firms, we are interested in interregional capital misallocation, specifically, measuring intra-provincial and inter-municipal capital misallocation in China. The only two previous papers that have adopted a regional focus are Brandt et al. (2013), who examine inter-provincial misallocation in China, and Hsieh & Moretti (2015), who explore labor misallocation across US cities. Second, we are the first to investigate the potential role played by fiscal decentralization in shaping interregional misallocation. This complements the previous literature on misallocation that utilize, as Restuccia and Rogerson (2017) called it, the direct approach.

Our work is also related to literature on fiscal federalism, especially to those papers that empirically examine the social and economic consequences of fiscal decentralization. Martinez-Vazquez et al. (2017) present a comprehensive review of the impact of fiscal decentralization on economy, society and politics. Example of topics that have been carefully examined include the impact of fiscal decentralization on public goods and service provision (e.g., Faguet & Sanchez, 2014;

Falch & Fischer, 2012), interregional disparities (e.g., Lessmann, 2009; Kyriacou et al., 2015), government size and corruption (e.g., Marlow, 1988; Jin & Zhou, 2002; Fisman & Gatti, 2002) and, most importantly, economic growth (e.g., Davoodi & Zou, 1998; Gemmell et al., 2013). However, to our knowledge, there has been no previous research on the potential impact of fiscal decentralization on misallocation. As suggested by Martinez-Vazquez et al. (2017), the interaction of decentralization and misallocation might be a reason for the very diverse results in the fiscal federalism literature on the effect of fiscal decentralization on economic growth. This paper fills this gap by empirically examining the effect of fiscal decentralization on the measured intra-provincial and inter-municipal capital misallocation in China. Our study aims at enriching the understanding of the economic consequences of fiscal decentralization and shedding a light on the following two questions. First, this research should be conducive to the better understanding of the impact of fiscal decentralization on economic growth since economic growth largely depends on resource allocation. We actually find that certain features of fiscal decentralization may help correct interregional capital misallocation in China helping boost the economy, which is consistent with the viewpoint that fiscal decentralization has served as a fundamental institution underlying China's rapid economic growth (Qian & Weingast, 1997; Xu, 2011). Second, we contribute to the literature on the impact of fiscal decentralization on interregional inequality because interregional inequality can be attributed to both heterogeneity in resource endowments and effectiveness in their use across different regions. However, our findings suggest that interregional inequality in China may not be due so much to the imbalances in capital allocation-- since fiscal decentralization tends to mitigate interregional capital misallocation. Nevertheless, others have found that overall, fiscal decentralization policies have worsened interregional disparities in China (Liu et al., 2017). Ultimately, the reason why poor areas in China remain poor would appear not to be due to the lack of capital but that they may have relative fewer complementary production factors, related to the provisions of public services such as the quality of human capital.

The rest of this paper proceeds as follows. Section 2 presents a theoretical framework of the relationship between fiscal decentralization and interregional misallocation. Section 3 describes the data we used, the measurement of intra-provincial and inter-municipal misallocation and the

econometric modeling. Section 4 shows the main empirical results and section 5 offers robustness checks using alternative measures of interregional misallocation. Section 6 concludes.

2 Theoretical Framework

Though there is no existing literature directly exploring the relationship between fiscal decentralization and interregional misallocation, achieving greater efficiency in the allocation of resources has been at the core of the fiscal federalism since its beginning. Viewing local governments as benevolent agents whose goal is to efficiently provide public goods and services within their jurisdictions, the first-generation fiscal federalism theory (FGT) contends that subnational governments have information advantages to provide heterogeneous levels of public goods when residents have heterogeneous tastes across jurisdictions (Oates, 1972). This mechanism is reinforced by the process of “voting with one’s feet” in Tiebout (1956) when the mobility of households exists. Therefore, compared with central governments which generally provide uniform levels of public goods and services, decentralized provision can meet diverse demands by providing, for example, more and better specific services in regions where residents value those services more than that in other jurisdictions. In this way, decentralization alleviates interregional misallocation of public output and results in greater allocative (consumer) efficiency. Extending this intuition to considering producer efficiency, subnational governments may also possess a superior knowledge of their production frontier. This may be especially the case for developing and transitional economies where governments more often directly and intensively intervene in the production process (Shah, 1999). A recent study by Huang et al. (2017) confirms this conjecture. Inspired by Hayek’s (1945) influential insight that local information is key to understanding whether production should be decentralized or centralized, Huang et al. (2017) examine China’s experience with the decentralization of State-owned Enterprises (SOE). They show that when the distance between the SOE and the government is farther, the SOE is more likely to be decentralized. Moreover, this distance-decentralization link is more pronounced when communication costs are high and firm-performance heterogeneity is large, implying that the central government is aware of the fact that local information which is better controlled by subnational governments leads to producer efficiency. By this logic and similarity to consumer efficiency, decentralization allows local governments to take advantage of region-specific

information and undertake different actions to better approach their production frontier. This, again, mitigates interregional resource misallocation.

The FGT, however, does not fully characterize the features and functions of decentralization since it simply assumes local governments are benevolent agents without accounting for different incentives public officials may face. Those incentives are fully taken into account in the second-generation fiscal federalism theory (SGT), which largely borrows insights not only from many other fields in economics but also from other disciplines especially political sciences (Qian & Weingast, 1997; Oates, 2005). In China's particular context, fiscal (economic) decentralization is combined with political centralization, where appointments, promotions and demotions of subnational officials are determined by upper level governments, especially the central government. Therefore, national authorities can use personal control to align regional interests with national ones and motivate local officials to pursue the central government's main goal, which, during the past decades, has been to promote economic development as measured by the growth rate of GDP (Li and Zhou, 2005; Xu, 2011). Under this arrangement, local governments are encouraged to undertake a series of activities that may correct interregional resource misallocation. First, strong fiscal and political incentives incentivize local officials to pursue market-supporting activities and initiate reforms to foster economic prosperity rather than service to particular interest groups (Weingast, 2009). For example, Jin et al. (2005) document that provincial decentralization in China has been associated with fast development in the non-state sector and reform in the state sector. Second, subnational governments tend to provide more "productive" goods such as transport infrastructure, which can lower the transportation cost and hence enhance geographical factor mobility (Kappeler et al, 2013). Third, regions will compete for attracting foreign direct investment (FDI) to boost economic growth while FDI itself will flow into areas with higher marginal capital returns. Liu and Martinez-Vazquez (2014) offer strong evidence in favor of the existence of this inter-jurisdictional competition in China. Hence, there are strong forces for the marginal products of capital across regions to be equalized and for capital misallocation to be erased. Last but not least, decentralization allows and motivates governments to try economic experiments to find successive economic policies that are conducive to economic vitality. One prominent example in China is the Special Economic Zone or Economic Development Zone experiment, which was introduced originally by the governor of Guangdong

province in 1979 and then extended to the whole nation after the experiment turned out to be successful. This policy has been credited with increasing FDI in China significantly and it has become a tool for local governments to compete for attracting firms (Liu and Martinez-Vazquez, 2014). According to Xu (2011), in 2005, when China became the largest FDI recipient country in the world, 93 percent of FDI was located in Special Economic Zones.

Of course, the discussion above does not capture the full array of potential effects of fiscal decentralization on resource allocation. As a double-edged sword, decentralization has undergone a hot debate on its merits and shortcomings. A survey of the related literature reveals that there are at least two main channels through which decentralization may lead to greater interregional resource misallocation. First, competition among governments that drives the flow of capital can have some serious side effects. Especially, rich regions can offer more favorable conditions to attract capital, so capital will not flow to poorer areas despite the potential higher returns they may obtain there. It is widely known that economic development in China has been very unbalanced, fostering an environment that may result in poor regions in non-coastal areas becoming poorer due to the lack of competitive ability. Moreover, when the gap between rich and poor regions is large enough, the governments in poor areas, knowing they will lose in the promotion-driven competition, simply give up, and this makes matters worse (Cai and Treisman, 2005). Lastly, in the process of a “race to the bottom”, local governments may lower tax rates, environmental standards or labor standards in order to attract investment, which may distort the flow of capital since the cost of firms is deliberately reduced to below the equilibrium level.

Second, subnational governments, for their own narrow benefits, might implement regional protectionist policies to prevent capital from flowing out of their jurisdictions, limiting the formation of economies of scale and causing interregional misallocation. At first, so to attain certain economic performance goals, subnational governments may be reluctant to see capital outflowing because it would result in a loss in revenues and a drop in the employment rate. Bai et al. (2004) present evidence that local governments in China tend to protect industries where the past tax-plus-profit margins and the share of state ownership are high, implying that local governments are pursuing the goal of maximizing fiscal revenue. In addition, the state-owned financial institutions in China endow governments with considerable more power than is usually the case to control the placement of

capital, facilitating subnational governments' intervention in national capital market (Boyreau-Debray and Wei, 2005). Thirdly, local protectionism can be promoted when local politicians can extract substantial rents from local enterprises (Sonin, 2010). Given the anecdotal evidence documented in Chinese media suggesting wide corruption among local officials, it is not surprising to expect that the Chinese regional policymaking-system, which lacks accountability and transparency, can induce local officials' rent-seeking behavior.¹

Summing up, the FGT argues that fiscal decentralization can mitigate resource misallocation while the SGT suggestions are much more nuanced, and fiscal decentralization can exert both positive and negative effects on interregional misallocation. According to the SGT, when subnational governments are doing what they should do, like providing infrastructure, fostering markets, and playing the role of "night-watcher" rather than disturbing the functioning of markets, through local protection by erecting interregional barriers, using improper subsidies or entering a "race to the bottom," the net effect of fiscal decentralization may be to reduce interregional misallocation. What forces will dominate cannot be predicted a priori, which brings up the necessity of conducting an empirical study of this issue. This is carried out in the next sections of the paper.

3 Measuring Interregional Misallocation, Model Specification and Data

3.1 Measuring interregional misallocation

As mentioned above, most of the existing literature on measuring misallocation concentrates on the methodology for measuring misallocation among firms and on exploiting the large firm-level data sets available. Nonetheless, the intuition is very similar when measuring interregional misallocation. That is, misallocation is characterized by the dispersion of marginal products of capital or labor across producers (Restuccia and Rogerson, 2017). Following this insight, we measure interregional capital misallocation by examining the variation in the marginal return of capital across municipalities within one province. In particular, we use the following formulation:

¹ For more evidence on local protectionism in China, please refer to Eberhardt et al. (2016) and Barwick et al. (2017).

$$misall_{i,t} = Std(MPK_{ijt})/Mean(MPK_{ijt}) \quad (1)$$

Here i denotes province, t denotes year and j denotes the municipality in province i ; MPK_{ijt} is the measured marginal products of capital at different times in municipality j . The numerator in (1) is the standard deviation of the marginal products of capital in province i at the municipal level and the denominator is its mean value across municipalities. Therefore, the greater (the coefficient of variation) $misall_{i,t}$ is, the more disperse is the marginal products of capital across municipalities for province i , and therefore the more inefficiently the capital is allocated within province i .

It is obvious that the marginal products of capital for each municipality need to be calculated at first. Following Caselli and Feyrer (2007) and in a more simplified manner, we exploit the fact that MPK equals the rate of return to capital in the standard neo-classic model featuring a constant-return production function and with perfect competition.² Under these conditions, the aggregate MPK can be recovered from data on total income, the value of capital stock and the share of capital in total income. If Y represents GDP, s stands for the capital share in GDP and K is the capital stock, then we have:³

$$MPK = sY/K \quad (2)$$

Now our task is to back out s , Y and K . Regarding Y , we can directly use data for municipal GDP to mirror total income. Some researchers have casted doubt on the accuracy of data for China's GDP (e.g., Angus Maddison 1998). However, our regression method, which exploits the variable variation and includes GDP as a control, allows for some mismeasurement. However, the capital share in total income is measured at the province level due to the lack of data availability at the municipal level. Following Bai et al. (2006), the labor share of income is calculated first and then we calculate s as one minus the measured labor share. The final piece of information we need is the capital stock K . Within the standard perpetual inventory approach, in order to measure capital stock we require data on investment, the initial capital stock and the depreciation rate. Factoring in general data availability, we set 1990 to be the baseline year. For investment, we employ the data series *investment in fixed*

² Banerjee and Duflo (2005) present a comprehensive review of existing methods for measuring MPK .

³ In Caselli and Feyrer (2007), they separate natural resources such as land from reproducible capital to correct the capital share and find substantial change in results. However, we simplify the measurement due to the lack of data in our sample.

assets, which is available at the municipal level and it is most frequently used by Chinese government officials to measure aggregate investment (Bai et al., 2006). In addition, we subtract *investment in housing construction* from the aggregate investment to get a measure of reproducible capital stock. For the depreciation rate, we assume it to be 10%, which is similar to that assumed in the recent studies (Zhang et al. 2004; Shan 2008).⁴ At last, as indicated above, we initialize the capital stock in 1990 as the ratio of investment in 1990 to the sum of the average growth rate of investment during 1991-1995 and the depreciation rate. Following these steps, we then arrive at the measures of *intra-provincial* and *inter-municipal* capital misallocation in China for 22 provinces over 2003-2015. The results are shown in Figure 1. Following the practice in most empirical studies based on provincial-level panel data in China, we exclude from the calculation the four direct-controlled municipalities (*Beijing, Shanghai, Tianjin* and *Chongqing*). In addition, several provinces (*Hainan, Qinghai, Xizang, Xinjiang* and *Yunnan*) are dropped because too few municipalities report data on investment in those jurisdictions. As an illustration, in the province of *Xizang*, only the capital city, *Lasa*, reports data on investment, so it is not possible to calculate the variance of MPK across municipalities and then compute *misall* with Eq. (1).

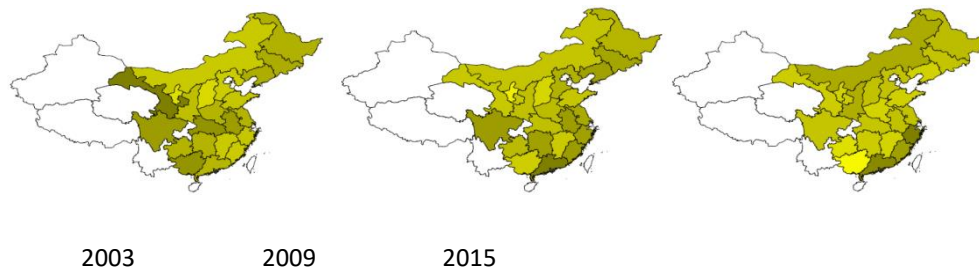


Figure 1 Intra-provincial and inter-municipal capital misallocation in China

NOTES: The deeper the color, the greater the misallocation level. No estimation results are available for those areas in white.

There are several other points worth noting in Figure 1. First, in general, the central areas in China exhibit the lowest misallocation level. Second, misallocation in the three northeastern provinces (*Heilongjiang, Jilin* and *Liaoning*) and the coastal provinces (including *Jiangsu, Zhejiang*,

⁴ Earlier studies adopted lower rates, for example, 5% in Perkins (1988) and Wang and Yao (2001) and 6% in Young (2003). The specific rates adopted in Zhang et al. (2004) is 9.6% and in Shan (2008) is 10.96%.

Fujian and *Guangdong*) tends to be more severe, implying that rich areas tend to suffer from higher interregional misallocation levels.⁵ Third, the distribution of misallocation across the country is dynamic over time. *Gansu*, as an illustration, was the most inefficient province at the beginning of the sample period, but the ranking of its misallocation level decreased while *Guangdong*, as a comparison, exhibits the opposite trend, with its misallocation level being lower in 2003 but then increasing dramatically.

3.2 Estimation Model

In this section, we present the empirical strategy to determine the net effect of fiscal decentralization on interregional misallocation and identify the conditions under which fiscal decentralization exerts a significant impact. We start with the two following simple regression models.

$$misall_{i,t} = \alpha + \beta FD_{i,t} + \gamma Z_{i,t} + \nu_t + \xi_{i,t} \quad (3)$$

$$misall_{i,t} = \alpha + \beta FD_{i,t} + \gamma Z_{i,t} + \eta_i + \nu_t + \xi_{i,t} \quad (4)$$

In both equations, the index i denotes provinces and t denotes years; ν_t represents year dummies to control for time fixed effects that may affect all provinces, such as the business cycle and the macroeconomic policy implemented by the central government at the national level; $\xi_{i,t}$ is the idiosyncratic error term. Compared to equation (3), equation (4) also in addition controls for province fixed effects by including province dummies (η_i) to capture the effect of unobserved factors that are constant over time but heterogenous across provinces. The reason why we also present results without controlling for province fixed effects is that we may throw away a lot of signaling in the data if only within-group information is used, given that the potential adjustment costs in misallocation may lower the variation of resource misallocation in a specific region. For example, the potential adjustment cost may lower the variation in misallocation for a specific province because it takes long time for a region to adjust its resource distribution.

⁵ The coastal provinces are the richest areas in China, and the northeastern region used to be the industrial base of China.

The dependent variable, $misall_{i,t}$, is our measure of interregional misallocation in a province based on municipal level data; $FD_{i,t}$ is the variable of interest, the index of fiscal decentralization, so if β is positive and statistically significant, then we would conclude that fiscal decentralization increases the level of interregional misallocation. Following Liu et al. (2017), we consider both revenue decentralization and expenditure decentralization, in turn measured as the ratio of municipal level governments' budget revenue (expenditure) to total government revenue (expenditure) within a province; $Z_{i,t}$ is a set of control variables, which are selected on the basis of findings in previous studies on the causes of misallocation. Specifically, the following variables are included:

Economic development level. We employ GDP per capita to measure the level of economic development in a province. It is a common practice to include economic development as a control variable when a macroeconomic variable is on the left side of the regression model in order to control for the general economic conditions. In addition, as can be seen in Figure 1, interregional misallocation tends to be higher in richer provinces, implying that GDP may play a role here.

Urbanization level. The ratio of urban population to total population serves as a proxy for the level of urbanization in a province of China. Given the large differences in the level of infrastructure provision, financial development, economic structure and many other prominent factors that can affect the allocation of capital between urban and rural areas, we can expect that the urbanization rate may have an impact on overall resource misallocation.

The share of the secondary sector. Considering the large heterogeneity in the agricultural, manufacturing and service sectors, we calculate the share of secondary sector by dividing the output in the secondary sector by regional GDP to control for the potential effects of economic structure.

Finance development. It is documented by a large body of literature that finance plays an important role in determining access to capital and hence its potential role on misallocation (see, for example, Midrigan and Xu, 2014; Moll, 2014). We measure the level of finance development by the ratio of total outstanding loans to provincial GDP.

Trade. Differences in trade protections due to tariffs, etc. can distort the allocation of resources across heterogeneous producers (Eaton and Kortum, 2002; Meltiz, 2003), and they have been found to play a significant role (Waugh, 2010; Tomebe, 2015). Besides, trade policy may also affect

misallocation through its effect on competition (Edmond et al., 2015). In view of this, trade is also included as a control variable and it is measured as the ratio of total trade (imports and exports) to GDP of that province.

The share of state-owned economy. In China's particular economy structure, state-owned enterprises (SOE), which take up a large share of the economy, are quite different from private ones in many aspects. The most relevant one here is that SOEs have easier access to credit loans due to their close relationship with government. As is shown in Brandt et al. (2013), much of the decrease in TFP of China's non-agricultural sector is attributed to the increasing misallocation of capital between state and non-state sectors. Therefore, we control for this effect by including "the share of state-owned economy", which is calculated by the share of total assets owned by state-owned enterprises at the provincial level.

Foreign direct investment (FDI). As is discussed above in the theoretical framework, FDI will flow to areas with higher returns spontaneously, resulting in lower misallocation levels (Lashitew, 2012). Besides, FDI also serves as a signal of openness, indicating higher-quality institutions or a "wiser" government, which are beneficial for resource allocation. We measure FDI as the ratio of FDI to GDP at the province level.

Pollution. Pollution itself may be considered a manifestation of misallocation, since it mirrors the fact that the economy is growing at the cost of the environment; this would appear to be especially true in the case of China. As discussed earlier, governments may enter a "race to the bottom" to compete for investment by lowering environmental and other economic standards. Here, we use the ratio of industrial sewage to industrial added value to measure pollution.⁶

Another two important explanatory variables are *provincial government intervention*, as a proxy for government intervention, and *the degree of marketization*⁷, as a proxy for "market-preserving"

⁶ We also tried to include air pollution measures but the availability of these data is not satisfying. Using the air pollution available we find that the results basically remain the same.

⁷ The marketization index is compiled by Fan and Wang, a comprehensive index that contains 23 sub-indices, covering aspects such as the relationship between markets and the government, the development of non-state economy, the development of production market, the development of production factor market and the development of intermediary agency and legal system. The final

behavior. Considering the overall difficulties in measuring government intervention, the two complementary variables used here are intended to characterize the existence or absence of government intervention in the economy. The former one, measured as the ratio of government budget expenditure after deducting expenditure on health and education services to GDP at the province level,⁸ is expected to be correlated with local governments' behavior involving improper subsidies to firms, direct investment intending to boost local economy, and perhaps with other activities fostering local protectionism, imposing interregional barrier, etc. As a complementary indicator, *the degree of marketization* is used to characterize the absence to a certain degree of the activities mentioned above. Note that these two variables not only serve as control variables, they are also employed in additional interaction terms with the measures of fiscal decentralization to identify potential mechanisms that may moderate the effects of fiscal decentralization itself. For that, we run the two following additional regressions:

$$misall_{i,t} = \alpha + \beta FD_{i,t} + \lambda FD_{i,t} * expenditure + \gamma Z_{i,t} + \eta_i + \nu_t + \xi_{i,t} \quad (5)$$

$$misall_{i,t} = \alpha + \beta FD_{i,t} + \lambda FD_{i,t} * market + \gamma Z_{i,t} + \eta_i + \nu_t + \xi_{i,t} \quad (6)$$

For model (5) and (6), the coefficient of first interest is λ , which captures the potential role of government intervention (the degree of marketization) in the relationship between fiscal decentralization and misallocation. For example, in equation (5) β can be interpreted as the effect of fiscal decentralization on misallocation when the variable “*government intervention*” is 0 and λ captures the moderation effect of government intervention. We expect λ in equation (5) to be significantly positive, implying that the impact of fiscal decentralization in reducing interregional resource misallocation will be reduced when government intervention is greater. In contrast, in equation (6), λ is expected to be statistically significant and negative, meaning that when market

marketization index is an arithmetic average of these 23 sub-indices. For more detailed information, please refer to the Appendix A in Li et al. (2009) and Fan et al. (2001).

⁸ In China, the government invests a large amount of money in infrastructure, but not all these are included in the government's official budgets. Many of these investments are usually conducted by large state-owned enterprises. On the other hand, a good part of government expenditure are used to provide regular public goods and services, which should not be viewed as “interventions” in the local economy. Therefore, our measure excludes expenditure on the provision of health and education services, the most common and important types of local public services.

forces are driving the flow of capital, the impact of fiscal decentralization on reducing misallocation will be enhanced.

3.3 Data

Because of several prominent reforms in China's administrative regions prior to 2003,⁹ the panel data set covers 22 provinces in China between 2003 and 2015. As mentioned above, four direct-controlled cities are excluded as are five provinces due to the lack of data. The data come from four different sources. First, municipal level data on investment, GDP, fiscal revenue and fiscal expenditure are drawn from *China City Statistics Yearbook*. Second, provincial level data for measuring decentralization (provincial level fiscal revenue and expenditure) and data on other control variables such as government intervention, province-level GDP, finance development, trade and FDI are taken from the Statistics Yearbook for each province. Third, the labor share of income used to calculate *MPK* and the control variable, share of state-owned enterprises are from the *China Statistics Yearbook*. Lastly, the data for measuring the degree of marketization of each province are from various issues of *NERI INDEX of Marketization of China's Provinces Report* edited by Fan and Wang.¹⁰ The summary statistics of main variables are reported in Table 1.

Table 1. Summary Statistics

Variable	Explanation	Obs	Mean	Std.Dev.	Min	Max
<i>misall</i>	measured misallocation	286	0.197	0.0716	0.00442	0.438
<i>fdrev</i>	revenue decentralization	286	0.782	0.109	0.493	0.975
<i>fdexp</i>	expenditure decentralization	286	0.751	0.114	0.339	0.907
<i>gdp</i>	provincial GDP per capita	286	28486	17578	3603	87995
<i>urban</i>	urbanization level	286	0.473	0.101	0.248	0.687
<i>secratio</i>	the share of secondary sector	286	49.48	5.103	31.81	61.50
<i>finance</i>	outstanding loan/GDP	286	0.910	0.269	0.354	1.904

⁹ In 2000, 21 regions were reformed to be prefecture-level cities and 2 county-level cities were upgraded to prefecture-level cities. In 2001, 6 regions were changed to prefecture-level cities and then in 2002, 10 more regions were authorized to be prefecture-level cities.

¹⁰ The *NERI INDEX of Marketization of China's Provinces Report* was first published in 2000 and seven reports had been issued so far. The latest report was published by Social Sciences Academic Press (China) in January, 2017. For more information, please refer to

<https://finance.qq.com/a/20160414/041777.htm>.

<i>trade</i>	(export + import)/GDP	286	0.251	0.300	0.0402	1.581
<i>soe</i>	the share of state-owned economy	286	0.518	0.191	0.140	0.850
<i>fdi</i>	foreign direct investment/GDP	286	0.00338	0.00244	3.87e-05	0.0127
<i>pollution</i>	industrial sewage/industrial added value	286	20.53	17.61	3.721	126.4
<i>intervention</i>	(government expenditure-expenditure on health and education services)/ GDP	286	0.141	0.0556	0.0625	0.325
<i>market</i>	NERI INDEX of Marketization	264	6.310	1.627	3.320	11.39

NOTES: We only have data on *market* to 2014, so the number of observations is reduced to 264. In the following regressions, when the *market* variable is included, the sample is from 2003 to 2014.

4 Empirical Results

4.1 Baseline Results

Table 2 reports the OLS estimates based on models (3) and (4). All specifications control for year fixed effects. Columns (2) and (4) also control for province fixed effects by including province dummies. Columns (1) and (2) include the variable capturing *government intervention* and the sample is from 2003 to 2015. Correspondingly, columns (3) and (4) include the *marketization* variable to characterize the absence of government intervention while the sample is from 2003 to 2014. Overall, as shown in Table 2, the *R-squared* value is over 0.6 when province dummies are included and over 0.3 even when we do not control for the province fixed effects in columns (1) and (3), indicating that our specifications have enough explanatory power on interregional misallocation.

For our variable of interest, *fdrev*, revenue decentralization, the estimated coefficient in column (1) is significantly negative, thus, revenue decentralization can alleviate interregional capital misallocation. Column (2), which additionally controls for province fixed effects, displays similar results for *fdrev* with the value getting larger and more significant. Quantitatively, a one standard deviation increase in revenue decentralization would result in a 0.3 standard deviation decrease in interregional misallocation, which equals to a roughly 11 percent decrease. Columns (3) and (4), include *marketization* (instead of *intervention*) as a control variable. As reported in column (3), the coefficient on revenue decentralization now is still negative but statistically insignificant with a p-value of 0.155. Column 4 provides the results obtained when province dummies are included, and the result suggests that the effect of revenue decentralization on misallocation is negative and statistically

significant at the 5% level. This, again despite the sample we used changed a little bit, supports the hypothesis that revenue decentralization can mitigate interregional capital misallocation.

As for the controls, we find a positive relationship between economic development and misallocation. The coefficient on *gdp* is positive and statistically significant in all specifications except for column (3), implying that rich areas in China tend to have higher level of interregional misallocation. The reasons for this are not very clear to us. One possible explanation is that richer areas enjoy more capital inflows, including FDI, and that this may introduce a wider distribution of rates of return, including existing firms that may widen their presence and reinvest. The *pollution* variables in columns (2) and (4) are significantly positive, which might suggest that the “race to the bottom” type processes push up the interregional misallocation level. The coefficient of *finance*, though being significant in three specifications in Table 2, is negative in column (3) but positive in column (2) and (4). This is also the case for the *trade* variable. Thus, we cannot determine the effect of those two variables. The coefficients for *government intervention* and *marketization* are not robust across different specifications as well (columns (3) and (4)). Other control variables such as the urbanization rate, the share of state-owned economy and foreign direct investment do not exert a significant and robust impact on interregional misallocation.

Table 2 Baseline results: the effect of revenue decentralization on misallocation

	(1)	(2)	(3)	(4)
VARIABLES	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>
<i>fdrev</i>	-0.141** (0.0562)	-0.199*** (0.0759)	-0.0787 (0.0552)	-0.190** (0.0789)
<i>gdp</i>	1.14e-06* (6.80e-07)	3.27e-06*** (1.05e-06)	8.71e-07 (7.03e-07)	1.74e-06* (9.31e-07)
<i>urban</i>	0.0711 (0.0777)	0.0597 (0.146)	0.108 (0.0814)	0.0693 (0.140)
<i>secratio</i>	-0.00531*** (0.000879)	-0.000764 (0.00123)	-0.00441*** (0.000929)	-0.00161 (0.00136)
<i>finance</i>	0.00921 (0.0191)	0.0568* (0.0289)	-0.0334** (0.0163)	0.0652** (0.0266)
<i>trade</i>	0.0890*** (0.0228)	-0.0842* (0.0485)	0.0711*** (0.0261)	-0.0743 (0.0456)

<i>soe</i>	0.138*** (0.0456)	0.00243 (0.100)	0.171*** (0.0520)	-0.0789 (0.109)
<i>fdi</i>	1.189 (1.845)	-1.040 (3.024)	-2.309 (1.914)	-1.821 (2.897)
<i>pollution</i>	-4.80e-05 (0.000390)	0.00162*** (0.000498)	1.04e-05 (0.000412)	0.00148*** (0.000548)
<i>intervention</i>	-0.547*** (0.126)	0.687** (0.312)		
<i>market</i>			0.0212*** (0.00718)	-0.0173** (0.00863)
<i>Constant</i>	0.486*** (0.0868)	0.224 (0.152)	0.239** (0.105)	0.454** (0.176)
Province fixed effects	N	Y	N	Y
Observations	286	286	264	264
R-squared	0.351	0.638	0.335	0.649

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 replicates the panel estimation in Table 2 but uses expenditure decentralization as the proxy for fiscal decentralization. As can be seen, the coefficient on *fdexp* is far from being significant in almost of the regressions, with the exception being in column (3). However, in column (3), the coefficient of expenditure decentralization is positive and significant at the 10% level. Combining with the result in column (4), where the coefficient on expenditure decentralization is negative but insignificant once the province fixed effects has been controlled for, we conclude that the expenditure decentralization seems to have no impact on interregional misallocation. Of course, this is quite contrary to the results for revenue decentralization in Table 2. These findings are consistent with those in Jin et al. (2005), who argue that revenue decentralization generates strong incentives motivating local governments to seek the development of the non-state sector and reforms of the state-owned sector, among other things to allow them to increase budget revenues. On the other hand, expenditure decentralization does not generate such incentives (see Table 6 in Jin et al. (2005)).

But, in addition, as discussed earlier in the theoretical framework, expenditure decentralization might also endow local governments with more capacity to implement intervention, such as to offer subsidies to attract firms and hence disturb the equilibrium price of capital. Another possible explanation for the diverse results on revenue and expenditure decentralization is that allowing

subnational governments to own more revenue can make the government more accountable and lead them to spend more wisely (see a recent paper by Gadenne (2017)).¹¹ Regarding the control variables, most of the coefficients in Table 3 are consistent with those presented in Table 2.

Table 3 Baseline results: the effect of expenditure decentralization on misallocation

VARIABLES	(1)	(2)	(3)	(4)
	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>
<i>fdexp</i>	0.0269 (0.0593)	-0.128 (0.113)	0.102* (0.0558)	-0.0295 (0.117)
<i>gdp</i>	1.22e-06* (6.97e-07)	3.22e-06*** (1.06e-06)	9.49e-07 (7.16e-07)	1.64e-06* (9.84e-07)
<i>urban</i>	0.0558 (0.0798)	0.0493 (0.150)	0.0962 (0.0832)	0.0466 (0.143)
<i>secratio</i>	-0.00580*** (0.000978)	-0.000410 (0.00125)	-0.00555*** (0.00107)	-0.00124 (0.00136)
<i>finance</i>	0.00557 (0.0194)	0.0432 (0.0299)	-0.0286* (0.0159)	0.0576** (0.0271)
<i>trade</i>	0.108*** (0.0216)	-0.0746 (0.0481)	0.0861*** (0.0242)	-0.0698 (0.0456)
<i>soe</i>	0.189*** (0.0406)	0.0773 (0.0993)	0.214*** (0.0488)	0.00112 (0.106)
<i>fdi</i>	-0.828 (1.885)	-1.117 (3.182)	-3.726* (1.947)	-2.643 (2.952)
<i>pollution</i>	-0.000332 (0.000410)	0.00139*** (0.000498)	-0.000353 (0.000439)	0.00126** (0.000549)
<i>intervention</i>	-0.440*** (0.140)	0.782** (0.324)		
<i>market</i>			0.0165** (0.00734)	-0.0149* (0.00882)
Constant	0.362*** (0.0696)	0.121 (0.133)	0.179* (0.0954)	0.276* (0.160)
Province fixed effects	N	Y	N	Y
Observations	286	286	264	264

¹¹ We realize that the accountability argument may have a reduced validity in China because of the absence of competed democratic elections of local officials.

R-squared	0.338	0.631	0.338	0.641
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Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.2 Identifying the role of government intervention and marketization

Having established the relationship between decentralization and misallocation, we consider next whether this relationship varies when local governments adopt different strategies toward the private sector. More specifically, we attempt to answer the following questions: under what conditions can fiscal decentralization lower interregional misallocation levels and do local governments play a role here? As is discussed in the theoretical framework section, the effect of fiscal decentralization on interregional resource misallocation is uncertain, but when the market forces rather than government interventions are driving the flow of capital, we expect revenue decentralization to reduce misallocation. In order to address these questions, we estimate models (5) and (6). The results are shown in Table 4. Columns (1) and (2) show the results when the interaction term is between revenue *fdrev* and *intervention*, and columns (3) and (4) correspond to the results when the interaction term is between *fdrev* and *marketization*.

Let us focus on column (1) first. When the interaction term between revenue decentralization, *fdrev*, and government intervention is included, the coefficient on revenue decentralization, which can be interpreted as the impact of revenue decentralization on misallocation when government intervention is 0, is negative and statistically significant. Moreover, in comparison, the magnitude of the effect (-0.500) is much larger than that in the specification without incorporating the interaction term (-0.141 in column (4) of Table 2), indicating that revenue decentralization drives down interregional misallocation substantially when there exists no government intervention. On the other hand, the coefficient on the interaction term is positive and significant at the 1% level. This means that when there is more government intervention, revenue decentralization actually tends to worsen interregional misallocation because revenue decentralization also endows subnational governments more capacity to implement interventions.

In column (2), additionally controlling for province fixed effects, we obtain similar results but the effect of revenue decentralization on misallocation now nearly doubled compared to that in column

(1). A one standard deviation increase in revenue decentralization would equally result in one standard deviation decrease in interregional misallocation, which equals to a more than 50% decrease.

Complementarily, we also use the degree of marketization to mirror the opposite side of government intervention and the corresponding results are presented in columns (3) and (4). As is shown in column (3), the coefficient on the interaction term between revenue decentralization and the degree of marketization is negative and significant at the 1% level, indicating that the impact of revenue decentralization on lowering misallocation significantly rises when market forces tend to be driving the allocation of capital. However, the coefficient on revenue decentralization alone is positive and statistically significant at the 1% level. This would seem to suggest that when the degree of marketization is low, revenue decentralization can increase the misallocation level. Thus we get confirmation that the government's strategy toward the market economy is quite decisive. Column (4) additionally includes the province dummies and this does not alter the estimation result for the interaction term between *fdrev* and *marketization*, while the coefficient of *fdrev* now becomes insignificant and the sign is still positive. This is quite to contrary to the previous findings in Table 2, which consistently present a negative association of revenue decentralization and interregional misallocation.

Table 4 The role of government intervention and marketization

	(1)	(2)	(3)	(4)
VARIABLES	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>
<i>fdrev</i>	-0.500*** (0.150)	-0.981*** (0.197)	0.463*** (0.168)	0.214 (0.269)
<i>fdrev*intervention</i>	2.491*** (0.920)	5.094*** (1.372)		
<i>fdrev*market</i>			-0.0921*** (0.0288)	-0.0704* (0.0421)
<i>gdp</i>	1.89e-06*** (7.15e-07)	2.96e-06*** (1.00e-06)	1.73e-06** (6.75e-07)	1.89e-06** (9.54e-07)
<i>urban</i>	-0.0744 (0.0939)	-0.0147 (0.136)	-0.00869 (0.0791)	0.120 (0.143)
<i>secratio</i>	-0.00613***	-0.000989	-0.00488***	-0.00159

	(0.000943)	(0.00122)	(0.000906)	(0.00134)
<i>finance</i>	0.0149	0.0238	-0.0105	0.0620**
	(0.0188)	(0.0269)	(0.0159)	(0.0261)
<i>trade</i>	0.106***	-0.0617	0.0752***	-0.0760*
	(0.0233)	(0.0490)	(0.0262)	(0.0459)
<i>soe</i>	0.115**	0.108	0.172***	-0.0707
	(0.0477)	(0.0967)	(0.0499)	(0.108)
<i>fdi</i>	1.269	-1.800	-2.167	-1.890
	(1.838)	(2.795)	(1.895)	(2.897)
<i>pollution</i>	-0.000406	0.00182***	-0.000299	0.00148***
	(0.000452)	(0.000497)	(0.000428)	(0.000554)
<i>intervention</i>	-2.330***	-2.822***		
	(0.681)	(1.014)		
<i>market</i>			0.0952***	0.0414
			(0.0252)	(0.0362)
Constant	0.862***	0.780***	-0.139	0.0947
	(0.180)	(0.196)	(0.152)	(0.290)
Province fixed effects	N	Y	N	Y
Observations	286	286	264	264
R-squared	0.373	0.665	0.366	0.656

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.3 Instrumental variables

A concern is that the potential endogeneity of fiscal decentralization might bias our estimator. Endogeneity may arise because of the reverse causality problem; that is, upper-level governments (in our context, province-level governments) may adjust the assignment of revenues and expenditures among the various layers of governments within their boundaries trying to address a perceived severe interregional misallocation problem. Moreover, fiscal decentralization and interregional misallocation both can be determined by other external factors, such as geographic characteristics, cultural factors, or demographic composition. For example, a mountainous region could both exhibit a high degree of

decentralization and a high level of interregional misallocation, both induced the high transportation and transaction costs.¹²

To deal with the potential endogeneity of fiscal decentralization, we need an instrumental variable. The instrumental variables for fiscal decentralization employed in prior studies usually include the initial value of decentralization, lagged independent variables and some type of geography variable (Martinez-Vazquez et al., 2017). However, as discussed earlier, a geography variable may not be an appropriate choice of instrument in our case because geographic characteristic could also affect the level of misallocation, for example, through information, transportation or transaction costs channels, thus violating the exclusion restriction for IVs. Therefore, we instrument for fiscal decentralization with its one-period lagged value, which can overcome the reverse causality problem since the past institutional design cannot be altered.

Table 5 reports the results for the effect of decentralization on misallocation when we use the IV approach. All specifications in Table 5 control for province fixed effects. In column (1) and (2), we measure fiscal decentralization from the revenue side and correspondingly, column (3) and (4) offer the results from the expenditure decentralization side. Columns (5) and (6) are the corresponding results from Table 4 when the interaction term is incorporated. Prior to discussing the coefficient on revenue and expenditure decentralization, we first take a look at the validity of the instruments. As we only have one instrumental variable in each regression, we need not to worry about the overidentification problem. The Kleibergen-Papp rk LM statistic used to test the under-identification restriction and the Cragg-Donald Wald F statistic for the weak identification test are presented at the bottom of table 5; it can be seen that all instruments are valid.

Turning to the estimated coefficients on revenue and expenditure decentralization, the results confirm our previous findings. An increase in revenue decentralization reduces the interregional misallocation level while expenditure decentralization does not have a significant impact. Furthermore, comparing the results in Table 5 and Table 2 shows that the IV estimates provide a much greater magnitude of the impact (-0.421 versus -0.199 and -0.496 versus -0.190). This implies

¹² Canavire-Bacarreza et al. (2016) document a significantly positive relationship between geographical fragmentation and fiscal decentralization.

that the endogeneity of revenue decentralization leads to an under-estimation of its impact on mitigating interregional misallocation. The results in columns (3) and (4) again show that expenditure decentralization does not have a significant impact on interregional misallocation, with the coefficient being negative but far from being significant in column (3) and insignificantly positive in column (4). Column (5) further introduces the interaction term between revenue decentralization and government intervention to identify the condition required for revenue decentralization to take effect. Similar to the estimation results in Table 4, the interaction term is significantly positive and the absolute value of the coefficient on *fdrev* is now much larger (-2.835 versus -0.981 in column (2) of Table 4). In addition, when we use the degree of marketization to characterize the role of the government in column (6), the previous finding is confirmed again, although the statistical significance of the coefficient on the interaction term is now lost. In summary, the IV estimation results confirm our previous findings.

Table 5 Replicating regressions in Table 2,3,4 with IV estimation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>	<i>misall</i>
<i>fdrev</i>	-0.421*** (0.133)	-0.496*** (0.177)			-2.835*** (1.095)	-0.174 (0.308)
<i>fdexp</i>			-0.0739 (0.160)	0.0880 (0.182)		
<i>fdrev*intervention</i>					15.21** (6.130)	
<i>fdrev*market</i>						-0.0562 (0.0397)
<i>gdp</i>	3.08e-06*** (9.96e-07)	1.39e-06 (9.53e-07)	3.10e-06*** (1.01e-06)	1.33e-06 (1.01e-06)	2.20e-06** (1.03e-06)	1.43e-06 (9.62e-07)
<i>urban</i>	0.236 (0.155)	0.296* (0.157)	0.181 (0.153)	0.198 (0.145)	-0.00238 (0.173)	0.318** (0.155)
<i>secratio</i>	-0.00129 (0.00118)	-0.00251* (0.00139)	-0.000820 (0.00116)	-0.00177 (0.00129)	-0.00210 (0.00146)	-0.00254* (0.00137)
<i>finance</i>	0.0503* (0.0279)	0.0701** (0.0284)	0.0318 (0.0284)	0.0583** (0.0271)	-0.0514 (0.0515)	0.0658** (0.0272)
<i>trade</i>	-0.0777* (0.0470)	-0.0715 (0.0461)	-0.0636 (0.0473)	-0.0623 (0.0483)	0.00241 (0.0603)	-0.0770* (0.0461)

<i>soe</i>	-0.0221 (0.105)	-0.146 (0.120)	0.117 (0.1000)	0.0326 (0.105)	0.297** (0.145)	-0.139 (0.118)
<i>fdi</i>	0.238 (2.771)	0.519 (3.563)	-0.626 (3.073)	-3.104 (3.130)	-1.988 (3.427)	0.809 (3.560)
<i>pollution</i>	0.00178*** (0.000559)	0.00170*** (0.000623)	0.00129** (0.000543)	0.00117* (0.000600)	0.00234*** (0.000722)	0.00170*** (0.000625)
<i>intervention</i>	0.808*** (0.286)		0.938*** (0.291)		-9.730** (4.313)	
<i>market</i>		-0.0170** (0.00865)		-0.0120 (0.00826)		0.0301 (0.0357)
Constant	0.361** (0.176)	0.688*** (0.235)	0.0312 (0.162)	0.142 (0.182)	2.110** (0.822)	0.408 (0.326)
Province fixed effects	Y	Y	Y	Y	Y	Y
Observations	264	242	264	242	264	242
R-squared	0.654	0.645	0.655	0.652	0.566	0.653
Validity of instruments						
K-P rk LM statistic	33.885	26.396	37.173	31.715	7.078	26.345
Cragg-Donald F statistic	77.845	54.372	156.455	139.150	8.092	27.005

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5 Robustness check: alternative measurement

As a robustness check we construct a new index to measure the level of intra-provincial and inter-municipal misallocation. Bartelsman et al. (2013) use three moments of firm-level distributions to assess the impact of misallocation and find that the covariance term exhibits systematic variation in terms of both levels and changes, while the within-industry dispersion measurement is relatively stable. They conclude that the covariance term is a robust measure of misallocation, both theoretically and empirically. Following Bartelsman et al. (2013), we posit that productive regions should receive more investment to achieve a better allocation of resources.¹³ Therefore, we compute our alternative measurement of interregional capital misallocation with the following formula:

¹³ The three measures in Bartelsman et al. (2013) are the within-industry standard deviations of labor productivity and of TFP and the correlation between firm size and the average product of labor based on the intuition that productive firms should be big in size.

$$misall2_{i,t} = \text{corr}(I_{i,j,t}, MPK_{i,j,t}) \quad (7)$$

As before, i denotes province, t denotes year and j denotes the municipality in province i ; I represents investment and Y stands for GDP. Interregional misallocation is measured by the correlation between investment and MPK . The greater the correlation coefficient is the more investment the productive regions receive, and the more effective the allocation of resources will be. Hence, in contrast to our earlier measure $misall$, this alternative measure, $misall2$ will be larger when interregional misallocation is lower and vice versa. The mean value of the measured $misall2$ is -0.025 while its standard deviation is 0.445, showing, as expected, a much larger variation.

Table 6 reports the estimation results when $misall2$ serves as the dependent variable. Column (1) to (4) replicates the regressions in Table 2 and 3. It is shown that the coefficient on revenue decentralization is positive and statistically significant while the coefficient on expenditure decentralization is statistically insignificant. This is in line with our previous findings that revenue decentralization reduces interregional misallocation while expenditure decentralization, as another dimension of decentralization, has no significant impact. In column (5) and (6), we run the regression based on equations (5) and (6). We can see that the coefficient on the interaction term between revenue decentralization and government intervention is negative but statistically insignificant (p -value=0.201), and the coefficient on revenue decentralization becomes quantitatively greater and statistically more significant (2.554 versus 1.238). Although the coefficient on the interaction between revenue decentralization and marketization is not significant in column (6), the sign of the coefficient is as expected and, more importantly, the coefficient on revenue decentralization, $fdrev$, is no longer significant. This, again, shows that revenue decentralization appears to enhance the efficiency of interregional allocation when government intervention in the market is low or absent.

Regarding the other control variables, the economic development variable, gdp , is negatively associated with the measured $misall2$, which is consistent with the previous results that richer regions are faced with higher misallocation levels. Also, the association between $pollution$ and misallocation does not change. Besides, we can see that increasing the share of state-owned enterprises results in greater misallocation while the development of financial market is conducive to a better allocation of capital.

Table 6 Alternative measurement: replicating baseline regression and identifying the role of government expenditure and marketization

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>
<i>fdrev</i>	1.238*** (0.408)	1.308*** (0.420)			2.554** (1.090)	1.137 (1.125)
<i>fdexp</i>			0.344 (0.675)	0.110 (0.706)		
<i>fdrev*intervention</i>					-8.569 (6.687)	
<i>fdrev*market</i>						0.0297 (0.193)
<i>gdp</i>	-1.17e-05* (6.34e-06)	-7.68e-06 (5.74e-06)	-1.16e-05* (6.57e-06)	-7.14e-06 (6.09e-06)	-1.11e-05* (6.37e-06)	-7.74e-06 (5.68e-06)
<i>urban</i>	0.499 (0.873)	-0.250 (0.897)	0.613 (0.811)	-0.0840 (0.842)	0.625 (0.893)	-0.271 (0.941)
<i>secratio</i>	-0.0236*** (0.00823)	-0.0253*** (0.00851)	-0.0255*** (0.00831)	-0.0278*** (0.00876)	-0.0232*** (0.00819)	-0.0253*** (0.00854)
<i>finance</i>	0.331* (0.171)	0.284 (0.194)	0.393** (0.174)	0.333* (0.192)	0.387** (0.184)	0.285 (0.193)
<i>trade</i>	-0.280 (0.240)	-0.341 (0.267)	-0.325 (0.255)	-0.369 (0.288)	-0.318 (0.247)	-0.340 (0.267)
<i>soe</i>	-1.486** (0.623)	-1.826*** (0.657)	-1.946*** (0.622)	-2.372*** (0.641)	-1.663*** (0.614)	-1.830*** (0.656)
<i>fdi</i>	-21.06 (17.09)	-29.12 (18.23)	-20.09 (16.53)	-23.39 (18.13)	-19.78 (17.69)	-29.09 (18.22)
<i>pollution</i>	-0.00844*** (0.00314)	-0.00894** (0.00352)	-0.00696** (0.00306)	-0.00745** (0.00340)	-0.00878*** (0.00312)	-0.00894** (0.00353)
<i>intervention</i>	-2.556 (1.770)		-2.931 (1.787)		3.348 (4.430)	
<i>market</i>		-0.0495 (0.0507)		-0.0652 (0.0518)		-0.0743 (0.167)
Constant	1.511* (0.825)	2.194** (1.010)	2.456*** (0.929)	3.480*** (0.993)	0.575 (1.178)	2.346 (1.473)
Province fixed effects	Y	Y	Y	Y	Y	Y
Observations	286	264	286	264	286	264

R-squared	0.674	0.685	0.665	0.675	0.676	0.685
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Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7 replicates the regressions in Table 6 but employs the one-period lagged value of decentralization as an instrument. As before, all the instruments are valid. In addition, as shown in columns (1)-(4), the results are quite similar to those in Table 2, 3, 5 and 6; that is, revenue decentralization lowers interregional misallocation but expenditure decentralization has no impact. Column (5) confirms our earlier findings on the role of the government intervention, while there is no strong evidence on the impact of the marketization (column 6).

Based on all the regression results from our empirical analysis, we arrive at the conclusion that revenue decentralization can lower interregional capital misallocation but that expenditure decentralization plays no significant role, and that this effect largely depends on the government' attitude towards market intervention.

Table 7 IV estimation with alternative measurement

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>	<i>misall2</i>
<i>fdrev</i>	3.450*** (1.026)	4.022*** (1.299)			21.53* (11.18)	4.815** (2.211)
<i>fdexp</i>			0.946 (1.258)	0.782 (1.266)		
<i>fdrev*intervention</i>					-113.9* (62.69)	
<i>fdrev*market</i>						-0.138 (0.271)
<i>gdp</i>	-9.90e-06 (6.12e-06)	-8.15e-06 (5.49e-06)	-9.88e-06 (6.32e-06)	-5.71e-06 (5.92e-06)	-3.32e-06 (8.56e-06)	-8.03e-06 (5.44e-06)
<i>urban</i>	1.007 (1.154)	0.127 (1.256)	1.410 (0.879)	0.722 (0.961)	2.790 (1.720)	0.183 (1.277)
<i>secratio</i>	-0.0200** (0.00901)	-0.0212** (0.00995)	-0.0240*** (0.00841)	-0.0277*** (0.00919)	-0.0139 (0.0114)	-0.0212** (0.00989)
<i>finance</i>	0.248 (0.192)	0.202 (0.231)	0.417** (0.194)	0.352* (0.212)	1.009** (0.476)	0.192 (0.229)
<i>trade</i>	-0.307	-0.349	-0.434	-0.465	-0.907**	-0.362

	(0.236)	(0.250)	(0.265)	(0.297)	(0.449)	(0.253)
<i>soe</i>	-0.775	-0.862	-1.920***	-2.354***	-3.168**	-0.844
	(0.733)	(0.847)	(0.695)	(0.720)	(1.235)	(0.852)
<i>fdi</i>	-7.991	-24.11	-1.365	3.687	8.682	-23.40
	(19.31)	(24.25)	(14.91)	(18.55)	(34.46)	(24.19)
<i>pollution</i>	-0.0107***	-0.0117***	-0.00666*	-0.00757*	-0.0149***	-0.0117***
	(0.00385)	(0.00441)	(0.00348)	(0.00386)	(0.00577)	(0.00441)
<i>intervention</i>	-1.475		-2.682		77.44*	
	(1.740)		(1.845)		(43.40)	
<i>market</i>		-0.0358		-0.0914*		0.0800
		(0.0560)		(0.0497)		(0.242)
Constant	-1.033	-0.787	1.447	2.683**	-14.12*	-1.477
	(1.233)	(1.695)	(1.274)	(1.365)	(8.362)	(2.467)
Province fixed effects	Y	Y	Y	Y	Y	Y
Observations	264	242	264	242	264	242
R-squared	0.651	0.647	0.674	0.686	0.371	0.647
Validity of instruments						
K-P rk LM statistic	33.885	26.396	37.173	31.715	7.078	26.345
Cragg-Donald F statistic	77.845	54.372	156.455	139.150	8.092	27.005

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

6 Conclusion

Misallocation has become in the recent literature a prominent explanation for why poor countries or regions stay underdeveloped. That is, underdevelopment is as much a consequence of the misallocation of available resources as it may be a consequence of the shortage in the endowment of resources. This paper focuses on interregional capital misallocation in China and investigates the potential role played by fiscal decentralization on that misallocation. In particular, we study the effect of revenue and expenditure decentralization on intra-provincial and inter-municipal capital misallocation. We find that revenue decentralization alleviates interregional misallocation while expenditure decentralization does not lead to any significant effect. We further identify that the attitude of local governments toward market intervention is a key intervening factor. Revenue decentralization can alleviate interregional misallocation when it is the market forces rather than

government intervention that drives the flows of capital allocation. The results are robust to different specifications, IV estimation and alternative measurement of interregional misallocation.

Our conclusion on the role of marketization or government intervention highlights the fundamental role played by market forces in attaining efficient resource allocation. Fiscal decentralization defines the relationship among various layers of governments while the degree of marketization or government intervention characterize the boundary between the government and market. While our findings suggest that decentralization on its own does not secure better capital allocation but it can facilitate resource allocation together with market forces since higher degree of marketization can mitigate the negative effect of decentralization on resource allocation. In fact, China has experienced fiscal decentralization before its marketization reform, but its rapid growth did not start until the reform and open up policy implemented in the late 1980s.

Our findings would suggest the importance of increasing revenue autonomy within the implementation of fiscal decentralization policy in China in order to improve interregional capital allocation. However, we also find that this beneficial effect depends on the presence of marketization forces and that contrary to a vision of a larger role of government in the economy, the higher presence of government intervention in the economy tends to dampen the positive impact of revenue decentralization on allocation.

Our results strongly indicate that China should increase the degree of revenue decentralization. This is a strong policy implication especially given the fact that currently subnational local governments in China enjoy much more expenditure authority relative to revenue autonomy. Our results would also seem to indicate that interregional inequality in China might be due more to the misallocation of human capital, labor or technology rather than capital itself since the level of interregional capital misallocation decreases while interregional inequality level increases with higher levels of fiscal decentralization. To the best of our knowledge, this paper is the first to study the impact of fiscal decentralization on (interregional) misallocation. Of course, more evidence from other countries and regions will be required to reach a deeper understanding of the interaction between decentralization and misallocation.

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