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Mapping Left-Behind Regions: A Classification of Regional Disparities in Türkiye

Geride Kalmış Bölgelerin Haritalanması: Türkiye'de Bölgesel Eşitsizliklerin Sınıflandırılması

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Öz

Bu çalışma, ekonomik marjinalleşme ve siyasi memnuniyetsizlik tartışmalarında öne çıkan "geride kalmış bölgeler" kavramı üzerinden Türkiye'deki bölgesel eşitsizlikleri incelemektedir. ABD, Birleşik Krallık ve Avrupa'daki geride kalmış bölgeler üzerine kapsamlı bir literatür olmasına rağmen, Türkiye bu bağlamda yeterince araştırılmamıştır. Bu çalışma, Geride Kalmışlık Endeksi (LBI) ve K-means kümeleme analizi kullanarak Türkiye'nin NUTS2 bölgelerini uzun vadeli ekonomik ve demografik eğilimlere göre sınıflandırmaktadır. Bulgular, Doğu-Batı ayrımının belirgin olduğu ve bazı bölgelerin ekonomik olarak geri kaldığı kalıcı bölgesel eşitsizlikleri ortaya koymaktadır. Avrupa'dan farklı olarak, Türkiye'deki geride kalmış bölgeler sanayisizleşme yerine ekonomik durgunluk, nüfus azalması ve dış göç ile tanımlanmaktadır. Sonuçlar, bölgesel eşitsizlikleri gidermeye yönelik hedefe yönelik politikaların gerekliliğini vurgulamaktadır. Bu çalışma, Türkiye'nin kendine özgü sosyo-ekonomik yapısını ortaya koyarak geride kalmış bölgeler üzerine küresel tartışmalara ampirik katkılar sunmaktadır.

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Abstract

This study examines regional disparities in Türkiye through the concept of "left-behind places," which has gained prominence in discussions on economic marginalization and political discontent. Despite the extensive literature on left-behind regions in the U.S., U.K., and Europe, Türkiye remains understudied. Using a Left-Behind Index (LBI) and K-means clustering analysis, this research identifies and classifies Türkiye's NUTS2 regions based on long-term economic and demographic trends. The findings reveal persistent regional inequalities, characterized by an East-West divide and the economic underperformance of certain regions. Unlike Europe, where deindustrialization plays a crucial role, Türkiye's left-behind regions are primarily defined by economic stagnation, population decline, and outmigration. The results underscore the need for targeted regional policies to address disparities. This study contributes to the broader discourse on left-behind places by providing empirical insights into Türkiye's unique socio-economic landscape.

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1. Introduction

Rising regional inequalities gained prominence in the aftermath of political events such as the Brexit referendum, Trump's election victory and rising right-wing populist votes in Europe. These events bring out the concept of left-behind into discussion, highlighting communities, and places that have experienced economic decline and marginalization, particularly in post-industrial regions and rural areas. These political events have underscored the direct link between rising regional inequalities and the concept of left-behind places, as economic decline and marginalization in these regions have fuelled dissatisfaction, shaping voting behaviours and reinforcing support for populist movements. These places often face challenges such as declining industries, limited access to job opportunities, and social unrest, leading to political shifts and increased calls for targeted policy interventions (MacKinnon, 2021). In this context, there have been many academic studies on the definition and identification of left-behind regions, especially in the USA, the UK and the EU.

Despite this growing literature and ongoing interest, there is a lack of research on the debate on left-behind places in Türkiye. This paper synthesizes theoretical and empirical work on left-behind places and introduces two new classifications of left-behind places in Türkiye's NUTS2 (Nomenclature of Territorial Units for Statistics) areas. In short, left-behind region classifications for Türkiye follow the other regional disparities patterns, pointing out the east-west divide and a contrast between metropolitan regions and left-behind regions. This study confirms significant long-term regional inequalities in Türkiye, with a clear divide between better-performing and left-behind regions. Left-behind places are characterized by economic underperformance, population decline, outmigration, and low-density settlement patterns, aligning with broader global discussions on regional disparities. However, unlike Europe, deindustrialization is not a defining factor in Türkiye's left-behind regions. Understanding the causes of being left-behind, as well as the economic, social, and political consequences, appears as a future direction for these studies.

The remainder of the paper is structured in four parts. After this introduction, the next section looks at left-behind places conceptualisations. The paper then turns to the Turkish context and conducts Left-Behind Index (LBI) and K-means clustering analysis for left-behind classification and mapping. The last section presents discussions and conclusions.

2. What are Left-behind Places?

The concept of left-behind places is complex and multidimensional, as there is no single, uniform narrative that defines what constitutes a left-behind place (Eisenberg, 2024). In attempts to define, questions arise about who or what is left-behind, where and when these places have emerged, how and why they have fallen behind, and relative to whom they left-behind. Different approaches attempt to explain the economic, demographic, social, and political factors necessary for a place to be considered left-behind, as well as the level of economic decline or social disadvantage required for this label.

Therefore, defining left-behind places is not an easy task. Moreover, as Pike et al. (2024: 1171) pointed out, "identifying and specifying definitions and meanings of the term and its spatial imaginary

requires consideration of the objects and subjects of ‘left-behind’ conditions, its geographies and scales, temporalities, and causes and explanations.” This suggests that left-behindness can occur at multiple levels—individual, regional, national— each with unique economic, social, and political implications and does not always share the same characteristics across different contexts. This study takes subnational, regional levels of left-behindness and adopts MacKinnon's (2023: 1918) definition that "left-behind acts as a shorthand label for places experiencing economic stagnation or decline, particularly post-industrial districts and rural areas marginalised by the concentration of skilled knowledge economy jobs in cities."

Left-behind places matter for several reasons. Economically, their underdeveloped potential hinders both local and national economic growth, reducing productivity, wages, and job opportunities while increasing disparities that complicate broader macroeconomic management (Fiorentino et al., 2024). Socially, the lack of opportunities and relative disadvantages faced by these regions exacerbate poverty, poor housing, and social exclusion, creating a cycle of deprivation (Fiorentino et al., 2024). Moreover, Tomaney et al. (2024) emphasize the emotional impact of losing social infrastructure and efforts to rebuild it as a source of hope and community resilience.

This growing social and economic exclusion also plays a critical political role. Thus politically, left-behind places matter because their growing sense of exclusion and marginalization fuels discontent, driving shifts toward anti-establishment movements that promise to restore economic opportunities (Fiorentino et al., 2024). According to Ejrnæs et al. (2024), the loss of pre-existing social infrastructure and associated hostility arising from the idea that the regions in one's relative comparison enjoy undeserved benefits can cause a political backlash by creating a sense of injustice and neglect. Therefore, economic hardship, social fragmentation, and cultural alienation in left-behind places have become significant drivers of political backlash, reinforcing support for populist and anti-establishment movements.

These different aspects of left-behindness and diversified implications also suggest that tackling left-behind places requires a comprehensive understanding of factors such as economic growth, equality, political trust, and regional belonging on addressing left-behind places.

There are also different conceptualisation and classification dimensions of left-behindness. Given the complex nature of left-behind places, it becomes essential to establish a clear conceptualization—defining what is meant by the term—and an identification methodology to empirically recognize and measure these places. There are various approaches to understanding what left-behind places mean abstractly, how their main components are defined, and the theoretical frameworks that guide these definitions. The concept of left-behind places is shaped by geography, with varying scales, causes, and impacts that depend on the specific regional context. Therefore, some studies focus solely on economic indicators, while others include social, political, and cultural factors.

First of all, studies consider economic decline and uneven spatial development related to long-term decline or slower growth compared to national averages as the underlying idea of left-behind places often relates to long-term decline or slower growth compared to national averages. Left-behind regions are emerging as the losers of globalization (Gordon, 2018; Rodrik, 2018), on the disadvantaged side of

rising inequality (Pike et al., 2024: 1170; World Bank, 2009), as a result of spatial polarization resulting from deindustrialization and the concentration of the knowledge economy.

Connected to the deindustrialisation point, left-behind places are characterised by loss of industry (Rodríguez-Pose, 2018). Moreover, these regions typically experience low productivity and low growth rates (Dobrzanski et al., 2024), and high rates of outmigration among younger and more educated people (McCann, 2020).

MacKinnon et al. (2024: 1162) also mention about conceptualisation of left-behind places through peripheralisation of inner peripheries of former industrial districts, coastal locations and rural areas in addition to traditional remote rural peripheries. These areas are also highlighted by Davenport and Zaranko (2020) as isolated and left-behind areas. Fiorentino et al. (2024:5) also highlighted remoteness as a key factor contributing to the economic decline of rural and isolated areas, placing them among the growing number of left-behind places affected by global economic shifts over the past forty years. Leibert and Golinski (2016) consider four dimensions of peripheralisation: out-migration of young, highly qualified, and well-educated people; disconnection from political and economic decision-making hubs; dependence on central areas, where they have little influence regarding investments or the distribution of funds; and lastly stigmatisation which means the negative labelling and portrayal of peripheral regions ultimately leading to a cycle of decline and reinforcing perceptions of hopelessness and failure.

More recently, left-behind places conceptualised through (Diemer et al., 2022) development trap which defines regions 'experience a relative decline in economic growth, employment, and productivity relative to their neighbours and to their own past economic trajectories' (Rodríguez-Pose, Dijkstra, et al., 2024). According to Rodríguez-Pose et al. (2024), development traps exacerbate political unrest, making residents of such areas significantly more inclined to vote for hard or moderate Eurosceptic political parties. Moreover, as economic stagnation persists for a longer time, support for parties opposing European integration grows stronger.

This conceptualisation also broadened by moving beyond a narrowly economistic of reading left-behind places with how regions are marginalised by the combined effects of economic, social and policy systems which impose barriers and exclusions on the people living and working there (Tomaney et al., 2024). Moreover, according to Fiorentino et al. (2024: 1) left-behind places are characterised by economic, social, or cultural disadvantages, especially in comparison to other regions, cities, towns, or communities that do not face these challenges. Comparing itself to others becomes an important part of the concept. In total lower or declining living standards become part of left-behind places as in declining areas.

Lastly, beyond economic, demographic or infrastructural characteristics, the concept of left-behindness also encompasses psychological and emotional dimensions, as these regions' prolonged decline often fosters feelings of frustration, fear of loss, and dissatisfaction. Hertrich and Brenner (2024) argue that feelings of being left-behind are driven by a lack of autonomy and low appreciation within these regions. These emotional factors, such as fear of loss and dissatisfaction, are often more decisive in shaping the perception of being left-behind. So other than economic hardship, emotional factors,

feelings of relative deprivation and concerns about maintaining economic security create regional resentment (Vasilopoulou and Talving, 2024) and feelings of being left-behind.

Long-term decline and austerity policies following the financial crisis have further increased feelings of neglect and abandonment (Essletzbichler et al., 2018). These feelings of being emotionally, economically, socially and/or politically ignored or neglected, combined with declining civic engagement, further alienate the residents of left-behind places from political participation. The result of all this together, as Rodríguez-Pose (2018: 4): "In recent years the places that 'don't matter' have increasingly used the ballot box (and, in some cases, outright revolt) to rebel against the feeling of being left-behind; against the feeling of lacking opportunities and future prospects." However, where feelings of being left-behind and ignored are reflected is not within the scope of this study. In the next section, the paper presents the empirical context of Türkiye.

3. Data and methods

3.1. Türkiye As an Empirical Context

As Fiorentino et al. (2024:4) stated: “Whatever the geography chosen, the general argument is that the people who live in a ‘left-behind’ area do not share the same economic opportunities, social amenities or quality of life as others in the areas around them or in the nation taken as a whole.” Starting from the idea that the characteristics of being left-behind will not be the same everywhere and at all times, it is natural for Türkiye, with its different economic trajectories and varying levels of development, to diverge in this sense from examples in dominated literature of the Global North. Different regions experience varying levels of left-behindness depending on their regional and national contexts, the causes of left-behindness differ across regions, and the impacts of being left-behind vary based on the unique experiences of the inhabitants in each region (Jessen, 2024: 202). For example, while there is a relationship between deindustrialization and left-behind regions in developed countries (MacKinnon et al., 2024), according to Fierro et al. (2024), in Latin America, this has been characterised by a historical pattern of persistent urban segregation. This makes it important to reveal the place- and context-dependent meanings of the concept and the political discontent's reflection in Türkiye's specific case. However, mapping left-behind places, revealing underlying causes, and analysing political results are extensive tasks that go beyond the scope of this study. Instead, this study specifically focuses on identifying and mapping left-behind places in Türkiye based on the literature, providing a foundation for future research on their causes and political implications.

In recent decades, many countries have experienced growing income and wealth inequality, leading to heightened social discontent and increasing political polarization (Dijkstra et al., 2020; MacKinnon et al., 2024; McCann, 2020). Moreover, spatial inequality is crucial as it undermines social bonds, obstructs governance and destabilises the country (Rodríguez-Pose and Tselios, 2010; Tomaney et al., 2010). In this climate, Türkiye strikes as one of the most unequal countries. According to the OECD (2020: 55) regional inequality index in gross domestic product (GDP) per capita, in the large regions (TL2), Türkiye is the second most unequal country. According to the index on small regions (TL3) result is more striking and Türkiye is the most unequal country.

There are studies on regional inequality in Türkiye. Aşık et al. (2023) provide a historical analysis of regional disparities since 1913, showing patterns of β-convergence and an evolving N-shaped trend in per capita value added while emphasizing the persistent economic lag of the East. Karahasan et al. (2016) focus on market potential as a key driver of regional wage disparities, demonstrating that economic opportunities are more concentrated in western regions, exacerbating inequalities. Korkmaz et al. (2024) examine the role of economic complexity, revealing that while it positively affects regional growth, the East struggles to capitalize on these gains due to structural imbalances.

Nevertheless, the discussion of left-behind places within the context of regional inequality is limited. Among few studies exploring Türkiye around left-behind places discussion, Özatağan and Eraydin (2024) explores the twists and turns that characterise the political responses of some left-behind places, using the example of Zonguldak. Moreover, Çınar (2023) investigates 26 NUTS 2 regions across Türkiye from 2014 to 2021 in the context of development traps. Another study (Comim et al., 2024: 176) analysed 451 NUTS 2 regions in 32 European countries, and identified regions in Türkiye as the most left-behind, along with regions in countries Bulgaria and North Macedonia.

According to Jessen's (2024: 205) bibliometric analysis of 43 papers on the definition of left-behind places from 2016 to 2022, 46.5% of the investigated papers focus on the UK, papers on the EU and US follow it. This indicates that while the concept of left-behind places has been widely explored in other regions, particularly the UK, EU, and US, there is a noticeable gap in the Turkish context, with no study directly addressing the definition and identification of left-behind regions within the country.

3.2. Data and Methods

In this regard, this paper takes NUTS2 regions as an analytical unit. The first reason for that is as mentioned above Türkiye suffers from spatial inequality and is among the most unequal countries in terms of NUTS2 regions. Secondly, in order to capture the impact of long-term decline, it is necessary to analyse data covering a longer period and NUTS2 offers better data availability. There are two dates widely mentioned in the literature on the emergence of left-behind places. First, economic policies based on the neoliberal approach have led to greater territorial polarization and widespread left-behind regions since the 1980s (Fiorentino et al., 2024:3; Rodríguez-Pose, et al., 2024). The other date focuses on the debate on increasing regional inequalities after the 2008 financial crisis and refers left-behind as places where citizens whose living conditions deteriorated after the 2008 Global Financial Crisis (Kemeny and Storper, 2020; Martin et al., 2022; Morettini and Compagnucci, 2024; Pike et al., 2024).

Two different methods have been used for the in-depth examination and identification of left-behind regions in Türkiye. In addition, two separate methods analyse two different historical periods and address the different dates that have been proposed in the literature for the emergence of left-behind regions. This allows us to see the impact of different periods on the definitions, while at the same time allowing us to see the impact of some data that is not available from 1980 to today but available from 2008.

3.2.1. Left-behind Index

In the conceptualisation section, the paper mentioned about the different conceptualisation of left-behindness and how definition efforts move from the economic dimension to the social and political dimension. As stated in the literature, "there is no single set of factors that characterise a 'left-behind' place" (Davenport and Zaranko, 2020: 315) or "what characterizes places as 'left-behind' cannot simply be expressed in a single or small number of indicators" (Pike et al., 2024: 1171) but applying these dimension to quantitative work is limited by data availability in terms of statistical unit or time frame. In order to overcome this issue, I combine different methods. In this context, I follow Connor et al.'s (2024) method of measuring left-behindness focusing on the economic dimension. With K-means clustering method, I expand the dimension.

As outlined in Connor et al. (2024), the four steps for classifying left-behind places are as follows: This analysis covers the time period of 1980-2023 as 1980 was stated as a turning point for rising inequalities (Storper, 2018). Firstly, for each time period in the study, I calculate the percentile rank of each region across four dimensions to cover broad economic underperformance and demographic loss: population change, GDP per capita, total employment change rate, and unemployment rate. Population decline is a common and crucial characteristic, as regions experiencing long-term demographic shrinkage often face economic stagnation and signal outmigration (Pinilla and Sáez, 2021; Rodríguez-Pose, 2018). Low GDP per capita serves as an indicator of limited economic growth, structural economic weaknesses poor productivity and weaker regional development (Dijkstra et al., 2020; Iammarino et al., 2019). Additionally, declining total employment signals structural economic weaknesses, particularly in regions struggling to adapt to economic transitions (Rodriguez-Pose et al., 2020). Finally, high unemployment rates highlight labour market challenges, making them a key metric in identifying left-behind areas (Pike, 2022). These indicators provide a systematic approach to mapping and analysing left-behind regions across different geographic and economic contexts. All data was retrieved from the Annual Regional Database of the European Commission's Directorate General for Regional and Urban Policy (ARDECO).

The factors that determine left-behindness here are different than Connor et al. (2024) except for the unemployment rate. One of the reasons for that is data availability for Türkiye but more importantly, factors this study handled are commonly stated as features of left-behind places. Therefore, these factors help capture how regions' economic conditions have changed over time.

To calculate the index, I use the average rank of these four dimensions to create the Left-behind Index for each region, i represents the NUTS2 regions in Türkiye, and t represents the years (from 1980 to 2023 or any other time period):

$$LBI_{it} = \frac{PopChange_{it} + GDPpc_{it} + EmpChgRat_{it} + UnempRate_{it}}{4}$$

After calculating the LBI for each region, the analysis ranks the regions based on their LBI and identifies those that fall below the 25th percentile as left-behind at that specific point in time. Lastly, I classify places into one of four trajectories—long-term left-behind, recently left-behind, no longer left-behind, or never left-behind—based on their LBI at both the starting and ending points of the study.

Long-term left-behind means regions which are below the 25th percentile at both the start and end points. Recently left-behind indicate regions which are above the 25th percentile at the start but below it at the end. No longer left-behind shows regions which are below the 25th percentile at the start but above it at the end. Lastly, never left-behind regions are always above the 25th percentile.

While the use of the 25th percentile provides a clear and straightforward way to identify left-behind regions, it does have limitations. Firstly, it has low sensitivity in categorising regions close to this percentage. Whilst these interpretations offer valuable insights, the 25th percentile threshold used to classify left-behind regions is arbitrary and may not fully capture regions that hover just above or below this cutoff. Regions close to the threshold may show significant signs of socioeconomic distress without being labelled as left-behind, while others near the threshold could be misclassified. To overcome this, I also interpret how different percentiles affect the classification.

Secondly, this method assumes a static threshold and does not take into account changes that occur in a region without changing class, which can mask regions that have experienced subtle yet significant shifts in their development trajectory. To overcome this, the paper also analyses the changes within each region. Lastly, the index focuses exclusively on economic indicators but there could be other social, environmental and political factors as we discussed in conceptualisation. These social and cultural factors may provide a more holistic understanding of regional disparities and left-behind places. To overcome these limitations, this paper conducts K-means clustering as a complementary to the percentile-based classification. By applying clustering, regions can be grouped based on their overall patterns and trajectories over time, rather than relying on a fixed percentile threshold. This approach allows for the identification of regions that may not fall below the 25th percentile at any given point but still share similar development patterns with regions that are consistently underperforming. Together, these approaches enable a more comprehensive classification of left-behind regions, factoring in both relative performance and the long-term trajectories of regions in Türkiye. Before presenting the results, the second method is introduced in the following section to ensure a smoother flow in the presentation of results and discussions.

3.2.2. K-means Clustering

K-means clustering employs methods to group observations into distinct clusters based on their features, aiming to minimize the overall variation within each cluster by reducing the deviation of observations from the cluster's average (Jessen, 2024: 209). This method goes beyond the LBI index by using longitudinal data rather than percentile ranks at two specific points in time and adding more variables to cover more dimensions of left-behindness. The K-means clustering method allows for the analysis of longitudinal data for 14 years, from 2008 to 2022 which captures the emergence of left-behind places as the nexus between the increase in regional inequality and the problem of political stability, using seven more variables which broaden economic and demographic dimension and add social and political dimensions in addition to four used in LBI.

In addition to those, this analysis uses other economic factors like economic growth as declining or stagnating growth rates indicate a region’s struggle to keep pace with broader economic trends (Storper, 2018) and industrial employment change as former industrial areas and industrial employment

also associated with left-behind places (Martin et al., 2021). Other than that demographic factors such as an ageing population, population density and net migration further highlight left-behindness, as regions with high proportions of people over 65 often suffer from brain drain and a shrinking labour force (Dijkstra et al., 2020). Population density is an important factor, as low-density areas tend to have weaker economic agglomeration effects, reduced infrastructure investment, and limited access to services, all of which contribute to economic marginalization (Rodríguez-Pose, 2018). Moreover, net migration is a crucial determinant of left-behind status, as persistent outmigration signals a lack of opportunity, whereas positive net migration may indicate economic renewal (Pike et al., 2024). Lastly, to go beyond the economic and demographic dimensions and have a more holistic approach, this paper uses education rate and turnout. The share of the population with tertiary education is a key determinant of regional resilience, with lower rates often indicating skill shortages and a weaker capacity for economic adaptation in knowledge-intensive industries (Goodwin, 2011; Rodrik, 2018). Lastly, voter turnout serves as a socio-political indicator, with lower participation rates suggesting disengagement, disillusionment, and a perceived lack of political representation, which are common in economically struggling regions (De Ruyter et al., 2021; Rodríguez-Pose et al., 2021). While these variables provide a solid basis for identifying left-behind places, other factors may also be relevant depending on the specific context. However, this is limited by data availability. Population change, GDP per capita, total employment change, unemployment rate, people over 65, GDP growth and net migration data are retrieved from the ARDECO database. In addition to these, industrial employment change, population density, tertiary education rate, and turnout as variables which are available at the OECD regional statistics database.

To conduct this method: firstly, before applying the K-means clustering analysis, I standardise the variables to ensure they are on the same scale, so that no single variable dominates the clustering process, and they contribute equally to the clustering process.

Also, before running the K-means clustering, the paper's approach uses the elbow method to determine the number of clusters which helps determine the optimal number of clusters. Each cluster represents distinct regional development trajectories. The idea is to run this algorithm for various numbers of clusters and compute the sum of squared errors within each cluster. WCSS calculates the total distance of each data point to its cluster centre; the smaller the WCSS, the greater the fit within a cluster. If one continues adding more clusters, the WCSS will decrease since the data will then be divided into even smaller groups. In the elbow method, the number of clusters is plotted against WCSS. The initial decreases in WCSS are sharp, then after some point—the "elbow"—the drop in WCSS is gradual. This "elbow" is the best number of clusters beyond which adding more and more does not significantly improve. In our case, the elbow method (Figure 1) indicates the optimal cluster number as 4.

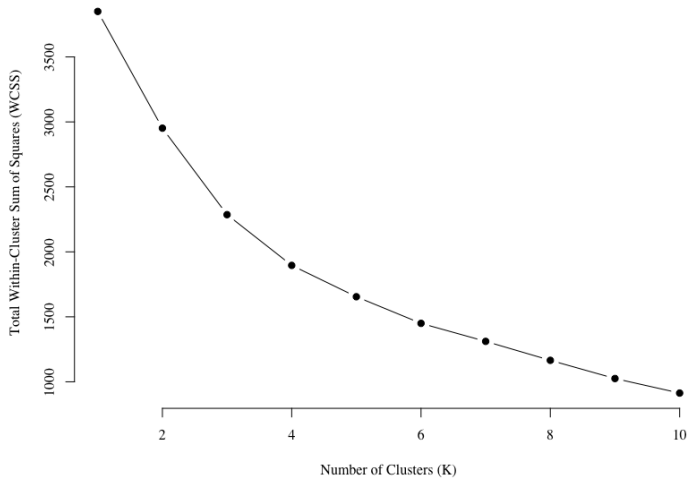

Figure 1. Elbow method for optimal K

After running the K-means clusters we have a chance to compare clusters to understand the relative position of each group of regions, define left-behind regions according to clusters and compare the results with LBI.

3.2.3. Results

The result of the LBI classification of NUTS2 regions of Türkiye appears in Figure 2. The Left-Behind Index Figure gives a detailed picture of economic trajectories in the NUTS2 regions of Türkiye from 1980 to 2023. This figure presents a view of the LBI values of each region, how they changed in years and which regions remained stable, improved or deteriorated. The plots depicting LBI values for the NUTS-2 regions of Türkiye from 1980 to 2023 reveal significant regional variation in economic performance and trends.

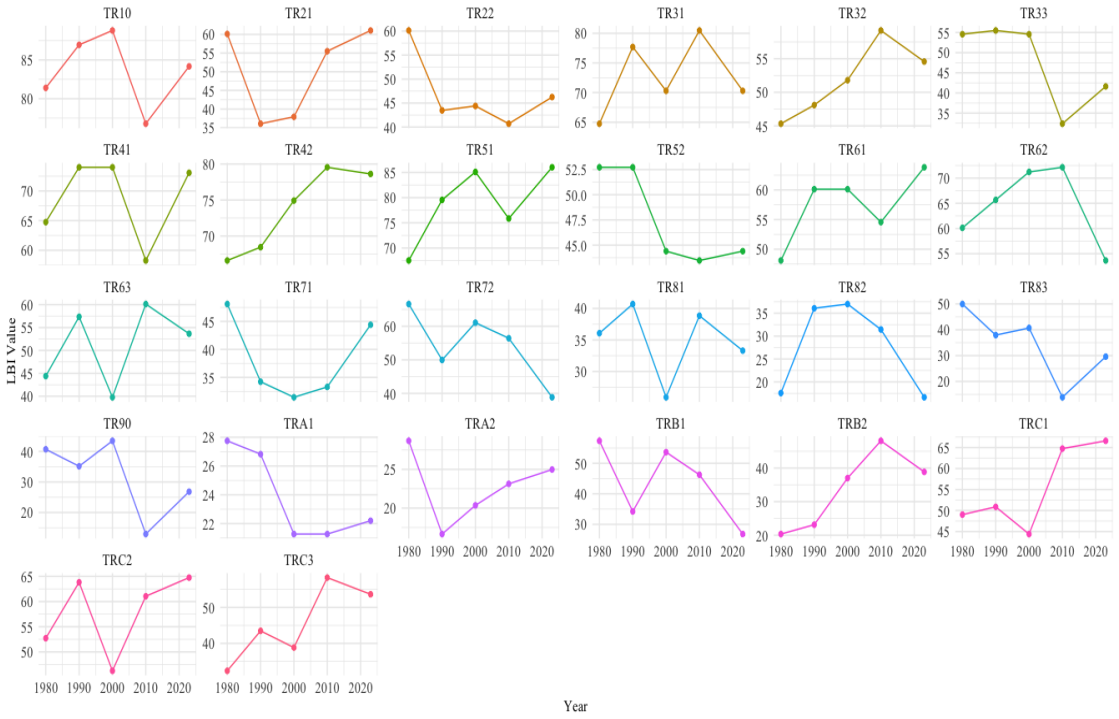

Figure 2. Left-behind index (LBI) for NUTS-2 regions of Türkiye (1980-2023)

First, the striking result is most regions classified as 'never left-behind' which represents those that have always remained above the 25th percentile of LBI in 1980, 1990, 2000, 2010 and 2023. Examples of such regions are TR10, TR31, TR41, and TR51. 20 out of 26 NUTS2 regions appear to be 'never left-behind'. Although considered a positive indicator in this classification, this group shows great variability within itself. Therefore, we cannot claim that all regions in this group have positive indicators and are immune to challenges. Another issue is about using the 25th percentile for identification of 'never left-behind' regions. The reason for using this percentile is that it is used in Connor et al. (2024) study. However, to assess the sensitivity of the classification and examine alternative regional rankings, the 33rd percentile is also considered. When we check the regions in this context, 4 more regions (TR33, TR71, TRB1, TRC3) appear as left-behind in one of the given years. As a result, 16 out of 26 NUTS2 regions appear to be 'never left-behind'.

'Long-term left-behind' regions are defined as those regions that have lagged economically throughout the entire period of the current study. TRA1 (Erzurum, Erzincan, Bayburt) and TRA2 (Agri, Kars, Igdir, Ardahan) appear as 'long-term left-behind' regions which showed persistently low LBI scores between 1980 and 2023. If we loosen the percentiles, TR82 (Kastamonu, Çankiri, Sinop) also can be classified as a 'long-term left-behind' region.

In contrast, 'recently left-behind regions', TRB1 (Malatya, Elazig, Bingöl, Tunceli), TR83 (Samsun, Tokat, Çorum, Amasya) and TR90 (Trabzon, Ordu, Giresun, Rize, Artvin, Gümüshane) are the regions which were relatively healthier economically in 1980, as shown by an LBI score above the 25th percentile, yet by 2023 had fallen into left-behind category. It follows from this that these areas have suffered an economic decline over the last few decades. Of those, two of the regions, TRB2 (Van,

Mus, Bitlis, Hakkari) and TRC3 (Mardin, Batman, Sirnak, Siirt), are indicated as 'no longer left-behind'; that means it moved in a positive direction. In the year 1980, these were relatively economically poor regions, but they improved their standing to above the 25th and even 33rd percentile in 2023.

There could be other interpretations other than these classifications. First of all, the best-performing regions align with the populations of their constituent provinces, regions with higher populations are the best-performing regions. TR10 (Istanbul) and TR51 (Ankara) stand out as best performers. Other better regions gathered around Istanbul. Secondly, each plot shows that region's left-behind index trajectory which could provide valuable insights, for example, the LBI performance of a region may be overshadowed by the fact that there is no change in the grouping such as while TR22 (Balikesir, Çanakkale) subject to decline without a change in classification, TR42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova) shows a good improvement. Therefore, LBI change could offer a nuanced story, as can be seen in Figure 3, TRB1 (Malatya, Elazig, Bingöl, Tunceli), TR72 (Kayseri, Sivas, Yozgat), and TR83 (Samsun, Tokat, Çorum, Amasya) are the regions which have seen the largest decline but still labelled as 'never left-behind'in the context of 25th percentile. Another important point is that 13 out of 26 regions have negative LBI change. Lastly, Regions like TRC3 (Mardin, Batman, Sirnak, Siirt), TR51 (Ankara), and TRB2 (Van, Mus, Bitlis, Hakkari) have seen the most significant improvements in LBI change. This figure points to an improvement primarily in the southeastern regions. Besides, the eastern, northern and interior regions are coloured with negative change. Finally, another striking feature is the positive change in the major cities and the southern coastal belt.

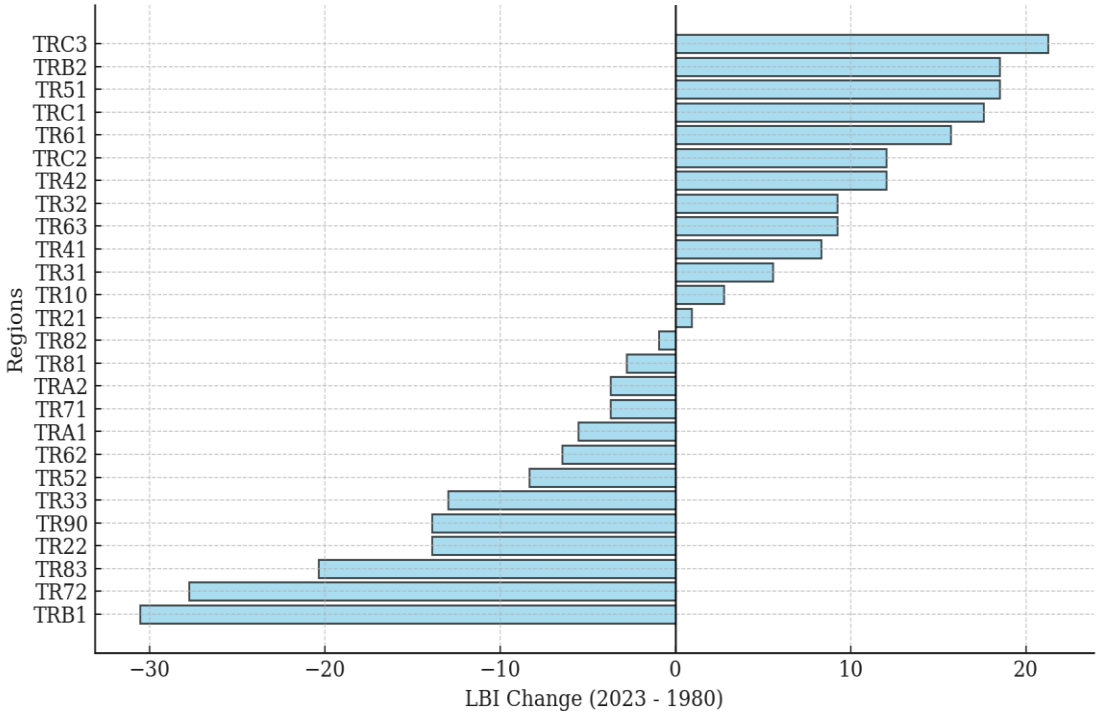

Figure 3. Change in LBI from 1980 to 2023 by region

To expand these results, understanding of left-behind places in Türkiye and to overcome the shortcomings mentioned in the Left-behind Index section, this method is supported with K-means

clustering analysis. This analysis groups regions into clusters based on their longitudinal development patterns with additional dimensions to economic indicators used in LBI, such as net migration, educational attainment and political turnout, offering a multidimensional understanding of left-behindness and more nuanced insights into regional characteristics.

The result of K-means clustering analysis is shown in Figure 4. According to it, the clusters are relatively well-separated, meaning that K-means has effectively divided NUTS2 regions into distinct groups. This suggests the clustering is meaningful and that each group has distinct characteristics based on the variables the analysis used.

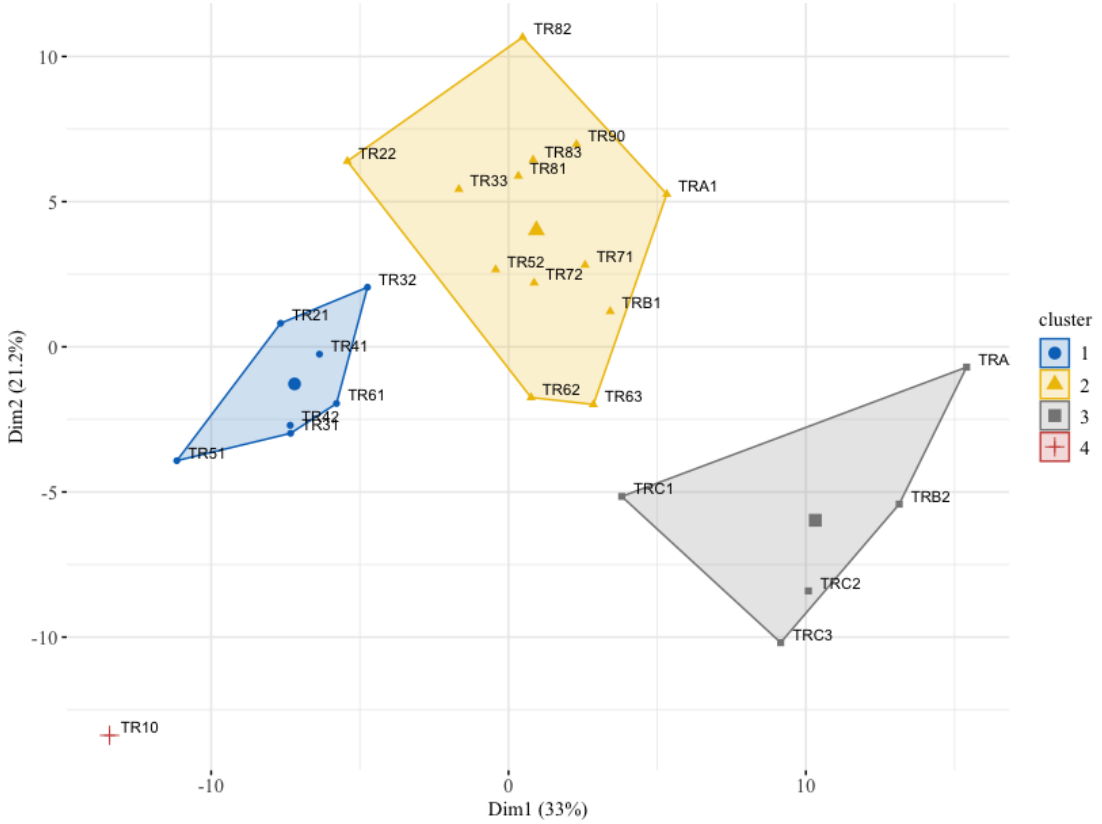

Figure 4. Clusters plot of Türkiye NUTS2 Regions

First of all, cluster ranking does not specify any hierarchy. According to the analysis, the variables that had the highest impact on the clustering are GDP per capita, net migration rate, turnout, and total employment change rate, as these variables show clear differences between the clusters.

When we analyse clusters separately, Cluster 1 is visually distinct and occupies a small, tightly packed space, thus it consists of regions that have similar characteristics, but with relatively lower variation among them. This cluster generally shows higher than average values across variables, suggesting better performance in various indicators. These are the highest proportion of the population aged 65+, highest GDP growth rate, highest positive total employment change rate, highest positive industrial employment change rate and lowest unemployment rate. Lastly, Cluster 1 shows it shares characteristics with Cluster 4 (TR10) but differs slightly.

Cluster 2 is the largest cluster, indicating that a significant number of regions share characteristics. There are regions from the north, inner and some western parts of Türkiye in this cluster. The spread of the points shows more variation within this cluster compared to Cluster 1. This cluster has moderate to low values for most variables, including turnout and GDP per capita, with some variation. This cluster also has the lowest GDP growth rate and highest unemployment rate.

Regions in Cluster 3 appear distinct from the others, with a moderate number of regions grouped here and concentrated on the eastern and southeastern parts of Türkiye. The distance from the other clusters indicates that the characteristics of these regions differ from the regions in Cluster 1 and Cluster 2. On the one hand, this cluster also tends to have lower turnout, moreover, this cluster especially has the lowest GDP per capita, highest outmigration, lowest tertiary education rate, lowest population density, lowest industrial employment change rate, and lowest population change rate, indicating potential economic and social challenges. On the other hand, these regions higher proportion of the younger generation.

Cluster 4 consists of only one point, Istanbul which stands out as an outlier. This cluster is characterised by high GDP per capita and turnout, highest positive net migration, highest turnout, lowest proportion of population aged 65+, highest tertiary education rate, highest population density, and highest population change rate, suggesting stronger economic performance and engagement.

4. Discussions and Conclusion

Overall, the study confirms significant long-term economic inequalities across Türkiye's NUTS2 regions. Most of the regions were classified as 'never left-behind', however, there is variability within this group, meaning not all are necessarily performing well. TRA1 and TRA2 have persistently low economic performance over the entire period, reinforcing the historical East-West economic divide. Some regions, such as TRB1, TR83, and TR90, were economically stronger in 1980 but declined significantly by 2023. The best-performing regions align with high-population centres in both analyses, with TR10 and TR51 standing out. Other than highly populated regions, improvement was mainly seen in southeastern regions, while many northern, eastern, and interior regions experienced negative changes.

When we put two analyses together, one of the biggest conclusions is the difference between the east and west of Türkiye, with a clear divide between the more developed western regions and the struggling eastern regions. Socio-economic regional disparity between the east and west of Türkiye is a long-standing phenomenon (Karahasan et al., 2016) which have deep historical roots, which widened during the early republic's industrialization policies that favoured western cities like Istanbul, Ankara, and Izmir (Aşık et al., 2023). We can conclude that Türkiye's left-behind places identification is consistent with other regional disparities works, especially with the socio-economic development levels distinction of the State Planning Organization stated in Korkmaz et al. (2024: 3). Despite negative indicators, the east part holds factors, such as a high percentage of the young population, which could potentially be leveraged for a positive impact.

LBI shows there are improvements for the southeastern part of Türkiye which may be attributed to regionally targeted policies, such as the Southeastern Anatolia Project (GAP). GAP, initially focused

on building 22 dams, 19 hydroelectric power plants, and irrigation systems to produce 27 billion kWh of energy annually and irrigate 1.7 million hectares, evolved into a multisectoral regional development project from the 1980s, incorporating agriculture, education, healthcare, and tourism, with a focus on sustainable human development and regional convergence under the 1989 GAP Master Plan (Sayan et al., 2024). The project has contributed significantly to regional development in southeastern Türkiye, particularly in infrastructure, energy production, agriculture, and industrialization. The number of organized industrial zones (OSBs) grew from 8 in 2000 to 24 in 2018, creating 174,170 jobs, the region's share in Türkiye's exports increased from 1.7% in 1996 to 5.5% in 2017, with a shift from raw materials to manufactured goods and unemployment in the region declined from 22% in the early 1990s to 15.8% by the late 2000s (GAP-BKİ, 2018). However, the success of GAP is still in discussion. Bilgen et al. (2021) argue despite the improvements, Gross Regional Product (GRP) and GDP remain lower than the national average, and regional income inequalities persist. The project also resulted in the displacement of people and the loss of cultural and historical sites (Bilgen et al., 2021).

The second important result that explains the disparities in the concept of left-behind is Kemeny and Storper's (2020) description of the pattern of increasing inequality as a split between prosperous superstar metropolises and left-behind places. Superstar regions become hubs for highly educated, high-wage workers, while less skilled workers in left-behind regions face stagnation. Aşık et al. (2023: 1328) find the spatial distribution of economic activity in Türkiye became increasingly concentrated, primarily due to ongoing migration to Istanbul and nearby provinces. Furthermore, both our analyses consistently classify metropolitan regions, such as Istanbul, Izmir, and Ankara, as 'never left-behind' and they reach the top 25th percentile. These regions are characterised by higher levels of economic activity, stronger employment growth, and sustained development over time. However, while our results support this concentration of economic activity in major metropolitan areas, it is important to distinguish between city-level dynamics and broader NUTS2 regional trends. Given that our study focuses on regional-level analysis, drawing specific conclusions about city-level dynamics would require additional justification or a separate analytical approach. Future research could consider conducting city-based analyses to clarify whether observed trends stem from regional patterns or distinct urban dynamics.

Lastly, on the definition of left-behind places, in the European context left-behind regions are described as deindustrialised, shrinking and rural regions. Regional development and the concept of left-behind regions are strongly linked to former industrial areas that underwent significant structural transformations during the 1970s and 1980s (Telford, 2022). Left-behind places are also identified with experience of population decline (Dijkstra, 2024). Moreover, the concept of left-behind places is closely linked to rural areas and small towns where economic decline is experienced because of city-centred development approaches and residents feel politically abandoned and disconnected from democratic institutions, in contrast to the more prosperous and rapidly growing metropolitan regions (Kenny and Luca, 2021; Rodríguez-Pose, 2018). MacKinnon et al. (2024) put it as "the term 'left-behind places' refers to post-industrial and rural areas characterised by economic under-performance and decline." When results are scrutinised in the Turkish context, this description stands except for deindustrialisation. Both analyses underline that left-behind places experience economic and population decline, outmigration and low density, in contrast, higher industrial employment aligns with better performance

of a region. As a result, in the Turkish context, left-behind places are regions that experience persistent economic underperformance, population decline, outmigration, and low-density settlement patterns, differing from Europe as they are not driven by deindustrialization.

Moreover, a contrast is drawn between where the western parts of Türkiye, particularly coastal and urban areas, have shown better performance. Meanwhile, the northeast, eastern and southeastern parts of the country appear to be left-behind. Thus, Türkiye with a different economic trajectory and policies than Europe reflects its own geographical, historical and social features which conclude by considering historical, and social factors that influence regional development patterns and provide a more nuanced understanding of why certain regions are left-behind or not.

This study draws attention to left-behind places in Türkiye, while understanding the underlying causes, as well as the economic, social, and political consequences of regional inequalities and being left-behind, remains an important avenue for future research. Certain aspects of left-behindness, discussed in the broader conceptual literature, could not be fully incorporated into the current methodological framework. One key aspect that remains underexplored is the emotional and psychological dimensions of left-behindness, including feelings of frustration, deprivation, and political alienation. While this study primarily relies on economic and demographic indicators, future research could integrate survey data or qualitative interview to assess how regional inequalities shape individual and collective perceptions of being left-behind. Similarly, the role of political and institutional marginalization—such as low civic engagement, trust in institutions, and access to policy-making processes—was not directly captured in this analysis. Future studies could examine these aspects using political turnout data, regional governance effectiveness, and qualitative case studies to explore how institutional exclusion interacts with economic decline. Moreover, the peripheralization framework, which considers how regions become structurally disconnected from economic and political decision-making centres, could offer a valuable lens for future studies. Thus, studies that take into account Türkiye's unique economic, political and cultural characteristics can be carried out and comparisons can be made with existing studies.

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