2014

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INTERNATIONAL CENTER FOR PUBLIC POLICY

International Center for Public Policy
Working Paper 14-03
January 2014

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April 2013

ABSTRACT

This paper aims to provide empirical evidence on the extent and possible channels of tax competition among provincial governments in China. Using a panel of provincial-level data for 1993-2007, we find strong evidence of strategic tax interaction among provincial governments. Tax policy is approximated by average effective tax rates on foreign investment, taking into account the tax incentives available to foreign investors. In line with the predictions of the theoretical tax competition literature, we also highlight the impact of each province's characteristics (including its size and level of industrialization) on the strategic interaction with its neighbors. Finally, the paper explicitly identifies the establishment of development zones as an important conduit for tax competition among provinces.

Keywords: Tax competition; development zone; China
JEL Classifications: H73, H77, R52, R58, C23

*We would like to thank the editors and three anonymous referees for very helpful comments and suggestions which substantially helped improve the paper. We also thank Haibo Feng and Baoyun Qiao for providing some of the data; seminar participants of the 2012 International Workshop on Regional, Urban, and Spatial Economics in China at Jinan University and the 2012 Chinese Economists Society Annual Conference for helpful comments and suggestions. We are grateful for the financial support from the Lincoln Institute of Land Policy through its China International Fellowship Program.

1. INTRODUCTION

Explaining the "miracle" of China's economic growth over the past three decades remains a challenging task. Recent studies have emphasized the role of local governments, essentially arguing that the main engine for growth has been a series of institutional reforms during the transition process which created large fiscal and political incentives for local governments to promote economic development and eventually evolving into a fierce competition for foreign capital (Gordon and Li, 2011; Xu, 2011). Along with the rapid economic growth observed in this period, the explosive boom in "economic development zones",[1] and the resulting losses of large amounts of agricultural land is another phenomenon that has attracted a great deal of attention in academic and policy circles (Cartier, 2001; Yang and Wang, 2008). A natural question that followed was whether the booming in development zones were related to the competing behaviors of local governments driven by the strong fiscal and political incentives they faced? Many scholars contend this has been the case (Xu, 2011; Zhang, 2011).

Since China is a unitary country with the central government setting uniform statutory tax rates across all provinces, the standard tax competition theory describing inter-jurisdictional competition through selecting tax rates does not apply automatically in the Chinese context. However, the favorable policies in development zones granted by the central government created high levels of administrative discretion for local governments to manipulate the effective tax rate faced by foreign investors locating in their jurisdictions, which, in turn, enabled local governments to compete for foreign investment (Xu, 2011). More specifically, local governments started to set up and use their own development zones as a conduit to offer tax incentives (e.g., tax exemptions, tax breaks, and preferential tax rates) to foreign investors.[2] Consequently, the "development zone fever" emerged as a showcase of inter-jurisdictional competition in China (Zhang, 2011).

Beyond this wide recognition, it is surprising to see that rigorous empirical evidence in support of these competing patterns and, especially, an account of the possible mechanisms through which this competition has been conducted are largely missing in the literature.[3]

This paper contributes to the literature in several significant ways. First, this paper is among the first to provide empirical evidence on provincial tax competition for foreign investment in China. Second, the paper provides evidence on the role played by the establishment of development zones as a vehicle for conducting provincial tax competition in China. Third, the paper employs two alternative methods to measure the average effect tax rate on foreign investment which take into account the tax incentives enjoyed by foreign investors. Lastly, based on the theoretical predictions derived in the tax competition literature, the paper examines the impact of each province's characteristics (i.e., size and level of industrialization) on the strategic interaction with its neighbors.

Using a panel of 30 Chinese provinces for 1993-2007 and applying both dynamic spatial lag specifications and structural models, we find that: (i) there is strong evidence on a positive strategic tax interaction among provincial governments; (ii) both province size and industrialization level have a positive effect on the tax rates chosen by the provinces, with the effect from the former generally being less significant; (iii) the introduction of development zones leads to significant reductions of effective tax rates, which in turn successfully helps attract more foreign investment; and (iv) more intensive use of development zones does not necessarily lead to lower tax effective rates on foreign investment.

The rest of the paper is organized as follows. Section 2 introduces the institutional setup on China that induces provincial governments to compete with each other; the particular mechanism through which the competition is actually conducted; and the baseline hypotheses derived from the theoretical tax competition literature to form the empirical identification strategy. Section 3 sets up the empirical methodology and discusses the data. Section 4 presents the empirical results. Finally, section 5 concludes.

2. INSTITUTIONAL BACKGROUND, MECHANISM, AND HYPOTHESES

Institutional Background

A distinctive feature of China's transition from a highly planned to a market economy has been its success in fostering strong fiscal and political incentives for local governments to promote local economic development (Gordon and Li, 2011; Xu, 2011). This has been largely achieved by decentralizing the country's fiscal system while maintaining rather centralized political institutions.

Starting from the early 1980s, the previous fiscal system of "unified revenue collection and unified spending" (*tongshou tongzhi*)[4] was replaced by the so-called "fiscal contracting system" (*caizheng chengbao zhi*), in which each province was assigned an independent responsibility to collect tax revenues in its domain and was entitled to retain a significant portion of the revenues–any residual "fiscal profits"– after they fulfilled the pre-determined sharing schemes. Local officials were thus motivated by the incentive contracts to promote local business development, which eventually increased their residual "fiscal profits" (Oi, 1992). In the meantime, administrative decentralization was also implemented to enhance the authorities of local governments in appointing subordinate government officials, approving investment, and allocating resources that could be used to attract foreign investors. This extensive administrative and fiscal decentralization reinforced each other in a way that facilitated the role of local governments in promoting economic development and enhanced regional competition for mobile tax bases. In light of this significant institutional transformation, some authors proceeded to label it as "Chinese-style, fiscal federalism", under which local governments played the function of "market-preserving" by supporting local business development (Qian and Weingast, 1997).

Nevertheless, after over a decade of the "fiscal contracting system", the marked declines in both the share of the central government revenues in total budgetary revenues and the

share of total budgetary revenues in GDP generated great concern at the central government level. This finally led to the "tax sharing system" (TSS) reform of 1994. This reform had the twin objectives of raising the central government's revenues and strengthening the control of the central government over the fiscal system. With the TSS, all taxes were classified into three categories: central taxes, local taxes, and shared taxes. Meanwhile, separate central (state) and local tax administration bureaus were established. The state tax bureau was put in charge of central and most of the shared taxes, while local tax bureaus were made responsible for collecting local taxes. Although the introduction of the TSS was successful in hardening the budget constraint of local governments, the fiscal incentives for local governments to compete for outside capital– and so for economic development – largely remained in place (Jin et al., 2005; Zheng, 2006; Zhang, 2011). Despite the recentralization of revenue assignments in 1994, the assignment of expenditure responsibilities remained virtually unchanged.[5] As a consequence, local officials experienced mounting fiscal pressures for financing their expenditure needs. This added to the local incentives to support business development to increase local and shared revenues. In order to cope, local officials also continued to look for possibilities to raise revenues outside the budget system, mainly extra-budgetary funds. Also via rent seeking and sometimes corrupt behavior, prosperous local economies also yielded direct financial rewards for local officials, in the form of fringe benefits, work-related travel expenses, and informal income (Zhang, 2011).

Beyond economic incentives, local officials also faced strong political incentives, which helped explain the strong enthusiasm showed by local governments in promoting the local economy (Li and Zhou, 2005; Xu, 2011). The political incentives were mainly generated by the highly centralized political system in China with strong top-down mandates and a homogeneous governance structure. Since local government officials are appointed by the upper level government, the central authorities maintain absolute control in deciding the promotion or dismissal of local officials, based on criteria strongly associated with improved economic performance. Trying stay ahead of the professional career ladder, local officials

generated a system of open "yardstick competition".[6]

In sum, the institutional transformation and economic reform in China created strong fiscal and political incentives for local governments to promote local growth, which ultimately mutated into fierce competition among local officials for capital, especially foreign capital.

Mechanisms of Competition

Given the highly centralized tax legislation in China, a practical question is how the fierce tax competition for foreign capital was actually conducted. We argue that a significant part of this had to do with the economic development zone policy that was launched by the central government in the late 1970s.

These zones, which have received different names, are special government-designated areas that aim to attract foreign investment and the transfer of foreign technology.[7] The zones granted preferential tax treatment and other benefits to foreign enterprises.[8] These included a reduced corporate income tax rate of 15 percent for foreign enterprises operating in the zones, compared to a rate of 33 percent imposed on domestic investors; full tax exemption in the first two profit-making years followed by a 50 percent reduction in tax liability during the three following years; and tariff exemption on imported materials. In addition, provincial governments have discretion to offer further local tax incentives, for example, a full waiver of the additional 3 percent local corporate income tax; reduced rates for the property tax, the urban construction tax, and the tax for occupation of arable land. Furthermore, provincial governments also use informal, often illegal approaches to further reduce the effective tax rates faced by foreign investors. This typically takes place in the form of illegally extending the tax exemption period, enlarging the eligibility of foreign enterprises that can be admitted to the zones, negotiating "revenue loss" contracts with enterprises to actually hide profits from central taxation, and lowering tax collection effort (Zheng, 2006).[9]

In light of the large scope for discretion created by the development zones and the successful experience in attracting foreign investment, provincial governments quickly involved

themselves in a tax competition game.[10] After the first development zone was approved in Dalian city in 1984, thousands of others were rapidly established across the entire nation. By the end of 1997, 30 out of 31 provinces (excepting Tibet) in China had built up their own development zones. Figure 1 displays the evolution of the emergence and intensity of development zones. It shows the expansion of zones from the coastal areas to the central and western areas and a tendency to cluster in relatively well developed regions. Although the legal authority for establishing zones is only assigned to the central and provincial governments,[11] lower-level governments quickly recognize the effectiveness of this tool and also started to set up their own zones, looking for the approval of their provincial governments. By one count, there were already 6,866 development zones in China in 2003, with a seized land area amounting to 38.6 thousand square kilometers, a figure that is 35 percent higher than the total urban build-up in China (Zhang, 2011). To highlight the effectiveness of development zones as a tool for tax competition for foreign capital, according to the calculation of the National Development and Reform Commission of China in 2003, the average effective tax rate for foreign enterprises inside development zones was approximately 11 percent, a value that was 16.9 percent lower than for the enterprises outside the zones, which faced a rate of 27.9 percent; total FDI located in 45 national-level development zones (out of 6,866 total development zones at all levels) was 10.3 billion USD, a value that was equivalent to 19.3 percent of total FDI received in the whole nation in 2003.[12]

Basic Hypotheses

In this subsection, we present a brief overview of the theoretical tax competition literature to form the baseline structure for our empirical identification.

Recent theoretical studies in this area originate in the fundamental work of Zodrow and Mieszkowski (1986) and Wilson (1986). These studies reach the current "benchmark conclusion" for this literature that, inter-jurisdictional competition for mobile tax bases leads to a tendency towards inefficiently low tax rates.[13] This is so because each jurisdiction faces

an incentive to keep its tax rate low in an attempt to preserve its tax base from flowing to other jurisdictions. In particular, when individual jurisdiction is large relative to the economy, it is able to affect the net return to capital in the economy by varying its tax rate; this in turn implies that the impact of a jurisdiction's choice of tax rate depends on the tax rates elsewhere. Therefore, the optimal tax rate in one jurisdiction depends on the tax rates in other jurisdictions, leading to the strategic interaction among jurisdictions [Hypothesis 1].[14] Although theory shows that, depending on functional forms, this strategic interaction can be either positive or negative; in almost all the related empirical studies, a positive interaction has been found (e.g., Nelson, 2002; Brueckner, 2003; Leprince et al., 2007).[15]

Hypothesis 1 *A province's optimal tax rate on foreign investment strategically interacts with those of the other provinces.*

This early tax competition literature provides valuable insights into the nature of competition among governments. However, it relies heavily on the assumption that all jurisdictions are identical and therefore choose the same tax rate. This assumption hides the potential for inter-governmental conflict and so the model fails to explain the actual asymmetric policy responses of governments as it is observed in some regions of the world.[16] Particularly, this assumption may not hold given the presence of exogenous asymmetries among the competing jurisdictions. A closer look at this issue has brought scholars' attention to the role that jurisdictional size may play in setting capital tax rates. Bucovetsky (1991); Wilson (1991) and Bucovetsky and Haufler (2007) argue that in equilibrium a small jurisdiction tends to set a lower tax rate than a large jurisdiction [Hypothesis 2], since the former faces a higher elasticity of capital supply.[17]

Hypothesis 2 *Smaller size provinces tend to set lower tax rate on foreign investment than larger size provinces.*

A separate literature argues that asymmetric policy responses may also emerge as a consequence of agglomeration economies. Under different game settings, Kind et al. (2000);

Ludema and Wooton (2000), and Baldwin and Krugman (2004) reach a similar conclusion that industrial concentration in core regions generates "agglomeration rents" for the firms located in these regions, which in turn provides these regions an ability to extract some of these rents through higher taxation[18] [Hypothesis 3]. Furthermore, Zissimos and Wooders (2008) show that even without agglomeration economies, variation across firms in their requirements for public goods yields the asymmetric outcome that the core regions may set a higher tax rate and provide a higher level of public infrastructure than the periphery regions. This is because the core regions with more efficient governments offer more-than-proportional increases in the level of public good production, which in turn reduces the production costs of the firms, making it optimal for some of them to pay higher taxes. Applying this hypothesis to China, we can expect the validation of Hypothesis 3.

Hypothesis 3 *Provinces with higher level of industrialization tend to set higher tax rates on foreign investment than provinces with lower level of industrialization.*

3. EMPIRICAL METHODOLOGY AND DATA

Our main empirical strategy is (i) to provide evidence on the existence of provincial tax competition in China along with the validation of the three basic hypotheses stated in the previous section; and (ii) to shed some light on the mechanism through which tax competition is actually conducted in the Chinese context. We first follow the existing literature setting up a dynamic spatial lag model to identify the competing behaviors of provinces, and then discuss a structural model as a way to unveil the mechanism for competition we laid out in the previous section. Before proceeding, we need to make two explicit assumptions. First, given that the statutory tax rate is fixed across provinces in China, we assume that the relevant tax rate is the average effective tax rate (AETR). Second, in line with the existence of a multilevel local government structure in China, we refer to the provincial government as a single entity that represents and captures all the competing behaviors of subnational

governments in that particular province. This is justified because under China's highly centralized political system, provincial governments maintain absolute powers in appointing local officials and deciding major local activities in their domains. In addition, besides the central government, the authority for establishing development zones is only legally assigned to provincial governments, which are also responsible for approving any setups of development zones at the sub-provincial level.[19]

Identification of Provincial Tax Competition

Specification. Tax competition theory suggests that τ_{it}, the AETR of province i in year t, is a reaction function of the tax rates chosen by its neighboring provinces. This gives us a spatial lag specification in the most general form that has been widely employed in the previous empirical research on tax competition (e.g., Devereux et al., 2008; Jacobs et al., 2010; Klemm and Van Parys, 2012).

$$(1) \qquad \tau_{it} = \lambda \tau_{it-1} + \delta \sum_{j \neq i} w_{ij} \tau_{jt} + \gamma pop_{it-1} + \theta indust_{it-1} + \mathbf{X}_{it-1}\beta + \eta_i + tt_t + \varepsilon_{it},$$

where τ_{it-1} is a one period time-lagged dependent variable, which is included to account for the high degree of persistence in tax policies; $\sum_{j \neq i} w_{ij} \tau_{jt}$ denotes the mean of the AETRs of the provinces other than province i in year t, weighted by the predetermined weights (row-normalized) $w_{i1}, ..., w_{iN}$,[20] and on the basis of Hypothesis 1, we predict a nonzero sloped reaction function, i.e., $\delta \neq 0$; pop_{it-1} is the population size of province i in year $t-1$; it is included to capture the effect of province size; $indust_{it-1}$ is our measure of industrialization level of a province and following Zhang et al. (2004), it is measured as the ratio of non-agricultural GDP to agricultural GDP of province i in year $t-1$.[21] As summarized in Hypothesis 2 and 3, both the size and industrialization level of a province are viewed as generating asymmetric tax policy responses among the provinces, and so we expect $\gamma > 0$

and $\theta > 0$. Both variables are lagged one period to avoid the potential endogeneity of these variables. Furthermore, the specification includes state fixed effects (η_i) to control for unobserved heterogeneity across provinces and also a linear time trend (tt_t); ε_{it} is an idiosyncratic error term.[22]

With the control variables $\mathbf{X}_{it-1}$ we seek to capture the main determinants of tax rates based on the existing theoretical and empirical literature. This leads to the inclusion of real GDP per capita, openness, government consumption, urban population share, geographical dummy variables, and tax reform dummy variable. Real GDP per capita serves as a measure of income; higher incomes are generally related to stronger demand for public services which may ultimately affect a province's choice of tax policies. Openness, measured by the ratio of imports plus exports to GDP, aims to capture the exposure of a province to trade and competition for capital. Government consumption as a percentage of GDP is included to account for the revenue need of the government. The proportion of urban population is a proxy for the demographic features of a province that may also influence government's preference for tax policies.[23] In addition, given the fact that many privileged policies were granted to the coastal provinces at the beginning of China's economic reforms in 1978, we include a geographical dummy variable, which takes the value 1 if the province is located in coastal region and 0 otherwise. Meanwhile, in order to account for the possible systematic difference of the tax policies before and after the critical TSS reform in 1994, we also include a post-reform dummy variable that equals 1 for the post-reform period and 0 otherwise. Finally, all control variables, excepting the dummy variables, are lagged by one period to avoid any endogeneity bias.

An important decision on the estimation of the above spatial lag models concerns the choice of the weighting matrix. The standard practice in the spatial econometrics literature is to assume that geographically closer jurisdictions interact more strongly with each other. This leads to two common methods for defining the weights. The first is a contiguity matrix, where a value of 1 is assigned if two jurisdictions share the same border and 0 otherwise.

The other alternative is to use the inverse distances between the two jurisdictions as weights. As argued in some of the recent empirical tax competition literature, however, in the case of competition for mobile capital, it is very likely that capital will go much beyond first order neighbors, which renders the contiguity method less useful (Devereux et al., 2008; Klemm and Van Parys, 2012). Beyond the geographical criterion, it has been suggested that jurisdictions may regard as neighbors other jurisdictions that are similar to them economically and so compete for the same types of firms or the same type of capital (Case et al., 1993). In order to account for these considerations, we construct a benchmark weighting matrix that incorporates both the physical distance between jurisdictions and the similarity of economy-size between jurisdictions. More specifically, the typical element of the weighing matrix is,

$$w_{ij} \equiv \begin{cases} \frac{s_{ij} d_{ij}}{\sum_{j=1}^{N} s_{ij} d_{ij}} & \text{for } i \neq j \\ 0 & \text{for } i = j, \end{cases}$$

where s_{ij} is the inverse of the absolute value of the difference in GDP per capita between provinces i and j; d_{ij} is the inverse of distance between provinces i and j. With these weights, a province that has a small difference in economy-size and is closer in geographic space would receive a higher weight. In order to check the sensitivity of the results, we also employ an alternative weighing matrix that is purely based on the similarity of economy-size.[24]

Estimation. In order to estimate specification (1) unbiasedly and efficiently, two critical endogeneity issues need to be addressed. First, the lagged dependent variable is endogenous since it is correlated with the state fixed effect in the composite error term ($\eta_i + \varepsilon_{it}$), which renders biased and inconsistent results if OLS or fixed effect estimators are applied. Second, the tax policies of competitors (the spatial lag variable) enter the specifications contemporaneously, so that the competitors' tax policies are endogenous and correlated with the error term (ε_{it}) and OLS would yield a biased estimate of parameter δ (Anselin, 1988).[25]

To circumvent both endogeneity problems, we employ the system GMM estimator devel-

oped by Blundell and Bond (1998), one that has been used quite often in the recent studies on tax competition with dynamic features (Ghinamo et al., 2010; Klemm and Van Parys, 2012). This estimator combines the moment conditions from both the first-differenced equation of the estimating equation and the estimating equation in levels, and then estimates the parameters by GMM. In dealing with the endogenous variables, the system GMM estimator uses lagged levels to instrument the endogenous differences and lagged first differences to instrument levels. In addition, following the standard spatial econometrics literature (Kelejian and Prucha, 1998; Kelejian and Robinson, 1993), we also use as additional exogenous instruments for the spatial lag variable the competitors' weighted averages of the explanatory variables, including weighted real GDP per capita, weighted openness, weighted government consumption as percentage of GDP, and weighted proportion of urban population.[26]

The overall validity of the instruments used in the regressions as well as the serial correlation in the residuals are evaluated by the Hansen test (or overidentifying restriction test) and the Arellano and Bond (1991) test, respectively. Both statistics are necessary to confirm the validity of the instruments used. Finally, given our small sample size and the significant amount of additional instruments introduced, we collapse the instrument matrix in the estimation in order to avoid the problem of "too many instruments" discussed in Roodman (2009a).[27]

Ideally one would also include time dummies in the specification (1) to prevent cross-province contemporaneous correlation. However, doing so would generate two problems in our context. Due to the large amount of instruments created by the system GMM estimator together with the external instruments, adding time dummies to our relatively small sample would lead to too many instruments which may weaken the Hansen test and overfit the endogenous variables (Bowsher, 2002; Roodman, 2009b). Additionally, Devereux et al. (2008) and Klemm and Van Parys (2012) point out that the inclusion of time dummies in a model with spatial lag variables results in a possible multicollinearity issue among the spatial lag variables and the time dummies,[28] which makes it hard to identify the true impact of each

variable. Therefore, following the suggestion by Devereux et al. (2008); Caldeira (2012) and Klemm and Van Parys (2012), we add a linear time trend variable which captures a common trend for all states, instead of using time dummies.

Development Zones as a Mechanism of Competition

In section 2, we argued that one of the main mechanisms for provincial governments to carry tax competition to attract foreign investment is through the establishment of development zones. To shed some light on this issue, we have to identify the extent to which the establishment of development zones reduces the AETR on foreign investment, and how this reduction of effective rates finally affects the foreign investment actually received by the provinces.

Specification. We estimate the following structural specifications,

$$(2) \qquad \begin{cases} FDI_{it} = \lambda\tau_{it} + \mathbf{Z}_{1it-1}\beta_1 + \eta_{1i} + \nu_{1t} + \varepsilon_{1it} \\ \tau_{it} = \rho d_{it} + \delta \sum_{j\neq i} w_{ij}\tau_{jt} + \mathbf{Z}_{2it-1}\beta_2 + \eta_{2i} + \nu_{2t} + \varepsilon_{2it}, \end{cases}$$

to establish the linkage running from the introduction of a development zone (d_{it}) to a lower level of AETR (τ_{it}), and then to a higher level of foreign direct investment (FDI) received by the provinces (FDI_{it}). In the system equations (2), FDI_{it} is measured as the ratio of inward FDI flow to GDP of province i in year t; d_{it} is the measure capturing the effect of development zones of province i in year t,[29] and it includes the following three indexes: a dummy variable for the existence of development zones (dum_dev_{it}), the accumulated number of development zones (dev_num_{it}), and the per capita accumulated land area occupied by the development zones (dev_land_{it}); while the first index aims to identify whether the introduction of development zones leads to an expected reduction of AETR, the last two indexes go a step further to explore whether the intensity of development zones within the provinces would have a second impact on the AETR; η_{1i} and η_{2i} are province-specific fixed effects

capturing the unobserved heterogeneity across provinces that are constant over time; and ν_{1t} and ν_{2t} are year dummies capturing the contemporaneous correlation among provinces.

In the FDI specification, besides τ_{it}, which captures the effect of tax rate on foreign investment, we add a set of control variables ($\mathbf{Z}_{1it-1}$) similar to those in the tax rate equation, including real GDP per capita, openness, government consumption as a percentage of GDP, and share of urban population. In addition, we include a geographical dummy variable and a post-reform dummy variable to capture the potential impacts of geographical characteristics and institutional changes. The control variables in the tax rate specification, $\mathbf{Z}_{2it-1}$, cover the whole list of variables we used in the previous subsection, including province size and industrialization level. Finally, all control variables, with the exception of dummy variables, are lagged by one period to avoid any bias arising from the possible joint determination of these variables and the dependent variable.

Estimation. Estimation of the system equations (2) requires an effective methodology to tackle several econometric issues simultaneously. First, appearance of the dependent variable τ_{it} on the RHS in the FDI specification creates the usual endogeneity problem in the estimation of simultaneous equations, which renders OLS estimators biased. However, under the framework of 2SLS estimation, the system is identified as not all explanatory variables in the tax rate equation are determinants of FDI location–those additional controls implicitly serve as instruments for the endogenous tax rate variable in the FDI equation. Second, the spatial lag variable on the RHS in the tax rate equation generates the same endogeneity issue as the one we faced before; we therefore use the same method to cope with it. That is, we use the competitors' weighted average of explanatory variables as additional exogenous instruments for the spatial lag variable. Finally, the possible omitted variables would affect both equations, leading to inefficiency caused by the possible correlation of the error terms ε_{1it} and ε_{2it} in the system. Thus we incorporate the seemingly unrelated regression model to extend the 2SLS to a 3SLS model in order to address the endogeneity problem and improve estimation efficiency.

Data

Our panel dataset covers 30 provinces over the period 1993-2007. Tibet is not included due to the lack of data availability. The selection of our observation period is based on data availability for our measure of the AETR. Year 1993 is the earliest we can get access to foreign tax revenue data; while year 2007 is the last the Chinese statistical office reports the foreign tax revenue data separately. With China's new *Corporate Income Tax Law* that took effect on January 1 2008, there is a unified corporate income tax regime for foreign and domestic enterprises. The data definitions, sources and summary statistics are presented in Table 1.

We measure AETR as the actual tax revenue from foreign investors relative to the relevant tax base. In particular, two indexes are constructed. The primary one (denoted as AETR1) is defined as the ratio of total foreign tax revenues (*shewai shuizhou zong'e*) to total investment of foreign-invested enterprises (FIEs). The alternative index (denoted as AETR2), which is employed for robustness checks, is defined as the ratio of total foreign tax revenues to total registered capital (*zhuce ziben*) of FIEs. The common numerator in both measures reflects the overall effective tax burden on foreign investment and should therefore be preferred to definitions based on total income tax revenues of FIEs only.[30] These measures of AETR follow the method of Mendoza et al. (1994) that has been widely used in macroeconomic analysis and some recent empirical studies of tax competition (e.g., Winner, 2005; Jacobs et al., 2010). They are also deemed as the most suitable measures of effective tax rate in our context for three reasons.[31] First, the AETR captures both relevant income and non-income taxes imposed on foreign investment, as well as all components determining the tax base, like legal and/or illegal deductions, exemptions, tax credits and the enforcement of tax rules. All these factors serve as important tools for provincial tax competition. Second, the AETR is an aggregate measure of tax burden that fits well with the assumption of a representative agent underlying most tax competition models. Third, since the AETR is a backward-looking measure of an average effective rate, it is appropriate for measuring distributional burdens,

and so it should be the relevant tax measure if jurisdictions compete for discrete location of foreign investment (Devereux and Griffith, 2003). Data for calculating the AETRs are extracted from various issues of the *Tax Yearbook of China*.

Information on the established development zones at the national and provincial levels is provided in a file compiled and published by the National Development and Reform Commission of China (NDRCC) with the assistance of the Ministry of Land and Resources and the Ministry of Housing and Urban-Rural Development in 2006. This file contains detailed information on individual development zones including year of establishment, land area occupied, leading industry it belongs to, and others.[32] We then aggregate the information from individual to provincial level for estimation purposes.[33]

Data for all other variables are obtained from various issues of *China Statistical Yearbook* and *China Compendium of Statistics 1949-2008*.

4. EMPIRICAL RESULTS

We now turn to the discussion of our estimation results. Evidence of provincial tax competition along with testing results for the three hypotheses laid out in section 2 are documented in the first subsection. The structural estimation results supporting the role of development zones as a mechanism for competition are presented next.

Provincial Tax Competition

Main results. Specification (1) is estimated using the system GMM method, along with robust and finite sample corrected standard errors. The F-statistics for first stage regression models, the Hansen test, and the Arellano and Bond (1991) test are reported at the bottom of each table, indicating the validity of the instruments used.

Based on both measures of AETR, Table 2 reports the main results from estimations controlling and not for the time trend. For all four regressions, we find a statistically sig-

nificant coefficient for the competitors' weighted AETRs in line with Hypothesis 1 that a province's tax rate reacts strategically to tax rates in other provinces. A positive value of this coefficient further confirms a general finding in the relevant literature to the point that a province raises (cuts) its own AETR if other provinces raise (reduce) their AETRs. The magnitudes of the coefficients, varying across the definitions of AETR and model specifications, range from 0.51 to 0.87. It shows that the inclusion of time trend tends to reduce the extent of strategic interaction among provinces. Intuitively, this may suggest that the changes of tax rates among different provinces are partially systematic and so the inclusion of a common time trend can pick up this effect and lead to a smaller strategic interaction. In addition, the magnitude of the coefficients become smaller when the alternative measure of AETR is used, which is not surprising given that AETR2 is a less accurate measure of effective tax rate. This measure uses total registered capital of FIEs as the denominator, which only reflects the capital endowment of the enterprises at the time of registration and may not vary significantly over time. Nevertheless, all four coefficients of weighted AETRs are smaller than one, which ensures the stationarity of the spatial lag model. Province size enters the model with a positive sign–a result that is consistent with Hypothesis 2, though the coefficients are only statistically significant when not controlling for the time trend. This may again suggest that a common trend of population changes across provinces explains a larger share of the variation of population size over time.[34] Turning to Hypothesis 3, the results reveal supporting evidence by showing a positive and significant effect of the province's industrialization level, though this effect is relatively small in magnitude.

For the control variables, the lagged dependent variable has a positive and significant coefficient, indicating higher persistence of the tax policies. Government consumption as a percentage of GDP has negative and significant coefficients in general, suggesting that with higher demand for revenues, a lower effective tax rate is chosen in order to attract more tax base. Other control variables are generally not statistically significant.

Robustness. In order to test for the robustness of the basic results, we conduct sensitivity

analysis along three dimensions. First, we utilize an alternative specification to control for the time fixed effects. As noted earlier, the inclusion of time fixed effects in the dynamic specification (1) would weaken the Hansen test and overfit endogenous variables in the estimation. However, omitting the time fixed effects may generate another source of bias—a common spatial shock. That is, the identified strategic interaction over tax rates may also be interpreted as a result from a common spatial shock across all provinces. To address this possibility, we drop the lagged dependent variable τ_{it-1} in specification (1) to estimate a static tax reaction function and controlling for both province fixed effects and time fixed effects. The weighted AETRs is again treated as an endogenous variable and instrumented by the same set of instruments we used before. Second, we employ an alternative weighting matrix that is purely based on the similarity of economy-size among provinces to characterize the competition pattern. Finally, we re-estimate specification (1) with a reduced sample size that excludes the four province-level municipalities and other provinces in the coastal region.[35] The objective is to examine the strategic interaction among relatively small provinces in economy-size, where all sub-provincial governments are atomistic from the viewpoint of the province. Presence of strategic interaction among these provinces would confirm that, at least partially, our main results have not been driven by any possible vertical competition between provincial governments and sub-provincial governments–even though, in theory, we have explicitly ruled out this possibility in the Chinese context.

Table 3 presents the robustness estimation results, which are highly consistent and robust with our main ones. They confirm the existence of a positive and significant strategic interaction over tax rates among provinces. On the effects of provincial characteristics, province size remains statistically insignificant when controlling for time trend or time fixed effects. Industrialization level of a province has the expected effect, though it turns to be statistically insignificant in the estimations with a reduced sample size—in large part due to the elimination of information from provinces with higher level of industrialization in the coastal region.

The Role of Development Zones

Main results. Table 5 presents the estimation results for the structural specifications (2) using 3SLS approach. The dependent variables are noted on the top of each column. dum_dev_{it} is used to examine the impact of the introduction of development zones. In light of the time it takes from the initial establishment of zones to attract foreign investment and to result in tax revenues, it is reasonable to expect more than one year lag. We experiment with a lag of up to 5 years to capture this effect. As shown in Table 5, in all FDI equations, the AETR is always negative and significant, confirming the traditional expectations. In all the tax rate equations, the introduction of development zones is found to be negatively associated with the AETR on foreign investment, though as expected, a lagged effect of two to five years is detected. Thus, we find support for a channel running from the introduction to development zone to a lower AETR to a higher level of FDI.

On top of the negative impact of development zones on the AETR, we ask whether the intensity of development zones plays a further role in reducing the effective tax rates faced by foreign investors. To do so, we add the explanatory variables dev_num_{it} and dev_land_{it}, the intensity of development zones, and re-estimate the models. The results are summarized in Table 5; the results for the control variables are not reported to save space. We find a statistically insignificant coefficient for our measure of intensity of development zones. Establishing more development zones or enlarging their sizes does not appear to further contribute to lower AETRs. This may be because the scope of manipulation and discretion for local authorities cannot be changed significantly with the changes of development zones; a further expansion of zones can just be used to contain a larger amount of FDI. Note finally that the coefficients for province size are positive and statistically significant in the tax rate equations, which gives support to Hypothesis 2.

Robustness. We run several additional estimations to check the robustness of our results. We re-estimate the structural specifications by using both the alternative measure of AETR (AETR2) and the alternative definition of weighting scheme respectively. In addition, instead

of measuring the FDI flows as a percentage of GDP, we also try to measure it as the log of per capita FDI received by each province. Overall, we find consistent evidence in supporting our main argument. The results are not reported for space reasons.

Lastly, given our interest in validating development zones as an important conduit for provincial governments to manipulate effective tax rates and so involving a tax competition game, we also test for the strategic interaction over development zones among provinces directly. If a positive interaction is found, that would give us further robust evidence on the role of development zones. We perform this analysis by modifying specification (1) replacing the tax rate variables (τ_{it}) with the development zones variables (dev_num_{it} and dev_land_{it}), as the strategic variables in the estimations. The results, as reported in Table 6, are comparable with each other. They confirm that regardless of the measurement of development zones, either in its number (dev_num_{it}) or its size (dev_land_{it}), there exists a positive and significant strategic interaction among provinces. The estimated coefficients take values around 0.5-0.6, indicating a relatively strong strategic interaction over the setup of development zones among provinces. The coefficients for the provincial characteristics are in general statistically insignificant, which is not surprising given their weak economic significance in the setting up of development zones.

5. CONCLUSION

This paper aims to answer two important questions on the Chinese economy. First, does provincial tax competition for foreign capital exist? A positive certain answer would provide support for the prevalent view of the role of local governments as one of the main engines for China's rapid economic growth over the past thirty years. Second, if the answer to first question is "yes", then the next important question is how is this competition conducted in the Chinese context where there is highly centralized tax system?

In answering the first question, we calculate for each province the AETR on foreign

investment, taking into account the tax incentives available to foreign investors for the period 1993-2007 covering 30 provinces. Our estimation results from dynamic spatial lag models provide strong evidence in support of the existence of positively strategic tax interactions among provincial governments in China. In line with the theoretical hypotheses, our results highlight the economic significance of a province' spatial characteristics in determining its choice of AETR. In particular, provinces with a higher level of industrialization tend to select a higher level of tax rate than provinces with a lower level of industrialization. Although, in theory, larger provinces are predicted to choose higher tax rates, our results only provide week support for this argument.

The answer to the second question lies on our observation of the booming trend in development zones that took place contemporaneously with China's rapid economic growth. Given the endorsed favorable tax policies and the large local administrative discretion granted by the central government to the development zones, we explore the establishment of development zones as a conduit for provincial tax competition. Our estimation results from the structural models confirm this conjecture to the extent that the introduction of development zones does lead to significant reduction of the AETR, which in turn successfully attract more foreign investment.

Our findings have significant policy relevance. If the continued loss of farmland from expanding development zones is deemed undesirable by the national authorities, there will be a need to rethink some other national policies, in particular providing subnational governments with significant measures of tax autonomy through which they may implement their competition policies. In all, some degree of competition at the subnational level can be beneficial to help keep the public sector more efficient, but that may be achieved with less detrimental externalities.

Notes

[1]See definition and more discussion on development zones in the next section.

[2]See Zheng (2006) table 3 for a detailed list of the major preferential tax policies for foreign capital investing in the development zones in China.

[3]Using Chinese provincial panel data for 1980-2004, Caldeira (2012) provides evidence on the existence of public spending interactions among provinces by estimating a spatial econometric model. In another recent paper, Agostini et al. (2010) examine the strategic interactions over the provision of public projects among 86 villages in rural China, where village election has been launched to increase the accountability of local officials in rural areas.

[4]This was a highly centralized fiscal system. Under this system, local governments were acting as the agents for the central government to collect revenues and execute spending mandates. Local governments just did not have their own budgets, and all revenues and expenditures were approved by the central government.

[5]See Martinez-Vazquez and Qiao (2010) for a detailed discussion of the expenditure assignment in China.

[6]See Xu (2011) for an excellent review. Li and Zhou (2005) provide empirical evidence that the central government indeed employs promotion and termination of provincial governors to induce provincial economic growth.

[7]In line with positioning and functions, they may be officially called economic development zones, economic and technological development zones, new and high-tech industrial development zones, industrial parks, exporting processing zones, bonded zones, border economic co-operative zones, etc. The government made clear the targets of development zones as "construction primarily relies on attracting and utilizing foreign capital; primary economics forms are Sino-foreign joint ventures and partnerships as well as wholly foreign-owned enterprises" (Wang, 2013). Therefore, domestic investors are not admitted to settle in these zones, only except a very limited amount of certain types of domestic enterprises that settle

in some specific types of development zones (e.g., domestic high-tech enterprises in new and high-tech industrial development zones).

[8]In the literature, location-based tax incentives have been shown to be successful in attracting more investment. For example, Hanson and Rohlin (2011) find that the federal Empowerment Zone program in U.S. is responsible for attracting about 2.2 new establishments per 1,000 existing establishments in the zone areas.

[9]See Wang (2013) for more description on other non-tax preferential policies, including property rights protection and land use policy, granted by the central government.

[10]There may be a concern that is generated by the relative extent of labor immobility. That is, due to the household registration (i.e. *Hukou*) system in China, labor mobility across regions is largely restricted; therefore, the expansion of development zones activies may reduce the economic activities of domestic firms outside the zones, resulting in a reduction of tax base outside the zones However, Wang (2013) provides quantitative evidence that the introduction of development zones neither crowds-in nor crowds-out domestic investment.

[11]Although the establishment of national-level development zones is at the discretion of the central government, provincial governments, indeed, exert an important role in influencing the central government's decision via their lobbying efforts. Thus, to some extent, national-level development zones are also a reflection of the competition outcome of provincial governments.

[12]We also want to report the corresponding values for total FDI received in all development zones and/or total FDI received in provincial-level development zones, however, these data are not available.

[13]Numerous subsequent works have extended and refined this view in a variety of directions (See Wilson, 1999; Wilson and Wildasin, 2004, for excellent surveys of the tax competition literature). Nevertheless, there are also a few others pointing out that in the presence of inter-jurisdictional externalities, this benchmark result may not necessarily hold (see, for example, Pinto, 2007).

[14]Ideally, testing the existence of strategic interaction among jurisdictions is not sufficient to fully validate the emergence of tax competition, as this strategic interaction may also arise through other possible channels, such as yardstick competition or simply policy diffusion. The distinction among the various possible channels to explain the detected strategic interaction in tax rates remains a difficult task in the literature. The tax competition avenue appears to be the most commonly accepted explanation.

[15]Noticeable exceptions include Chirinko and Wilson (2011) and Parchet (2012). Both of these papers find a negative strategic interaction in tax rates among U.S. states and Swiss municipalities, respectively. Rork (2003) concludes that the slope of tax reaction functions depends on the mobility of the tax base.

[16]For instance, despite the increasing mobility of capital and competitive pressure on the governments in the European Union, the variation of effective average tax rates among members remains high, ranging from 8.8 percent in Bulgaria to 35.5 percent in Germany in 2007 (Elschner and Vanborren, 2009).

[17]Country size is measured in these studies by the population. However, this result is shown to be quite consistent with the other measures of country size. For example, Marceau et al. (2010) model country size by the stocks of immobile capital, and obtain a similar result.

[18]Baldwin and Krugman (2004) derive this result under a sequential game setting assuming the more-developed region assumes the leader role. Therefore, a confirmation of Hypothesis 3 may also suggest the emergence of a Stackelberg type game in reality.

[19]Therefore, horizontal competition among sub-provincial governments should not be an issue, since they act as agents of provincial governments at the local level, and so their behaviors, at most, are only the reflections of provincial governments' policies. On the other hand, vertical competition between provincial and sub-provincial governments is unlikely to exist in the Chinese context, given what as we just described that provincial governments maintain absolute top-down control within the province.

[20]Note that our focus is on competition among Chinese provinces, and therefore we do

not take into account the potential competition of those provinces near international borders with neighboring countries. Geys and Osterloh (2013) point out the possibility of this kind of border effect.

[21]For robustness checks, we also use the share of non-agricultural GDP in total GDP as the measurement of industrialization level. The results are largely unchanged.

[22]Note that the error term ε_{it} may also be modeled as a spatial process. However, under our system GMM estimation framework (as elaborated below), the possible presence of spatial error dependence would not bias our estimate of the spatial parameter δ in specification (1). Since neighbors' tax rates are instrumented, the estimate of δ should not be affected by the potential spatial auto-correlation in the error term ε_{it} (see for example, Kelejian and Prucha, 1998; Revelli, 2001; Agostini et al., 2010).

[23]The shares of young and elderly population may be alternatively better proxies for the demographic features of a province. Unfortunately, annual data for these variables are not available at the provincial level.

[24]Instead of using the difference in GDP per capita to capture the similarity among the provinces, we also tried the difference in the level of industrialization. We obtained quite similar results and so they are not reported in the paper. But all results are available upon request.

[25]This second endogeneity is a typical issue in the spatial econometrics literature. Two conventional approaches for getting consistent estimates of the spatial parameter are suggested in the literature. The first approach is to use instrumental variables (Anselin, 1988), where the use of the weighted average of competitors' exogenous or control variables as instruments are typically suggested (Kelejian and Prucha, 1998; Kelejian and Robinson, 1993). An alternative approach is to rely on the maximum likelihood approach. Under this method, a non-linear reduced form for the original equation is computed by inverting the system. A non-linear optimization routine is then used to estimate the spatial parameter. See Brueckner (2003) for more discussion. Although both approaches yield consistent estimates of the

spatial parameter, the later method is generally more challenging in computation.

[26]The weights are constructed in the same way as discussed previously.

[27]A finite sample size with too many instruments may weaken the Hansen test to the point where it generates implausibly good p values of 1.000 (Bowsher, 2002).

[28]The reason here is that the inclusion of time dummies is equivalent to adding the average value of the dependent variable in each year, which by its nature is highly correlated with the spatial lag variables.

[29]Given our focus on provincial tax competition, all development zones data refers to development zones set up by provincial governments only.

[30]This is because, as we elaborated in the previous sections, offering preferential income tax rates or reductions to foreign investors is not the only tool for provincial governments to compete with each other. Exerting different degrees of tax enforcements on other indirect taxes and fees such as VAT, local business tax, land usage tax, and even individual income tax can also be important means for competition. According to our calculation, FIEs income tax revenue only accounts for a small share of total tax revenue collected from FIEs, ranging from 8.9 percent in year 1993 to 19.2 percent in year 2006.

[31]Note that these measures of AETR also suffer from some concerns. Among them one important concern is that the AETR may vary considerably according to the underlying economic conditions in a province, even if there is no change in tax regimes (Devereux et al., 2008). This issue can be addressed if some alternative measures of AETR, as the ones proposed by Devereux and Griffith (2003) that are based on forward-looking concepts, are employed. Even though, given data availability, we are unable to create such kinds of tax measures as robustness check; we believe, this issue should not be significant since the provincial fixed effects in our estimations will be able to pick up some of these effects.

[32]The file is in the title of "Directory of China Development Zone Audit Announcement (*zhongguo kaifaqu shenhe gonggao*)", which is freely available online at http://www1.ndrc.gov.cn/zcfb/zcfbgg/2007gonggao/W020070406535176330304.pdf/.

[33]Note that the data on the development zones are available from 1984 to 2006. So whenever the development zone variables enter the specifications, the estimation period is up to 2006.

[34]This result is consistent with Jacobs et al. (2010), which also find an insignificant effect of states' population size on the U.S. states' tax settings in a dynamic estimation framework.

[35]These include Beijing, Tianjin, Shanghai, Chongqing, Fujian, Guangdong, Guangxi, Hainan, Hebei, Jiangsu, Liaoning, Shandong, and Zhejiang.

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TABLE 1: Summary Statistics

Variable	Description	Mean	Std. Dev.	Min.	Max.	N
AETR1	Ratio of total foreign tax revenues to total investments of FIEs	0.031	0.028	0.0004	0.207	446
AETR2	Ratio of total foreign tax revenues to total registered capital of FIEs	0.052	0.051	0.001	0.523	446
FDI_GDP	Ratio of FDI to GDP	0.036	0.042	0.00002	0.243	450
pop	Total population, log	8.077	0.793	6.146	9.186	450
indust	Non-agricultural GDP to agricultural GDP	8.601	14.041	1.638	118.733	449
gdppc	Real GDP per capita, log	7.420	0.641	6.097	9.324	450
open	Ratio of total trade to GDP	0.273	0.355	0.032	1.845	450
govcon	Ratio of government consumption to GDP	0.016	0.012	0.002	0.082	447
urban	Proportion of urban population	0.312	0.154	0.127	0.868	447
dum_dev	Dummy=1 if development zones exist, 0 otherwise	0.990	0.097	0	1	420
dev_num	Total number of development zones in the province	24.405	22.892	0	171	420
dev_land	Per capita land areas occupied by development zones	1.232	1.167	0	7.574	420
dum_coastal	Dummy=1 if coastal province, 0 otherwise	0.400	0.490	0	1	450
dum_reform	Dummy=1 if 1995 onward, 0 otherwise	0.867	0.340	0	1	450

Notes: Time period is 1993-2007.

TABLE 2: Provincial Tax Competition: Main Results

Dependent variable	Avg eff tax rate (AETR1)		Avg eff tax rate (AETR2)	
	(1)	(2)	(3)	(4)
Avg eff tax rate $t-1$	0.237**	0.219*	0.556***	0.543***
	(1.96)	(1.88)	(3.47)	(3.78)
Weighted avg eff tax rate	0.869***	0.704***	0.608***	0.505**
of neighbors	(7.21)	(3.88)	(3.23)	(2.26)
Population $t-1$ (*pop*)	0.003†	0.001	0.005*	0.003
	(1.42)	(0.44)	(1.81)	(1.09)
Industrialization $t-1$ (*indust*)	0.004***	0.004**	0.006**	0.007**
	(3.01)	(2.21)	(2.19)	(2.53)
Per capita GDP $t-1$ (*gdppc*)	-0.003	-0.002	-0.005	-0.004
	(-0.92)	(-0.59)	(-1.44)	(-0.81)
Proportion of urban population	-0.004	-0.008	-0.000	-0.012
$t-1$ (*urban*)	(-0.15)	(-0.31)	(-0.02)	(-0.40)
Openness $t-1$ (*open*)	-0.001	0.003	-0.008	-0.005
	(-0.35)	(0.66)	(-0.66)	(-0.42)
Government consumption as %	-0.326***	-0.279***	-0.284**	-0.300***
of GDP $t-1$ (*govcon*)	(-4.46)	(-2.98)	(-2.52)	(-2.64)
Reform dummy (*dum_reform*)	-0.001	-0.002	-0.002	-0.001
	(-0.49)	(-0.64)	(-0.59)	(-0.24)
Coastal dummy (*dum_coastal*)	-0.003	-0.002	0.001	0.001
	(-1.03)	(-0.81)	(0.35)	(0.30)
Province fixed effect	Yes	Yes	Yes	Yes
Time trend	No	Yes	No	Yes
Observations	416	416	416	416
First stage F-statistics	45.58	43.29	60.89	57.13
Hansen test (p-value)	0.310	0.265	0.342	0.235
AR(1) (p-value)	0.0183	0.0357	0.175	0.186
AR(2) (p-value)	0.409	0.327	0.286	0.284

Notes: Robust t-statistics in parentheses. Time period is 1993-2007. Models are estimated by system GMM estimator. ***, **, * denote significance at the 1, 5, and 10% level, respectively. † represents significance at the 10% level under one-tail test.

TABLE 3: Provincial Tax Competition: Robustness Checks

Dependent variable	Static model		Alternative weight		Reduced sample	
	Avg eff tax rate (AETR1)	Avg eff tax rate (AETR2)	Avg eff tax rate (AETR1)	Avg eff tax rate (AETR2)	Avg eff tax rate (AETR1)	Avg eff tax rate (AETR2)
Avg eff tax rate $t-1$			0.282**	0.673***	0.227***	0.406***
			(2.50)	(6.57)	(2.90)	(2.63)
Weighted avg eff tax rate	0.628***	0.646***	0.610***	0.581*	0.847***	0.744***
of neighbors	(2.71)	(2.63)	(3.34)	(1.93)	(3.45)	(3.51)
Population $t-1$ (*pop*)	0.001	0.033	0.001	0.002	0.005	0.012
	(0.02)	(0.40)	(0.31)	(0.71)	(1.16)	(1.47)
Industrialization $t-1$ (*indust*)	0.005**	0.010**	0.004**	0.005**	0.002	0.020
	(2.21)	(2.09)	(2.03)	(2.11)	(0.19)	(0.86)
Per capita GDP $t-1$ (*gdppc*)	-0.003	-0.001	-0.003	-0.008*	-0.011*	-0.020*
	(-0.20)	(-0.03)	(-0.67)	(-1.72)	(-1.68)	(-1.77)
Proportion of urban population	0.074*	0.135	0.005	-0.001	0.024	0.022
$t-1$ (*urban*)	(1.71)	(1.49)	(0.19)	(-0.05)	(0.38)	(0.26)
Openness $t-1$ (*open*)	-0.008	-0.023	0.001	-0.005	0.075	0.163
	(-0.69)	(-1.00)	(0.23)	(-0.50)	(0.95)	(1.22)
Government consumption as %	-0.305	-0.604	-0.290**	-0.309*	-0.061	0.171
of GDP $t-1$ (*govcon*)	(-1.21)	(-1.17)	(-2.52)	(-1.76)	(-0.26)	(0.41)
Reform dummy (*dum_reform*)	0.012	0.012	-0.001	0.000	-0.005	-0.006
	(0.64)	(0.31)	(-0.48)	(0.13)	(-0.89)	(-0.70)
Coastal dummy (*dum_coastal*)			-0.002	0.004		
			(-0.68)	(0.83)		
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	No	No	No	No
Time trend	No	No	Yes	Yes	Yes	Yes
Observations	446	446	416	416	238	238
First stage F-statistics	74.90	47.20	48.68	74.55	20.55	32.67
Hansen test (p-value)	-	-	0.151	0.338	0.983	0.999
AR(1) (p-value)	-	-	0.0285	0.169	0.0536	0.184
AR(2) (p-value)	-	-	0.104	0.195	0.580	0.422

Notes: Robust t-statistics in parentheses. Time period is 1993-2007. Models are estimated by system GMM estimator. Alternative weighing matrix is purely based on the similarity of economy-size among provinces. Reduced sample does not include the four province-level municipalities and other provinces in the coastal region. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

TABLE 4: Development Zones as a Mechanism of Competition: The Impact of the Introduction of Development Zone

Dependent variable	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)
Avg eff tax rate	-0.603***		-0.670***		-0.702***		-0.659***		-0.598***	
	(-3.16)		(-3.55)		(-3.56)		(-3.35)		(-2.97)	
Weighted avg eff tax rate of neighbors		0.600***		0.605***		0.635***		0.662***		0.689***
		(2.64)		(2.97)		(3.16)		(3.28)		(3.35)
Population $t-1$ (*pop*)		0.067*		0.087**		0.081**		0.077**		0.063*
		(1.75)		(2.35)		(2.26)		(2.13)		(1.71)
Industrialization $t-1$ (*indust*)		0.005**		0.005**		0.005**		0.005***		0.005***
		(2.50)		(2.41)		(2.53)		(2.59)		(2.66)
Per capita GDP $t-1$ (*gdppc*)	0.059***	0.001	0.060***	-0.004	0.060***	-0.002	0.060***	-0.002	0.059***	-0.002
	(3.98)	(0.06)	(3.92)	(-0.26)	(3.91)	(-0.11)	(3.96)	(-0.15)	(4.02)	(-0.12)
Proportion of urban population $t-1$ (*urban*)	-0.309***	0.055	-0.304***	0.045	-0.301***	0.043	-0.304***	0.044	-0.309***	0.051
	(-6.78)	(1.35)	(-6.53)	(1.12)	(-6.41)	(1.07)	(-6.58)	(1.08)	(-6.81)	(1.26)
Openness $t-1$ (*open*)	0.025***	-0.006	0.027***	-0.005	0.027***	-0.007	0.027***	-0.009	0.025***	-0.011
	(2.81)	(-0.54)	(2.89)	(-0.44)	(2.92)	(-0.68)	(2.88)	(-0.86)	(2.79)	(-1.04)
Government consumption as % of GDP $t-1$ (*govcon*)	0.926***	-0.395*	0.918***	-0.387*	0.915***	-0.341	0.920***	-0.334	0.927***	-0.325
	(3.57)	(-1.70)	(3.46)	(-1.65)	(3.41)	(-1.45)	(3.50)	(-1.41)	(3.61)	(-1.37)
Reform dummy (*dum_reform*)	-0.337***	-0.574	-0.320***	0.000	-0.039**	0.008	-0.040**	0.003	-0.352***	0.001
	(-3.33)	(-1.58)	(-3.19)	(0.04)	(-2.21)	(0.45)	(-2.31)	(0.59)	(-3.23)	(0.26)
Coastal dummy (*dum_coastal*)	0.089***	0.019	0.086***	0.024**	-0.009	0.106	0.086***	0.101	0.089***	0.075
	(5.13)	(1.59)	(4.89)	(2.06)	(-0.93)	(1.62)	(4.92)	(1.54)	(5.13)	(1.12)
Development zone dummy $t-1$ (*dum_dev*)		-0.016								
		(-1.45)								
Development zone dummy $t-2$ (*dum_dev*)				-0.017***						
				(-2.98)						
Development zone dummy $t-3$ (*dum_dev*)						-0.013***				
						(-3.04)				
Development zone dummy $t-4$ (*dum_dev*)								-0.011***		
								(-2.94)		
Development zone dummy $t-5$ (*dum_dev*)										-0.007**
										(-2.24)
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	446	446	446	446	446	446	446	446	446	446
R-squared	0.795	0.672	0.784	0.673	0.778	0.669	0.786	0.668	0.796	0.665

Notes: t-statistics in parentheses. Time period is 1993-2006. Models are estimated by 3SLS estimator. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

TABLE 5: Development Zones as a Mechanism of Competition: The Impact of the Intensity of Development Zones

Dependent variable	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)	FDI as % of GDP (FDI_GDP)	Avg eff tax rate (AETR1)
	Ln.=L.		Ln.=L2.		Ln.=L3.		Ln.=L4.		Ln.=L5.	
Panel A:										
Avg eff tax rate	-0.567***		-0.666***		-0.699***		-0.651***		-0.517***	
	(-3.08)		(-3.51)		(-3.53)		(-3.31)		(-2.64)	
Ln.development zone		-0.016		-0.017***		-0.012***		-0.010***		-0.007**
dummy (*dum_dev*)		(-1.51)		(-2.92)		(-2.96)		(-2.87)		(-1.99)
Ln.development zone		0.157		0.060		0.037		0.017		0.059
numbers (*dev_num*)		(1.56)		(0.45)		(0.30)		(0.14)		(0.50)
Observations	446	446	446	446	446	446	446	446	446	446
R-squared	0.801	0.676	0.784	0.675	0.778	0.670	0.787	0.668	0.808	0.667
Panel B:										
Avg eff tax rate	-0.623***		-0.644***		-0.685***		-0.657***		-0.573***	
	(-3.27)		(-3.44)		(-3.48)		(-3.33)		(-2.87)	
Ln.development zone		-0.016		-0.017***		-0.012***		-0.010***		-0.007**
dummy (*dum_dev*)		(-1.47)		(-2.90)		(-2.95)		(-2.90)		(-2.17)
Ln.development zone		0.003		0.001		0.001		0.001		0.000
areas (*dev_land*)		(1.51)		(0.60)		(0.70)		(0.30)		(0.16)
Observations	446	446	446	446	446	446	446	446	446	446
R-squared	0.792	0.674	0.788	0.674	0.781	0.670	0.786	0.668	0.800	0.665

Notes: t-statistics in parentheses. Time period is 1993-2006. Models are estimated by 3SLS estimator. All specifications are estimated with a full list of control variables, provincial-fixed effect and time fixed effect. Operator "Ln." represents lagged by n period, which is noted on the top of the table. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

TABLE 6: Development Zones as a Mechanism of Competition: Robustness Checks

Dependent variable	Development zone numbers (dev_num)		Development zone areas (dev_land)	
	(1)	(2)	(3)	(4)
Development zone numbers $t-1$	0.785***	0.826***		
	(7.88)	(7.06)		
Weighted development zone numbers	0.653***	0.615***		
of neighbors	(5.37)	(4.56)		
Development zone areas $t-1$			0.854***	0.872***
			(10.43)	(9.56)
Weighted development zone areas			0.526***	0.518***
of neighbors			(4.13)	(3.12)
Population $t-1$ (*pop*)	0.000	-0.000	-0.286	-0.026
	(0.08)	(-0.13)	(-0.54)	(-0.05)
Industrialization $t-1$ (*indust*)	0.000	0.001	1.715*	1.914**
	(0.00)	(0.22)	(1.74)	(1.96)
Per capita GDP $t-1$ (*gdppc*)	-0.003	-0.003	-1.103	-1.566
	(-0.93)	(-0.51)	(-0.84)	(-0.59)
Proportion of urban population	-0.000	-0.002	-6.704	-6.012
$t-1$ (*urban*)	(-0.01)	(-0.20)	(-1.11)	(-0.83)
Openness $t-1$ (*open*)	0.001	0.002	0.470	0.002
	(0.42)	(0.65)	(0.35)	(0.00)
Government consumption as %	-0.139*	-0.140**	-71.769	-51.735
of GDP $t-1$ (*govcon*)	(-1.73)	(-2.16)	(-1.08)	(-0.68)
Reform dummy (*dum_reform*)	-0.006***	-0.004***	-3.394***	-3.018***
	(-4.62)	(-4.99)	(-3.53)	(-3.25)
Coastal dummy (*dum_coastal*)	-0.001	-0.002	-1.291	-0.768
	(-0.58)	(-0.53)	(-1.46)	(-0.64)
Province fixed effect	Yes	Yes	Yes	Yes
Time trend	No	Yes	No	Yes
Observations	639	639	639	639
First stage F-statistics	233.96	217.02	306.96	285.76
Hansen test (p-value)	0.584	0.705	0.561	0.530
AR(1) (p-value)	0.0652	0.0643	0.0508	0.0503
AR(2) (p-value)	0.518	0.500	0.239	0.243

Notes: Robust t-statistics in parentheses. Time period is 1984-2006. Models are estimated by system GMM estimator. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

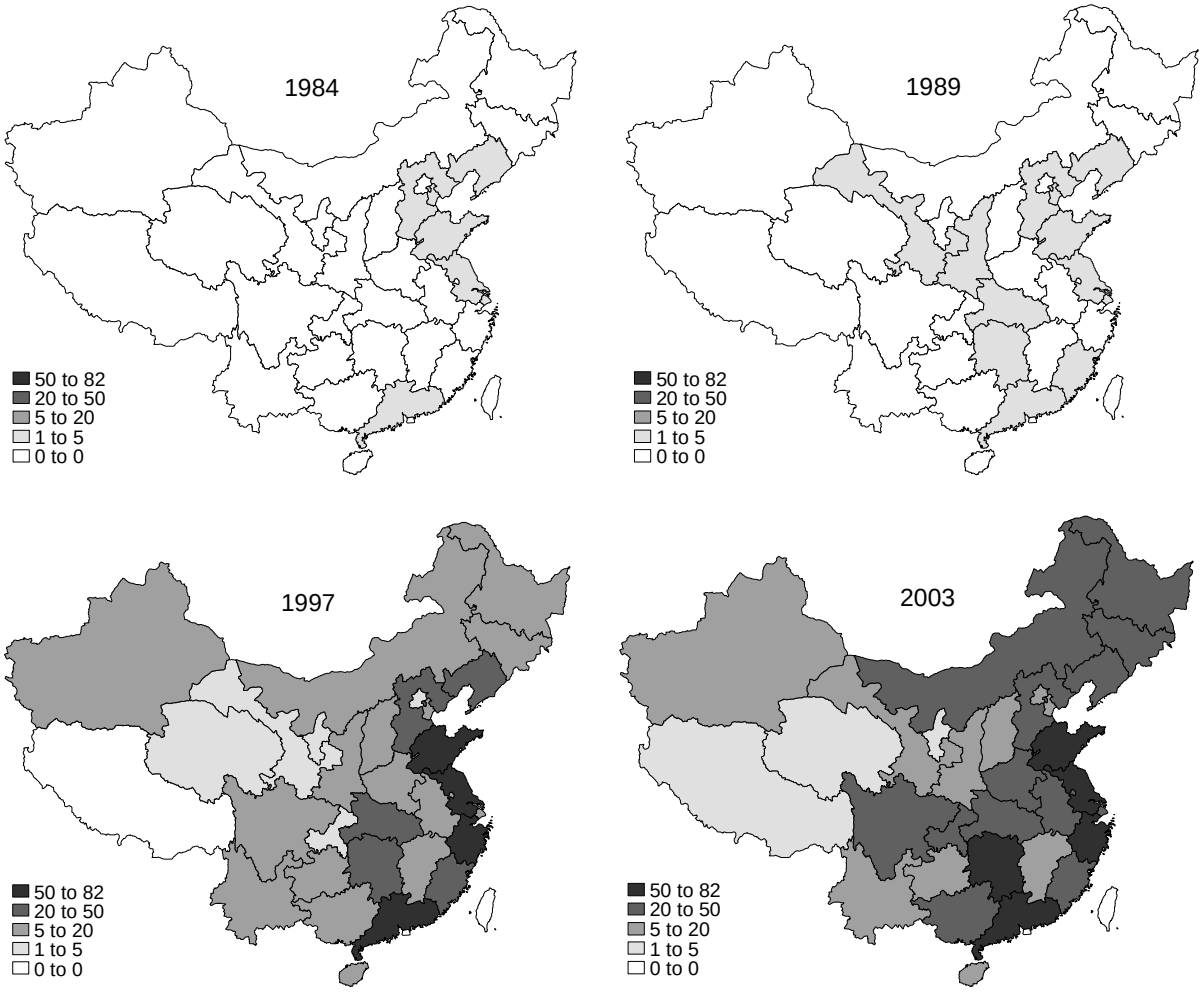

FIGURE 1: Evolution of the Setup of Development Zones in China, 1984-2003.
Source: NDRCC (2006)