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Fiscal Decentralization and Interregional Capital Misallocation: Evidence from China

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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 city-level panel data set, we measure intra-provincial and inter-municipal capital misallocation in China over 2003-18. The empirical results based on provincial-level panel data suggest that fiscal decentralization can lower inter-municipal capital misallocation while revenue decentralization performs better than expenditure decentralization. We further find that this positive effect is more significant and much larger when the market rather than government intervention is driving the flow of capital. The results are robust to subsample regressions, IV estimations, spatial autoregressions 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.

Keywords: fiscal decentralization, interregional misallocation, China

JEL Classification: H11, H23, H70

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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 administrated 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 over 80 percent 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 city-level data for China over the period 2003-18. Our empirical results show that fiscal decentralization can lower interregional capital misallocation, while revenue decentralization performs better than expenditure decentralization. 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, alternative measurement of interregional misallocation and spatial econometric estimations.

Our study is closely related to two threads of the literature. First, this paper contributes to the 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 TFPR, while TFPR is proportional to the geometric average of the marginal products of capital and labor. Based on micro data on manufacturing firms, Hsieh and Klenow (2009) find that TFP in China and India would increase by 30-50 percent and 40-60 percent, respectively, if their resources were reallocated to the U.S. level.

A series of papers extended this approach to other countries and other sectors, including Busso et al. (2013) for 10 Latin American countries, Kalemli-Ozcan and Sorensen (2016) for 10 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

and Xu, 2014; Moll, 2014), imperfect information (David et al., 2016) and government regulation (Hsieh and 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 inter-municipal capital misallocation in China. The only two previous papers that have adopted a regional focus, and which are further discussed below, are Brandt et al. (2013), who examine inter-provincial misallocation in China, and Hsieh and Moretti (2015), who explore labor misallocation across U.S. cities. Second, we are the first to investigate the potential role played by fiscal decentralization policy in shaping interregional misallocation. This complements the previous literature on misallocation that utilize, as Restuccia and Rogerson (2017) called it, the direct approach.

Second, our work is also related to literature on fiscal federalism, especially to those papers that empirically examine the social and economic impact of fiscal decentralization. Example of topics that have been carefully examined include the impact of fiscal decentralization on public goods and service provision (e.g., Faguet and Sanchez, 2014; Falch and Fischer, 2012), interregional disparities (e.g., Lessmann, 2009; Kyriacou et al., 2015), government size and corruption (e.g., Marlow, 1988; Jin and Zhou, 2002; Fisman and Gatti, 2002) and, most importantly, economic growth (e.g., Davoodi and Zou, 1998; Gemmell et al., 2013). See Martinez-Vazquez et al. (2017) for a comprehensive review of the impact of fiscal decentralization on economy, society, and politics. 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 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, to contribute to the better understanding of the impact of fiscal decentralization on economic growth since economic growth critically depends on the efficiency of 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 and 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 the fact that the existing capital 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, the measurement of inter-municipal misallocation, and the econometric modeling. Section 4 shows the main empirical results, and section 5 offers several robustness checks. 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 greater, 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 and 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 move 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 improve efficiency by lowering transportation costs and also enhance geographical factor mobility (Kappeler et al., 2013). Third, regions 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 type of inter-jurisdictional competition in China. Therefore, there are strong forces for the marginal products of capital across regions to be equalized and for capital misallocation to be decreased. Last but not least, decentralization allows and motivates governments to try economic experiments to find successive economic policies that are conducive to economic development. 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' investment (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 necessarily flow to poorer areas despite the potential higher returns they may obtain there. In this regard, it is widely known that economic development in China has been 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, may simply give up, making 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, beyond other negative consequences, may distort the flow of capital because firms' costs are 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. Specifically, so to attain certain economic performance goals, subnational governments may be reluctant to see capital outflowing because it could 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 pursing the goal of maximizing fiscal revenues. In addition, the state-owned financial institutions in China endow governments with considerably more power than is usually the case to control the placement of capital, facilitating subnational governments' direct

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 implications are much more nuanced, with fiscal decentralization potentially exerting 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 erecting interregional barriers, using improper subsidies or entering into 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 calls for conducting an empirical analysis of this issue to discern the final net impact. 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 measuring misallocation among firms and exploiting the large firm-level data sets available. Nonetheless, the intuition is very similar when measuring interregional misallocation. That is,

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

misallocation is characterized by the dispersion of marginal products of capital or labor across producers (Restuccia and Rogerson, 2017). Following this insight, we propose to measure interregional capital misallocation by examining the variation in the marginal return of capital across cities within one province. In particular, we use the following formulation:[2]

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

Here i denotes province, t denotes year and j denotes the city in province i; MPK_{ijt} is the measured marginal products of capital at different times in city j. The numerator in (1) is the standard deviation of the marginal products of capital in province i at the city level and the denominator is its mean value across cities. Therefore, the greater (the coefficient of variation) $misall_{i,t}$ is, the more disperse is the marginal products of capital across cities 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 city 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.[3] Under these conditions, the aggregate

[2] We realize that most studies measure misallocation based on micro firm-level data. In particular, relevant studies on China use data from the Chinese Annual Survey of Industrial Firms, which is a census of all non-state firms with more than 5 million yuan in revenue plus all state-owned firms (for example, Hsieh and Klenow, 2009). However, using this firm-level dataset would result in some other problems. First, the dataset is not available after the year of 2013, and actually most studies focus on the sample period before 2009 considering the quality of the data. Therefore, it cannot provide enough observations of inter-municipal misallocation for us to conduct panel regressions. Second, measuring interregional misallocation based on firm-level data can be quite complicated. In the context of this paper, misallocation comprises inter-municipal misallocation and misallocation within each city, but we focus only on the former. Furthermore, distinguishing between these two types of misallocation relies on the assumption that the factors of production are first allocated within the city to attain the optimal and then allocated across cities, which is not necessarily the case in reality. Third, this dataset covers only manufacturing firms, hence we cannot gain a full picture of misallocation with this dataset, especially when the share of the service sector in China has increased from 39% to 60% over the sample period. In fact, when it comes to measuring spatial misallocation, aggregate data is often employed by researchers (see Brandt et al., 2013; Hsieh and Moretti, 2019).

[3] Banerjee and Duflo (2005) present a comprehensive review of existing methods for measuring *MPK*.

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:[4]

$$MPK = sY/K \tag{2}$$

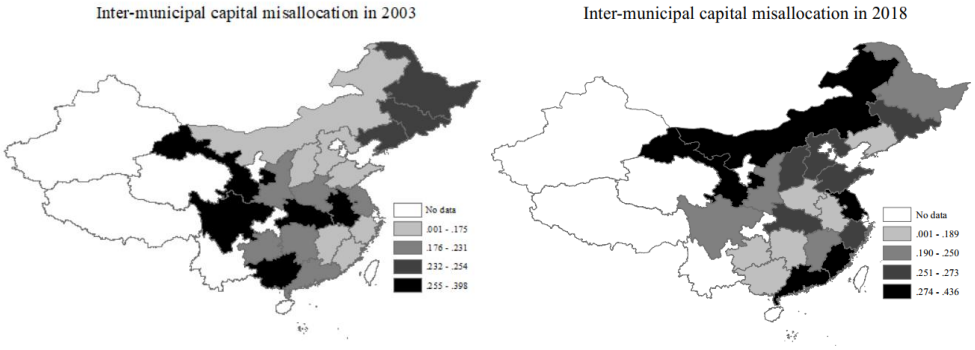
Now our task is to back out *s*, *Y* and *K*. Regarding *Y*, we can directly use data for city GDP to mirror total income. Some researchers have casted doubt on the accuracy of data for China's GDP (e.g., Angus Maddison, 1998). However, our regression method, which exploits the variable variation and 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 city 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 assets*, which is available at the city 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 percent, which is similar to that assumed in the recent studies (Zhang et al., 2004; Shan, 2008).[5] At last, as indicated above, we initialize the capital stock in 1990 as the ratio

[4] 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.

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

of investment in 1990 to the sum of the average growth rate of investment during 1991-95 and the depreciation rate. Following these steps, we then arrive at the measures of *intra-provincial* and *inter-municipal* capital misallocation in China for 21 provinces over 2003-18. 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 cities (*Beijing, Shanghai, Tianjin* and *Chongqing*). In addition, several provinces (*Hainan, Qinghai, Xizang, Xinjiang, Ningxia and Yunnan*) are dropped because too few cities 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 cities 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, there exists spatial autocorrelation in the distribution of misallocation. For example, in the year of 2018, two northern provinces (*Neimenggu* and *Gansu*) and the coastal provinces (including *Jiangsu*, *Zhejiang*, *Fujian* and *Guangdong)* tend to suffer from higher levels of inefficient allocation. On the other hand, misallocation in western areas was much more severe in 2003. This means, third, that the

distribution of misallocation across the country is dynamic over time. *Guangxi*, as an illustration, was one of the most inefficient provinces at the beginning of the sample period, but the ranking of its misallocation level decreased while its neighboring province, *Guangdong*, as a comparison, exhibits the opposite trend, with its misallocation level being lower in 2003 but then increasing dramatically. One tentative explanation is that after 15 years of rapid economic growth, *Guangdong* now is the most developed province with a large amount of capital stock which, however, is distributed quite unevenly across cities, while *Guangxi* province has much less capital stock and hence its cities are "equally" poor. This also helps explain why the developed coastal provinces have higher levels of interregional misallocation. However, note that the underdeveloped northwestern province of *Gansu* also exhibits a severe misallocation. For this latter the possible explanation is the fact that the resources are concentrated in the province's capital, an usual occurrence, especially for the less-developed areas in China.

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 following simple regression model.

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

In equation (3), the index i denotes provinces and t denotes years; η_i is province dummies to capture the effect of unobserved factors that are constant over time but heterogenous across provinces; 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.

The dependent variable, $misall_{i,t}$, is our measure of interregional misallocation in a province based on city-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 city-level governments' budget revenue (expenditure) to total government revenue (expenditure) within a province; $Z_{i,t}$ is a set of other 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 (*lngdp*): We employ the natural log of 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 (*urban*): 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 (*secratio*): 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 (*finance*): 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 (*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 (*soe*): 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.

Another important explanatory variable is *provincial government intervention* (*intervention*), as a proxy for government intervention. Considering the overall difficulties in measuring government intervention and following Barro (1990), here we characterize the existence of government intervention in the economy with government consumption, net of spending on education, health care and social insurance. In particular, government intervention is measured as the ratio of government budget expenditure after deducting expenditure on health care, education and social to GDP at the province level,[6] which is expected to be correlated with local governments' behavior involving improper subsidies to firms, direct investment intending to boost the local economy, and perhaps with other activities fostering local protectionism, imposing interregional barrier, etc. Note the government intervention variable not only serve as control variables, but it is employed in additional interaction terms with the measures of fiscal decentralization to identify potential mechanisms that may moderate the effects of fiscal decentralization itself.

To further characterize the degree of marketization, we also use the marketization index (denoted by *market*) compiled by Fan and Wang (2016), which includes 23 sub-indices, covering aspects such as the relationship between market and the government, the development of non-state economy, the development of production market, the development of production factor market

[6] 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 is 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, education and social insurance services, the most common and important types of "justified" local public services.

and the development of intermediary agency and legal system. The final marketization index is an arithmetic average of these 23 sub-indices. However, since the sub-indices have changed since the year of 2008, this index is available from 2008 to 2014. Therefore, when we include the *market* variable, the sample size would shrink substantially.

To investigate the role of marketization or government intervention, we run the three following additional regressions:

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

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

For model (4) and (5), 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 (4) 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 (4) 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 equations (5), λ is expected to be statistically significant and negative, meaning that when market forces are driving the flow of capital, the impact of fiscal decentralization on reducing misallocation will be enhanced.

As suggestive complementary evidence of the role of marketization, we also divide our full sample into two groups, eastern provinces and non-eastern provinces, and run regressions in these two subsamples separately. Eastern provinces include *Hebei*, *Liaoning*, *Jiangsu*, *Zhejiang*, *Fujian*, *Shandong* and *Guangdong*, and the rest are non-eastern provinces. As is known, China's economic growth is unbalanced, with its coastal or eastern areas being much more developed

than the inland provinces. It is then logical to suppose that eastern areas enjoy a higher degree of marketization than non-eastern ones. In fact, as can be seen in Table 1, eastern provinces trade more, enjoy more FDI inflows, have a smaller share of state-owned enterprises, and, of course, have a significantly higher marketization index. Combined with our earlier theoretical analysis, we expect that fiscal decentralization can significantly mitigate inter-municipal capital misallocation in eastern provinces relative to non-eastern provinces.

Table 1. The Degree of Marketization: Eastern Provinces versus Non-Eastern Provinces

Variable	Eastern Provinces		Non-eastern Provinces			
	Mean	SD	Mean	SD	Difference	T-Stat
trade	0.577	0.034	0.107	0.003	0.470	19.265***
fdi	0.567	0.029	0.188	0.006	0.379	16.969***
soe	0.314	0.013	0.591	0.009	-0.277	-17.102***
market	7.496	0.181	5.453	0.094	2.042	11.066***

Notes: For variables *trade*, *fdi* and *soe*, we have 112 observations in eastern province sample and 224 observations in non-eastern province sample. For the *market* variable, the corresponding sample sizes are 49 and 98, respectively. Data source is given in the next subsection. *** p<0.01.

3.3. Data

Because of several prominent reforms in China's administrative regions prior to 2003,[7] the panel data set covers 21 provinces in China between 2003 and 2018. As mentioned above, four direct-controlled cities are excluded as are six provinces due to the lack of data. The data come from three different sources. First, city-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

[7] In 2000, 21 regions were reformed to be prefecture-level cities and 2two county-level cities were upgraded to prefecture-level cities. In 2001, six regions were changed to prefecture-level cities and then in 2002, 10 more regions were authorized to be prefecture-level cities.

income used to calculate *MPK* and the control variable, share of state-owned enterprises are from the *China Statistics Yearbook*. The summary statistics of main variables are reported in Table 2.

Table 2. Summary Statistics

Variable	Explanation	Obs	Mean	Std.Dev.	Min	Max
misall	measured misallocation	336	0.207	0.073	0.022	0.455
fdrev	revenue decentralization	336	0.789	0.113	0.480	0.975
fdexp	expenditure decentralization	336	0.766	0.114	0.339	0.935
lngdp	log of provincial GDP per capita	336	10.217	0.697	8.212	11.654
urban	urbanization level	336	0.493	0.106	0.248	0.707
secratio	the share of secondary sector	336	0.482	0.059	0.246	0.615
finance	outstanding loan/GDP	336	0.961	0.301	0.354	2.243
trade	(export + import)/GDP	336	0.264	0.306	0.029	1.625
soe	the share of state-owned economy	336	0.499	0.192	0.140	0.850
fdi	foreign direct investment/GDP	336	0.314	0.263	0.061	1.326
intervention	(government expenditure-expenditure on health and education services)/ GDP	336	0.119	0.043	0.056	0.286
market	the degree of marketization	147	6.134	1.427	3.380	9.950

4. Empirical Results

4.1. Baseline Results

Table 3 reports the estimates based on model (3). All specifications control for province and year fixed effects. Columns (1) and (2) report the results from OLS estimation while columns (3) and (4) are the results from IV regressions. Columns (1) and (3) present the results for revenue decentralization. Correspondingly, columns (2) and (4) are the results for expenditure decentralization. Overall, as shown in Table 3, the *R-squared* value is about 0.6 in IV regressions and the within *R-squared* is close to 0.3 when two-way fixed effects model is employed, 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 negative but insignificant (the p-value is 0.29), thus, we find weak evidence that revenue decentralization can alleviate interregional capital misallocation. Column (2), which uses

expenditure decentralization to measure fiscal decentralization, displays similar results for *fdexp*, but the coefficient is more insignificant (the p-value is 0.520). This weak negative impact is not surprising since we have theoretically argued that there are both potential positive and negative effects of fiscal decentralization on misallocation. Also, we have argued that the effect of fiscal decentralization on misallocation depends on the role of government intervention or marketization, therefore these insignificant results might be a result of the heterogenous impact of decentralization. That is, the impact may be significant for provinces with higher degree of marketization but not for the provinces where government interventions are more pronounced, which we will discuss later.

The insignificant estimates could also be due to the potential endogeneity issue. 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.

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

characteristics could also affect the level of misallocation, for example, through information, transportation or transaction costs channels, thus violating the exclusion restriction for IVs. The initial and lagged values of fiscal decentralization are also not likely to be suitable instruments. Therefore, we instrument for fiscal decentralization with the weighted average of fiscal decentralization from its neighbors. We instrument for *fdrev* with the product of inverse-distance matrix and *fdrev* while we instrument for *fdexp* with the product of contiguity matrix and *fdexp* because otherwise our instruments would suffer from weak instrument problem. The logic here is that subnational governments in China tend to interact with each other, especially with those geographically closer ones (Liu et al., 2017). Therefore, the province's fiscal decentralization design tends to be related to its neighbors' fiscal institution while the neighbors' fiscal decentralization does not affect its own misallocation level.

Columns (3) and (4) present similar results for IV estimation. 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 Cragg-Donald Wald F statistic for the weak identification test is presented at the bottom of Table 3; it can be seen that all instruments are valid. As reported in column (3), the coefficient on revenue decentralization is negative and statistically significant at the 5-percent level, suggesting that an increase in revenue decentralization can significantly reduce the interregional misallocation level. Quantitatively, one standard variance deviation in revenue decentralization would lower misallocation by 0.84 standard variance. However, the result displayed in column (4) suggests that expenditure decentralization still does not exert a significant impact on misallocation. These results together provide only weak evidence that fiscal decentralization may mitigate interregional capital

misallocation, while revenue decentralization tends to perform better than expenditure decentralization.

The potential difference in the effects of revenue and expenditure decentralization on interregional capital misallocation could be explained by several mechanisms. First, Jin et al. (2005) 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). 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 (Gadenne, 2017),[8] which is consistent with a recent study by Jia et al.(2020) showing that vertical fiscal imbalances lead to subnational governments' fiscal indiscipline. 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.

As for the controls, we find a positive relationship between urbanization and misallocation. The coefficient on *urban* is positive and statistically significant in all specifications except for column (3), implying that areas with a higher urbanization rate 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 urban areas enjoy more capital inflows, including FDI, and that this may

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

introduce a wider distribution of rates of return, including existing firms that may widen their presence and reinvest. The coefficient of *trade*, though being insignificant in column (3), is significant and negative in three specifications in Table 3, indicating that trade can increase capital allocation efficiency. This finding is quite intuitive and in line with previous studies on the relationship between trade and misallocation (Restuccia and Rogerson, 2008). On the other hand, the coefficients on *finance*, *fdi* and *soe* are insignificant across all four specifications. Thus, we cannot determine the effect of these variables. The coefficients for *government intervention* are not robust or statistically significant across different specifications as well, despite the fact that the signs of the coefficients remain positive in all four regressions.

Table 3. Baseline Results: The Effect of Revenue and Expenditure Decentralization on Misallocation

VARIABLES	(1) *misall*	(2) *misall*	(3) *misall*	(4) *misall*
	OLS		IV	
fdrev	-0.178		-0.542**	
	(0.165)		(0.270)	
fdexp		-0.180		0.155
		(0.296)		(0.474)
lngdp	-0.103*	-0.072	-0.095*	-0.104
	(0.054)	(0.079)	(0.052)	(0.109)
urban	0.485**	0.420*	0.574***	0.460**
	(0.177)	(0.208)	(0.188)	(0.189)
secratio			-0.153	-0.0221
			(0.216)	(0.177)
finance	-0.027	-0.038	-0.018	-0.024
	(0.030)	(0.028)	(0.029)	(0.034)
trade	-0.159*	-0.147	-0.169**	-0.154*
	(0.079)	(0.086)	(0.079)	(0.080)
soe	0.181	0.242	0.0470	0.234
	(0.150)	(0.170)	(0.165)	(0.152)
fdi	-0.033	-0.030	-0.038	-0.036
	(0.039)	(0.039)	(0.040)	(0.033)
intervention	0.270	0.353	0.213	0.189
	(0.363)	(0.405)	(0.276)	(0.450)
Constant	1.059**	0.750	1.393***	0.814
	(0.490)	(0.665)	(0.527)	(0.715)
Year fixed effects	Y	Y	Y	Y
Province fixed effects	Y	Y	Y	Y
Observations	336	336	336	336
R-squared	0.299	0.292	0.560	0.574
Cragg-Donald Wald F statistic	/	/	55.138	60.851

Notes: Robust standard errors in parentheses. All the standard errors are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1.

4.2. Identifying the Role of Government Intervention

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 overall 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 (4) and (5) with OLS approach. 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) present the results when the marketization index (*market*) is used to construct the interaction term.

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, now becomes negative and statistically significant at the 5-percent level. Moreover, in comparison, the magnitude of the effect (-0.605) is much larger than that in the specification without incorporating the interaction term (-0.178 in column (1) of Table 3), indicating that revenue decentralization drives down interregional misallocation substantially when there exists no government intervention. Quantitatively, a one standard deviation increase in revenue decentralization can mitigate interregional capital misallocation by 0.93 standard

deviation. On the other hand, the coefficient on the interaction term is positive and significant at the 10-percent 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), we use expenditure decentralization to measure decentralization. As can be seen, however, the coefficient on the interaction term is insignificant. Furthermore, as a sharp contrast to the coefficient on *fdrev* in column (1), the coefficient on *fdexp* remains insignificant even when government intervention is absent, suggesting again that revenue decentralization can alleviate interregional capital misallocation while expenditure decentralization cannot.

Complementarily, we also use *market* to characterize the degree of marketization (in other words, the absence of local protectionism) and hence to mirror the opposite side of government intervention and the corresponding results are presented in columns (3) and (4). As we discussed earlier, the sample size is now reduced to 147. As is shown in column (3), the coefficient on the interaction term between revenue decentralization and *market* is negative and significant at the 10% 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. This would seem to suggest that when the degree of marketization is low, revenue decentralization would worsen interregional misallocation when the marketization is weak. Thus, we get confirmation that the government's strategy toward the market economy is quite decisive. Column (4) gives the result for expenditure decentralization. Similar to the result in column (2), the coefficient on the interaction term between *market* and *fdexp* is insignificant, which indicates that increasing the degree of marketization or openness is not helpful for expenditure decentralization to correct

interregional misallocation. This is in line with the previous finding that revenue decentralization performs better than expenditure decentralization in lowering misallocation.

Table 4. The Role of Government Intervention and Marketization

VARIABLES	(1) *misall*	(2) *misall*	(3) *misall*	(4) *misall*
*fdrev*intervention*	3.275*			
	(1.695)			
*fdexp*intervention*		0.819		
		(1.951)		
*fdrev*market*			-0.105*	
			(0.052)	
*fdexp*market*				-0.080
				(0.058)
fdrev	-0.602**		0.518*	
	(0.284)		(0.256)	
fdexp		-0.307		-0.083
		(0.461)		(0.389)
lngdp	-0.077	-0.050	-0.086	0.020
	(0.059)	(0.086)	(0.140)	(0.139)
secratio	-0.129	-0.094	-0.340	-0.393
	(0.181)	(0.183)	(0.319)	(0.333)
urban	0.442***	0.412*	0.472	0.520
	(0.154)	(0.200)	(0.474)	(0.492)
finance	-0.043	-0.041	-0.027	-0.028
	(0.029)	(0.029)	(0.021)	(0.023)
trade	-0.140*	-0.141	0.072	0.108
	(0.075)	(0.088)	(0.101)	(0.109)
soe	0.220	0.239	0.491	0.582**
	(0.128)	(0.168)	(0.323)	(0.263)
fdi	-0.030	-0.033	0.133	0.196
	(0.037)	(0.038)	(0.185)	(0.209)
intervention	-2.130*	-0.239	0.722	1.164**
	(1.178)	(1.146)	(0.615)	(0.522)
market			0.088*	0.072
			(0.048)	(0.052)
Constant	1.206**	0.692	0.200	-0.542
	(0.527)	(0.720)	(1.370)	(1.294)
Province fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
Observations	336	336	147	147
R-squared	0.313	0.294	0.303	0.363

Notes: Robust standard errors in parentheses are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1.

Considering the potential endogeneity, we also use IV approach to replicate the regressions in Table 4 and the obtained results are displayed in Table 5. The Cragg-Donald Wald F statistics to test the validity of the instruments are reported at the bottom of Table 5. As can be seen, all the instruments are valid expect those in column (2), so we will not pay much attention to the result

in column (2). In column (1), the coefficient on the interaction term between *fdrev* and *intervention* is positive and only slightly significant with a p-value of 0.15. Similarly, the coefficient on *fdrev* is negative and slightly significant with a p-value of 0.13. Plus, the magnitude is much greater than that in column (3) Table 3, where no interaction term is included to control for the moderation effect of government intervention. Together, and given that our sample size is not large, these estimates provide weak evidence of the role of government intervention or marketization discussed earlier. In columns (3) and (4), we use marketization index to characterize the presence of market forces. As can be seen in column (3), when the interaction term is included, the coefficient on revenue decentralization is positive and significant at the 10% level, indicating that revenue decentralization may increase misallocation level when the variable *market* takes the value of 0. Also, the coefficient of the interaction term is negative, though being insignificant with a p-value of 0.147. The estimation result in column (4) offers a stronger evidence of the moderation effect: the coefficient on the interaction term between *fdexp* and *market* is negative and significant at the 5% level. In addition, the coefficient of *fdexp* is positive and significant, affirming again that fiscal decentralization leads to severer misallocation when market forces are absent.

Table 5. The role of Government Intervention and Marketization: IV Estimation

VARIABLES	(1) *misall*	(2) *misall*	(3) misall	(4) misall
*fdrev*intervention*	8.677			
	(6.023)			
*fdexp*intervention*		30.550		
		(26.730)		
*fdrev*market*			-0.162	
			(0.111)	
*fdexp*market*				-0.267***
				(0.103)
fdrev	-1.321		1.167*	
	(0.882)		(0.620)	
fdexp		-4.144		1.376**
		(3.911)		(0.573)
Province fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
Observations	336	336	147	147
R-squared	0.560	0.003	0.761	0.757
Cragg-Donald Wald F statistic	11.414	2.579	20.851	13.067

Notes: Robust standard errors in parentheses are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1. We include the same control variables as in Table 4, which are omitted to save space.

4.3. Subsample Regressions

Since we only have data for marketization index after 2008, we would lose a large portion of information in our sample when the variable *market* is included. To offer complementary evidence of the moderation effect of the government's strategy towards market, we further partition our full sample into two subsamples (eastern provinces with a higher degree of marketization and non-eastern provinces with a lower one) and then implement subsample regressions. The idea here is that we theoretically predict that fiscal decentralization would lower misallocation level more significantly where the market economy is more developed, which means that we expect that the estimates should be more significant for the eastern province sample. We admit that, however, eastern provinces and non-eastern provinces can be different in many ways, therefore it may be differences in other factors result in the diverse results. But since we focus on the coefficient of fiscal decentralization and theoretically no other factors have closer and more direct relationship with the misallocation impact of fiscal decentralization than

government intervention or marketization, subsample regressions should be able to provide suggestive additional evidence.

The results obtained are reported in Table 6. Panel A displays the results from OLS estimation and Panel B reports the results from IV estimation. It can be seen that in columns(1) and (5), the coefficients are both negative and statistically significant at the 1-percent level while in columns (3) and (7) we get insignificant results, which suggests that our prediction is correct. In addition, the coefficients of expenditure decentralization are all insignificant in columns (2), (4) and (8), showing that revenue decentralization can alleviate misallocation while expenditure decentralization cannot.

Table 6. The Role of Government Intervention and Marketization: Subsample Regressions

Panel A OLS estimation	(1) *misall*	(2) *misall*	(3) *misall*	(4) *misall*
	Eastern Provinces		Non-eastern Provinces	
fdrev	-0.684***		-0.162	
	(0.148)		(0.149)	
fdexp		-0.825		-0.253
		(0.497)		(0.296)
Panel B IV estimation	(5) *misall*	(6) *misall*	(7) *misall*	(8) *misall*
	Eastern Provinces		Non-eastern Provinces	
fdrev	-1.077***		-0.138	
	(0.168)		(0.264)	
fdexp		-0.965		0.368
		(9.850)		(0.320)
Cragg-Donald Wald F statistic	18.549	0.088	37.384	57.445

Notes: Robust standard errors in parentheses are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1. We include the same control variables as in Table 3 and all the specifications include province and year fixed effects. The instrument variables used in Panel B are also the same as in Table 3. Note that in column (6) the instrument variable suffers from the weak instrument issue, so we may just ignore this specification. In fact, we have attempted to use other instruments instead, including the product of *fdexp* with the inverse distance matrix and the one-period lagged value of *fdexp*, but both turn out to be weak instruments in the eastern-province subsample.

5. Robustness Check

5.1. Considering Neighborhood Effects with Spatial Autoregressive Model

As is shown in Figure 1, one area's capital misallocation level might be associated with one another in the "neighborhood", suggesting the presence of spatial spillover effects. Therefore, we use here a spatial autoregressive model to account for the potential neighborhood effect. The corresponding results from spatial autoregressive estimation are displayed in Table 5. Panel A reports the results for full sample while panel B and panel C are the results for the eastern provinces subsample and non-eastern provinces subsample, respectively. The spatial weighting matrix used in the left two columns in each panel is the contiguity matrix, where only adjacent areas spill over to one another and the right two columns employee an inverse-distance spatial weighting matrix. Overall, we find no robustly significant evidence of the spillover effect, but it does exist in certain cases such as columns (7) and (8).

In Panel A, we can clearly see that when using spatial autoregression method, the coefficient on *fdrev* is negative and significant at the 1% level, which indicates that revenue decentralization can alleviate interregional misallocation. Similarly, it can be seen that both revenue decentralization and expenditure decentralization can mitigate misallocation based on the results in columns (2), (3) and (4). Turning to the subsample regression results in panels B and C, we notice that all the coefficients on revenue and expenditure decentralization are significantly negative, with the magnitude of the mitigation effect being much greater in panel B than in panel C, which echoes our argument that decentralization can allay misallocation more significantly in areas enjoying higher levels of marketization.

Table 7. Spatial Autoregressive Estimation: The Effect of Fiscal Decentralization

Spatial weighting matrix	contiguity matrix		Inverse-distance matrix	
Panel A	(1)	(2)	(3)	(4)
Full sample	*misall*	*misall*	*misall*	*misall*
Weighted Avg. of dependent variable	0.108	0.110	-0.324	-0.320
	(0.101)	(0.101)	(0.239)	(0.240)
fdrev	-0.185***		-0.182***	
	(0.069)		(0.069)	
fdexp		-0.195*		-0.189*
		(0.102)		(0.102)
Observations	336	336	336	336
Panel B	(5)	(6)	(7)	(8)
Eastern Provinces	*misall*	*misall*	*misall*	*misall*
Weighted Avg. of dependent variable	-0.175	-0.193	-1.578***	-1.458***
	(0.255)	(0.268)	(0.583)	(0.605)
fdrev	-0.685***		-0.667***	
	(0.121)		(0.114)	
fdexp		-0.838***		-0.801***
		(0.291)		(0.277)
Observations	112	112	112	112
Panel C	(9)	(10)	(11)	(12)
Non-eastern Provinces	*misall*	*misall*	*misall*	*misall*
Weighted Avg. of dependent variable	0.099	0.065	-0.436	-0.494
	(0.128)	(0.128)	(0.345)	(0.347)
fdrev	-0.167**		-0.154*	
	(0.080)		(0.080)	
fdexp		-0.251**		-0.254**
		(0.106)		(0.105)
Observations	224	224	224	224

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All the specifications include province fixed effects, year fixed effects and the same control variables as in the previous tables.

We further consider the moderation effect of government invention on the impact of fiscal decentralization on misallocation by including the interaction terms in the spatial econometric model. Table 8 replicates the estimation in Table 4. In column (1) of panel A, the coefficient on the interaction term between revenue decentralization and government intervention is positive and significant at the 1% level. Meanwhile, the coefficient on revenue decentralization is significantly negative and the magnitude is much greater than that in column (1) Table 7, which is in line with our previous conclusion on the role of government. That is, when government intervention is absent, revenue decentralization can perform much better in mitigating misallocation. In addition, the result in column (3) conveys similar message. Columns (2) and (4) present the corresponding results for expenditure decentralization but no such effects are

founded. We further us *market* to portray marketization in panel B. As can be seen, the results obtained are highly consistent with our identification of the moderation effect of marketization.

Table 8. Spatial Autoregressive Estimation: The Role of Government Intervention

Spatial weighting matrix	contiguity matrix		Inverse-distance matrix	
Panel A	(1)	(2)	(3)	(4)
	misall	*misall*	*misall*	*misall*
Weighted Avg. of dependent variable	0.091	0.112	-0.375	-0.322
	(0.101)	(0.101)	(0.244)	(0.240)
*fdrev*intervention*	3.179**		3.444**	
	(1.402)		(1.395)	
*fdexp*intervention*		0.890		0.836
		(1.470)		(1.464)
fdrev	-0.590***		-0.621***	
	(0.191)		(0.190)	
fdexp		-0.318		-0.304
		(0.227)		(0.226)
Observations	336	336	336	336
Panel B	(5)	(6)	(7)	(8)
	misall	*misall*	*misall*	*misall*
Weighted Avg. of dependent variable	0.362***	0.309**	-0.482	-0.512
	(0.141)	(0.144)	(0.439)	(0.440)
*fdrev*market*	-0.098**		-0.104**	
	(0.043)		(0.044)	
*fdexp*market*		-0.069		-0.083*
		(0.048)		(0.048)
fdrev	0.492*		0.511**	
	(0.240)		(0.246)	
fdexp		-0.107		-0.067
		(0.262)		(0.265)
Observations	147	147	147	147

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All the specifications include province fixed effects, year fixed effects and the same control variables as in the previous tables.

5.2. Alternative Measurement

Despite the convincing evidence we have provided so far, we construct a new index to measure the level of inter-municipal misallocation as a robustness check. 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 more productive regions should receive more investment

to achieve a better allocation of resources.[9] Therefore, we compute our alternative measurement of interregional capital misallocation with the following formula:

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

As before, *i* denotes province, *t* denotes year and *j* denotes the city in province *i*; and *I* represents fixed asset investment. 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 -0.011 and its standard deviation is 0.413.

Table 9 reports the estimation results when *misall2* serves as the dependent variable. Columns (1) to (2) use the full sample to replicate the regressions in Table 3, estimating the effects of fiscal decentralization on interregional capital misallocation with the IV approach. As shown there, the coefficients on both revenue decentralization and expenditure decentralization are insignificant. As we discussed earlier, this insignificant impact is not accidental since theoretically decentralization can both mollify and aggravate misallocation and the net effect counts on the relationship between the government and market. Therefore, we expect that decentralization can indeed reduce misallocation level in areas where the market economy is more developed. To test this prediction, we turn to the subsample regressions. In column (3), we find that the coefficient of revenue decentralization is positive and significant at the 10-percent level, which suggests that revenue decentralization can mitigate interregional misallocation in the

[9] 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.

subsample of eastern provinces. However, the result for the less developed non-eastern provinces in column (5) is not significant. The contrasting results again support our hypothesis on the role of government or marketization in determining the effect of decentralization on misallocation.

Table 9. Alternative Measurement of Interregional Capital Misallocation

VARIABLES	(1) *misall2*	(2) *misall2*	(3) *misall2*	(4) *misall2*	(5) *misall2*	(6) *misall2*
	Full sample		Eastern Provinces		Non-eastern Provinces	
fdrev	-0.626		3.657*		0.535	
	(1.350)		(2.227)		(1.446)	
fdexp		-2.708		-17.855		-1.568
		(2.763)		(41.530)		(2.904)
lngdp	0.210	0.620	0.010	1.887	-0.203	0.083
	(0.651)	(0.872)	(0.419)	(3.694)	(0.893)	(1.144)
urban	0.118	-0.355	0.659	-4.159	1.630	1.624
	(1.935)	(1.772)	(1.452)	(6.150)	(3.194)	(3.086)
secratio	-0.868	-1.219	-4.312**	-1.383	1.034	0.593
	(1.326)	(1.394)	(1.697)	(6.836)	(1.238)	(1.542)
finance	0.436	0.309	-0.187	0.220	0.168	0.037
	(0.267)	(0.266)	(0.178)	(0.717)	(0.346)	(0.433)
trade	0.070	0.167	-0.093	0.507	-1.657	-1.967
	(0.280)	(0.292)	(0.338)	(0.583)	(1.777)	(1.906)
soe	-1.542	-1.324	3.922**	-0.610	-1.261	-1.499
	(1.254)	(1.207)	(1.616)	(4.724)	(1.294)	(1.311)
fdi	0.165	0.197	0.586***	0.026	0.529	0.683
	(0.271)	(0.276)	(0.226)	(0.665)	(0.928)	(0.923)
intervention	-2.979	-1.855	4.334	2.757	-1.080	-0.029
	(2.008)	(1.609)	(6.581)	(9.270)	(3.264)	(3.356)
Constant	-0.337	-2.293	-3.457	-1.665	1.239	0.584
	(6.037)	(6.102)	(2.401)	(4.716)	(7.489)	(8.104)
Province fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Observations	336	336	112	112	224	224
R-squared	0.558	0.543	0.708	0.401	0.508	0.467
Cragg-Donald Wald F statistic	55.138	60.851	18.549	0.088	37.384	57.445

Notes: Robust standard errors in parentheses are clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1. As before, the instrument variable for expenditure decentralization for eastern province sample is weak, so we will not discuss the result in column (4). We also attempted to instrument for *fdexp* with other instruments or simply use OLS estimation in column (4), but no significant result is founded.

Based on all the regression results from our empirical analysis, we arrive at the conclusion that fiscal decentralization can lower interregional capital misallocation while revenue decentralization performs better than expenditure decentralization in most cases, and that this effect largely depends on the government' attitude towards market intervention.

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. To the best of our knowledge, this paper is the first to study the impact of fiscal decentralization on (interregional) misallocation.

We find that fiscal decentralization can mitigate interregional capital misallocation while revenue decentralization performs better than expenditure decentralization. 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, subsample regressions, spatial autoregressive estimation and alternative measurement of interregional misallocation.

Our conclusion on the role of marketization or degree of 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. Our findings suggest that while decentralization on its own does not secure better capital allocation, it can facilitate a more efficient 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 reforms and opening up policies 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 larger presence of government intervention in the economy tends to dampen the positive impact of revenue decentralization on allocation.

In terms of policy implications, our results strongly suggest that China should increase the degree of revenue decentralization. This is a strong policy implication especially given the fact that there is currently a high level of vertical imbalance in China, with subnational governments enjoying much more expenditure authority relative to revenue autonomy (Jia et al., 2020). 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. Overall, the results are strongly suggestive, but 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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