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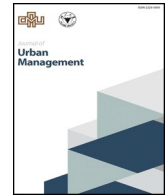
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Urban size and senior executive compensation: Evidence from China

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ABSTRACT

Relying on data of Chinese listed companies and city scale during 2005–2010, we document a positive relationship between the size and location of urban firms and total senior executive compensation. Tenure and corporate performance have a positive impact on the total senior executive compensation in mega-cities and large cities. Higher wages in big cities may be compensating for the price of housing and price of city amenity. This conclusion may explain why people, especially senior executives, are heading to big cities.

1. Introduction

Scholars and society pay more attention to senior executive compensation of listed companies. Senior executive compensation is more complicated because they are a special kind of labor. The level of executive compensation is closely related to many factors, such as corporate performance, difficulty in corporate management, executive human capital, market salary, corporate governance structure, internal and external supervision intensity, personal characteristics, enterprise characteristics, business environment and so on (Zhang, 2014).

Research on the relationship between senior executive compensation and corporate performance are based on the optimal contract theory, which means that compensation is set by the client (shareholders) in order to encourage the agent (senior executive) to maximize their interests (Jensen & Meckling, 1976). Carpenter and Sanders (2002) found that there is a significant positive relationship between CEO compensation and corporate performance (ROA and Tobin Q) for companies when senior executive compensation is proportional to the their complexity. Palia (2001) uses a synchronous model that shows that there is a weak positive relationship between management pay and corporate performance when taking internal factors into account. We see different conclusions being drawn due to the use of different sample areas, research times and methods. In addition, non-performance compensation is also common, such as CEO rewarded for power (Bebchuk & Fried, 2004) and luck (Bertrand & Mullainathan, 2001). Chen and Kleiner (2004) argued that 70%–80% of senior executive compensation relate to stock performance for internet-related companies. So stock performance greatly affects the level of executive compensation. After studying the corporate performance of 350 companies during 1985–1995, Conyon, Peck, and Sadler (2000) found that executives can get higher compensation if they hold more shares. So the shareholding ratio of senior executives have a certain impact on their compensation. Bebchuk et al. (2009), Bebchuk

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and Fried (2004) found that senior executives can influence or control the design of their compensation package because they have control over the company, which can lead a favorable compensation package for management staff. Jensen and Murphy (1990) also found out that executives have the ability to influence their compensation package because the initial proposal for executives compensation prepared by the personnel department is reviewed by senior executives and then voted by the compensation committee.

Inspired by Francis et al. (2012), we choose senior executives of listed companies to represent high-skilled labor to discuss the effect of city scale on senior executive's compensation, and examine whether this effect derives from urban agglomeration or skill-sorting. There are three main reasons for selecting senior executives in our analysis: firstly, senior executives represent high-skilled labor and therefore, can provide a good sample to overcome the upward bias in urban agglomeration due to skill-sorting. Secondly, we can analyze the relationship between wage premium and urban agglomeration under the premise that the labor force can migrate freely because senior executives are considered to be highly mobile due to low migration costs compared with ordinary workers. Thirdly, introducing spatial location factors into the corporate governance theory expands the original frame work of optimal contract theory.

The remainder of this study is structured as follows. The second section describes the empirical model, variables description and data source. The third and fourth sections are the results and robustness test respectively. Finally, our conclusions are presented and discussed at the end.

2. Empirical models, variable description and data source

2.1. Model construction

This paper uses two models to test the effect of urban agglomeration on senior executive's compensation and analyze the relationship between senior executive's compensation and price of housing and price of city amenity.

$$\log(\text{wage}_{i,j,t}) = \alpha + \beta * \text{urbansize}_{i,t} + \sum \lambda_i * \text{control}_{i,t} + \text{firm}_{i,t} + \text{industry}_{j,t} + \text{year}_{t} + \eta_{i,j,t} \tag{1}$$

$$\log(\text{wage}_{i,j,t}) = \alpha + \beta_1 * \text{hou sin gprice}_{i,t} + \beta_2 * \text{amenity}_{i,t} + \sum \gamma_i * \text{control}_{i,t} + \text{firm}_{i,t} + \text{industry}_{j,t} + \text{year}_{t} + \eta_{i,j,t} \tag{2}$$

$\text{wage}_{i,j,t}$ is the dependent variable and represents senior executive's compensation in i company of j industry in t year. $\text{urbansize}_{i,t}$ is the size of the city where the company is located. β is the core coefficient that represents the impact of urban agglomeration on compensation, and we expect that the larger the city scale, the greater the β . $\text{hou sin gprice}_{i,t}$ and $\text{amenity}_{i,t}$ is the price of housing and price of city amenity respectively, and we expect wages to compensate for the price of housing and city amenity according to the Rosen-Roback model. $\text{control}_{i,t}$ is a series of control variables that influence senior executives compensation: skill level, tenure, age, the proportion of independent directors (out), ownership concentration (stock-share), whether the manager is the chairman (same), company size (scale), company's life (life), corporate performance (ROA) and leverage level (leverage). $\text{firm}_{i,t}$, $\text{industry}_{j,t}$ and year_{t} are control variables: listed company, industry and year respectively, which are used to control bias and the endogenous problem due to heterogeneity. $\eta_{i,j,t}$ is the random perturbation.

2.2. Variable description

This paper uses the total annual compensation of CEO (wage_1) to measure senior executive's compensation. According to the "China City Statistical Yearbook," we divided prefecture-level city into five levels based on districts under city non-agricultural population² in the end of 2005: (1) large city: more than 2 million people; (2) mega-city: 1–2 million people; (3) big city: 5 hundred thousand people; (4) medium-sized city: 2–5 hundred thousand people; (5) small city: less than 2 hundred thousand people. So, taking the small city as a reference, we set four dummy variables: large city: urbansize_1 , mega-city: urbansize_2 , big city: urbansize_3 , medium-sized city: urbansize_4 . Generally, the price of city amenity measures the implicit attribute of a whole city and includes commercial and residential amenity. Furthermore, the local average temperature in January is usually used as commercial amenity and three higher weights dimension that measure residential amenity are good school, public safety and climate respectively (Gottlieb, 1994). Due to the availability of prefecture-level data, we use industrial gas emissions (pollution) to measure the price of residential amenity. We expect that the higher the industrial emissions the higher the wage to compensate for a worse living environment. We choose unit residential housing price in prefecture city (housing_1) to substitute housing price.

With regard to control variables, according to Garvey and Milbourn (2006), we use the net profit of listed companies to regress the average net profit of the industry and the weighted net profit of the industry, and choose the residual as the skill level of senior executives. We expect that the skill level has a positive impact on compensation. It is worth noting that introducing skill is designed to control skill-sorting. That is the impact of urban agglomeration on wage premium will lead an upward bias if executives in big cities are high-skilled. The higher ownership concentration and the proportion of independent directors can correct the insufficient supervision (Petroni&Safieddine, 1999), so we use the shareholding ratio of the largest shareholder to measure ownership

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² People usually use city population to divide city size, this paper uses city non-agricultural population because our focus is on the impact of urban agglomeration on senior executive's compensation and agricultural activities are too decentralized to reflect urban agglomeration.

Table 1
Statistical description of variables.

Variable	Obs	Mean	Std. Dev	Min	Max
wage_1	3036	12.45692	0.9293244	9.902028	14.65406
wage_2	3017	4.174557	0.8960792	1.791759	6.292916
wage_3	3033	13.5642	0.8641884	11.41191	15.9367
housing price	2953	7.605721	0.4759416	4.828314	9.849771
pollution	2990	89.6058	96.37798	0.012	710.8
green	3013	97.28564	140.3735	2.97	533.73
tenure	3023	1.060536	1.14731	1	12
age	3033	46.37125	6.589349	26	73
skill	3036	-0.1958859	5.081152	-12.03721	40.98053
life	3036	8.931818	4.590546	1	20
out	2979	0.3595129	0.05172	0.0833333	0.6666667
stock	3036	34.79861	15.17747	8.81	75.84
ROA	3035	0.0275968	0.0918547	-0.4666611	0.2334576

concentration. Tenure is calculated by the current year minus the initial year of CEO, and it is calculated on a yearly basis. Executives will have more impact on shareholders with their tenure increasing, so they can design a more favorable pay system (Baker & Gompers, 2003). There will be self-design pay if managers are also the chairman. The age of senior executives is a substitute for reputation and older executives have a better reputation (Milbourn, 2003). Company size is represented by the logarithm of the total year end asset. Using ROA to measure corporate performance, which is closely related to senior executive's compensation (Jensen & Murphy, 1990). The life of company is calculated by the current year minus the year when company listed and leverage level is measured by asset-liability ratio. For the robustness test, we use the top three senior executives compensation (*wage_2*) and the top three chairman, supervisors and executives compensation (*wage_3*) to substitute compensation, and use unit housing price (*housing_2*) to measure housing price level and use per capital area of green land (*green*) to represent city amenity.

2.3. Data source and descriptive statistics

The data on executive compensation and basic company information was obtained from CSMAR and Wind, and the database covers all A-share companies listed in the Shanghai and Shenzhen Stock Exchange during 2005–2010. The CEO compensation is searched using the key words “president”, “manager”, “CEO”. The prefecture-level data was obtained from the “China Statistical Yearbook” and CEIC database. Matching the company data to city level data based on Wind. There are two statistical caliber in the “China Statistical Yearbook”: “total city” and “district under city”, where “total city” include city, suburb and country-level city, and “district” include city and country-level city. We use districts under city level data because urban agglomeration exists mainly in there. Given the influence of abnormal values, we do a 1% shrink-down on the original data, and exclude financial and insurance industries and sample that remaining data, finally, we get 1841 listed companies and 224 prefecture-level cities, where 22 large cities, 29 mega-cities, 69 big cities, 84 medium-sized cities and 20 small cities. Table 1 shows a summary of statistical description.

3. Results

In order to control the endogenous problem, we introduce industry, year and firm in LSDV. We do not use the fixed panel model because city scale changes over time. The disturbance items among every individuals are independent but the disturbance items of one individual in different periods are auto-correlated, so we introduce the clustered robust standard deviation, furthermore, it is allowed that correlation exist in same sections (listed company) but not in different sections. We define CEO as the dependent variable to estimate the effect of city scale on compensation, and results are as shown in Table 2.

Column (1) of Table 2 shows the results of the whole sample. *urbansize_1*, *urbansize_2*, *urbansize_3* and *urbansize_4* are all significant at the 1% level and the coefficients decrease gradually. After controlling the corporate governance level variables, mega-cities pay senior executives 48% more compensation than small cities, there is no significant difference between large cities (16%) and big cities (15.1%), and medium-sized cities pay 6% more than small cities. This proves our proposition: urban agglomeration measured by city scale has a positive impact on compensation of high-skilled labor. In addition, there is a ladder-like effect of different city scale on senior executive compensation. Mega-cities have the greatest impact on compensation, followed by large cities and big cities, and finally medium-sized cities. To determine whether big cities pay high-skilled labor higher compensation due to accumulation of human capital by learning and imitating, column (2) introduces tenure and four city scales as cross items to capture the influence of tenure on compensation. The results show that executives in mega-cities are paid 7.4% more compensation for every additional tenure compared to small cities. The cross items of tenure and mega-cities, large cities and medium-sized cities have a positive but not significant impact on compensation. Our results are consistent with Glaeser and Gottlieb (2009), that is, city scale is complementary with high-skilled labor, big cities themselves are unable to produce knowledge but can promote the circulation of information, so high-skilled labor can accumulate human capital by imitating and communicating frequently. Therefore, they will benefit the most from urban agglomeration.

Columns (4)–(8) in Table 2 are the results of different city scale samples. We want to analyze the impact of skill, tenure and

Table 2
City scale and senior executives compensation.

Variable	Full sample	Full Sample	Full sample	Sub_sample urbansize_1	sub-sample urbansize_2	sub-sample urbansize_3	sub-sample urbansize_4	sub-sample urbansize_5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
urbansize_1	0.487*** (0.084)	0.405*** (0.1)						
urbansize_2	0.16* (0.092)	0.113 (0.108)						
urbansize_3	0.151* (0.089)	0.102 (0.102)						
urbansize_4	0.063*** (0.087)	0.016 (0.104)						
housing_price			0.136*** (0.057)					
pollution			0.001* (0.001)					
urbansize_1* tenure		0.074** (0.035)						
urbansize_2* tenure		0.034 (0.044)						
urbansize_3* tenure		0.042 (0.038)						
urbansize_4* tenure		0.04 (0.053)						
tenure	0.044*** (0.014)	0.001 (0.026)	0.032*** (0.01)	0.072*** (0.02)	0.049** (0.024)	0.04 (0.04)	0.025 (0.03)	-0.107 (0.093)
age	0.01*** (0.003)	0.01*** (0.003)	0.011*** (0.003)	0.016*** (0.005)	0.009 (0.006)	0.001 (0.008)	0.011 (0.009)	0.019 (0.035)
skill	0.027*** (0.007)	0.026*** (0.007)	0.01*** (0.008)	0.018** (0.009)	0.01* (0.016)	0.013** (0.013)	0.018** (0.028)	-0.04 (0.062)
life	-0.011 (0.006)	-0.011 (0.006)	0.113*** (0.012)	-0.008 (0.01)	-0.012 (0.013)	-0.002 (0.015)	-0.045*** (0.017)	-0.007 (0.065)
out	-0.005 (0.445)	0.007 (0.443)	0.225 (0.345)	0.794 (0.783)	-0.472 (0.674)	-0.864 (0.859)	-0.113 (0.849)	-2.997 (3.077)
stock_shares	-0.007* (0.002)	-0.007** (0.002)	-0.002 (0.003)	-0.004** (0.002)	-0.001 (0.003)	-0.012*** (0.005)	-0.018*** (0.005)	-0.032*** (0.014)
ROA	1.352*** (0.275)	1.371*** (0.277)	0.348* (0.225)	1.472*** (0.37)	1.243*** (0.608)	0.861 (0.578)	1.506 (0.749)	3.68 (2.243)
scale	0.252*** (0.029)	0.252*** (0.029)	0.163*** (0.039)	0.249*** (0.044)	0.408*** (0.054)	0.241*** (0.051)	0.226*** (0.085)	0.172*** (0.425)
leverage	-0.126*** (0.075)	0.122*** (0.075)	0.248*** (0.101)	-0.048 (0.103)	-0.093 (0.143)	-0.39*** (0.181)	-0.133*** (0.184)	-0.411*** (0.848)
same	0.05*** (0.063)	0.05* (0.063)	0.01*** (0.059)	0.01 (0.098)	0.115 (0.102)	0.169*** (0.16)	-0.013*** (0.159)	-0.386*** (0.323)
cons	6.352*** (0.666)	6.39*** (0.668)	6.417*** (0.892)	5.882*** (1.062)	3.434*** (1.21)	7.313*** (1.113)	7.349*** (1.843)	12.049*** (9.476)
R-squared	0.396	0.397	0.303	0.344	0.49	0.447	0.454	0.665
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OBS	2941	2941	2812	1310	621	533	412	65

() the clustered robust std. Dev.

*Significant at the 1% level.

**Significant at the 5% level.

***Significant at the 10% level.

corporate performance on compensation for different city scales. The coefficient of skill has a significant impact on compensation in mega-cities, large and medium sized cities at the 1% level, that is, different cities pay the same compensation to different skilled labor. This illustrates firstly that there is no skill-sorting, secondly, the higher compensation is not due to skill level in big cities, and finally there is no upward bias in columns (1) and (2). The coefficient of tenure in mega-cities and large cities are 0.072 and 0.049 respectively and are both significant at the 1% level, but is not significant in big and medium-sized cities. The interpretation of the results is similar to that of the analysis of the cross item of tenure and city scale as discussed earlier. The coefficient of ROA in large cities is 1.472, which is larger than the 1.243 in mega-cities, but the ROA has no significant impact on other city scales. Therefore, we believe that companies in mega-cities and large cities are more productive so they pay senior executives higher compensation.

According to the results of the sub-sample, we can understand that tenure and corporate performance have a significant positive impact on senior executive compensation in mega-cities and large cities, but there is no support for other city scales. With the

Table 3
Robustness results.

Variable	dependent variable:wage_2			dependent variable:wage_3		
	(1)	(2)	(3)	(4)	(5)	(6)
urbansize_1	0.345*** (0.049)			0.289*** (0.049)		
urbansize_2	0.268*** (0.053)			0.259*** (0.052)		
urbansize_3	0.065 (0.055)			0.072 (0.054)		
urbansize_4	0.082 (0.054)			0.06 (0.053)		
urbansize_new_1		0.299*** (0.038)			0.236*** (0.038)	
urbansize_new_2		0.155*** (0.037)			0.149*** (0.037)	
housing price			0.084*** (0.025)			0.057*** (0.022)
green			-0.002* (0.001)			-0.001*** (0.001)
skill	0.003 (0.003)	0.003 (0.003)	0.007*** (0.002)	0.005 (0.003)	0.005** (0.003)	0.009 (0.002)
out	-0.224 (0.239)	-0.172 (0.241)	0.06 (0.139)	-0.2 (0.232)	-0.157*** (0.235)	0.087 (0.124)
blockholders	-0.005*** (0.001)	-0.005*** (0.001)	0.001 (0.001)	-0.005*** (0.001)	-0.005*** (0.001)	0.001*** (0.001)
ROA	1.804*** (0.164)	1.817*** (0.165)	0.252*** (0.075)	1.824*** (0.161)	1.84*** (0.162)	0.276*** (0.068)
scale	0.293 (0.015)	0.293 (0.015)	0.188*** (0.013)	0.273 (0.014)	0.273*** (0.014)	0.19*** (0.012)
leverage	-0.119*** (0.042)	-0.118*** (0.042)	-0.182*** (0.028)	-0.092*** (0.036)	-0.091*** (0.037)	-0.131*** (0.026)
same	0.001 (0.037)	0.015 (0.038)	0.013 (0.021)	0.021 (0.033)	0.033 (0.034)	-0.042 (0.019)
cons	-2.301*** (0.337)	-2.306*** (0.336)	-0.726*** (0.336)	7.456*** (0.325)	7.441*** (0.324)	8.762*** (0.301)
R-squared	0.392	0.388	0.381	0.393	0.388	0.415
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Obs	8299	8299	8140	8286	8286	8128

() the clustered robust std. Dev.

*Significant at the 1% level.

**Significant at the 5% level.

***Significant at the 10% level.

increasing time spent living in a city, the influence of tenure on wage premium is positive, which we consider as the “growth effect”. The positive impact of productivity on compensation in big cities has nothing to do with the amount of time spent living in a city but instead the impact depends on whether executives move in or out of mega-cities, which we consider as the “horizontal effect”. In addition, the level of skill is not significant in all the sub-samples, so we exclude the bias caused by skill-sorting. The results of the sub-sample also confirm why there is a significant wage premium in mega-cities and large cities but not in other city scales. In summary, results of columns (1)–(2) and (4)–(8) in Table 2 prove the proposition 1: city scale and urban agglomeration are positively related and urban agglomeration has a positive impact on compensation. This impact comes from high productivity in big cities which provide better learning opportunities for high-skilled labor, which we represent as the “horizontal and growth effect.”

Column (3) in Table 2 analyses the relationship between housing price, city amenity and compensation in the whole sample. Housing price has a positive impact on compensation and is significant at the 1% level and its coefficient is 13.6%. City amenity measured by sulphur dioxide emissions has a positive effect on compensation and is significant at the 10% level and its coefficient is 0.1%. This result proves proposition 2: wages compensates for price of housing and price of city amenity, that is, under the conditions of spatial equilibrium, executives gain same indirect utility in different cities and the differences in wages reflect housing price and city amenity. It is worth noting that this report on executive's compensation does not involve the impact of consumer price index because firstly, it is hard to obtain prefecture-level CPI and when it is available, it is often not comparable to different prefecture-level cities. Secondly, CPI does not include housing consumption, and food and other goods consumption are difficult to reflect the real “living cost”. Column (3) defines housing price as the main explanatory variable to explain wage differences. On the one hand, wages can be seen as compensation for the price of goods that cannot be traded between regions. On the other hand, price of housing equates to the living cost. According to this, if we use sulphur dioxide emissions as a variable to measure living cost and then wages

reflect living costs in different cities. In propositions, higher wages in large cities may be due to compensating for higher housing prices and worse city amenity, that is, the cost of living in big cities is higher.

4. Robustness test

Different urban scale classification methods may cause bias in the effect of urban agglomeration on wage premium. So we learn from Francis³ (2012) and classify the top 10 non-agriculture population cities as mega-city, city with more than 1 million non-agriculture population as big city and others as small and medium-sized city. Taking the small and medium-sized city as a reference, we set two dummy variables: mega-cities (*urbansize_new_1*) and big cities (*urbansize_new_2*). We use the top three senior executives compensation (*wage_2*) and the top three chairman, supervisors and executives compensation (*wage_3*) to substitute executives compensation, and remove the age and tenure because it is difficult to measure tenure and age of this group. We use unit housing price to measure housing price and use per capital area of green land to measure city amenity, we expect the higher the per capital area of green land the higher the compensation. The Robustness results are as shown in Table 3.

Columns (1) and (4) in Table 3 shows that the top three senior executives compensation and the top three chairman, supervisors and executives compensation in mega-cities and big cities are higher than small and medium-sized cities, and the coefficient of urban scale is significantly positive. The results of columns (2) and (4) that are based on Francis proves Table 2 is robust, that is, urban agglomeration caused by different city scales contribute to wage premium. In addition, columns (3) and (4) show that higher housing prices have a positive impact on wages and the improvement of per capital area of green land leads to a decrease in compensation.

5. Conclusion

Relying on data of Chinese listed companies and 287 prefecture-level cities during 2005–2010 and classifying mega-cities, big cities, large cities, medium-sized and small cities according to districts under city non-agricultural population in 2005, we find that big cities pay more compensation to senior executives and there is a ladder-like effect of different city scales on senior executive compensation. Tenure and corporate performance have a positive effect on compensation in mega-cities and large cities, and results of our sub-sample indicate that there is no “ability-sorting” in different city scales, so we can exclude the upward bias. In addition, housing price has a positive impact on compensation and lower wages maybe a compensating factor for better city amenity. As a real reflection of living cost in different cities, the higher senior executive compensation in big cities is due to the higher living cost. By introducing different classification methods and different variables to measure compensation, housing price and city amenity, the above results are still robust.

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³ Based on American census data, Francis classify headquarters located in the top ten cities as urban agglomeration firm, headquarters in metropolitan statistical area with more than 1 million population as urban firm, and others as rural firm.