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EFFECT OF PER CAPITA INCOME ON THE REGIONAL DISTRIBUTION OF PHYSICIANS: GROWTH CURVE MODEL

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ABSTRACT

Aim: The economic basis of the imbalance of the regional distribution of physicians is the imbalance of per capita income among residential areas. As per capita income raises the demand for health services increases. On the other hand, doctors prefer high-income cities in order to generate more revenue. Turkey has a wide range of differences in inter-provincial income levels. In this study, the relationship between the distribution of doctors and per capita income in 70 cities between 1991 and 2000 in Turkey has been examined. Thus, it is aimed to point out the importance of the economic basis of the imbalance in the distribution of physicians.

Method: The survey data of the Income Distribution by Provinces between 1991-2000 provided by Turkish Statistical Institute and the total number of specialists, GPs and total physicians in these provinces, gross domestic product per capita, and population data have been used. Multilevel regression analysis has

been used in order to find out whether doctors prefer high-income cities, and how this preference changes as the income level changes, and whether this trend is higher among the specialists compared to the GPs.

Results and Conclusion: There is a statistically significant positive relationship between domestic product per capita and the total number of specialists, GPs and total physicians per 10000 people. It is determined that doctors prefer the provinces where per capita income levels are high. A statistically significant difference is determined in the changes of

the medium of the total number of specialists, GPs and total physicians per 10000 people and domestic product per capita in time. It is seen that as the provincial income levels per capita increase the number of physicians in the provinces also increase. This relationship is stronger among specialists compared to GPs. The importance of economic development in providing equality of the accessibility to health services is an obvious reality.

1. INTRODUCTION

In order to provide adequate healthcare to everybody in need, well balanced management and recruitment is essential countrywide besides health workforce that is equipped with necessary knowledge and required skills [1].

Accessibility within the healthcare sector is closely related to the available health facilities and geographical distribution of health care professionals. The distributions of physicians across the countries affect the maternal mortality, infant mortality, and children under the age of five years mortality [2,3]. Primary care and income inequality exerted a strong and significant direct influence on life expectancy and total mortality [4].

In all countries, including Turkey, the main issue is the distribution of health care workers, especially physicians. Physicians are one of the most essential human resources for maintaining health. Equal distribution of physicians in consideration of health care needs is a crucial part of health policy. The unequal distribution of physicians is a worldwide, longstanding and serious problem [5-9].

The number of physicians working within big cities is disproportionately condensed compared to rural areas [10, 11]. Generally within all countries, rich or poor, health workers are prevalent within socio-economically developed and prosperous urban areas [6, 12]. This issue is greater in poorer countries; for example there is more than a fivefold difference in Tanzania which is one of the poorest countries in the world with the least number of doctors and lowest per

capita income between the urban districts with the lowest and highest number of health workers per capita [13]

Comparing Turkey with Europe/OECD countries, manpower supply for healthcare is found to be limited. Especially, the density of practitioners and the ratio of physicians to nurses are half of the average rate in those countries [9, 14]. In addition to this, the number of expert physicians is greater than the number of practitioner physicians, and the number of midwives and nurses is less than the number of physicians which shows another dimension of the overall problem [1, 9, 15].

Macroeconomic trends, such as gross domestic product (GDP) and personal income, are good predictors of physician utilization. Growth in the utilization of health care workers generally, and of physicians in particular, might correlate with economic expansion. Health employment and health expenditures behaved similarly with respect to GDP [16].

In this study, we examined the relationship between the number of practitioners and specialists per 10.000, and the income per capita in various cities for the period of 1991-2000. The change in the distribution of physicians with respect to the change in the level of income during the 10-year period was analyzed.

2. INCOME LEVEL AND DISTRIBUTION OF PHYSICIANS

In the health sector, cost and demand is rapidly outgrowing the available funding. In countries, where

the general public shapes governments, they are under pressure to increase health spending to meet their expectations. In addition, healthcare workers are trying to maintain or increase their incomes [14].

The physician distribution imbalance indicates some kind of social and economic reason especially within cities and city centers. In economic literature, the most widely accepted measure of total economic performance is the per capita income (GDP). Therefore, the relationship between the 'per capita income' and the density of physicians has been the focus of attention for researchers in this area. Analysis from OECD countries, including the United States has been identified the relationship between physician distribution and per capita income multiple times [16].

According to Newhouse et al. [17] geographic concentration of income is an important factor in distribution of physicians; size of towns is the second factor. "Standard economic theory, (neoclassical) assumes that physicians seek to maximize their profit and therefore tend to practice in regions with high income. The existence of a positive relationship between the number of physicians and the level of income has been proven empirically [18].

As long as physicians provide services without being subject to public intervention, their location is decided by the GDP in the region. "Increase in per capita income, a measure of community wealth, was significantly associated with an increase in the number of physicians... residential population size and community wealth were still strong determinants of change in local physician supply" [19].

The market demand for physicians increases with the level of GDP. The increase in GDP also affects the demand for specialist physicians. This also increases the overall demand for general healthcare. When comparing specialist physicians with practitioners, special physicians work with market demands with higher GDP communities; therefore, higher GDP cities have a larger number of specialist physicians than the lower GDP areas. When we observe an increase in an area's GDP, we also observe an increase in specialist physicians.

"In normal competitive markets, an increase in supply results in price reductions that, in turn, may induce increased consumption. Empirical studies of the

medical care system, however, sometimes contradict these two basic behavioral patterns. Fees were sometimes positively, rather than negatively, related to physician supply; even without price declines, the per capita consumption of medical care also seemed positively related to supply. To explain this anomalous behavior, two related target-income theories were proposed: the fee control model and the physician-induced demand model. The first suggests that as physicians find themselves with fewer patients, they raise their fees to maintain a desired level of income" [20]. In other words, the service providers in the health care service system struggle to maintain their income [14].

Medical practice in Japan is financially based on a fee-for-service reimbursement system. There is no restriction on practice location. Physician distribution is determined largely by the market and by physicians' individual preferences. Physicians prefer geographically attractive urban areas with high income. These lead to geographic maldistribution of physicians [7]. This can lead to the concentration of primary care physicians in urban areas resulting in a shortage in rural areas [21].

Therefore, societal perspective market mechanisms alone do not allow and adequate supply of health personnel to be reached, public interventions such as human resources planning are a means to correct for market failures [22].

Health authorities are carrying out necessary practices to increase the number of physicians almost all over the world. However, increasing the number of physicians is not a solution for the distribution problem. Despite the increase in the number of physicians, the distribution imbalance continues to exist [10, 21, 23].

3. MATERIAL AND METHOD

In this study between 1991 and 2000, the number of physicians to population data by province and GDP were used. For GDP analysis, Turkish Statistical Institutes' between the years 1987 to 2000 data was used [24]. In particular, our reason to choose this period is due to the presence of provincial GDP data for this period in Turkey.

Number of specialists and general practitioners (GPs) per 10,000 population and, per capita income¹ constituted the input for our analysis. We decided to include the data of 70 cities (out of 81) and 1991 to 2000 (10 years) period to obtain a complete data set with maximum number of years and maximum number of cities.

In our original plan we were supposed to investigate the 1987 to 2000 period with 81 cities, but during the aforementioned period (at different years) the government restructured the boundaries of some of the cities and created “new” cities. It was not possible to trace back some of the “new” cities’ data. Therefore for the sake of balanced and widest data we decided to drop data of some of the cities and the periods. The city, “Kırıkkale” was also dropped from the data (even though it has a complete data set) because, in our preliminary analysis it was detected as outlier.

Multilevel Regression Analysis (a growth model) has been utilized in order to determine if specialists and GPs prefer higher income cities and the preference is more among specialists compared to GPs. We set up two regression analyses: In one of them, “number of specialists per 10,000” is the dependent variable and in the other, “number of general practitioners per 10,000” is the dependent variable. We started with the null model and finalise it with a two level random coefficient model where “per capita income” and “year” are the explanatory variables. We specified random effects at the city-level. Besides random intercept we allowed random slope on “year”. In order to let both the intercept and the “year” slope depend on “per capita income”, the interaction term “per capita income x year” has been added to the regression equation for a cross-level interaction. The analyses were performed by STATA 10.0.

4. RESULTS

Null Model (the Intercept-Only Model)

The intercept-only model (the intercept vary across cities) is useful that serves as a benchmark with which other models are compared [25]. For our data, the intercept-only model is written as:

$$\text{Specialist}_{ij} = b_0 + u_{0j} + e_{ij} \quad i = 1, \dots, 70$$

$$\text{and } j = 0, \dots, 9$$

$$\text{GP}_{ij} = b_0 + u_{0j} + e_{ij}$$

The regression coefficient (b_0) estimates the grand mean of the dependent variable (average number of specialists or general practitioners per 10,000 across all cities), and the residuals (e_{ij}) are the individual deviations from the mean. The term, u_{0j} represents the deviations of the city means from the grand mean.

¹ Input as x1,000 TL. Each year’s PCI has been divided by the GDP deflator (1998=100) of that year in order to reflect real income variations.

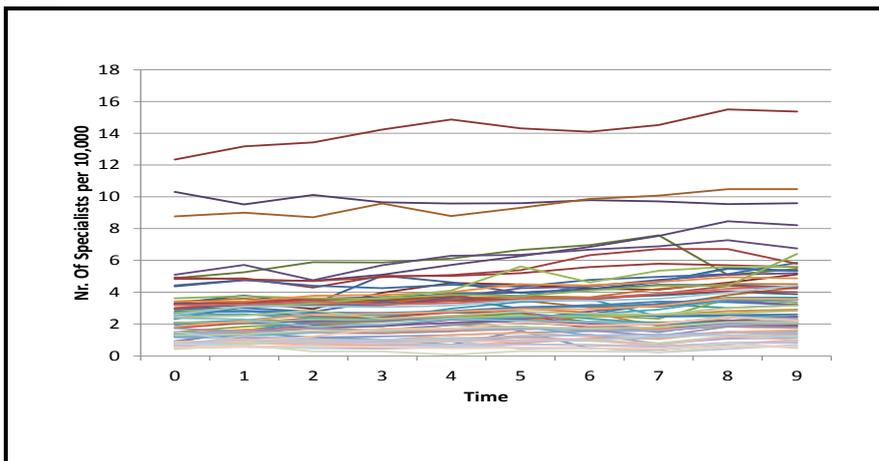
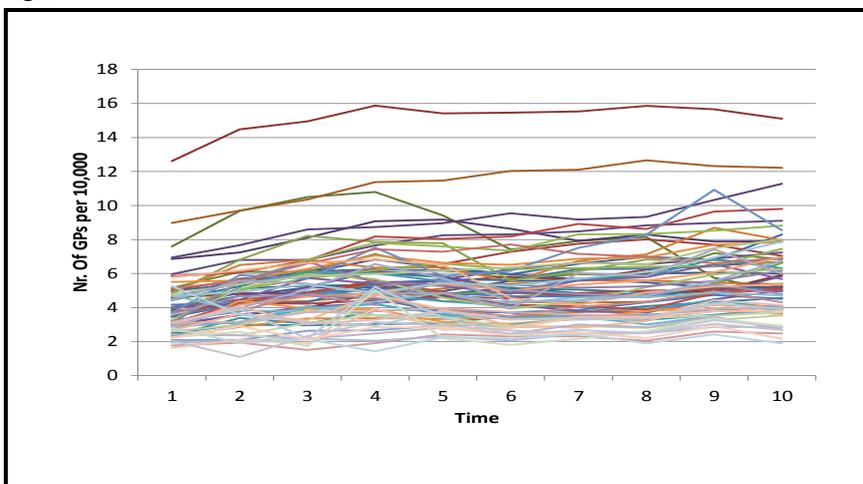
Table.1

The Null Model	Specialists		G. Practitioners	
Fixed Part	Coefficient	Standard Err.	Coefficient	Standard Err.
Intercept	2.93	0.27	5.12	0.26
Random Part				
σ_e	0.52	0.01	0.85	0.02
σ_{u0}	2.29	0.19	2.12	0.18
(ICC)	0.95	0.01	0.86	0.02
Deviance	1431.23		2043.47	

Average number of “specialists per 10,000” (b_0) is 2.93 (Table.1). Between city variation (σ_{u0}) is 2.29 which points to a high variation. Within city variation (σ_e) is 0.52. ICC (Intraclass Correlation - the proportion of the variance explained by the grouping structure in the population) equals to 95% indicating clearly that a multilevel model is required [26].

For general practitioners, the average number of “GPs per 10,000” is 5.12. σ_{u0} is 2.12, again pointing to a high variation. The high level of ICC 86% , warns us to conduct multilevel model.

Indeed, the graphs of number of specialists and GPs per 10,000 versus time (each line presents one city) suggests a linear growth, city-specific random intercepts and city-specific linear trends (Fig.1 and 2).

Fig.1**Fig.2**

Random Coefficient Model with One Explanatory Variable – “Year”

Since number of specialists and GPs growth per 10,000 vary from city to city through the years, we included

“year” as an explanatory variable allowing for a random intercept and random slope on “year”:

$$\text{Specialist}_{ij} = b_0 + b_1 * \text{year}_{ij} + u_{0j} + u_{1j} * \text{year} + e_{ij}$$

$$\text{GP}_{ij} = b_0 + b_1 * \text{year}_{ij} + u_{0j} + u_{1j} * \text{year} + e_{ij}$$

Table.2

Random Coefficient Model	Specialists		G. Practitioners	
Fixed Part	Coefficient	Standard Err.	Coefficient	Standard Err.
Intercept (b ₀)	2.47	0.25	4.48	0.24
year (b ₁)	0.10	0.01	0.14	0.02
Random Part				
σ _e	0.30	0.009	0.59	0.02
σ _{u0}	2.08	0.18	1.97	0.17
σ _{u1}	0.09	0.009	0.14	0.01
σ _{u01}	0.43	0.11	0.11*	0.13
Deviance	871.82		1707.69	

*: Not significant

As for Specialists; average number of specialists per 10,000 is 2.47 across cities at the beginning of the 10-year period, and the standard deviation of the constant (σ_{u0}) is 2.08 (SE= 0.18) indicating a high variation of the constant (Table.2). The regression coefficient of “year” is 0.10 (which is significant at 95% confidence level - 95% confidence interval is 0.08 and 0.13) meaning that average number of specialists per 10,000 increases by 0.10 each year. The SD of the coefficient of the “year” variable (σ_{u1}) is 0.094 (SE=0.009) also pointing to a significant deviation. The random intercept and slope have a positive correlation (σ_{u01}) of 0.43. This means that cities that tend to show higher number of specialists per 10,000 for average cities also tend to show higher gains in number of specialists per 10,000 per year.

As for GPs; average number of GPs per 10,000 is 4.48 (SE=0.24) and increases by 0.14 (SE=0.02) each year. The SD of the intercept (σ_{u0}) is high (1.97; SE=0.17) but not as high as compared to the specialist’s situation. The variation of the coefficient of the “year” variable (σ_{u1}) is 0.14 (SE= 0.01) pointing to a high deviation at city level. We can also use the standard normal distribution to estimate the percentage of regression coefficients that are negative: 15% of the cities are expected to have a regression coefficient that is actually negative² (for specialists it is 14%).

Given the large and significant variance of the regression coefficient of “year” across cities it is attractive to attempt to predict its variation using city level variables (i.e. per income capita).

Random Intercept and Slope with One Explanatory Variable – “year” and by Introducing One Explanatory Variable – “per capita income” at the City Level (2-Level Regression Model)

Taking up from our last premise we added “per capita income (PCI)” as level-2 explanatory variable. However we grouped cities into two, with respect to their 10 year average PCI, as high income and low income cities. The dividing line between the two groups is the median 50 (cities were listed from high to low income and upper median 50 is labeled as “high income - SES_1” and lower median 50 as “low income - SES_2”).

² Mean regression coefficient (b1) is 0.14 with sd (σ_{u1}) of 0.14.

The regression equation (for the specialists) was constructed as follows :

$$\text{Specialist}_{ij} = \underbrace{b_{0(\text{SES}_1)} \text{SES}_{1ij} + b_{0(\text{SES}_2)} \text{SES}_{2ij} + b_{1(\text{SES}_1)} (\text{year}_{ij} * \text{SES}_{1ij}) + b_{1(\text{SES}_2)} (\text{year}_{ij} * \text{SES}_{2ij})}_{\text{Fixed part}} + \underbrace{u_{i0(\text{SES}_1)} \text{SES}_{1ij} + u_{i1(\text{SES}_1)} (\text{year}_{ij} * \text{SES}_{1ij}) + u_{i0(\text{SES}_2)} \text{SES}_{2ij} + u_{i1(\text{SES}_2)} (\text{year}_{ij} * \text{SES}_{2ij})}_{\text{Random part}}$$

Table.3

Random Coefficient Model Adding Level-2 Explanatory Variable (per capita inc.)	Specialists		G. Practitioners	
	Coefficient	Standard Err.	Coefficient	Standard Err.
Fixed Part				
Intercept ($b_{0(\text{SES}_1)}$)	3.58	0.41	5.37	0.38
Intercept ($b_{0(\text{SES}_2)}$)	1.36	0.13	3.59	0.20
Year*SES _{1ij} ($b_{1(\text{SES}_1)}$)	0.14	0.02	0.16	0.03
Year*SES _{2ij} ($b_{1(\text{SES}_2)}$)	0.06	0.01	0.12	0.07
Random Part				
$\sigma_{(\text{SES}_1)}$	2.40	0.29	2.21	0.27
$\sigma_{(\text{year} * \text{SES}_1)}$	0.10	0.01	0.15	0.02
$\sigma_{(\text{SES}_2)}$	0.73	0.09	1.14	0.15
$\sigma_{(\text{year} * \text{SES}_2)}$	0.08	0.01	0.13	0.02
Deviance	806.43		1677.59	

Specialists

The regression coefficient of SES₁ (3.58; 2.78 – 4.37) is significantly higher than that of SES₂ (1.36; 1.11 – 1.61) meaning that SES₁ is on the average 2.22 points higher on number of specialists per 10,000 (Table.3).

The difference between SES₁ and SES₂ grows wider as years pass by (the growth of number of specialists per 10.000 per year is significantly higher in SES₁ than that of SES₂).

year * SES₁ = 0.14 (0.11 – 0.18)

year * SES₂ = 0.06 (0.035 – 0.09)

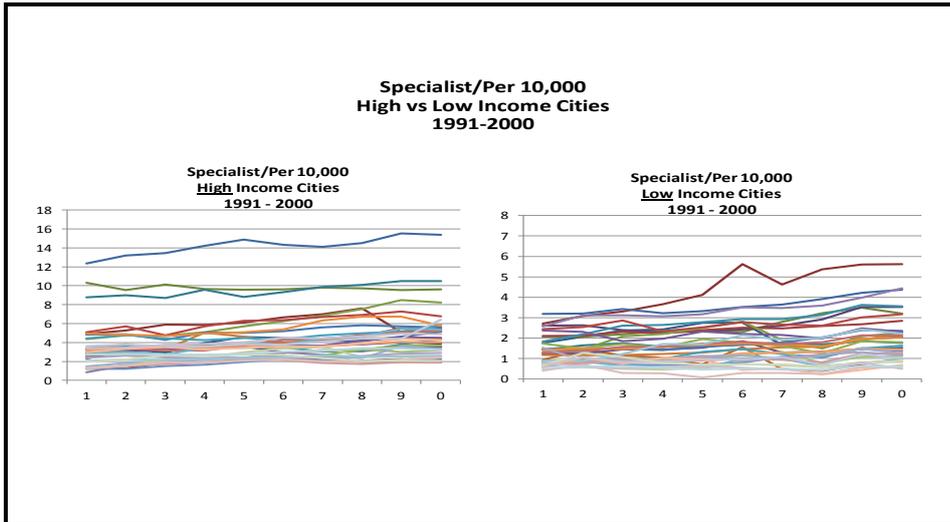
This concludes that there is a systematic difference in the overall population mean line between SES₁ and SES₂.

SD (SES₁) is 2.40 (1.90- 3.04) and it clearly shows that regression slopes for SES₁ vary across cities significantly. SD (SES₂) is 0.73 (0.57 – 0.93), it means that regression slopes for SES₂ vary across cities significantly, too, however the variation in SES₂ is far below than that of SES₁ (i.e. SES₁ and SES₂

demonstrate different variability about their respective average lines) (Fig.3).

SD (year * SES₁) and SD (year * SES₂) are significant but are very low to have a significant impact.

Fig.3



GPs

The regression coefficient of SES_1 (5.37; 2.63 – 6.12) is significantly higher than that of SES_2 (3.58; 3.20 – 3.98) meaning that SES_1 is higher on number of GPs per 10,000.

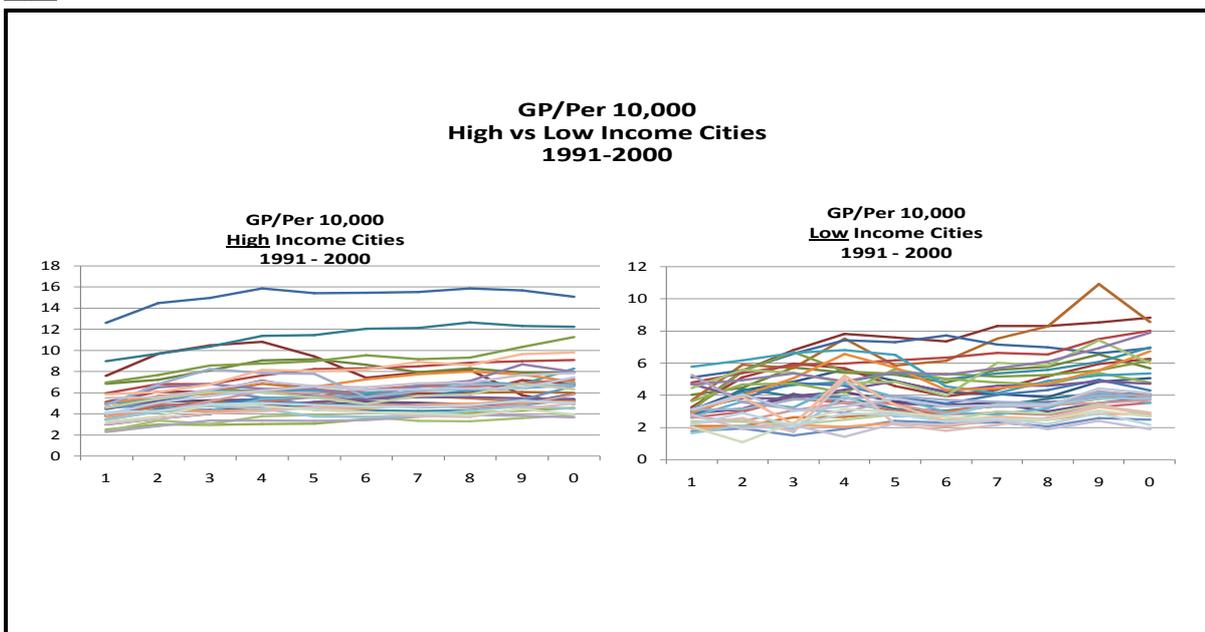
The difference between SES_1 and SES_2 with respect to the growth of number of GPs per 10.000 per year is not significant. This means that the difference between the two groups with respect to number of GPs per 10.000 (the difference in regression slopes) is

significant but the difference is not growing at a higher rate as years pass by.

year * SES_1= 0.16 (0.11 – 0.21)
year * SES_2= 0.12 (0.075 – 0.17)

SD (SES_1) is 2.21 (1.7 - 2.81) and it clearly shows that regression slopes for SES-1 vary across cities significantly. SD (SES_2) is 1.13 (0.88 – 1.46), it means that regression slopes for SES_1 vary across cities significantly however the variation in SES_2 is far below than in SES_1 (Fig.4).

Fig.4



5. DISCUSSION

Studies on OECD countries indicate that (as demonstrated by cross-sectional studies); there is evidence of a correlation between the level of economic development of a country and its level of human resources for health. Countries with higher GDP per capita are said to spend more on health care than countries with lower income. While the distribution of medical practitioners is more balanced in many countries, due to the higher demand of specialist physicians from people with high income, it is seen that there is not a balanced distribution of specialist physicians [27, 28].

In our study, through the years even though there is a decrease in the acceleration rate of increasing number of specialists and GPs who prefer higher income cities and the preference is more among specialists compared to GPs. The variation of number of specialists between the cities is much higher compared to GPs. Cities with higher number of doctors initially attract more doctors as years pass by. The correlation is higher among specialists compared to GPs.

Matsumoto et al., [29] indicate that constant increase in the number of physicians per unit population during the past 25 years did not result in an equal distribution of physicians proportional to community population in Japan and the US, there is no improvement of unequal distribution of physicians. The US physicians may continue to concentrate according to income, rather than according to population health needs. Correlation between physician-to-population ratio and per capita income among the communities was stronger in the US than in Japan and has increasingly been strengthened during the period 1980 and 2005.

In the study of Toyabe et al., [30] compare the numbers of physicians in Japan between 1996 and 2006, as the number of physicians increase, working at hospitals has significantly increased in urban wealthy areas. This results into exacerbation of maldistribution of physicians between urban and rural areas. The unequal distribution of physicians between the urban and rural areas will be a long term trend in Japan.

In our study, we have found that, between 1987 and 2000, as the income level of the cities increased, the

number of physicians in those cities increased as well, and we have determined that this relation is stronger for specialists than practitioners.

With increased specialization, physicians need access to large populations to find sufficient number of patients, populations with enough financial resources to afford the expensive treatments. Population with lower household income or regions with lower socioeconomic status were associated with fewer specialists per population [1, 31].

The study of Rutten [32] is to determine the macro-economic impacts of migration of skilled medical personnel from a receiving country's perspective; health workers migrate to better developed countries to improve their socioeconomic and financial situation or for the purpose of career development. Migration of health care workers can seriously impact the regional distribution of physicians. There is a relation between the economic development level of a country and its human resources for health. In both developed and developing countries, rural areas of physicians have much lower concentration in contrast to urban areas [22].

In the study of Isabel et al., the geographic disparities in physicians density is a result of geographic income inequality. As a result, the socioeconomic level of the cities are improved and there will be an equal regional distribution and observed inequality of physicians to population ratio will be decreased [18].

The increasing political attention for addressing health inequalities needs to be accompanied by more evidence on how to ensure that interventions reach lower socio-economic groups [33]. To improve the imbalanced socioeconomic factors between the urban and rural areas, adequate number of health care workers, determined and rationalist political approach are the essentials for equal distribution of the health workforce [6].

Limitation of this study is that only physician to population ratio and GDP was used for assessing geographic imbalances of physicians. Health status, number of hospitals and hospital beds, healthcare needs, branch of medical practices or physicians demands of employment were excluded from this study.

Turkish politicians consider primary reason for unequal distribution of physicians is to increase the number of physicians. However, only increasing the number of physicians is not a real solution for the problem of the unequal distribution. Despite the increase in the number of physician per population, the distribution imbalance continues to exist.

6. CONCLUSION

Comparing our final model (in which we have introduced PCI as class variable) with the previous one (random coefficient model with one explanatory variable – “year”) yields the following:

- The deviance test (Hox, 2002), comparing two models is significant for both specialists and GPs at 95% confidence level ($p < 0.001$ for both). This is to state that our final model fits significantly better than our previous models.

We noted down the following conclusions as per our final model reveals:

- Comparing intercepts, it is revealed that either the number of specialists or GPs per 10,000 in the

“higher income cities” (SES_1) is higher than that of the lower income cities (SES_2).

- Among specialists; annual growth rate for the number of specialists per 10,000 is significantly higher in SES_1 compared to SES_2. In other words, the gap between the higher and the lower income cities has grown during 1991 and 2000 period. Among GPs, there is no statistical evidence that the gap between the SES_1 and SES_2 is getting wider.

As per our findings we concluded that there had been geographically unfair distribution of physicians and this continued, indeed, deteriorated between the years 1991-2000. Cities with high income attracted more and more physicians, and this tendency is more among specialists compared to the GPs.

In our study, during the 10-year between the 1991 and 2000, we found that as the GDP increases so does the level of specialist physicians and practitioners. All of which shows, that the permanent solution to inequality of healthcare and distribution of specialist, physicians and practitioners can be effected by the reduction of socio-economic disparities.

REFERENCES

- [1] Solak M, Bayraktar N, Kapıcıoğlu MİS, Dilsiz A, Kerkiüklü M, Zırh H, Duman MÖ, Güngör H, Binler A. Türkiye’de Sağlık Eğitimi ve Sağlık İnsangücü Durum Raporu, Haziran 2010, Ankara.
- [2] Yardım MS, Üner S. Türkiye’de Hekim Dağılımında Coğrafi Farklılıklar, TAF Preventive Medicine Bulletin 2013; 12(5).
- [3] Anand DS, Bärniyghausen T. Human resources and health outcomes: cross-country econometric study. The Lancet; Volume 364, Issue 9445, p. 1603 – 1609.
- [4] Shi L, Starfield B, Kennedy B, Kawachi I. Income inequality, primary care, and health indicators. J Fam Pract 1999 Apr; 48(4):275-84.
- [5] Blumentahl D. Geographic imbalances of physician supply: an international comparison. Journal of Rural Health 1994; 10(2):109-118.
- [6] Dussault G, Franceschini MC. Not enough there, too many here: understanding geographical imbalances in the distribution of the health workforce. Human Resources for Health 2006; 4:12.
- [7] Matsumoto M, Inoue K, Noguchi S, Toyokawa S, Kajii E. Community characteristics that attract physicians in Japan: a cross-sectional analysis of community demographic and economic factors. Human Resources for Health 2009; 7:12.
- [8] Tanihara S, Kobayashi Y, Une H, Kawachi I, Urbanization and physician maldistribution: a longitudinal study in Japan, BMC Health Services Research 2011; 11:260.
- [9] Molahaliloğlu S, Hülür Ü, Gümrükçüoğlu OF, Ünüvar N, Aydın S. Sağlıkta İnsan Kaynaklarının Mevcut Durum Analizi. TC Sağlık Bakanlığı Refik Saydam Hıfzısıhha Merkezi Başkanlığı Hıfzısıhha Mektebi Müdürlüğü; Ankara, 2007.

- [10] Pong R W, Pitblado J. Geographic Distribution of Physicians in Canada: Beyond How Many and Where, *Health Human Resources*, Canadian Institute for Health Information 2005; p. 59.
- [11] Rivo ML, Kindig DA. A report card on the physician work force in the United States. *N Engl J Med* 1996; 334:892-896.
- [12] Dubois CA, McKee M, Nolte E. Avrupa'da Sağlıkta İnsan Kaynakları, Türkiye Cumhuriyeti Sağlık Bakanlığı Yayınları; Ankara, 2011, p.24.
- [13] Munga MA, Maestad O. Measuring inequalities in the distribution of health workers: the case of Tanzania. *Human Resources for Health* 2009; 7:4.
- [14] Akdağ R. Turkey Health Transformation Program Evaluation Report (2003-2010); T.C. Sağlık Bakanlığı Yayını, 2011.
- [15] Akdağ R. İlerleme Raporu, Türkiye Sağlıkta dönüşüm Programı. T C Sağlık Bakanlığı; 2008.
- [16] Cooper RA, Getzen TE, Laud P. Economic expansion is a major determinant of physician supply and utilization. *Health Serv Res* 2003; 38:675-696.
- [17] Newhouse JP, Williams AP, Schwartz WB, Bennett BW. The Geographic Distribution of Physicians: Is the Conventional Wisdom Correct? US Department of Health and Human Services, The Rand Corporation, 1982.
- [18] Isabel C, Paula V. Geographic distribution of physicians in Portugal. *The European Journal of Health Economics* August 2010; Volume 11, Issue 4, p. 383-393.
- [19] Jiang HJ, Begun JW. Dynamics of change in local physician supply: an ecological perspective. *Social Science & Medicine* 2002; vol. 54, issue 10, p. 1525-1541.
- [20] Luft HS, Arno P. Impact of increasing physician supply: a scenario for the future. *Health Affairs* 1986; 5(4):31-46.
- [21] Matsumoto M, Inoue K, Farmer J, Inada H, Kajii F. Geographic distribution of primary care physicians in Japan and Britain. *Health & Place* January 2010; Volume 16, Issue 1, p. 164-166.
- [22] Zurn P, Dal Poz MR, Stilwell B, Adams O. Imbalance in the health workforce. *Human Resources for Health* 2004; 2:13.
- [23] Ide H, Koike S, Kodama T, Yasunaga H, Imamura T. The distribution and transitions of physicians in Japan: a 1974-2004 retrospective cohort study. *Human Resources for Health* 2009; 7:73.
- [24] State Institute of Statistics, National Accounts 2001.
- [25] Hox J. Multilevel Analysis. Techniques and Applications, 2nd edition:Lawrence Erlbaum Associates, 2002, London, p. 16-44.
- [26] Ringdal K. Multilevel Models. 2013. <http://essedunet.nsd.uib.no>, chapter 3 -Variance component.
- [27] Blomqvist G, Carter L. Is health care really a luxury? *Journal of Health Economics* 1997; 16:207-229.
- [28] Van Doorslaer E, Masseria C, Koolman X. Inequalities in access to medical care by income in developed countries, *CMAJ* January 2006; 174(2)-177.
- [29] Matsumoto M, Inoue K, Bowman R, Noguchi S, Toyokawa S, Kajii E. Geographical distributions of physicians in Japan and US: Impact of healthcare system on physician dispersal pattern. *Health Policy* 2010 Aug; 96(3):255-61).
- [30] Toyabe S. Trend in geographic distribution of physicians in Japan. *International Journal for Equity in Health* 2009; 8:5.
- [31] Aneja S, Ross JS, Wang Y, Matsumoto M, Rodgers GP, Bernheim SM, Rathore SS, Krumholz HM. US Cardiologist Workforce From 1995 To 2007: Modest Growth, Lasting Geographic Maldistribution Especially In Rural Areas. *Health Affairs* 2011; 30(12): 2301-9.
- [32] Rutten M. Medical Migration: What Can We Learn from the UK's Perspective?, The World Bank Development Research Group 2008; Policy Research Working Paper Series Number 4593.
- [33] Houweling TA, Kunst AE. Socio-economic inequalities in childhood mortality in low- and middle-income countries: a review of the international evidence. *British Medical Bulletin* 2010; 93: 7-26.