I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11893

Minimum Wage Competition between Local Governments in China

Yanan Li
Ravi Kanbur
Carl Lin

OCTOBER 2018

I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11893

Minimum Wage Competition between Local Governments in China

Yanan Li
Beijing Normal University

Ravi Kanbur
Cornell University and IZA

Carl Lin
Bucknell University, China Institute for Income Distribution and IZA

OCTOBER 2018

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Minimum Wage Competition between Local Governments in China

The theory of fiscal and regulatory competition between jurisdictions is more advanced than its empirical testing. This is particularly true of labor regulation in general, and minimum wage regulation in particular, and especially so for developing countries. This paper utilizes the spatial lag methodology to study city-level strategic interactions in setting and enforcing minimum wage standards during 2004-2012 in China. We manually collect a panel data set of city-level minimum wage standards from China's government websites. This analysis finds strong evidence of spatial interdependence in minimum wage standards and enforcement among main cities in China. If other cities decrease minimum wage standards by 1 RMB, the host city will decrease its standard by about 0.7-3.2 RMB. If the violation rate in other cities increases by 1 percent, the host city will respond by an increase of roughly 0.4-1.0 percentage points. The results are robust to using three estimation methods, Maximum Likelihood, IV/GMM and a dynamic panel data model. Our findings of strategic interactions suggest the need for policy coordination in labor regulation in China.

JEL Classification: J38

Keywords: minimum wage, enforcement, race to the bottom, strategic interactions, China

Corresponding author:
Yanan Li
Department of Economics
Beijing Normal University
Beijing
China

E-mail: Yananlzd@gmail.com

1. Introduction

Strategic interactions of fiscal policies among governments have been well discussed in both theoretical and empirical studies. Early examples of theory papers on tax competition include Kanbur & Keen (1993), Edwards & Keen (1996), and Wilson & Wildasin (2004).[1] Compared to tax competition and environmental policy competition, however, jurisdictional interactions of labor standards and regulatory policies have not been studied as intensively (some examples include Duanmu, 2014; Davies & Vadlamannati, 2013).

A conventional wisdom is that there is a potential "race to the bottom" in labor standards across countries. Governments might undercut each other's labor standards to attract foreign capital (e.g., Chau & Kanbur, 2006; Davies & Vadlamannati, 2013; Olney, 2013). On the other hand, strategic interactions among jurisdictions could also lead to a "race to the top" of labor standards, for example, in the case that labor becomes a scarce resource. Regardless it is race to the bottom or to the top, the key idea is that policies in one country might be influenced by those in others. While the existing literature has provided evidence on between-country interactions in labor standards, there is so far little evidence on within-country competition, especially in developing countries. Given the importance of this issue, this paper fills the gap by providing the evidence for strategic interactions on minimum wage standards in China.

This paper focuses on minimum wages as a leading example of labor standards for the following reasons. First, minimum wage standards directly reflect the overall level of labor standards in the local labor market. For instance, an increase in minimum wages leads to a rightward shift of the whole wage distribution (Neumark, 2004). Second, the frequent adjustments of minimum wage standards in recent years make China an ideal policy setting to identify interjurisdictional competition within a country. Before the year 2004, a minimum wage standard was close to nonexistent, with low statutory levels and weak enforcement of the laws. From the mid-2000s onwards, however, rising concerns on inequality led to considerable strengthening of regulation and enforcement of minimum wage standards. As a result, there have been large time and spatial variations in both minimum wage standards and the enforcement since 2004. Third, the decision-making system of minimum wage standards and the enforcement is relatively decentralized in China, which is also critical to the study of jurisdictional competition. Therefore, we use minimum wages as an example to study labor standard competition.

This paper relies on a Spatial Lag framework combined with exogenous covariates to identify the spatial interdependence in setting up and enforcing minimum wage standards in China. In the analysis of minimum wage standards, we collect a panel data set of city-level minimum wage standards from China's government websites during 2004-2012. To estimate the magnitude of spatial interdependence, we first estimate a spatial static panel data model using both Maximum Likelihood method and Instrumental Variables (IV/GMM) method, then estimate a dynamic panel data model using Arellano-Bond GMM estimator. The analysis finds strong evidence of spatial correlation in minimum wage standards. If other cities increase (or decrease) minimum wage standards by 1 RMB, the host city will increase (or decrease) its standard by about 0.7-3.2 RMB.

Then we conduct a parallel analysis of strategic interactions on minimum wage enforcement. The literature on fiscal competition has found that enforcement policies are used as instruments for fiscal competition, when competition in tax rates are banned (Cremer & Gahvari, 2000). For instance, Ronconi (2012) finds that governments react to the competitive pressures produced by FDI inflow by turning a blind eye to noncompliance of labor laws. Bhorat, Kanbur and Mayet (2012) is an example of the recent literature documenting non-compliance with minimum wage regulation in developing countries. Despite data limitations, the current paper makes the first attempt to assess competition on the enforcement of minimum wage standards. We find that if the violation rate in other cities increases by 1 percent, the host city will respond by an increase of roughly 0.3 percentage points.

The rest of the paper is organized as follows. Section 2 introduces the institutional background of minimum wage setting in China. Section 3 describes data. Section 4 sets the empirical model and discusses identification strategies. Section 5 presents the main results, followed by robustness checks in Section 6. Section 7 concludes by putting our results in the context of the broader literature and looks ahead to areas for further research.

2. Institutional Background

2.1 Minimum wage setting and enforcement in China

Minimum wage regulations have been existing in China since the 1990s, but only with low levels of standards and weak enforcement. Things did not change until the early 2000s, when rising income inequality became a national concern. In 2004, the Ministry of Labor and Social Security issued the "Minimum Wage Regulations" law, stipulating that provinces should adjust minimum wage levels at least every two years to fit local living standards. Then the next decade saw frequent upward minimum wage adjustments along with improved compliance. Table 1 shows that around 60 percent of cities adjust minimum wage standards each year during 2004-2012 (except for 2009). While real minimum wage rates almost doubled during 2004-2009, the average noncompliance rate decreased from 8.9 to 7.6 percent.

The decision process of minimum wage adjustment varies by provinces. In some provinces, prefecture-cities are actively involved in adjusting minimum wage standards.[2] For instance, the city Chengdu in Sichuan province and the city Shenzhen in Guangdong province could set their own minimum wage standards, according to our survey with local practitioners. In other provinces, cities and counties are sorted into several tiers based on their economic development levels (usually four). The provincial government then consults with labor unions and sets the floors of minimum wage standards for each group of cities. The wiggle room left for city governments in deciding the final minimum wage standards is articulated in two ways: which group to be grouped into; and whether (and of what magnitude) it is possible to further adjust the standard upward given the floor. For instance, the city of Haimen in Jiangsu province was in tier 2 areas before 2007, but in tier 1 since 2008. Therefore, cities in this second type of provinces also have some degree of flexibility in the final decision of minimum wage standards. Overall, cities all have some flexibility in setting up minimum wage standards, which is evidenced by large within province variations of minimum wage standards.

When it comes to enforcing minimum wage laws, the "Minimum Wage Regulation" law specifies that governments at the county level and above are in charge of the enforcement in local areas. Therefore, prefecture-level cities, which stand one level above counties, will have full control over minimum wage enforcement in their cities. And this authority makes it possible for cities to compete against each other in the enforcement of minimum wage laws.

2.2 Motivation of local leaders to compete on minimum wages

Leaders of city governments have at least the following three motivations to compete against each other on minimum wage standards and enforcement. While they are all plausible and have been documented in the literature, this paper does not discriminate one source from another.

The first incentive for interjurisdictional competition on minimum wages is competing for capital, which could lead to a race to the bottom of minimum wages. If we assume capital flows to places with lower labor cost, then more stringent labor standards (e.g., minimum wages, labor rights) in local areas compared to other areas would reduce the attractiveness of local environments for firms. Therefore, local leaders might undercut each other's labor standards and employment protections to attract foreign (and domestic) capital (Chau & Kanbur, 2006; Davies & Vadlamannati, 2013; Olney, 2013).

The second incentive for interjurisdictional competition on minimum wages is competing for labor which, to the opposite of the first incentive, might lead to a race to the top of minimum wages. It has been argued that China has passed the Lewis turning point, and the era of surplus labor is over (Zhang, Yang & Wang, 2011). Moreover, because a tightening labor market in an era of high economic growth gives workers stronger wage bargaining power, the last decade has seen rising labor costs across the country. Therefore, city governments might engage in the competition for labor.

Last but not least, city leaders might strategically set and enforce minimum wage standards driven by promotion incentives. Promotion of local leaders in China is decided by their upper-level governments, based on performance comparison across jurisdictions. It has been shown that such a promotion scheme leads to tournament competition among local leaders in multiple aspects, such as in investment (Yu, Zhou & Zhu, 2016) and coal mine safety (Shi & Xi, 2018). In a similar vein, city leaders might be motivated to engage in tournament competition in minimum wage standards, if labor standards are important components of the performance evaluation for local government leaders. This motivation is likely in particular because China is faced with rising inequality and minimum wage standards have been used as an important tool to curb the rising inequality.

3. Data

We construct a panel data set from several sources. City level minimum wage standards in 2004-2012 are manually collected from local government websites (through searching "Baidu", a Chinese version of Google).[3] City characteristics and boundary shapefiles are compiled from China Data Online (see Table A.1 in the appendix for descriptive statistics of city characteristics).

The final data set for the analysis of minimum wage standards includes 252 prefecture-level cities in 25 provincial-level administrative units as opposed to all 294 prefecture-level cities in 34 provincial-level units of China. This subsample property will not bias our estimations for the following three reasons. First, the final data set is not derived by a non-random selection process; rather it is a result of combining data sets from different sources.[4] Second, results are not driven by individual provinces, as the estimates are not sensitive to dropping any individual provinces (Section 6.1 will give more details). Third, we also run two-sample t-tests for each economic variable in the omitted sample and the included sample. None of the mean differences is statistically significant.[5]

As discussed earlier, the frequent upward minimum wage adjustments provide a good source of identification for interjurisdictional dependence. Table 1 shows that about 58 percent of prefecture-level cities adjust minimum wages in each year during 2004-2012. The only exception is 2009, when no provinces adjusted minimum wages due to the financial crisis. 2006, 2010 and 2011 all witnessed a two-digit increase of minimum wages compared to the previous years.

In the second main analysis, “race on minimum wage enforcement”, we proxy the degree of enforcement by noncompliance rates of minimum wage standards in the city, which is derived from the 2002-09 Urban Household Survey (UHS hereafter). UHS is a continuous, large-scale social-economic survey conducted by the National Bureau of Statistics of China to study the conditions and living standards of urban households. Survey subjects include local urban households, non-local urban households who have lived in the city for at least six months, and some rural-urban migrant households. The survey covers 16 representative provinces, but our sample only keeps the cities that were surveyed throughout all years during 2004-2009. As a result, the final data set in the analysis includes only 66 prefecture-level cities distributed in nine provinces. Again, the relatively small sample size should not bias our estimates of the spillover effect of minimum wage enforcement, given the randomness of UHS sampling and sample selection process. As a matter of fact, the economic characteristics are by and large quite similar between these 66 prefecture-level cities and those dropped from the analysis.[6]

To calculate city specific noncompliance rates, we take advantage of the employment and wage information from the questionnaire.[7] Specifically, violation rates of minimum wage standards are defined as, the number of workers paid below local minimum wage standards divided by the employment size in the city. As Table 1 shows, on average, 9.2 percent of workers are underpaid during the study period. An important determinant of noncompliance rates is Kaitz ratio, namely the ratio of minimum wage standards and median wages. Cities with higher Kaitz ratio might be harder to fully enforce minimum wage standards, and hence have a higher violation rate than cities with lower Kaitz ratios. Table 1 shows that the level of minimum wage standards is on average 38 percent of the median wage in a city.

Table 1. Trend of minimum wage standards, 2004-2012

Year	Min wage	Growth of min wage (%)	% of jurisdictions adjusting min wage	Violation Rate	Kaitz ratio (min wage/ median wage)
2004	366	9.3%	66%	8.9%	37%
2005	395	7.9%	35%	8.5%	35%
2006	459	16.2%	88%	9.0%	37%
2007	487	6.1%	62%	10.0%	40%
2008	509	4.4%	64%	9.8%	41%
2009	512	0.6%	0%	7.6%	38%
2010	616	20.4%	99%		
2011	682	10.7%	78%		
2012	745	9.2%	68%		
Total	493	8.9%	58%	9.2%	38%

Note: Minimum wages are deflated by the provincial level CPI, using 2002 CPI as the base. City-level violation rate is calculated as the fraction of workers paid below local minimum wages.

4. Empirical Specification

This paper uses a spatial lag framework to estimate city-level strategic interactions in setting and enforcing minimum wage standards.[8] For each analysis, we first estimate a spatial static panel data model using both Maximum Likelihood method[9] and Instrumental Variables (IV/GMM) method, then we estimate a dynamic panel data model using the Arellano-Bond GMM estimator.

4.1 Race on minimum wage standards

To test whether minimum wage standards in the host city depend on minimum wage standards in other cities, we estimate the following Spatial Autoregression Regression (SAR) model,

$$MW_{i,t} = \beta_0 + \rho \sum_{j\neq i} \omega_{j,i} MW_{j,t} + \beta X_{i,t-1} + \eta_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

where $MW_{i,t}$ is the minimum wage standard in city i in year t; $\sum_{j\neq i} \omega_{j,i} MW_{j,t}$ is the Spatial Lag, the weighted average of minimum wage standards in other jurisdictional areas. ρ captures the spatial dependence of minimum wages. $X_{i,t-1}$ is a vector of city-level economic characteristics, including GDP, per capita GDP, industry share in total GDP, labor force participation rate, the proportion of employees in the primary industry, student enrollment in secondary schools, student enrollment in primary schools, the number of large-scale enterprises, the number of beds in hospitals.[10] We take a 1-year lag of the covariate vector to enhance the case for exogeneity[11]. All values such as GDP and minimum wages are deflated by the provincial level Consumer Price Index, with 2002 as the base year. η_i controls for city fixed effects; δ_t controls for year fixed effects. For descriptive statistics, see Table A.1 in the appendix.

The key independent variable, spatial lag, is constructed using two different weighting matrices ($\omega_{j,i}$) in the main results, and four additional weighting matrices in the robustness checks. First, we use a contiguity matrix, where a city's neighbors are defined as prefecture cities that share borders with it. The weighting matrix is normalized so that the row sum equals to unity. If the host city i has n_i neighbors, then the weight that city i puts on city j is defined as,

$$\omega_{j,i} = \begin{cases} \frac{1}{n_i}, \ if\ city\ j\ is\ one\ of\ the\ n_i\ neighbors\ of\ city\ i's, \\ \qquad\qquad 0, otherwise \end{cases} \tag{W1}$$

Second, we use an inverse distance-based weighting matrix, assuming that closer cities have stronger impacts on city i than cities farther away. The neighborhood-inverse distance matrix is as follows.

$$\omega_{j,i} = \frac{1}{d_{ij}}, \text{where } \mathrm{d_{ij}} \text{ is the distance between the centroids of city i and city j} \tag{W2}$$

The main econometric challenge to identify the magnitude of the spatial interdependence is the reflection problem (Manski, 1993). Because $MW_{i,t}$ and $MW_{j\neq i,t}$ are simultaneously determined, the spatial lag term is not orthogonal to the error term. As a result, OLS does not give consistent estimates. To deal with this endogeneity, the most common methods include Maximum Likelihood method and Instrumental Variables (IV/GMM) method (Brueckner, 2003; Davies & Vadlamannati, 2013; Shi & Xi, 2018). We use both methods to derive the estimates and then compare the consistency of the results. In the spatial IV method, we instrument the spatial lag with $\sum_{j\neq i}\omega_{j,i}X_{jt-1}$, the weighted average of other cities' exogeneous variables. The identification assumption is that city j's exogeneous variables only affect its own minimum wage standards but do not directly impact those in city i.

In addition to estimating a static spatial lag model in Equation (1), we add time-lagged minimum wage standards into the right-hand side of the model because minimum wage standards in the current year might also depend on minimum wages in the previous year. By doing so, the model becomes a dynamic panel model and fixed effect estimators are no longer consistent. To address this issue and potential endogeneity concerns, we follow Olney (2013) and estimate the dynamic model using Arellano–Bond GMM estimator (Arellano and Bond, 1991). This method takes the first difference of the model and instruments the right-hand side differenced terms with all their lagged levels.[12] We also include additional instruments, the lagged levels of weighted averages of other cities' exogenous variables, $\sum_{j\neq i}\omega_{j,i}X_{jt-1}$, which were used as instruments in estimating Equation (1). The estimation equation is as follows:

$$\Delta MW_{i,t} = \alpha \cdot \Delta \mathrm{MW}_{i,t-1} + \rho \cdot \Delta \sum_{j\neq i}\omega_{j,i}MW_{j,t} + \beta \cdot \Delta X_{i,t-1} + \Delta\delta_t + \Delta\varepsilon_{i,t} \qquad (2)$$

where $\Delta MW_{i,t}$ is the change of minimum wage standards in city i from year t-1 to year t; $\Delta\sum_{j\neq i}\omega_{j,i}MW_{j,t}$ is the change of the spatially lagged minimum wage standards in city i from year t-1 to year t. This method identifies a causal impact of other cities' minimum wage policies on the host city's policy.

4.2 Race on minimum wage enforcement

To study interjurisdictional interactions on enforcement, we modify model (1) by changing $MW_{i,t}$ to $E_{i,t}$, where $E_{i,t}$ is the enforcement level in city i year t. The model is as follows,

$$E_{i,t} = \beta_0 + \rho\sum_{j\neq i}\omega_{j,i}E_{j,t} + \beta X_{i,t-1} + \gamma Kaitz_{i,t} + \eta_i + \delta_t + \varepsilon_{i,t} \qquad (3)$$

where $Kaitz_{i,t}$ indicates the ratio of minimum wage to median wage calculated for each city. This is the only additional covariate compared to Equation (1); we add it because cities with higher minimum wage standards tend to have lower enforcement and higher violations.

Enforcement intensity could ideally be measured by the amount of resources (e.g., inspectors) that the local government invests to regulate minimum wage laws, but such data are lacking. Instead, because stronger enforcement intensity is associated with lower minimum wage noncompliance (Bhorat et al., 2012), we proxy enforcement by the headcount ratio of minimum wage violations: the number of workers receiving below minimum wages divided by the total number of working population. Again, Equation (3) is estimated using both MLE and IV methods, using the same instruments as when estimating Equation (1).

Because the enforcement analysis uses household survey data to compute violation rates, and the household survey is conducted in a randomly selected subsample of cities in the country, we end up having many "islands" and other cities with few contiguous neighbors. Therefore, we only use the inverse distance weighting matrix to construct spatial lags. The construction of the matrix is the same as the formula (W2).

Again, we introduce a time-lagged enforcement variable into the righthand side of Equation (3) and estimate the dynamic panel model using Arellano-Bond estimator. The first differenced model is as follows,

$$\Delta E_{i,t} = \alpha \cdot \Delta \mathrm{E}_{i,t-1} + \rho \cdot \Delta \sum_{j \neq i} \omega_{j,i} E_{j,t} + \beta \cdot \Delta X_{i,t-1} + \gamma \cdot \Delta Kaitz_{i,t} + \Delta \delta_t + \Delta \varepsilon_{i,t} \quad (4)$$

where $\Delta E_{i,t}$ is the change of minimum wage violation rates in city i. This model identifies a causal impact of other cities' enforcement levels on the host city's enforcement.

5. Main Results

5.1 Race on minimum wage standards

Table 2 presents estimation results for jurisdictional interdependence on minimum wage standards using three different estimation methods and two weighting matrices. Models 1-2 both use MLE method, with model 1 using the contiguity matrix (Formula W1) and model 2 using the inverse distance matrix (Formula W2). Likewise, Models 3-4 show IV/GMM estimation results;

Models 5-6 use the Arellano-Bond difference GMM estimation method, using all lagged terms as instruments.

Table 2 Results of the analysis of min wage standards, 2004-12

	MLE		IV/GMM		Arellano-Bond GMM	
	(1) Contiguous	(2) Distance	(3) Contiguous	(4) Distance	(5) Contiguous	(6) Distance
Spatial lag of minimum wages	0.72***	0.97***	0.99***	2.33***	0.98***	3.23***
	(0.02)	(0.00)	(0.11)	(0.18)	(0.04)	(0.17)
L. min wage					0.06**	0.05
					(0.03)	(0.03)
GDP (log)	5.03	-8.65	12.73*	-0.80	20.29	-33.80
	(8.45)	(10.90)	(7.31)	(8.02)	(26.01)	(26.46)
per capita GDP (log)	-8.90	-4.42	-12.99**	-9.42	-37.47**	-33.05*
	(6.36)	(8.46)	(5.55)	(6.36)	(16.55)	(19.49)
Labor participation Rate (%)	0.79**	1.16***	0.77***	1.48***	2.64**	5.22***
	(0.34)	(0.40)	(0.30)	(0.37)	(1.07)	(1.23)
Industry share (%)	-0.39	-0.61*	-0.21	-0.23	-0.09	0.51
	(0.27)	(0.35)	(0.20)	(0.22)	(0.41)	(0.53)
# of enterprises (1000)	5.55*	8.98**	3.27	8.56**	-1.84	1.61
	(2.99)	(3.85)	(3.93)	(3.45)	(2.95)	(3.54)
# of beds in hospitals	-13.49	-25.68**	-5.46	-10.15	-8.85	34.34
	(10.28)	(11.71)	(8.75)	(9.26)	(26.11)	(25.18)
stud enroll in secondary school	-1.73***	-1.73***	-1.74***	-1.67***	-0.72	-0.29
	(0.50)	(0.54)	(0.51)	(0.47)	(1.10)	(1.38)
% of secondary employment (%)	-0.33	-0.53*	-0.14	-0.20	-0.94**	-1.17*
	(0.22)	(0.28)	(0.18)	(0.21)	(0.46)	(0.60)
stud enroll in primary school	0.95	2.51**	0.02	1.48*	-0.59	-2.67
	(0.95)	(1.14)	(0.73)	(0.79)	(1.58)	(1.93)
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	2016	2016	2016	2016	1512	1512
R2			0.96	0.94		
Kleibergen-Paap rk Wald F stat			66.21	305.17		
Hansen J statistic (p-val)			0.750	0.245	0.822	0.773
AR (2) p-value					0.998	0.210

Models 1-2 show MLE estimation results. Column 1 uses simple contiguity matrix (equation W1); column 2 uses inverse distance matrix (Equation W2). Likewise, Models 3-4 show IV/GMM estimation results; Models 5-6 use the Arellano-Bond difference GMM estimation method, using all lagged terms as instruments. Results also hold using Arellano-Bond system GMM method. Control variables are taken a 1-year lag. Robust standard errors in parentheses are clustered at the city level. Year 2009 is dropped from all analyses, because no minimum wage adjustments occurred in any city during the year.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Overall, these models give consistent results that other cities' minimum wage standards have a positive effect on the host city's minimum wage standards. The magnitude of spatial dependence ranges between 0.7 and 3.2. In other words, if other cities increase their minimum wages by 1 RMB, the host city will increase its minimum wage standard by 0.7-3.2 RMB. This estimated magnitude of spatial dependence is comparable to that by other studies using similar methods. For instance, Davies & Vadlamannati (2013) use the IV/GMM method to estimate spatial interactions in labor standards across countries and find point estimates between 0.2 and 2. Olney (2013) finds the point estimate of intergovernmental dependence in employment protection is between 0.18 and 0.44 when using Arellano-Bond GMM method, but as large as between 1.6 and 2.9 when using the IV method.

Across the models, a few control variables have statistically significant point estimates. First, cities with higher labor force participation have higher minimum wages. Second, a higher enrollment rate of primary school students is associated with higher minimum wages, but a higher enrollment rate of secondary school students is associated with lower minimum wages. Third, a higher number of large-scale enterprises is associated with higher minimum wages, which could be explained by higher demand for labor. In addition, the estimates from Equation (2) show positive coefficients on the lagged minimum wage term, suggesting that minimum wage standards might be persistent over time.

5.2 Race on enforcement

Table 3 presents estimation results for jurisdictional interdependence on minimum wage enforcement using different estimation methods and the inverse distance weighting matrix. Enforcement is proxied by the headcount ratio of minimum wage violation. Model 1 uses MLE method; Model 2 uses IV/GMM estimation method; Model 3 uses the Arellano-Bond difference GMM estimation method.

The results consistently show evidence of a race on the enforcement of minimum wage standards, with the point estimate ranging in [0.38, 0.85] across three models. In other words, if the weighted violation rate in other cities increases by 1 percent, the violation rate in the host city will increase by 0.38-0.85 percentage points. The insignificant coefficient on the lagged violation rate in the dynamic model (in column 3 of Table 3) suggests that the strictness of enforcement is not persistent over time. The share of secondary industry GDP in total GDP and the share of secondary industry employment in total employment are both positively associated with the violation rates of the minimum wage standards. In addition, the positive coefficient of Kaitz ratio indicates that a higher minimum-to-median wage ratio results in a higher violation rate of the minimum wage law in the city.

Table 3 Results of the analysis of minimum wage enforcement, 2004-09

	MLE (1)	IV/GMM (2)	Arellano-Bond GMM (3)
Spatial lag (Violation Rate)	0.38**	0.60*	0.85*
	(0.16)	(0.36)	(0.48)
L. Violation Rate			-0.07
			(0.11)
GDP (log)	1.78	1.99	7.60
	(1.93)	(1.67)	(14.61)
per capita GDP (log)	-0.35	-0.31	-3.93
	(1.35)	(1.45)	(6.69)
Labor participation Rate (%)	-0.12*	-0.13*	-0.03
	(0.06)	(0.07)	(0.44)
Industry share (%)	0.15***	0.14***	0.09
	(0.06)	(0.05)	(0.16)
# of enterprises (1000)	0.02	0.07	0.37
	(0.39)	(0.45)	(1.57)
# of beds in hospitals	0.29	-0.08	-3.00
	(2.92)	(2.99)	(7.95)
student enroll in secondary school	-0.32	-0.34	-0.08
	(0.30)	(0.28)	(2.29)
% of secondary employment	0.10*	0.11**	0.11
	(0.05)	(0.05)	(0.18)
student enrollment in primary school	-0.34	-0.34	0.13
	(0.24)	(0.21)	(0.82)
Kaitz ratio (%)	0.42***	0.40***	0.36***
	(0.05)	(0.05)	(0.14)
City FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	396	396	264
R2		0.48	
Kleibergen-Paap rk Wald F stat		63.56	
Hansen J P-value		0.860	0.662
AR (2) p-value			0.360

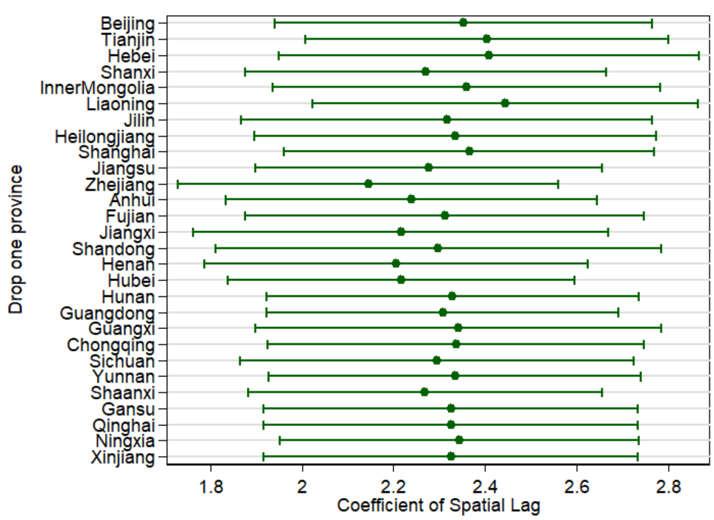
Model 1 shows MLE estimation results. Model 2 shows IV/GMM estimation results; Model 3 uses Arellano-Bond difference GMM estimation method. All models use inverse distance weighting matrices to construct the spatial lag term. Control variables are taken a 1-year lag. Robust standard errors in parentheses are clustered at the city level. *** p<0.01, ** p<0.05, * p<0.1

6 Robustness checks

6.1 Robustness to sample changes

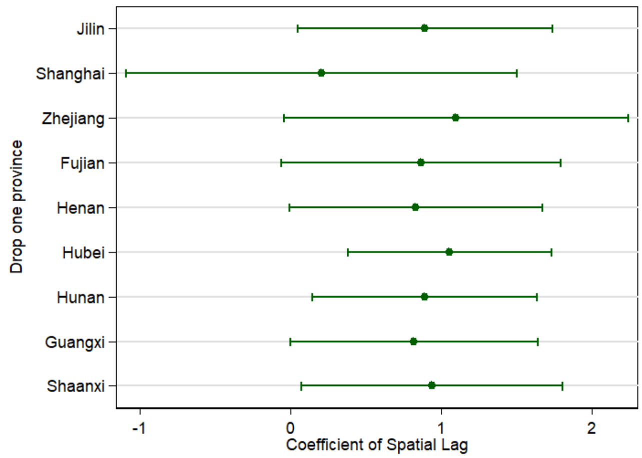
There might be potential concerns that the evidence of spatial interdependence in minimum wage standards is driven by a subset of the provinces. To address this concern, we examine the sensitivity of point estimates to the exclusion of individual provinces. Results are plotted in Figure 1. For instance, the first point shows that the magnitude of spatial interdependence is 2.35 after excluding Beijing; the second point shows that the magnitude of spatial interdependence is about 2.4 after excluding Tianjin; and so on. Overall, the point estimates are not sensitive to excluding a particular province, with the magnitudes in the range [2.1, 2.5]. Note that while these estimates are derived using the IV/GMM method, the MLE and Arellano-Bond estimation methods also give robust evidence of spatial interdependence.

Likewise, there might be potential concerns that the evidence of spatial interdependence in the minimum wage enforcement is driven by only a subset of the sample. We conduct a similar subsample analysis and show the results in Figure 2 which is parallel to Figure 1. It suggests that the evidence of spatial interdependence in minimum wage enforcement is robust to excluding any individual provinces, with the estimated coefficients ranging between 0.2 and 1.1.



Note: Each point estimate is the coefficient of the spatial lag of minimum wages, using IV/GMM estimation method and inverse distance weighting matrix, after excluding the labelled province.

Fig 1. Robustness of minimum wage competition to excluding a province



Note: Each point estimate is the coefficient of the spatial lag of minimum wage violation rates, using IV/GMM estimation method and inverse distance weighting matrix, after excluding the labelled province.

Fig 2. Robustness of minimum wage enforcement competition to excluding a province

6.2 Robustness to alternative weighting matrices

While the previous estimates in the main results are derived using distance-based weighting matrices, economic distance might also be important. A city might be more likely to reference minimum wage standards in cities that have similar economic development levels rather than cities do not. Economic characteristics weights are common in the literature, e.g., Davies & Vadlamannati (2013), Olney (2013). Therefore, we construct four economic characteristics-based weighting matrices and re-estimate the model.

Economic characteristics are all taken from the year 2003, one year before the first year of our analysis, so that the weighting matrix is arguably exogenous. In the case of GDP weighting matrix, the weight is calculated by $\omega_{j,i} = \frac{1}{|\ln GDP_{j,t=2003} - \ln GDP_{i,t=2003}|}$ and standardized to row sum equal to 1. Likewise, we replace log GDP by three other economic indicators, labor force participation rate, the number of enterprises and per capita GDP, to construct three other weighting matrices. Lastly, we multiply the inverse distance weighting matrix and the per capita GDP weighting matrix to construct a new matrix, which will then incorporate both geographical and economic distance. Table 4 presents estimation results using these weighting matrices, each with three estimation methods. Again, the results are robust to the choice of weighting matrices. All models give consistent results of spatial dependence in minimum wage standards. The magnitudes of estimation are also comparable to those in the main results.

Table 4 Robustness of minimum wage competition to alternative weighting matrices

	2003 GDP (log) (1)	Labor force part. rate (2)	# of enterprise (3)	Distance + (log) per cap GDP (4)
Panel A: MLE Results				
Spatial lag of minimum wages	0.16***	0.18***	0.38***	0.92***
	(0.04)	(0.05)	(0.08)	(0.02)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2016	2016	2016	2016
Panel B: IV/GMM Results				
Spatial lag of minimum wages	1.42***	0.73***	1.12***	1.07***
	(0.30)	(0.27)	(0.28)	(0.07)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2016	2016	2016	2016
R2	0.88	0.90	0.90	0.96
Kleibergen-Paap rk Wald F statistics	52.84	49.98	225.00	179.60
Hansen J statistic	0.52	0.40	0.49	0.23
Panel C: Arellano-Bond GMM Results				
Spatial lag of minimum wages	0.63***	0.32**	0.98***	1.19***
	(0.15)	(0.15)	(0.19)	(0.04)
L. min wage	0.10**	0.14***	0.08*	0.09***
	(0.04)	(0.05)	(0.04)	(0.03)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1512	1512	1512	1512
Hansen J P-value	0.737	0.747	0.736	0.781
AR (2) p-value	0.395	0.250	0.414	0.371

Notes: Each column uses a different weighting matrix to construct the spatial lag. Column (1) uses 2003 GDP (log); column (2) labor force participation rate; column (3) the number of enterprises; column (4) combines inverse distance and per capita GDP. Panel A show MLE estimation results for each model; Panel B presents IV/GMM estimation results; Panel C uses the Arellano-Bond difference GMM estimation method, using all lagged terms as instruments. Control variables are taken a 1-year lag. Robust standard errors in parentheses are clustered at the city level.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Similarly, we construct economic characteristics-based weighting matrices and re-estimate the race on the enforcement models. Table 5 shows that MLE and Arellano-Bond estimation methods yield statistically significant results, whereas IV/GMM method does not. The magnitudes of the estimates are comparable to those in the main results (Table 2). Overall, the finding of a race on enforcement is robust to using economic characteristics-based weighting matrices.

Table 5 Robustness of enforcement competition to alternative weighting matrices

	2003 GDP (log) (1)	Labor force part. rate (2)	# of enterprise (3)	Distance + (log) per cap GDP (4)
Panel A: MLE Results				
Spatial lag (violation rate)	0.06	0.20***	0.21*	0.13*
	(0.09)	(0.06)	(0.11)	(0.07)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	396	396	396	396
Panel B: IV/GMM Results				
Spatial lag (violation rate)	0.18	0.15	0.09	0.26
	(0.61)	(0.40)	(0.48)	(0.54)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	396	396	396	396
R2	0.46	0.48	0.47	0.47
Kleibergen-Paap rk Wald F statistics	8.33	9.18	9.64	5.34
Hansen J statistic	0.59	0.69	0.73	0.10
Panel C: Arellano-Bond GMM Results				
Spatial lag (violation rate)	0.68*	0.72**	0.70**	0.26
	(0.35)	(0.32)	(0.33)	(0.36)
L. min wage violation rate	-0.05	-0.16	-0.07	-0.06
	(0.12)	(0.13)	(0.08)	(0.12)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	264	264	264	264
Hansen J P-value	0.701	0.744	0.535	0.887
AR (2) p-value	0.419	0.461	0.138	0.114

Notes: Each column uses a different weighting matrix to construct the spatial lag. Column (1) uses 2003 GDP (log); column (2) labor force participation rate; column (3) the number of enterprises; column (4) combines inverse distance and per capita GDP. Panel A show MLE estimation results for each model; Panel B presents IV/GMM estimation results; Panel C uses Arellano-Bond difference GMM estimation methods, using lagged terms as instruments. Control variables are taken a 1-year lag. Robust standard errors in parentheses are clustered at the city level.
*** p<0.01, ** p<0.05, * p<0.1

7. Conclusion

The theory of fiscal and regulatory competition between jurisdictions is more advanced than its empirical testing. This is particularly true of labor regulation in general, and minimum wage regulations in particular, and especially so for developing countries. Olney (2013) finds evidence of a race to the bottom in employment protection among OECD countries, with a reaction coefficient of 1.0-2.8. Davies & Vadlamannati (2013) find labor rights in one country are positively correlated with those elsewhere, i.e., a cut in labor rights in other countries reduces labor rights in the host country, with the reaction coefficient about 0.55-0.88. They also argue that international competition lies more in enforcement than in labor laws.

This paper focuses on within-country competition on labor standards, and takes up the case of China, which introduced a vigorous minimum wage regime from the mid-2000s onwards. The analysis utilizes the spatial lag framework and three estimation methods (including maximum likelihood estimation, IV/GMM method and Arellano-Bond GMM method) to study city-level strategic interactions in setting and enforcing minimum wage standards during 2004-2012 in China. We manually collect a panel data set of city-level minimum wage standards from China's government websites. The analysis finds strong evidence of spatial correlation in minimum wage standards and enforcement among main cities in China. If other cities decrease minimum wage standards by 1 RMB, the host city will decrease its standard by about 0.7-3.2 RMB. If the violation rate in other cities increases by 1 percent, the host city will respond by an increase of 0.4-1.0 percentage points.

The Chinese government has expanded minimum wage intervention greatly, in response to concerns about rising inequality. Our results show that there is significant interjurisdictional competition on the level of the minimum wage and in the enforcement among local governments. Such competition could be wasteful, and lead to a race to the bottom, undermining the government's objectives. The interactions identified in this paper thus suggest the need for policy coordination on labor regulation in China.

Our analysis has broader significance given the resurgence of interest in minimum wages in developing countries as an instrument for addressing rising inequality. Bhorat, Kanbur and Stanwix (2017) provide a review of minimum wages in Africa. They find that "most countries in Sub-Saharan Africa (SSA) have adopted minimum wage regulation" and that "SSA as whole reflects a bias towards a more aggressive minimum wage policy compared to the rest of the world." In South Africa, for example, the current government has proposed a national minimum wage to replace the collection of sector and region-specific minimum wages. The question of whether to allow local setting of minimum wages to take account of local conditions is an area of open debate. In Asia, the decentralization reforms in Indonesia were accompanied by a decree allowing local governments to set minimum wages. As countries like Myanmar start a new era of labor regulation, the questions of minimum wages and local flexibility in implementation are at the forefront. In Russia, minimum wage setting was decentralized in 2007. Around the world, therefore, interjurisdictional competition in minimum wages is a live issue. Our analysis provides an initial framework in which competing perspectives on these debates can be assessed quantitatively.

Our evidence on jurisdictional interdependence in minimum wage setting within a country also raises a set of interesting further research questions. What we have shown is that local government react to each other in setting minimum wages, and in the enforcement of minimum wages. A natural interpretation of that is a possible "race to the bottom", as jurisdictions lower labor standards to attract investment. But could there also be a "race to the top" in other dimensions? Rather than lower labor standards, a local government could improve infrastructure, or improve the quality of local governance, to make investment more attractive. This could set in motion a chain of reactions through which other localities respond by improving their infrastructure and business environment so that there is an upward virtuous cycle of overall improvement in labor productivity rather than a downward vicious spiral of lowering labor costs through lowering labor standards. This raises the empirical question—do we see such a virtuous race to the top in practice? And the policy question—what can the government do to trigger the virtuous spiral?

Appendix

Table A.1 Descriptive Statistics, 2004-2012

	N	Mean	Std. Dev	Min	Max
GDP (log)	2,268	5.7	1.2	2.5	9.9
per capita GDP (log)	2,268	10.3	0.7	8.0	12.6
Labor participation Rate (%)	2,268	17.6	10.4	1.8	97.4
Industry share (%)	2,268	51.5	12.0	8.0	89.0
# of enterprises (1000)	2,268	0.6	1.4	0.0	18.5
# of beds in hospitals (per 100 people)	2,268	0.5	0.2	0.0	2.5
student enroll in secondary school (per 100 people)	2,268	6.6	2.6	0.9	71.6
% of secondary employment	2,268	47.6	14.0	3.8	81.9
student enrollment in primary school (per 100 people)	2,268	7.8	3.0	1.1	32.5
Minimum wages (deflated by 2002 CPI)	2,268	530.3	155.9	212.0	1164.2
Kaitz ratio (%)	396	38.0	9.1	18.6	72.0

Note: Industry share in total GDP = Secondary industry GDP/ total GDP. Labor force participation = the number of employees / population. The student enrollment in secondary schools, the student enrollment in primary schools and the number of hospital beds are all standardized by population. Kaitz ratio is equal to minimum wage divided by median wage.

Notes

1. Examples of other papers on tax competition, environmental regulation competition and welfare competition include: Allers & Elhorst, 2005; Brueckner & Saavedra, 2001; Edmark & Agren, 2008; Fredriksson & Millimet, 2002; Konisky, 2007; Markuse, Morey & Olewiler, 1995; Plümper, Troeger & Winner, 2009.
2. China's administrative structure includes, from high to low levels, provinces, prefecture-level cities, and counties. A prefecture-level city comprises a central urban area and several counties.
3. In the case that there are multiple levels of minimum wage standards within one prefecture-level city, we use the highest one as that prefecture-level city's minimum wage level. In (rare) cases of two upward adjustments happening within one year (e.g. Hebei Province and Beijing city in 2007), we take the second (and higher) one as that year's minimum wage standard.
4. China Data Online originally includes 286 cities. By combining it with minimum wage data and generating a city-level data set, we lost 25 prefecture-level cities. Later, we lose 1 city when combining with the shapefile data set and drop 1 city because it is not present in all years. As a result, we get seven "island" cities that have no neighboring cities. We drop these "islands" when constructing the contiguity weighting matrix, and thereby losing 7 additional cities. Provincial-level units absent in the sample are Gansu, Qinghai, Xinjiang, Guizhou, Hainan, Guizhou, Tibet, Hongkong and Macao.
5. The results of t-test statistics for each economic variable is available upon request.
6. The results of t-test statistics for each economic variable is available upon request.
7. Individual monthly wage is derived by annual income/the number of months worked in the year.
8. Other studies using the Spatial Lag framework include, for example, Brueckner & Saavedra, 2001; Davies & Vadlamannati, 2013; Edmark & Agren, 2008; Konisky, 2007; Ollé, 2003; Olney, 2013; Plümper et al., 2009; Shi and Xi, 2018; Yu et al., 2016.
9. A critique by Lyytikäinen (2012) is that the cross-sectional maximum likelihood Spatial Lag estimation and Spatial IV model overestimate the degree of interdependence in tax rates, as compared to the policy change IV estimates. However, the author finds that the inclusion of municipality fixed effects in the panel data model significantly reduces the bias (in the analysis of general property tax). By this logic, as our model already takes advantage of panel data and includes city fixed effects, we expect that any potential (upward) bias would become minimum.
10. Industry share in total GDP = Secondary industry GDP/ total GDP. Labor force participation = the number of employees / population. The student enrollment in secondary and primary schools and the number of hospital beds are all standardized by population.
11. Our results remain when using 2-year or 3-year lags, but for the sake of sample size we use 1-year lags.
12. The estimation results are robust to using fewer lagged levels as instruments, and robust to using the Blundell and Bond (1998) SYS-GMM method instead of difference GMM. The central idea of the instruments is that, y_{it-2} is orthogonal to the differenced error term $\Delta\epsilon_{it}$, or $E(y_{it-2}\Delta\epsilon_{it}) = 0$. Stata command is xtabond2 (Roodman, 2006).

References

Allers, M. A., & Elhorst, J. P. (2005). Tax mimicking and yardstick competition among local governments in the Netherlands. *International Tax and Public Finance*, *12*(4), 493-513.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277-297.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Belotti, F., Hughes, G., & Piano Mortari, A. (2016). Spatial panel data models using Stata.

Belotti, F., Hughes, G., & Piano Mortari, A. (2017). XSMLE: Stata module for spatial panel data models estimation.

Bhorat, H., Kanbur, R., & Mayet, N. (2012). Estimating the causal effect of enforcement on minimum wage compliance: the case of South Africa. *Review of Development Economics*, *16*(4), 608-623.

Bhorat, H., Kanbur, R., & Stanwix, B. (2017). Minimum wages in Sub-Saharan Africa: a primer. *The World Bank Research Observer*, *32*(1), 21-74.

Brueckner, J. K. (2003). Strategic interaction among governments: An overview of empirical studies. *International Regional Science Review*, *26*(2), 175-188.

Brueckner, J. K., & Saavedra, L. A. (2001). Do local governments engage in strategic property—tax competition? *National Tax Journal*, 203-229.

Chau, N. H., & Kanbur, R. (2006). The race to the bottom, from the bottom. *Economica*, *73*(290), 193-228.

Cremer, H., & Gahvari, F. (2000). Tax evasion, fiscal competition and economic integration. *European Economic Review*, *44*(9), 1633-1657.

Davies, R. B., & Vadlamannati, K. C. (2013). A race to the bottom in labor standards? An empirical investigation. *Journal of Development Economics*, *103*, 1-14.

Duanmu, J. L. (2014). A race to lower standards? Labor standards and location choice of outward FDI from the BRIC countries. *International Business Review*, *23*(3), 620-634.

Edmark, K., & Ågren, H. (2008). Identifying strategic interactions in Swedish local income tax policies. *Journal of Urban Economics*, *63*(3), 849-857.

Edwards, J., & Keen, M. (1996). Tax competition and Leviathan. *European Economic Review*, *40*(1), 113-134.

Fredriksson, P. G., & Millimet, D. L. (2002). Strategic interaction and the determination of environmental policy across US states. *Journal of Urban Economics*, *51*(1), 101-122.

Kanbur, R., & Keen, M. (1993). Jeux Sans Frontieres: Tax competition and tax coordination when countries differ in Size. *American Economic Review*, *83*(4), 877-92.

Konisky, D. M. (2007). Regulatory competition and environmental enforcement: Is there a race to the bottom?. *American Journal of Political Science*, *51*(4), 853-872.

Lyytikäinen, T. (2012). Tax competition among local governments: Evidence from a property tax reform in Finland. *Journal of Public Economics*, *96*(7-8), 584-595.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *The Review of Economic Studies*, 60(3), 531-542.

Markusen, J. R., Morey, E. R., & Olewiler, N. (1995). Competition in regional environmental policies when plant locations are endogenous. *Journal of Public Economics*, 56(1), 55-77.

Neumark, David. "Minimum wage effects throughout the wage distribution", *Journal of Human Resources*, 2004, vol. 39, issue 2

Ollé, A. S. (2003). Electoral accountability and tax mimicking: the effects of electoral margins, coalition government, and ideology. *European Journal of Political Economy*, *19*(4), 685-713.

Olney, W. W. (2013). A race to the bottom? Employment protection and foreign direct investment. *Journal of International Economics*, *91*(2), 191-203.

Plümper, T., Troeger, V. E., & Winner, H. (2009). Why is there no race to the bottom in capital taxation?. *International Studies Quarterly*, *53*(3), 761-786.

Ronconi, L. (2012). Globalization, domestic institutions, and enforcement of labor law: Evidence from Latin America. *Industrial Relations: A Journal of Economy and Society*, *51*(1), 89-105.

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system GMM in Stata.

Shi, X., & Xi, T. (2018). Race to safety: Political competition, neighborhood effects, and coal mine deaths in China. *Journal of Development Economics*, *131*, 79-95.

Wilson, J. D., & Wildasin, D. E. (2004). Capital tax competition: bane or boon. *Journal of Public Economics*, *88*(6), 1065-1091.

Yu, J., Zhou, L. A., & Zhu, G. (2016). Strategic interaction in political competition: Evidence from spatial effects across Chinese cities. *Regional Science and Urban Economics*, *57*, 23-37.

Zhang, X., Yang, J., & Wang, S. (2011). China has reached the Lewis turning point. *China Economic Review*, *22*(4), 542-554.