# DISTRIBUTIONAL DYNAMICS OF REGIONAL INCOMES IN TURKEY: 1987-2014

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## Abstract

This study examines the evolution of regional disparities in Turkey during a period of continuous turmoil and transformation. Given natural differences between pre and post 2001; 1987-2001 and 2004-2014 episodes are explored separately. First set of results from Markov Chain analysis show that sizable regional disparities exist in Turkey regardless of the investigated time interval. That said, post 2001 period shows higher stability and rising regional income inequality. Moreover convergence towards steady states is slower during the 2004-2014 period. Our second set of analyses from spatial conditioning indicate that spatial networks are quiet divergent, as regions locked in relatively poor areas are getting even more isolated and losing their chances to increase their income levels. This finding is stronger for the 2004-2014 period; indicating that post 2001 witness rising spatial heterogeneity and persistent regional inequalities.

**Keywords:** Inequality, Spatial Markov Chain, Turkey

**JEL Classifications:** R11, R12

# TÜRKİYE'DE BÖLGESEL GELİRLERİN DAĞILIM DİNAMİĞİ: 1987-2014

## Öz

Bu çalışma Türkiye'de dönüşüm ve değişimin sürekli olarak yaşandığı bir dönemde bölgesel eşitsizliklerin oluşumunu incelemektedir. 2001 yılı öncesi ve sonrası ortaya çıkan doğal farklılıklardan ötürü iki farklı zaman aralığı ele alınmış: 1987-2001 ve 2004-2014 dönemleri ayrı ayrı incelenmiştir. Markov Zincirleri analizlerinden elde edilen ilk bulgularda Türkiye'de bölgesel eşitsizliklerin her iki dönemde de şiddetli olduğu görülmektedir. Ancak 2001 sonrası dönemde bölgesel eşitsizliklerin arttığı ve dağılımın sabitliğinin yükseldiği görülmektedir. Ayrıca 2004-2014 döneminde bölgelerin uzun dönem denge seviyelerine yaklaşma hızının da azalmaya başladığı tespit edilmiştir. Çalışmanın mekânsal koşullandırmaya dayalı olan ikinci bulguları incelendiğinde ise mekânsal ilişkilerin farklı farklı sonuçlar ortaya çıkarttığı anlaşılmaktadır. Gelir seviyesi düşük alanlara kapalı kalan bölgelerde daha yüksek bir gelir grubuna çıkma şansı daha düşük olmaktadır. Bu bulgunun özellikle 2004-2014

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döneminde daha şiddetli olduğu görülmüş; 2001 sonrası dönemin mekânsal heterojen yapının ve bölgesel eşitsizliklerin kalıcı hale gelmeye başladığı bir dönem olduğu anlaşılmıştır.

**Anahtar Kelimeler:** Eşitsizlik, Mekânsal Markov Zincirleri, Türkiye

**JEL Sınıflaması:** R11, R12

## 1. Introduction

Regional inequalities and the endogenous link with socio-economic environment stand as a core debate for development economist. Even regional differences are investigated in details; still different approaches exist to define inequalities. More importantly measurement of inequalities at regional scale stands as a long lasting question. Even origins of these discussions go back to location theory, recent attempts to understand regional inequalities mostly gather around the neo-classic framework. Solow (1956) emphasizes the notions of decreasing return and steady states; both of which represent benchmark for understanding the level and path of regional disparities.

The so-called convergence framework relies on the expectation that rich nations/regions will realize decreasing returns to capital unlike some other relatively poor nations/regions. Capital accumulation will differ in size and speed until returns are equalized as regional differences will eventually vanish in the long run. Therefore regions that have disadvantageous initial conditions will realize higher growth; which in return will explain the growth slow-down in relatively more developed locations. Barro and Sala-i Martin (1992) underlined that convergence exists for US regions as well as a set of countries. Later on convergence framework becomes a generalization to most of the growth models investigating the roots of inequalities at regional scale.

Even convergence framework is exhaustively studied among regional scholars, it is Quah (1993) to react by indicating the possibility of club-convergence. Club convergence and formation emphasizes that different set of regions may have different steady states and convergence that is captured by the traditional neo-classic framework can actually be a convergence to different steady states by different set of regions. This in turn explains the cross country/region differences prevailing in different geographies of the globe. Quah (1993) underlined that rather than comparing initial conditions with growth potentials, it is more useful to observe the structure of regional income distribution. For instance detecting convergence implies that regions with initially bad conditions (i.e. poor regions) are realizing higher growth within a given time interval. However this pattern does not explain whether these poor regions are increasing their relative position within the distribution (i.e. moving to a higher income group). Therefore rather than observing the relationship between initial conditions and growth potential, Quah (1993) re-defined the inequality measurement and advised to use transition probability analysis within Markov Chain framework. The basic idea is to trace the chances of moving within the regional income distribution and to assess whether poor regions are able to move to higher income groups within a time interval.

Originating from these developments this study focuses on Turkey as a case study and investigates the regional disparities by not only implementing Markov Chain Analysis but also augmenting the framework by incorporating spatial conditioning. An important contribution will be on the time dimension of the study, which covers 1987-2014. Even 1987-2001 era is investigated in details, our knowledge on the post 2001 period is quiet limited. However as now new data sets are supplied by the national statistical authorities (Turkish Statistics Office, TurkStat) it is necessary to use different approaches in order to understand what happened (is happening) during the post 2001 era, in which Turkey realized massive transformation in its social and economic life. Therefore two time intervals will be considered (1987-2001 and 2004-2014) and pattern of inequalities in these time episodes will be evaluated from a comparative perspective. A second important contribution is the use of Markov Chain analysis together with spatial conditioning. To our knowledge this has not been attempted for Turkey. Keeping in mind the existence of sizable spatial spillovers for regional incomes (See Gezici and Hewings, 2007 among others) neglecting the impact of spatial hinterland will underestimate the true transition probabilities.

## 2. Regional Inequalities in Turkey

Regional inequalities and origins of imbalances are both subject to discussions among scholars and policy makers. From economic policy side Priority Development Areas (PDA), Industrial Zones Implementations, Rural Development Plans and State Incentive Mechanisms for Investment are on the agenda for decades. More recently new measures are taken in order to activate Regional Development Agencies by Ministry of Development. Meanwhile regional scholars investigated historical origins of regional disparities, suggesting the rising east-west dichotomy. Filiztekin (1998), Doğruel and Doğruel (2003), Karaca (2003) and Karahasan (2014) underlined that even there are signs of convergence; still sizable gap between poor-east and rich-west exists among the territory of Turkey. Karahasan (2014) remarks that convergence is not global for Turkey; as it is mostly the growth slow-down in the developed areas rather than a catch-up attempt of the less developed eastern areas of the country. Similarly Doğruel and Doğruel (2003) underlined that even there is convergence in general (i.e. beta convergence), it is far away from successfully closing the gap between east and west side of the country.

An important dimension of the literature on regional inequalities in Turkey originates from data concerns. As regional Gross Domestic Product (GDP) data was supplied for 1987-2001; studies fail in investigating the post 2001 era. Karahasan (2014) used descriptive and exploratory tools to shed light on the post 2001 period; suggesting that there is lack of evidence for improvement of imbalances during an era of continuous restructuring. Similarly Karahasan (2015) used 26 economic areas (NUTS II regions) and remark that there is no evidence on an improvement of regional wage income distribution. However given that TurkStat now produces regional GDP data for 2004-2014 period, interest will focus on different dimensions of regional inequalities in Turkey.

Table 1 gives the summary of inequality measures for the regional income distribution and suggests that historically there is a tendency for regional inequalities to diminish considering per capita GDP. [1] While this period coincides with an increase in average income, there is evidence that both deviation as well as variation of regional incomes decrease during the time interval. Other than the standard deviation and variation measures; inequality indices (Min/Max, Gini, Theil) also validate that inequalities are falling in both time intervals. A final measure that could be considered is spatial concentration. Moran's I and Geary's C statistics are computed for cut-off years. [2] This time; while we detect falling spatial concentration during 1987-2001 period, very limited yet significant rise (and persistence) in spatial concentration is observed for the post 2004 period. This reminds that locations are getting more connected within their hinterlands but seem to lose their ties with other proximity areas.

**Table 1:** Inequality Measures

|  | 1987 | 2001 | 2004 | 2014 |
|---|---|---|---|---|
| **Standard Deviation (ln)** | 0.54 | 0.47 | 0.37 | 0.33 |
| **Coefficient of Variation** | 0.55 | 0.51 | 0.39 | 0.35 |
| **Min./Max.** | 0.06 | 0.09 | 0.18 | 0.19 |
| **Gini Coefficient** | 0.28 | 0.24 | 0.21 | 0.19 |
| **Theil Index** | 0.14 | 0.10 | 0.07 | 0.05 |
| **Moran's I** | 0.50 | 0.47 | 0.28 | 0.30 |
| **Geary's C** | 0.43 | 0.46 | 0.69 | 0.69 |

While these analyses are helpful to have an overall idea for regional differences, they do not describe the shape of the regional income distribution. Figure 1 illustrates the regional per capita income distribution for different years. Both regional per capita income but also relative regional per capita income is plotted (relative to overall GDP). [3] These kernel density functions contain interesting findings. First considering per capita incomes, 1987-2001 seems to witness an episode of improvement considering the left tail of the distribution. This fat left tail seems to shift towards the mid of the distribution from 1987 to 2001. It is also true that distribution is getting tighter which is suggesting a fall in the inequalities. However given limited rise in the average per capita incomes,
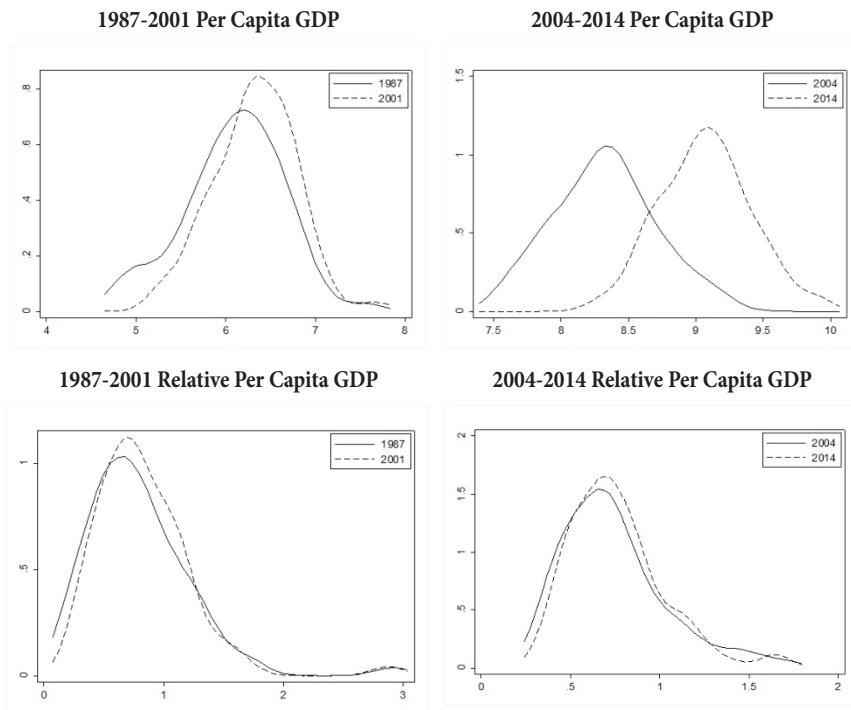
1   Note that 1987-2001 and 2004-2014 regional GDP measures have methodology differences. This makes it difficult to make a healthy comparison between 1980s and 2000s. Therefore two intervals of 1987-2001 and 2004-2014 are going to be evaluated based on their own fundamentals. This we believe should not bias our overall aim which is basically to compare regional inequalities between 1987-2001 and 2004-2014.

2   Moran's I lies between -1 and 1, where a rise in the statistic indicates rising spatial concentration. Meanwhile Geary's C is between 0 and 2. Values lower than 1 indicates rising spatial concentration. Note that all spatial concentration values are significant at 1% significance level.

3   Number of provinces change between 67 and 81 throughout the 1987-2001 period. In order to observe the shape of the distribution new provinces are added backed to their departure provinces. For this reason kernel density functions as well as the remaining analysis use 67 and 81 provinces for 1987-2001 and 2004-2014 periods respectively. Note that given that these new regions share more or less similar socio-economic structures with their departures, we do not see any problem for using 81 provinces for the second time interval.

regions located in the upper income groups witness very limited change in the distribution. This makes one feel that if there is any sign of convergence (or fall in inequalities) during the 1987-2001, it mostly comes from an upgrading of the less developed regions. However 2004-2014 give us a different picture. This time jump in the average per capita incomes is more visible, however considering the shape of the distribution very limited change can be detected. If there is any significant change in the shape, it mostly comes from the enlargement observed in the left-side of the distribution. This makes one think that density of regions with below average income is rising. Keeping these analyses on one side, figure 1 also contains the kernel density functions for relative per capita figures. Once per capita of each region is observed relative to Turkey's per capita income, kernel density functions give us less mobility and change in the shape of the distribution (within both time intervals). Specifically for both set of analyses density of poor regions seems to be stable while there is limited but significant change among the density of the relatively rich regions. More remarkably this pattern is stronger for the post 2004 period as the enlargement and the existence of small hills in the right-tail of the distribution signals the presence of outlier rich regions with an income level far above the average income level of the country.

**Figure 1:** Kernel Density Functions

### 1987-2001 Per Capita GDP

### 2004-2014 Per Capita GDP

### 1987-2001 Relative Per Capita GDP

### 2004-2014 Relative Per Capita GDP



**Source:** TurkStat, Author's own calculations.
**Notes:** Straight Lines represent 1987 and 2004; Dashed Lines represent 2001 and 2014.

In general while descriptive analyses signal a fall in equalities for both time intervals; based on spatial concentration measures as well as kernel density analyses possible clustering and club formations should be examined in more details. Revisiting Karahasan (2015) it is vital to remember that post 2000s have different fundamentals which could not be directly handled by neglecting the distributional dynamics in Turkey. Next sections aim to widen this discussion.

## 3. Markov Chains and Transition Probability

In order to better understand behavior of the distribution fallowing Quah (1993) traditional Markov Chain analysis is implemented. $F_t$ denotes the distribution of income across regions at time $t$ and $F_{t+1}=M.F_t$ represents the evolution by the law of moment. This represents some way of a first order auto-regressive framework. $M$ represents a transition probability matrix in each elements $(i,j)$ indicates the probability that a region in class $i$ in one period ends up in class $j$ in another period (see equation 1). As formalized by Quah (1993) this presentation can be used to understand the future cross section distributions as in equation 2. Note that; as reaction towards the traditional convergence framework accelerates, use of Markov Chain Analysis gains interest among scholars. See Quah (1993) for a cross section of countries, Quah (1996a; 1996b) for US and EU, Lopez-Bazo et al. (1999) and Le Gello (2004) for EU.

$$(1) \qquad M = \begin{bmatrix} P_{1,1} & P_{1,2} & . & . & P_{1,k} \\ P_{2,1} & P_{2,2}. & . & . & P_{2,k} \\ . & . & . & . & . \\ . & . & . & . & . \\ P_{k,1} & P_{k,2}. & . & . & P_{k,k} \end{bmatrix}$$

$$(2) \qquad F_{t+s} = (M.M.......).F_t = M^S.F_t$$

Based on the defined Markov Chain framework two separate transition probability matrices are constructed for 1987-2001 and 2004-2014 intervals (See Table 2 and 3 respectively). [4] Transition probability analysis contains sizable information on the mobility of regions. First of all; diagonal elements of the matrices indicate that there is significant and sizable persistence in the regional income distribution. Note that during the 2004-2014 era persistence of the distribution is higher as for each income class probability of staying in the same income group is higher during the post 2004 period. Even extent of stability is remarkable destination of the remaining mobilities also contains additional information. For instance, during the 1987-2001 era upward mobility probability is around 7% for the poorest set of regions. Same probability is around 6.6% during 2004-2014. Considering the upward mobility of regions for 2nd, 3rd and 4th income group probabilities are 10.4%, 10.2% and 8.8% respectively for 1987-2001 period. Remarkably these

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[4] Note that all Markov Chain Analysis use 5 equal class rule for grouping the regions between different income classes. Rather than using per capita income directly, provincial per capita figures are taken relative to national income. Also note that all analyses are carried out for provincial regions (NUTS III).

probabilities fall during the post 2004 episode. For the same income classes upward mobility probabilities are 6.9%, 7.4% and 5.7% respectively during the 2004-2014 period. On contrary considering downward mobility, regions in the richest income group have 8.8% probability of moving to 4th income group during 1987-2001. Meanwhile during 2004-2014 same probability is just 5.6%. Moreover downward mobility from 4th, 3rd and 2nd income groups are 11.6%, 10.2% and 7.7% during 1987-2001 period respectively. For the same incomes groups probability of observing a downward mobility is 7.6%, 6.8% and 6.9% during 2004-2014. Comparing these sub-periods show that net effect for the 2nd income class is 2.7% of chances of downgrading and 0% of mobility, for the 3rd income group 0% mobility and 1% probability of upgrading and finally for the 4th income class 2.8% chances of downgrading and 1.9% probability of again downgrading (1987-2001 and 2004-2014 respectively). This overall picture is quiet remarkable and shows that given sizable stability of the distribution, remaining mobilities underline a worsening specifically for poor regions during the 2004-2014 period.

**Table 2:** Transition Probability Matrix: 1987-2001

| Past State | Current State | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | 0.929 | 0.066 | 0.005 | 0.000 | 0.000 |
| 2 | 0.077 | 0.819 | 0.099 | 0.005 | 0.000 |
| 3 | 0.000 | 0.102 | 0.797 | 0.102 | 0.000 |
| 4 | 0.000 | 0.000 | 0.116 | 0.796 | 0.088 |
| 5 | 0.000 | 0.000 | 0.000 | 0.088 | 0.912 |

**Table 3:** Transition Probability Matrix: 2004-2014

| Past State | Current State | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | 0.935 | 0.065 | 0.000 | 0.000 | 0.000 |
| 2 | 0.069 | 0.863 | 0.069 | 0.000 | 0.000 |
| 3 | 0.000 | 0.068 | 0.858 | 0.074 | 0.000 |
| 4 | 0.000 | 0.000 | 0.076 | 0.867 | 0.057 |
| 5 | 0.000 | 0.000 | 0.000 | 0.056 | 0.944 |

While transition probability analysis contains sizable information, in order to understand roots of the inequalities they can also be used to produce some specific inequality measures. For instance Monfort (2008) underlines that an indicator of speed can be calculated by using the second eigenvalue $\lambda_2$ obtained from the transition probability matrix. Equation 3 is the half-life of convergence (t°) which is obtained from the transition probabilities.

$$(3) \qquad t^{\circ} = \frac{-\ln(2)}{\ln(\lambda_2)}$$

Similarly stability of the distribution can also be calculated by using the same transition probability matrix. As discussed in Monfort (2008) stability index in equation 4 yields information on the stability of the distribution, where *Tr(P)* is the summation of the all elements of the main diagonal of the matrix (*n* represents number of states). Finally as discussed in Pellegrini (2002) a convergence index is calculated which proposes that probability of movement from the original distribution towards the final one is increasing towards the limiting stationary distribution (See Monfort, 2008 for an application). Results are given in table 4. In general they are supporting the transition mobility analyses. For all measures 2004-2014 period witness higher stability and longer duration for closing half of the gap to the steady states. Moreover convergence index is slightly lower for the 2004-2014 period. These results support the view of the Markov Chain Analysis and indicate that 2000s witness an ongoing polarization despite the overall rise in the per capita income of Turkey.

$$(4) \qquad S = \frac{Tr(P)}{n}$$

**Table 4:** Markov Chain Analysis: Index Calculations

|  | 1987-2001 | 2004-2014 |
|---|---|---|
| **Half-Life of Convergence** | 16.980 | 27.378 |
| **Stability Index** | 0.85 | 0.89 |
| **Convergence Index** | 0.234 | 0.225 |

## 4. Spatial-Lag Markov Chains and Transition Probability

Even Markov Chain Analysis explains the distributional dynamics of the regional incomes; they can also be developed further by considering different dimensions of regional structures. For instance earlier findings on descriptive analysis (See Table 1) show that for both time intervals there is significant amount of spatial concentration. Meaning that, regions that are in close proximity have similar per capita incomes suggesting the formation of clusters. Even these spatial patterns are heavily investigated among regional scholars (See Rey and Montouri, 1999 for application of spatial convergence framework; Le Gallo and Ertur, 2003 for use of Exploratory Spatial Data Analysis) considering spatial dimension of mobility within regional income distribution is mostly neglected. Rey (2001) is a first attempt to consider different spatial variants of the traditional Markov Chain Analysis (See also Rey, 2014). Within this study spatial lag procedure offered by Rey (2001) is going to be preferred and mobility within the distribution will be conditioned

on the relative income level of the neighbor regions (spatial lag and hinterland). [5] Our point is similar to Rey (2001) as we would like to assess whether calculated transition probabilities for the two time intervals (See Table 2 and 3) change when regions are grouped based on the per capita income level of their surroundings. Three groups of neighbors are considered; rich, middle income and poor regions (based on equal number of regions in each income class). Results are given in Table 5 and 6.

First we consider the 1987-2001 period in table 5. Results show that income level of the hinterland effects the stability of the distribution. For instance for the poorest set of regions (income class 1) having poor neighbors gives 5% upward mobility probability (to income class 2). Note that for the same income class probability of upward mobility is around 7% if spatial conditioning is neglected. Interestingly, for those poorest set of regions with middle income neighbors upward mobility chances jumps to 12%. Moreover it is remarkable that for the entire 1987-2001 period having middle income regions decreases the chances to stay in the same income class, notifying that spatial spillovers coming from higher income levels influences the probability of upgrading within the distribution.

**Table 5:** Spatial Markov Chain Analysis: 1987-2001

| Past State | Neighbours Income | Current State | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Rich | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 | Middle | 0.88 | 0.12 | 0.00 | 0.00 | 0.00 |
| 1 | Poor | 0.94 | 0.05 | 0.01 | 0.00 | 0.00 |
| 2 | Rich | 0.00 | 0.91 | 0.09 | 0.00 | 0.00 |
| 2 | Middle | 0.06 | 0.81 | 0.12 | 0.01 | 0.00 |
| 2 | Poor | 0.11 | 0.81 | 0.07 | 0.00 | 0.00 |
| 3 | Rich | 0.00 | 0.04 | 0.75 | 0.21 | 0.00 |
| 3 | Middle | 0.00 | 0.13 | 0.82 | 0.06 | 0.00 |
| 3 | Poor | 0.00 | 0.09 | 0.79 | 0.12 | 0.00 |
| 4 | Rich | 0.00 | 0.00 | 0.04 | 0.84 | 0.12 |
| 4 | Middle | 0.00 | 0.00 | 0.22 | 0.69 | 0.08 |
| 4 | Poor | 0.00 | 0.00 | 0.25 | 0.75 | 0.00 |
| 5 | Rich | 0.00 | 0.00 | 0.00 | 0.08 | 0.92 |
| 5 | Middle | 0.00 | 0.00 | 0.00 | 0.12 | 0.88 |
| 5 | Poor | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |

Next, once 2004-2014 period is investigated we end up more or less similar results. For the poorest set of regions with poor neighbors we identify 3% probability of upward movement towards

5    See Filiztekin and Karahasan (2015) for a different application of spatial Markov Chain Analysis via local spatial statistics of human capital endowments of Turkish districts.

the second income class. During the post 2004 era this probability is around 6.5% if we do not condition for the spatial surroundings. Once again having middle income regions increases the chances of upgrading during this period. However impact of the middle income regions is visible only for the 1st and 4th income classes.

Note that for both time intervals it is difficult to assess the impact of spatial proximity for the richest set of regions. This mostly originates from the relatively stronger persistence of the richest set of regions (See also Table 2 and 3 for details). Still some of the findings stand interesting for the richest set of regions. For instance during the 1987-2001 period, high income regions may fall by one income class with a probability of 12% if they have middle income regions in their surroundings. However during the 2004-2014 period we report that downward mobility of rich regions are lower even if they have middle income or poor regions in their spatial proximity. This finding validates the traditional Markov Chain analysis which shows higher stability among high income regions especially during the post 2004 period.

**Table 6:** Spatial Markov Chain Analysis: 2004-2014

| Past State | Neighbours Income | Current State | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Rich | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 | Middle | 0.56 | 0.44 | 0.00 | 0.00 | 0.00 |
| 1 | Poor | 0.97 | 0.03 | 0.00 | 0.00 | 0.00 |
| 2 | Rich | 0.00 | 0.81 | 0.19 | 0.00 | 0.00 |
| 2 | Middle | 0.06 | 0.88 | 0.06 | 0.00 | 0.00 |
| 2 | Poor | 0.11 | 0.85 | 0.04 | 0.00 | 0.00 |
| 3 | Rich | 0.00 | 0.05 | 0.86 | 0.09 | 0.00 |
| 3 | Middle | 0.00 | 0.07 | 0.88 | 0.05 | 0.00 |
| 3 | Poor | 0.00 | 0.09 | 0.77 | 0.14 | 0.00 |
| 4 | Rich | 0.00 | 0.00 | 0.05 | 0.85 | 0.10 |
| 4 | Middle | 0.00 | 0.00 | 0.18 | 0.79 | 0.03 |
| 4 | Poor | 0.00 | 0.00 | 0.02 | 0.96 | 0.02 |
| 5 | Rich | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |
| 5 | Middle | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 5 | Poor | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |

A final remark which would clarify the impact of neighbors' income level is to summarize the transition probabilities based on the pre-defined indices. Results of the Markov Chain Index calculations based on spatial conditioning are given in table 7. Stability index shows that regions with rich neighbors exhibit higher mobility during 1987-2001; whereas it is the regions with middle income neighbors showing higher mobility during the 2004-2014 period. This finding seems to contradict with the initial remarks from previous set of transition probability analyses (from spatial version) that having middle income regions increases the chances of upward

mobility. However note that stability index calculations do not control for the direction of the relationship, rather tends to describe the general pattern. We believe convergence index calculations also contain a similar problem as for spatial conditioning analysis convergence index is interestingly higher for the regions with poor neighbors. This contradiction originates from the fact that convergence index is unable to differentiate the mobility between mean of the distribution and the $2^{nd}$ and $4^{th}$ income classes. That is a downward mobility from the $4^{th}$ income class to the mean of the distribution can be over valuing the convergence index. Therefore final remarks on the convergence should be done via half-life of convergence analysis which aims to identify the necessary time period to reach the half way to the long run steady state income levels. Results underline that having lower income neighbors increases the necessary time period to reach to the steady state income level. Remarkably for the 2004-2014 period regions with middle income and poor neighbors need more than 50 and 80 years respectively to close half of the gap between their current income level and long run steady state income levels. These results together with the transition probability analysis of the spatial lag framework underline that poor regions are getting more isolated during the 2004-2014 period. In general chances of escaping from the lowest income groups are falling compared to 1987-2001 period. Given rising per capita income of Turkey during 2000s, this reminds the concerns on the extent to which economic growth is distributed regionally.

**Table 7:** Spatial Markov Chain Analysis: Index Calculations

| Neighbours Income | 1987-2001 | | |
| --- | --- | --- | --- |
| | Stability Index | Convergence Index | Half-Life of Convergence |
| **Rich** | 0.68 | 0.192 | 9.426 |
| **Middle** | 0.82 | 0.279 | 8.769 |
| **Poor** | 0.82 | 0.434 | 10.480 |
| **Neighbours Income** | **2004-2014** | | |
| | Stability Index | Convergence Index | Half-Life of Convergence |
| **Rich** | 0.87 | 0.232 | 10.480 |
| **Middle** | 0.82 | 0.311 | >50 |
| **Poor** | 0.89 | 0.373 | >80 |

## 5. Conclusion

Turkish Statistics Office announced new GDP series in 2016. In addition to the change in the GDP calculation methodology, an important dimension is the announcement of regional GDP figures (for post 2001). Given that last available data on regional GDP belongs to 2001, economists as well as social scientist from different disciplines are highly enthusiastic on using the new data set

to explore different dimensions of regional socio-economic environment in Turkey. Meanwhile given the change in the GDP calculations' methodology there is an ongoing discussion on the comparability of the previous data set (1987-2001) with the new data set which covers the 2004-2014 period. In order to escape from the possible biases these two time intervals are investigated separately and path of regional inequalities are explored by focusing on individual (and separate) results obtained from both time intervals.

Results obtained from traditional Markov Chain analyses show that regional disparities are persistent in both time intervals. However a careful observation also indicates that distributional dynamics are quite different. Even stability persists from 1987-2001 to 2004-2014 poor regions are getting more isolated as their chances to move upwards within the regional income dispersion is declining. This finding is also highlighted once the proximity of regions to their steady state income levels is investigated. After 2004 regions start to need more time to close half-way of the gap between their initial and long run income levels. These findings become more remarkable once spatial conditioning is considered. In general for both time intervals spatial proximity significantly matters. Regions with low income level, especially spatially linked with some set of poor regions are getting worse-off and losing their chances to move towards a higher income group. Note that this pattern is stronger during the 2004-2014 period. Once the duration towards the steady state is investigated results highlight that those regions (mostly low income regions) with middle income and poor neighbors are getting more distant to steady state income levels. This pattern validates the concerns on clustering and club formation both of which is linked with persistence of regional inequalities. Therefore even average regional incomes as well as the national income is rising for the post 2001 period, results underline the presence of continuous income duality. Given objectives of increasing the extent of inclusive growth for sustainable development, this pattern should also be discussed as intolerable from the economic policy point of view.

To our knowledge investigating the post 2000s on regional basis as well as implementing an augmented version of transition probability analysis for Turkey is quiet new. Therefore an important expectation (remaining objective) of this study is to help in opening up new debates in order to explore and understand different dimensions of regional disparities for the post 2000s in Turkey.

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