

# **The Determinants of Inter-city and Intra-city Wage Differentials in Korea**

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## **Abstract**

The purpose of this paper is to identify the determinants of inter-city and intra-city wage differentials in Korea. To do so, it is first necessary to delineate the Korean Metropolitan Statistical Areas (MSAs). As there have not been much studies on both wage differentials across cities and economically-defined geographic areas, the regional differences in the standard of living have barely been analyzed.

Since Korea's rapid growth in the 1970s, more of the population has concentrated around the Capital area, Seoul. However, it is very difficult to find a concrete reason for this over-concentration in some sense. According to the Roback model, individuals in an open economy maximize their utility by choosing their location of residence with consideration of the regional average wage, cost of living, and amenities. The wage differentials is therefore a very important factor in the choice of where to live and work. In many cases, these wage differentials also represent regional competitiveness. Inter-city wage differentials are the comparison of average wage levels across cities, while intra-city wage differentials are the comparison of income disparities within cities. Therefore, it is both necessary and meaningful for regional policy to identify the determinants of inter-city and intra-city wage differentials.

This research will use the Korean Occupational Employment Statistics (OES), a unique regional micro database for wages along with individual characteristics such as age, sex, education, and detailed working experience (including occupations and industries). Although it is not panel data, it provides valuable yearly labor income information on approximately 100,000 workers since 2001. There are a couple of important findings from the empirical work: First, inter-city wage differentials and intra-city wage differentials are bigger in large cities. Second, wage does not seem reflective to an economy much, which means wage is substitutable not only to the cost of living but also something else. The third, intra-city wage differentials have a negative relationship with the employment of knowledge based manufacturing industries.

## **I. Introduction**

In general, wage differentials is recognized as an important factor of migration, which is crucial to an economy. It would be very important issue especially in Korea facing mono-centric development around Capital area. Therefore the purpose of this paper is to identify the determinants of inter-city and intra-city wage differentials and to give some implications in regional policy.

Since 2003, Korea has considered regional policy seriously; because of over-concentration issue has been getting bigger not only in academic side but also in social side. As regional disparity between Capital area and non-Capital area has been increased, balanced development became a policy goal recently. In order to analyze regional disparity across regions and within regions, it is first step to identify income level. However, there was no appropriate measurement to compare regional economies except Gross Regional Domestic Product (GRDP), which is about production side. It might be not much related with individuals' behavior to choose their location. Therefore, it is not a good proxy for regional income level. On the other hand, especially, wage, cost of living, and amenities are most important factor to choose resident location according to the Roback model. Therefore, it is necessary to figure out the wage level across regions. For that, city boundaries is supposed to delineated in terms of economic geography, which is different from administrative districts in general. Since metropolitan areas are usually defined by commuting flow, Korean Metropolitan Statistical Areas(MSAs) delineated by Kim et. al(2008) has been used here to grasp economic spatial range of cities.

This research contributes to regional economic analysis comparing wage differentials among inter-cities and intra-cities in Korea in that this is almost first attempt to compare wages across cities. Further, inter-city wage differentials was measured by average wage in

MSAs and intra-city wage differentials was measured by the wage ratio of high income occupations to low income occupations. Then, the determinants of those wage differentials were analyzed for regional policy implications.

## II. Literature Review

The most well known literature in this wage differentials is Roback model. According to her model, people move to maximize their utility which consists of average wage level, costs of living, and amenities in a specific location. Therefore, in general wage is supposed to be compensated for higher living costs as long as amenities are not much different across region. In other words, higher nominal wages in larger cities could be interpreted as a compensation for the higher living costs, such as relatively high rent. At an equilibrium that people moved voluntarily to maximize their utility, the indirect utilities( $V$ ) across regions are all same shown in following equation.

$$V_i(w_i, p_i; a_i) = V^* = V_j(w_j, p_j; a_j) \quad (1)$$

, where  $w_i$ , is average wage in the region  $i$ ,  $p_i$ , is cost of living in the region  $i$  and  $a_i$ , is amenity level in the region  $i$ .

O'Sullivan(2008) paid attention to the agglomeration effect of urbanization. According to him, not only nominal wage increases with city size, but also real wage increases, too, due to the spillover effect of agglomeration economy. On the other hand, Kim et al(2009) pointed out that the real wage may not increase much with city size, because nannies in larger cities may not have any specialties comparing to nannies in small towns. Therefore, it could be just compensation for higher living costs. Addario and Patacchini(2008) also showed that the agglomeration effect seemed not significant with Italian micro data, even though wage level

increased by 0.1% as 100 thousand increased in city population. Krashinsky(2011) also showed that increase in wage to city size is not significant as long as family characteristics are considered. Comes, Duranton, and Gobillon(2008) figured out determinant of spatial wage differentials as “skill composition of workforce” from French data. It means that skilled workers could be sorted to city size.

There are a couple of Korean literatures regarding wage differentials. Lee(2002) found that spatial wage differentials especially among 7 Metropolitan Cities is determined by the individual characteristics such as education and experience. Jang and Lee(2001) figured out the wage increases by 3% as the number of education increases by 1 year. However, Lee(2002) said that only skilled workers with advanced degree have positive effect from migration. Therefore, in this paper, more appropriate wage differentials are measured across cities and within cities. The following sections are for newly defined cities based on economic geography and regional wage analysis using that city concept.

### **III. Delineation of Korean Metropolitan Statistical Areas**

The first step to analyze wage differentials in inter-city wide and/or intra-city wide, the definition of city is supposed to be defined. In this paper, Korean Metropolitan Statistical Areas(MSAs) newly defined by Kim et al (2009) are used as economic context of city. The definition of a city is crucial to compare any statistical indicators across cities. Nevertheless, only a few researchers have attempted to define a city but not many of them analyze the statistical data across economic geographic cities in Korea. Unfortunately, administrative districts such as the 16 Provinces or 232 Counties are used thus far. There were a little researches simply defining Metropolitan Areas such as the MSA in the United States.

Therefore, Korean MSAs is delineated first in this section in the following ways (Kim et. al. 2008). Counties are the basic geographic classification in defining MSAs in Korea. For cross-commuting rates, commuting flow data from the National Census for workers and students over 12 years old was used. The criteria for delineating MSAs are as follows:

- ① Central city:
  - any metropolitan cities or general cities with over 50 thousand people
- ② Peripheral city:
  - i) any adjacent *Si-Gun-Gus* over 100people/km<sup>2</sup> of population density to a central city AND
  - ii) commuting rates of any *Si-Gun-Gus* to or from a central city are over 10%

Based on the criteria, a total of 50 MSAs are shown in Table 2, which cover 44% of the land area and about 95% (44 million) of the total population reside in 2005. Among those 50 MSAs, there are 14 MSAs that consist of more than two Counties. The Seoul MSA includes 18 Counties in Gyeonggi-do. The population of the Seoul MSA was about 16.7 million in 2005, which is much smaller than that of Capital Area, Seoul-Incheon-Gyeonggi, but much larger than that of Seoul Metropolitan City<sup>1</sup>. The Busan MSA, including Gimhae and Yangsan is the second largest MSA, but its population is only about 4.2 million which is about one-fourth of Seoul MSA. The third largest MSA, the Daegu MSA with Gyeongsan has a population of 2.7 million, which is about one-seventh that of Seoul MSA.

In Table 1, the population growth in the Seoul MSA from 2000 to 2005 is higher than the average population growth in the MSAs. However, there were population decreases in the Busan MSA and Daegu MSA during that time period. In the mid size MSAs, Suwon-

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<sup>1</sup> 23 million in Seoul-Incheon-Gyeonggi and 10 million in Seoul Metropolitan City in 2005

Hwaseong-Osan MSA, Ulsan MSA, and Cheonan-Asan MSAs have experienced population increases, while the population in the Changwon-Masan-Jinhae MSA has not changed much. In small MSAs of less than 300 thousand people, only the Wonju MSA, Geoje MSA, and Dongducheon MSA had population growth at higher rate than the average. In short, the MSAs with higher concentrations of manufacturing industries have population increases. In particular, the employment rate in manufacturing industry in the Gwangju MSA and the Daejeon MSA are 15.7% and 12.2% in 2005, which are much less than the national average rate of 19.7%. It is an evidence that over-concentration in the Seoul MSA is an issue not only from the primary city but also large cities.



Figure 1. Korean Metropolitan Statistical Areas

Table 1. Korean MSAs

Korean MSAs	pop2000	pop 2005	pop growth
Seoul MSA	15765399	16627149	1.09%
Busan MSA	4186838	4172514	-0.07%
Daegu MSA	2708784	2706844	-0.01%
Incheon MSA	2461831	2519009	0.46%
Daejeon MSA	1532781	1599887	0.88%
Gwangju MSA	1452330	1504928	0.72%
Suwon-Hwaseong-Osan MSA	1238868	1465363	3.66%
Changwon-Masan-Jinhae MSA	1079359	1079837	0.01%
Ansan-Siheung MSA	1014428	1071228	1.12%
Ulsan MSA	868188	1049177	4.17%
Cheonan-Asan MSA	598598	730302	4.40%
Jeonju-Gimje MSA	719057	713950	-0.14%
Cheongju-Jeungpyeong MSA	615933	671577	1.81%
Pyeongtack-Anseong MSA	478727	537636	2.46%
Pohang MSA	515714	489698	-1.01%
Jinju-Sacheon MSA	450869	444093	-0.30%
Suncheon-Gwangyang MSA	398569	398001	-0.03%
Gumi MSA	341550	383786	2.47%
Jeju MSA	279996	311281	2.23%
Iksan MSA	323687	308144	-0.96%
Wonju MSA	268352	284360	1.19%
Yeosu MSA	303233	277995	-1.66%
Gyeongju MSA	275842	267872	-0.58%
Chuncheon MSA	252547	260887	0.66%
Gunsan MSA	272715	250011	-1.67%
Mokpo MSA	250480	244888	-0.45%
Gangneung MSA	228232	221329	-0.60%
Chungju MSA	217927	204800	-1.20%
Geoje MSA	168022	196481	3.39%
Icheon MSA	179719	188556	0.98%
Andong MSA	182098	169788	-1.35%
Seosan MSA	143154	144091	0.13%
Gimcheon MSA	147855	135923	-1.61%
Jecheon MSA	143710	132864	-1.51%
Gongju MSA	130376	127076	-0.51%
Tongyeong MSA	123842	121555	-0.37%
Jeongup MSA	129152	115760	-2.07%
Yeongju MSA	126507	114081	-1.96%
Miryang MSA	115962	105966	-1.72%
Sangju MSA	116493	105937	-1.81%
Yeongcheon MSA	111392	104012	-1.33%
Boryeong MSA	109535	97176	-2.26%
Donghae MSA	96679	93183	-0.72%
Namwon MSA	94926	86052	-1.87%
Sokcho MSA	87985	84908	-0.70%
Donduchon MSA	73502	80277	1.84%
Seoguiipo MSA	80860	78369	-0.62%
Mungyeong MSA	90846	70926	-4.39%
Samcheok MSA	75647	68116	-1.99%
Taebaek MSA	54196	55344	0.42%
MSA Total	41683292	43272987	0.76%
Total	46136101	47278951	0.50%

Source: Kim et. al (2008)

#### IV. Inter-City Wage Differentials and Determinants

For the analysis of wage differentials across MSAs, Korean Occupational Employment Statistics(OES) has been used, which is unique wage data set across Counties in Korea. The data set has been built since 2001. As shown in Table 2, the total number of employees (respondents) in 2009 survey is 101,674. However, because their monthly wage varies, data was truncated. The outliers below the minimum wage and above 20 times of minimum wage have been removed from the sample. The minimum wage from the Minimum Wage Council was 2009 was about 4 US Dollar. Therefore, average monthly wage below 640 USD or over 12,800 USD are excluded in this empirical work. As a result, 80,371 observations were taken in 2009.

Table 2. Korean Occupational Employment Statistics

year	Number of households	Number of employees	Number of samples
2001	49,559	65,193	51,204
2002	51,519	71,360	53,471
2003	51,008	71,790	53,715
2004	51,182	70,016	51,128
2005	51,121	70,254	51,994
2006	75,999	100,129	79,753
2007	76,377	103,813	76,561
2008	76,594	101,617	77,903
2009	75,735	101,674	80,371

The average wages were measured in two ways: One is average monthly wage and the other is average hourly wage. Table 3 shows the average hourly wages in MSAs from 2001 through 2009. The highest hourly wage in 2009 is 56.5 USD, which is in Yeosu MSA whose population is about 278 thousand in 2005. Yeosu is well known for a traditional



manufacturing city where chemical industries are heavily concentrated since 1960s. The second highest hourly wage is 54.5 USD in Suncheon MAS adjacent to Yeosu MSA. Suncheon MSA with 398 thousand of people in 2005 is the second largest port (Gwangyang Port) city in Korea. The third highest hourly wage is 53.3 USD in Ulsan MSA, which is well known for Hyundai Automobile Co. The population of Ulsan MSA in 2005 was about 1.05 million. In general, the mid size cities having specialized localization economies have higher wages. The hourly wages in larger MSAs over one million of population vary 39.7 USD to 53.3 USD. Among them, Busan MSA has the lowest hourly wage. It is not very consistent to theory, Roback model, because wage is supposed to compensate for higher living costs, which is positively related to city population size.

Table 3. Inter-City Hourly Wage Differentials in Korean MSAs (unit: USD)

MSAs	2001	2002	2003	2004	2005	2006	2007	2008	2009
Seoul	31.2	34.4	35.8	37.6	38.5	46.5	46.5	50.5	50.6
Busan	25.6	27.8	26.6	29.3	30.9	35.2	37.4	41.5	39.7
Daegu	25.4	27.2	28.7	29.2	30.9	37.3	35.7	40.8	40.1
Incheon	28.1	33.5	33.7	35.6	38.1	42.5	41.6	44.2	45.1
Gwangju	28	33.2	32.9	33	34.8	37.7	39.6	43.7	44.3
Daejeon	28.3	32.8	32.5	31.7	34.2	37.8	39.8	46.5	43.3
Ulsan	32.5	37.1	34.4	39.2	40.9	49.7	49	55.8	53.3
Suwon	28.2	34.4	34.8	35	34.3	39.4	44.5	50.5	47.9
Pyeongtaek	21.6	31.4	33.1	33.3	39	35.6	43.5	45	46.9
Dongducheon	23.5	28.3	29.6	26.5	31.1	28.7	32.2	33.5	33.6
Ansan	27.4	29.4	29.7	33.8	34.6	37.6	41.5	44.4	44.6
Icheon	29.9	21.7	22.6	30.5	30.9	37.4	42.1	51.4	34.4
Chuncheon	24.2	28.1	32.6	27	30.3	42.7	36.5	38.4	45
Wonju	35.7	31.9	34.4	29.5	32.7	37.8	36.8	42.8	48.2
Gangneung	30.9	31.3	31.2	31.8	37.9	29.1	39	40.3	37.8
Donghae	34.5	30.3	32.1	34.8	40.8	36.7	38.8	46	59
Taebaek	21.2	36.1	33.5	36.8	38.8	43.7	41.7	47.1	42.8
Sokcho	20.7	25.5	22.2	28.3	24.5	40.6	37.5	33.1	34.9
Samcheok	29.5	29	27.5	35.6	39.3	32.5	35.4	44.5	51.4
Cheongju	30.4	31.1	33.6	35.8	36.2	38.4	47.7	50.1	47.3
Chungju	20.6	27.1	26.3	29.8	32.3	37.1	35.8	33.7	37.9
Jecheon	19.3	28	31.6	32.5	34.4	41.9	42.5	46.5	34.3
Cheonan	26	32.7	34.7	35.3	38.8	38.7	44.2	39.2	42.7
Gongju	24	26.6	29.6	31.6	31.1	36.3	35.3	40.9	36.7
Boryeong	24.5	26.4	28.3	32.8	32.9	36.4	42.9	34	34.1
Seosan	25.8	34.8	41.2	35.7	38.1	43.2	52.9	37.3	47
Jeonju	26.6	32.7	35	32.3	43	43.9	44.9	44.5	42.7
Gunsan	22.7	26	28.4	31.5	34.1	43	43.4	41.4	38.6
Iksan	24.2	29.8	28.5	29.5	34.2	33.4	36	39.9	49.2
Jeongeup	22.9	29.1	32.7	35	35.7	26.7	29.3	34.7	30.2
Namwon	28.2	28.4	31.3	28.8	31.4	30.2	37.3	35.5	32.9
Mokpo	29.8	31	29.4	29.9	33.3	36.3	37.1	41.8	39
Yeosu	26.9	36.6	32.9	35.3	35.4	42	57.9	50.8	56.5
Suncheon	27	32.2	32.9	39.9	42.5	47.9	54.2	56.2	54.5
Pohang	29	32.7	35.4	37.5	43.9	34.9	52.9	47.7	48.9

Gyeongju	27.9	29.5	33.8	32	35.7	39.2	42.2	46.8	40.1
Gimcheon	26	24.6	31.3	25.4	29.9	26.9	27.5	31.2	42
Andong	27.6	26	30.8	30.7	25.9	37.1	35.4	36.3	34.5
Gumi	37.1	25.6	28	30.4	32.4	39	38.6	41.3	41.1
Yeongju	21	27.4	22.2	24.2	33.5	39	40.6	38.1	35.3
Yeongcheon	20.3	22.5	28.8	31.9	32.1	36.2	30.4	29.7	36.2
Sangju	28	27.2	27.3	21.6	37.9	34.6	29.7	29	36.9
Mungyeong	30	24.5	29.9	39.3	33.6	27	36.1	25.3	35
Changwon	30	29.7	33.9	31.5	34.1	41.5	42.9	46.9	50.4
Jinju	24.7	30.4	32.8	33.9	37.5	37.5	39.2	45.4	39.8
Tongyeong	27.8	32	26.6	28.8	34.5	46.3	36.6	35.2	36.6
Milyang	21.5	29.1	28.1	26.5	25.8	27.8	29.5	34.6	29.6
Geoje	32.5	34.3	30.8	35.1	40.7	50.7	44.7	66.2	51.1
Jeju	28.4	27.7	30.4	28.7	33.4	36.2	36.8	38	39.3
Seogwipo	30	23.2	28.7	29.2	32.1	34.5	40.9	32.9	51.2

Now, the determinants of wage differentials across MSAs are discussed based on the Roback's model. The regional wage is expressed with a function of cost of living and amenities. In this paper wage has been measured in two ways: One is monthly wage and the other is hourly wage.

$$w = f(C, A) = \alpha + \beta_1 pop + \beta_2 rent + \beta_3 commute + \beta_4 api + \varepsilon \quad (2)$$

In Table 3, the first two columns are the regressions of average monthly wage and the others are the regressions of hourly wage. Even though there are no significant independent variables for wages, still the regression results are very meaningful. First of all, the city population size(log of population) is positively related with wages, which is coincident to the theoretical model. Average wages in larger cities are more likely to be higher. Second, housing price or rent price are also positively related with wages. It also means wages are somewhat compensation for costs of living. The third, relatively, amenities are not very important, because the land area in Korean is pretty small and thus not much variation in amenities except congestions and pollutions. The regression results showed that wage level is higher, as air polluted more. The working time varies to MSAs from 46.5 hours per week in Donghae MSA to 58.9 hours per week in Suwon MSA. Accordingly, it is expected that the hourly wages are a bit different from the monthly wage. However, the regressions for the wage differential determinants showed indifferent results. It is because working time is not

serious to Korean workers. In many cases, overtime work is neither special, nor burden at all. In addition, since housing price is more often considered as price of asset, not be cost of living, the rent price substituted for housing price. Again, results are not much different. To conclude, the significance level is not serious but still costs of living, amenities and city sizes are important factors of regional wages.

Table 4. Determinants of Inter-City Wage Differentials in Korean MSAs

indep. var.	wage	wage	hourly wage	hourly wage
log(population)	7.0658 [4.99]	6.6216 [5.73]	7.0658 [4.99]	6.6216 [5.73]
housingprice	0.0115 [0.04]		0.0115 [0.04]	
rentprice		0.0277 [0.09]		0.0277 [0.09]
commutingtime(min)	-0.6343 [1.17]	-0.5698 [1.12]	-0.6343 [1.17]	-0.5698 [1.12]
air pollution index	0.0208 [0.06]	0.021 [0.06]	0.0208 [0.06]	0.021 [0.06]
Observations	50	50	50	50
R-squared	0.14	0.14	0.14	0.14

Standard errors in brackets; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## V. Intra-City Wage Differentials and Determinants

To analyze intra-city wage differentials, it is necessary to define the wage differentials (gap) first. There is a common way to measure wage differentials within a city, which is the wage ratio of skilled labor to unskilled labor within a city. Then, the definition of skilled labor and unskilled labor are supposed to be defined. In this paper, those are categorized with high income occupations and low income occupations shown in Table 4. In general, managers and doctors are in high wage occupations, while nurses and child care teachers are in low wage occupations.

$$\text{wage differentials} = \frac{\text{average wage in higher income occupations}}{\text{average wage in lower income occupations}} \quad (3)$$

Table 5. High Income(Wage) and Low Income(Wage) Occupations

High Income (Wage) Occupation	Low Income (Wage) Occupation
Administrative Managers	Secretaries
Manager in Constructions	Child Care Teachers
Managers in IT industry	Nurses
Sales Managers	Physical Therapist Helper
Managers in Environments	Barbers
Accountants and Appraisals	Ticket Seller
Financials in Banking and Insurance	Sales Person
Doctors and Pharmacists	Security Guards
Computer Programmers	

*Source : Korean National Statistical Office*

The intra-city wage differentials in Seoul MSA has been decreased in early 2000s right after Asian Financial Crisis in 1998 and then increased again. The highest intra-city wage differential was reported in Jeonju MSA in 2009 with 714 thousand of people in 2005. However, the intra-city wage differential in the largest Seoul MSA is only about 3.01. In general, larger cities have more variety in human resources, which means intra-city wage differentials are bigger in larger cities.

Table 5. Intra-City Wage Differentials in Korean MSAs

MSAs	2001	2002	2003	2004	2005	2006	2007	2008	2009
Seoul	2.54	2.29	1.93	2.64	2.40	2.67	3.01	2.89	3.01
Busan	2.35	2.75	1.81	2.90	1.71	3.06	3.48	3.38	3.05
Daegu	3.33	2.38	2.09	2.98	1.71	2.89	2.86	3.28	3.10
Incheon	2.46	2.55	2.10	3.01	3.13	3.15	3.40	3.03	3.30
Gwangju	2.48	2.18	2.07	2.64	2.13	2.36	3.09	3.48	2.78
Daejeon	2.14	2.48	2.36	2.75	1.74	2.18	3.27	2.99	3.57
Ulsan	2.62	2.80	2.96	2.91	2.66	3.41	3.37	4.02	4.21
Suwon	2.47	2.56	1.56	2.68	2.61	2.24	3.03	2.48	3.48
Pyeongtaek	1.76	2.34	1.48	2.26	3.04	2.70	3.89	2.61	4.24
Dongducheon	1.09	1.15		4.18		1.58	2.53	2.37	2.66
Ansan	2.06	2.09	1.71	1.65	1.67	2.67	2.57	2.92	2.52
Icheon	5.89	3.13		4.60	0.97	1.93	2.34	1.89	3.17
Chuncheon	2.21	2.51	1.74	1.88		3.78	3.39	2.72	3.46
Wonju	2.67	1.75	2.50	2.03	1.98	3.54	3.33	2.31	3.52
Gangneung	1.80	2.41	2.55	3.06	1.55	3.00	3.13	3.05	1.92
Donghae		1.66		3.52		1.51	2.12	2.68	3.79

Taebaek							3.33	3.96	4.58
Sokcho	1.28	1.56	1.80	3.72		2.03	4.08	4.73	2.07
Samcheok	3.13			1.56			1.46	2.35	2.26
Cheongju	2.28	2.04	1.23	3.13	1.97	2.54	2.84	2.80	3.15
Chungju	1.99	3.37		1.78		4.69	4.29	3.63	2.60
Jecheon	2.12	2.01				2.27	3.02	2.41	2.73
Cheonan	1.60	2.42	2.30	3.15	2.22	2.71	3.38	3.23	3.39
Gongju	2.19	4.90		2.86		1.99	3.29	3.04	3.39
Boryeong	2.36	1.92		2.89		2.65	3.24		3.03
Seosan	1.81	3.02	2.01	3.71		2.18	4.17	3.11	4.20
Jeonju	3.64	3.05	1.38	2.71	3.37	2.78	3.17	3.72	4.87
Gunsan	2.23	3.17	5.42	1.47	1.63	2.64	3.98	4.73	4.24
Iksan	2.28	2.20	2.34	2.00		2.73	3.25	2.26	3.70
Jeongeup	1.44		3.75	2.06		1.54	2.91	2.21	4.82
Namwon	1.96	1.53		2.76		2.00	5.69	2.75	3.78
Mokpo	2.58	3.07	1.38	2.27		2.40	3.44	3.39	3.90
Yeosu	3.45	1.94	1.67	2.76	4.46	3.21	5.16	6.88	4.46
Suncheon	1.22	1.42	2.51	2.36	2.53	3.33	2.88	2.12	2.96
Pohang	2.19	1.69	1.77	3.71	3.08	2.37	3.48	3.03	3.08
Gyeongju	2.13	2.52		2.15	0.88	2.09	2.73	3.27	3.06
Gimcheon	3.14	2.33		1.60	4.54	4.94	4.78	2.44	3.19
Andong	2.33	2.80	1.50	2.61	2.35	2.64	3.21	2.40	3.13
Gumi	1.88	2.61	1.83	4.84	2.27	2.71	2.48	3.19	3.73
Yeongju	2.01	2.99		1.68		7.03	2.86	3.44	4.85
Yeongcheon	1.32	0.95		1.44	1.76	2.21	3.06	3.98	3.31
Sangju	3.01			1.13		1.66	2.44	3.58	2.92
Mungyeong	3.19					2.34			3.21
Changwon	2.67	2.55	1.81	2.73	2.85	3.18	3.52	3.19	2.93
Jinju	2.33	2.15	1.65	3.65	2.67	2.26	3.25	2.87	3.81
Tongyeong	1.71	1.90	1.38	3.46		9.09	3.82	2.15	4.10
Milyang		1.86		1.27		1.94	4.74	3.17	4.07
Geoje	3.13	2.19	1.39	3.05		1.71	6.35	4.99	3.77
Jeju	3.01	2.34	1.70	3.05		2.28	2.52	3.08	3.52
Seogwipo	1.47			1.20			2.14	2.45	3.60

Then, what makes the wage differentials within a city? These determinants of intra-city wage differentials are analyzed more detail in the following regression. The intra-city wage differentials would be composed of city population size(P), industrial structure(I) and human capital structure(H) shown in the equation (4). More precisely, industrial structure could be measured with employment rate and employment ratio of knowledge based manufacturing industry and knowledge based service industry. Human capital could be measured by the advanced human capital, which is the ratio of human capital with master's degree or higher. The population is also measured by the total population and the old age index, the old over 65 to the young below 15.

$$wageratio = f(P, I, H) = \alpha + \beta_1 pop + \beta_2 rent + \beta_3 emp + \beta_4 indus + \beta_4 humancap + \varepsilon \quad (4)$$

Table 5. Determinants of Intra-City Wage Differentials in Korean MSAs

indep. var.	wage gap	wage gap	wage gap
log(population)	0.1636 [0.27]	0.1991 [0.35]	0.1458 [0.35]
employment rate (knowledge based mfg)	0.025 [0.04]	0.0258 [0.04]	0.025 [0.04]
employment rate (knowledge based service)	-0.0613 [0.22]	-0.063 [0.22]	-0.0586 [0.22]
ratio of master+	-42.5619 [51.89]	-40.1844 [54.42]	-44.2053 [56.35]
oldtoyoung	-0.0105 [0.01]	-0.0103 [0.01]	-0.0105 [0.01]
emprate05	-9.5403* [4.93]	-9.3458* [5.12]	-9.6659* [5.23]
log(housingprice)		-0.1866 [1.12]	
log(rentp)			0.1041 [1.29]
Observations	48	48	48
R-squared	0.10	0.10	0.10

Standard errors in brackets; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## VI. Conclusion and Policy Implications

In conclusion, there are a couple of important findings from the empirical work regarding wage differentials and their determinants. First, inter-city wage differentials and intra-city wage differentials are bigger in large cities in general, which coincides to Roback model. Second, wage does not seem reflective to an economy much, which means wage is substitutable not only to the cost of living but also something else. Wage is not differentiated across cities enough. Korea has almost uniformed wage system. In addition, larger cities such as Seoul MSA has immeasurable attracts, because average wage is not enough to compensate for high living costs. It could either attracts or myth. The third, intra-city wage differentials have a negative relationship with the employment of knowledge based manufacturing industries. As industrial structure is concentrated more on manufacturing, the intra-wage differential(gap) lessens.

Since 2003, the goal of regional policy in Korea has been set to “Balanced Development across Region”. It’s because of the social conflicts from mono-centric development around Capital area. Not only physical capital but also human capital has been concentrated. And thus, the regional disparity has grown and the balanced development has been issued. Hopefully, this research gives some policy implications to both central government and local governments how to approach balance.

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