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DOES THE COMPOSITION OF GROWTH MATTER FOR UNEMPLOYMENT? A DISAGGREGATED OKUN ANALYSIS FOR TÜRKİYE

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Abstract

This study examines whether the composition of economic growth matters for unemployment outcomes in Türkiye by estimating a disaggregated version of Okun's Law using quarterly data from 2006Q1 to 2025Q4. The standard Okun framework treats output as a single aggregate. However, unemployment may respond differently to different components of output, making growth composition relevant for labor market policy. While a growing literature has explored this question across various economies, no prior study has applied the disaggregated Okun framework to Türkiye. The analysis employs the difference version of Okun's equation estimated via ordinary least squares with Newey-West standard errors robust to heteroscedasticity and autocorrelation. Dummy variables control for pandemic-period outliers. The aggregate Okun coefficient is approximately -0.26 and remains stable across specifications. Sectoral decomposition reveals that services and construction exhibit higher unemployment intensity than agriculture and industry, though the differences are not statistically significant. The expenditure decomposition provides strong evidence of heterogeneity: private consumption has the largest effect on unemployment, followed by investment and exports, while government consumption has no significant effect. The main results are largely robust to controlling for structural breaks. These findings imply that not all growth is equally effective in reducing unemployment and that demand-side, labor-intensive output components generate the greatest employment returns in Türkiye.

Keywords ***:*** *Okun's Law; Disaggregated Okun Relationship; Unemployment; Economic Growth.*

Jel Classification ***:*** *E24; E01; C22.*

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BÜYÜMENİN BİLEŞİMİ İŞSİZLİK İÇİN ÖNEMLİ Mİ? TÜRKİYE İÇİN AYRIŞTIRILMIŞ OKUN ANALİZİ

Öz

Bu çalışma, 2006Q1-2025Q4 dönemine ait çeyreklik verilerle Okun Yasası'nın ayrıştırılmış bir versiyonunu tahmin ederek, ekonomik büyümenin bileşiminin Türkiye'deki işsizlik sonuçları için önemli olup olmadığını incelemektedir. Standart Okun çerçevesi çıktıyı tek bir toplam olarak ele almaktadır. Ancak işsizliğin çıktının farklı bileşenlerine duyarlılığı farklılık gösterebilir ve bu da büyüme bileşimini işgücü piyasası politikası için önemli hale getirmektedir. Bu soruyu çeşitli ekonomilerde inceleyen giderek büyüyen bir literatür olmasına rağmen, daha önce hiçbir çalışma ayrıştırılmış Okun çerçevesini Türkiye'ye uygulamamıştır. Analiz, heteroskedastisite ve otokorelasyona karşı dayanıklı Newey-West standart hataları ile sıradan en küçük kareler yöntemiyle tahmin edilen Okun denkleminin fark versiyonunu kullanmaktadır. Pandemi dönemi aykırı değerleri kukla değişkenler aracılığıyla kontrol edilmektedir. Toplam Okun katsayısı yaklaşık -0,26'dır ve tüm spesifikasyonlarda istikrarlı kalmaktadır. Sektörel ayrıştırma, hizmet ve inşaat sektörlerinin tarım ve sanayi sektörlerine göre daha yüksek işsizlik yoğunluğuna sahip olduğunu ortaya koymaktadır, ancak farklılıklar istatistiksel olarak anlamlı değildir. Harcama ayrıştırması, heterojenliğe dair güçlü kanıtlar sunmaktadır. İşsizlik üzerindeki en büyük etki özel tüketime aittir, bunu yatırım ve ihracat takip etmektedir, kamu tüketiminin ise anlamlı bir etkisi bulunmamaktadır. Temel sonuçlar yapısal kırılmalar dikkate alındığında da büyük ölçüde geçerliliğini korumaktadır. Bu bulgular, her sektör ve harcama grubundaki büyümenin işsizliği azaltmada eşit derecede etkili olmadığını ve Türkiye'de en büyük istihdam getirisini talep yönlü, emek yoğun üretim bileşenlerinin sağladığını göstermektedir.

Anahtar Kelimeler ***:*** *Okun Yasası; Ayrıştırılmış Okun İlişkisi; İşsizlik; Ekonomik Büyüme.*

Jel Sınıflandırılması ***:*** *E24; E01; C22.*

INTRODUCTION

Okun's Law suggests that there is a negative relationship between unemployment and economic growth (Okun, 1962). In fact, this empirical relationship was originally intended to measure potential output but later became a framework for explaining unemployment dynamics (Tatom, 1978). Although there is some debate over the stability of Okun's Law (Meyer & Tasci, 2012; Ball et al., 2017; Peláez-Herreros, 2025), there are numerous empirical studies that support this relationship. Indeed, Perman et al. (2015) conducted a meta-regression analysis of 269 estimates of Okun's relationship from 28 studies and reported that most estimates were statistically significant. The implication is clear: sustained economic growth is a prerequisite for reducing unemployment. However, Okun's Law is not informative enough for economic policymakers. Economic growth is conventionally measured by changes in real gross domestic product (GDP). GDP is the sum of sectoral value added under the production approach and the sum of expenditures on final uses of goods and services under the expenditure approach. The unemployment rate may respond differently to changes in different components of GDP. Therefore, to design the right economic policies in the struggle against unemployment, policymakers need to know which sectors and expenditures growth has more impact on the unemployment rate. Otherwise, the wrong sectors and expenditures in terms of the fight against unemployment may be supported and thus resources may be wasted.

The theoretical basis of Okun's Law lies in the link between output and labor input. Output growth can be decomposed into the growth of labor productivity, hours worked per employee, employment, and the labor force. An increase in output therefore does not translate one-for-one into a decline in unemployment. Part of it is absorbed by higher productivity and longer working hours, and part of it draws new entrants into the labor force (Okun, 1962; Peláez-Herreros, 2025). Labor hoarding reinforces this pattern. Because hiring and firing are costly, firms adjust employment more slowly than output over the business cycle (Oi, 1962). These channels explain why estimated Okun coefficients are typically well below one in absolute value.

The same logic implies that the unemployment response to growth need not be uniform across the components of GDP. Components differ in their labor intensity, their import content, and the extent to which they are met by domestic production. On the production side, services and construction generally require more workers per unit of output than capital-intensive industry. Agriculture is also labor-intensive, but its employment is dominated by self-employment and unpaid family work, so output changes in agriculture are absorbed mainly by hours and productivity rather than by registered unemployment. On the expenditure side, private consumption is largely directed toward labor-intensive services, such as retail trade and accommodation. Exports, by contrast, are closely tied to manufacturing, and both investment and exports rely partly on imported capital goods and intermediate inputs. Government consumption consists mainly of wages paid to existing public employees and is therefore only loosely related to cyclical hiring, while import growth shifts part of domestic demand toward foreign producers. From this perspective, the aggregate Okun coefficient can be viewed as a weighted average of component-specific responses. Changes in the composition of growth may therefore partly explain the instability of the aggregate relationship observed in the literature (Anderton et al., 2014). These mechanisms are particularly relevant for Türkiye, where growth has often been driven by domestic demand and construction. Accordingly, this study tests whether the unemployment response to growth differs across production sectors and expenditure components, and whether private consumption has the strongest effect.

A growing branch of the Okun's Law literature examines this heterogeneity empirically. Research in this new field estimates the disaggregated version of the Okun relationship based on sectoral and/or expenditure components of GDP (Anderton et al., 2014; Pesliakaitė, 2015; Apap & Gravino, 2017; Andonova & Petrovska, 2019; Lee et al., 2020; Hashmi et al., 2021; Kraim et al., 2023). This study aims to contribute to this new literature by examining the case of Türkiye. In the study, the impact of changes in the sectoral and expenditure components of GDP on the change in the unemployment rate in Türkiye is investigated. Several studies have examined Okun's Law in Türkiye (Göçer, 2015; Erdoğan et al., 2019; Coşar & Yavuz, 2021; Akkoyunlu, 2024; Benli, 2024; Yağmur, 2025) and the sectoral pattern of growth and unemployment (Akusta, 2025). However, to the best of our knowledge, no study has yet estimated the response of the unemployment rate to growth in the sectoral and expenditure components of GDP within the Okun framework. We expect the results to be useful for policymakers in Türkiye.

The rest of the paper is organized as follows: Chapter Two reviews the disaggregated Okun relationship literature. Chapter Three introduces the dataset, model, and methodology. Chapter Four presents the analysis results. Chapter Five summarizes the findings and policy recommendations.

I. LITERATURE REVIEW

The standard Okun (1962) framework treats GDP as a single aggregate variable in explaining unemployment dynamics. While this approach has proven useful as a rule of thumb, it conceals potentially important heterogeneity in how different sources of growth affect labor markets. A growing body of empirical work has responded to this limitation by disaggregating output – either by expenditure component or by production sector – and estimating the differential unemployment sensitivity of each. This section surveys the key contributions in this literature.

The foundational study is Anderton et al. (2014), who decompose GDP growth into private consumption, investment, government spending, exports, and imports, entering each component separately into a single Okun equation. Their panel covers 17 euro area countries over 1996Q1-2013Q4, estimated via fixed effects, mean group, and GMM. The central finding is that unemployment responds most strongly to private consumption – which they attribute to the labor-intensive nature of services – while foreign trade components exert considerably weaker effects. Beyond the coefficient estimates, the study makes a methodological point: the disaggregated specification improves one-quarter-ahead unemployment forecasts by roughly 20% relative to the standard aggregate model, making a concrete empirical case for the approach.

Pesliakaitė (2015) examines how sectoral and expenditure components of GDP differentially affect unemployment in Lithuania over 1996–2014. Capital-intensive exports and the manufacturing sector show low elasticity, while labor-intensive components – consumption, construction, and services – account for most of the unemployment variation. That this pattern holds in a transition economy with a

different structural profile than the euro area suggests the disaggregated framework is not contingent on the specific institutional context in which it was originally developed.

Apap & Gravino (2017) extend the production-side approach further by focusing explicitly on the differential mechanisms through which sectors affect unemployment. Using quarterly Maltese data for 2000-2012, they decompose GDP into services and manufacturing contributions in a single equation. Unemployment proves more responsive to the services sector, but the more interesting result concerns the mechanism: manufacturing affects unemployment through layoffs, while the services sector operates by absorbing new labor market entrants. The distinction matters for how one interprets aggregate Okun instability, particularly in economies undergoing deindustrialization.

Andonova & Petrovska (2019) reach broadly similar conclusions in their analysis of North Macedonia covering the period 2004Q1–2016Q4. According to the authors, while domestic demand components have a decisive effect on unemployment, foreign trade (exports and imports) remains relatively limited. They also show that the disaggregated specification yields better forecasting performance than the aggregate benchmark.

Lee et al. (2020) analyze the impact of the sectoral composition of growth on unemployment in a much larger canvas, drawing on ILO data for advanced, developing, and emerging economies over 1992-2017. In advanced economies, sectoral elasticities vary considerably: labor-intensive sectors such as agriculture, construction, wholesale and retail trade, and transport exhibit strong unemployment responses, whereas capital-intensive and knowledge-based sectors tend to generate weaker and often insignificant effects. In developing and emerging economies, however, sectoral composition plays a limited role. In these countries, the informal economy and the dominance of small and medium-sized enterprises substantially weaken the output–unemployment transmission.

Hashmi et al. (2021) examine how unemployment responds to output changes across BRICS economies over 1991–2018, employing common constant, fixed effects, and pooled mean group estimators. Their findings indicate that private consumption is the dominant driver of unemployment dynamics, with a negative and statistically significant coefficient. While government expenditure, exports, and imports also play a role, their effects are smaller in magnitude and less robust across specifications. Notably, Okun coefficients are systematically larger in the post-2008 subsample, pointing to a crisis-induced deepening of the output–unemployment link in these economies.

Kraim et al. (2023) apply a sectoral Okun framework to 17 petroleum-exporting economies over 2000–2019. Using CS-ARDL and pooled mean group estimators, they find that services output drives unemployment more than the manufacturing and agriculture sectors. They also find that oil rents significantly moderate the sectoral Okun coefficients. The implication is that resource dependence weakens the transmission from growth to job creation – a structural feature that has parallels in other commodity-dependent economies.

Evidence for Türkiye remains limited. Yağmur (2025) applies wavelet coherence analysis to quarterly data for 2005Q1–2024Q2. The study finds that Okun's Law largely holds in Türkiye, but the strength of the relationship varies over time and across frequencies. The study closest to ours is Akusta (2025), which examines the effect of sectoral GDP shares on unemployment using annual data for 2000–2022. Based on an ARDL model, it finds that increases in the shares of agriculture, industry, construction, and services all reduce unemployment. Neither study, however, decomposes output growth into its components within the Okun framework or considers the expenditure side of GDP.

Several common threads run through this literature. The disaggregated specification consistently dominates the aggregate alternative in explanatory and predictive terms. Private consumption and labor-intensive service activities are the most reliable channels through which output growth reduces unemployment, while capital-intensive and export-oriented components tend to generate weaker labor market responses. At the same time, country-specific factors – economic structure, informality, resource dependence, development level – substantially condition the magnitude of these effects, which means that estimates from one context cannot be straightforwardly transferred to another. Türkiye presents a case where these conditioning factors are particularly pronounced: a large and persistent informal sector, a growth trajectory historically concentrated in construction and domestic demand, and a tradable sector

that has expanded rapidly but unevenly. Despite this, no study has yet applied the disaggregated Okun framework to Türkiye, a gap the present paper addresses.

II. DATA, METHODOLOGY AND MODEL

This study uses quarterly data for Türkiye from 2006Q1 to 2025Q4. The sample period is determined by the availability of quarterly unemployment rate data. All variables employed in the study were created using data from the Turkish Statistical Institute (TURKSTAT). Information regarding the data is presented in Appendix Table 1.

Time series analysis requires all variables to be stationary; otherwise, the spurious regression problem may arise and render the results unreliable (Granger & Newbold, 1974). Because all variables are measured as year-on-year changes or growth rates, stationarity at level is expected. The unit root test results confirm that all variables are stationary at level (Appendix Table 2). Fourier-based unit root tests, which allow for smooth structural breaks of unknown number and form, do not alter this conclusion (Appendix Table 3). Accordingly, the analyses show no evidence of spurious regression risk.

All equations are estimated using OLS. Because the analysis uses time-series data for a single country, OLS provides a straightforward, transparent estimation framework consistent with the approach adopted in several country-level studies in this literature (Pesliakaitė, 2015; Apap & Gravino, 2017). Standard errors are computed using the heteroscedasticity and autocorrelation consistent (HAC) estimator of Newey and West (1987) with three lags.

This choice offers several advantages. Because all variables are stationary, OLS can be applied without cointegration techniques and without the risk of spurious regression. The specification is also directly comparable with the benchmark studies in this literature. Alternative approaches were considered but not adopted. ARDL models mainly add lag dynamics to a relationship that the literature usually treats as contemporaneous. VAR models would require identifying restrictions to isolate the effect of each growth component, while time-varying parameter models would be imprecisely estimated with only 80 quarterly observations.

The approach also has some limitations. The estimates capture contemporaneous associations and should not be interpreted as causal effects. In addition, correlation among the growth rates of different components may reduce the precision of individual coefficients. With 80 observations, the F-test of equal coefficients also has limited power to detect moderate differences across components. This limitation is taken into account when interpreting the sectoral results.

In this study, we first estimate the aggregate version of the Okun relationship. Two equations can be used to estimate the Okun relationship. One is the difference equation and the other is the gap equation. The difference equation captures the contemporaneous co-movement between output growth and the change in the unemployment rate, while the gap equation models deviations of both variables from their respective potential levels. While the levels version of Okun's Law is also widely used in the literature, it requires the estimation of potential output and the natural rate of unemployment, which are unobservable variables. Because errors in estimating these potential levels directly translate into errors in the Okun coefficient, this study follows several studies in the literature (Anderton et al., 2014; Apap & Gravino, 2017; Hashmi et al., 2021) and uses the difference equation. This equation can be presented as follows:

$$\mathrm{DUR}_t = \alpha + \beta \mathrm{DGDP}_t + \varepsilon_t \quad (1)$$

In this equation, DUR is the annual percentage point change in the unemployment rate, and DGDP is the annual percentage change in GDP, or in other words, economic growth. Here, α is the constant term, β is the slope coefficient, and ε is the error term. In this model, β is called the Okun coefficient and indicates the response of the unemployment rate to economic growth. It is expected that this coefficient is negative and statistically significant.

Secondly, the study estimates the sector-disaggregated version of the Okun relationship. GDP calculated by the production approach contains taxes and subsidies on products as well as sectoral value added. Excluding taxes and subsidies yields gross value added (GVA). Because the impact of changes in taxes

and subsidies on the unemployment rate is outside the scope of this analysis, this part of the study defines economic growth as the annual percentage change in real GVA. GVA is calculated as the sum of value added in the four main sectors: agriculture, industry, construction, and services. Then, GVA growth is decomposed into its sectoral components, as shown below:

$$\mathrm{DGVA_t} = \mathrm{D}\sum \mathrm{GVA_{st}} \approx \sum \frac{\mathrm{GVA_{st}}}{\mathrm{GVA_t}}\,\mathrm{DGVA_{st}} \equiv \sum \lambda_{st}\mathrm{DGVA_{st}} \quad (2)$$

Here λ_{st} is the share of GVA in sector s in total GVA in time t. Because growth rates are computed year on year, each sector's weight is measured using its share in the same quarter of the previous year, so the weighted sum of sectoral growth rates exactly replicates aggregate GVA growth. After that, Equation 1 is rewritten as follows:

$$\mathrm{DUR_t} = \alpha + \sum \beta_s\lambda_{st}\mathrm{DGVA_{st}} + \varepsilon_t \quad (3)$$

In contrast to the aggregate version of the Okun relationship, this equation estimates separate coefficients for each component of economic growth. Following Anderton et al. (2014), introducing DGVAst allows the unemployment intensity of each sector, βs, to be identified separately from the composite term βsλst, which would otherwise conflate sensitivity and size effects across sectors. Once β_s is estimated, multiplying it by λ_{st} yields the component elasticity for each sector – a measure of how proportionally responsive the unemployment rate is to growth in that particular GVA component. Equivalently, these component elasticities can be recovered by directly regressing the change in the unemployment rate on sectoral GVA growth rates.

Finally, the study estimates the unemployment rate's response to changes in the expenditure components of GDP. GDP calculated by the expenditure approach consists of five main expenditure components: private consumption, government consumption, investment (gross capital formation and changes in inventories), exports, and (minus) imports. Similar to how GVA growth is decomposed into its sectoral components, GDP growth is also decomposed into its expenditure components as follows:

$$\mathrm{DGDP_t} = \mathrm{D}\sum \mathrm{GDP_{et}} \approx \sum \frac{\mathrm{GDP_{et}}}{\mathrm{GDP_t}}\,\mathrm{DGDP_{et}} \equiv \sum \lambda_{et}\mathrm{DGDP_{et}} \quad (4)$$

Here λ_{et} is the share of expenditure e in total GDP in time t. As growth rates are computed on a year-on-year basis, each expenditure item's weight is measured using its share in the same quarter of the previous year, so that the weighted sum of expenditure growth rates exactly replicates aggregate GDP growth. Then, estimates are made using the following equation:

$$\mathrm{DUR_t} = \alpha + \sum \beta_e\lambda_{et}\mathrm{DGDP_{et}} + \varepsilon_t \quad (5)$$

This equation estimates separate coefficients for each expenditure component of economic growth. Following Anderton et al. (2014), import growth enters the regression as a positive value, consistent with the treatment of all other expenditure components. Its expected positive Okun coefficient reflects the fact that imports carry a negative sign in the national accounts identity: faster import growth substitutes domestically produced goods and services and thus reduces labor demand. The positive component elasticity ($\beta_e\lambda_{et}$) for imports is therefore interpreted as a dampening effect on employment.

When all βs coefficients in Equation 3 are equal, the equation reduces to a standard aggregate Okun regression of the unemployment rate change on overall GVA growth. In this case, the sectoral composition of growth is irrelevant, and the disaggregated specification offers no informational advantage over its aggregate counterpart. Similarly, if all the β_e coefficients in Equation 5 are equal to each other, the equation reduces to an aggregate regression, and the expenditure composition of growth becomes irrelevant. Following Anderton et al. (2014) and Lee et al. (2020), this restriction can be tested via an F-test of coefficient equality within each equation. Failure to reject implies that aggregate growth

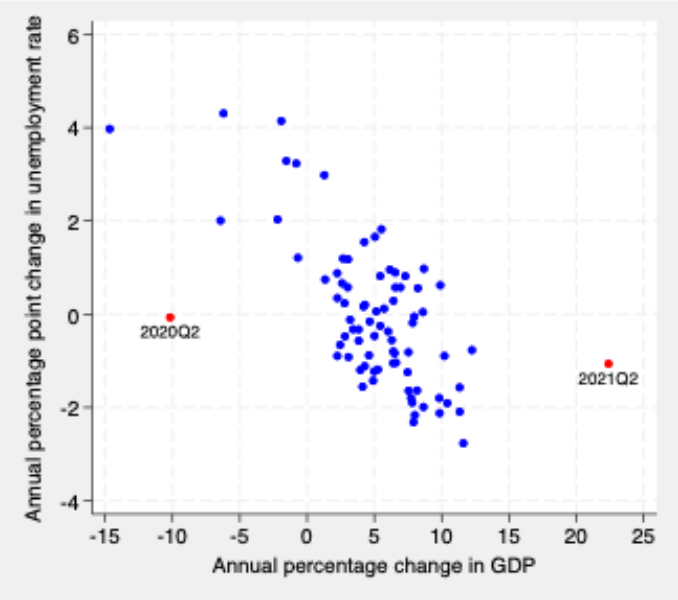
alone is sufficient to explain unemployment dynamics, while rejection provides statistical evidence that the composition of growth matters.

III. EMPIRICAL RESULTS

III.I. Aggregate Okun Relationship

Empirical analysis begins with examining the scatter plot of two main variables. Figure 1 plots the year-on-year change in GDP against the year-on-year change in the unemployment rate in Türkiye over 2006Q1–2025Q4. The visual pattern broadly confirms the expected negative relationship: quarters of strong economic growth coincide with declines in unemployment, while contractions or slowdowns are associated with rising unemployment. However, two major departures from the general trend occur around the COVID-19 pandemic. The pandemic caused a sharp decline in economic growth in the second quarter of 2020, while the unemployment rate did not rise because the government imposed a layoff ban. A year later, in the second quarter of 2021, strong economic growth was recorded owing to a base effect, but this was accompanied by only a modest decrease in unemployment. These observations constitute clear outliers that, if left unaddressed, would distort the estimated Okun coefficient. Therefore, we control for them using dummy variables in the regression analysis that follows.

Figure 1.: Changes in GDP and the Unemployment Rate in Türkiye



Source: TURKSTAT

Table 1 presents OLS estimates of the aggregate Okun relationship under three specifications. Column (1) covers the full sample (2006Q1–2025Q4) without any pandemic adjustment. The estimated Okun coefficient is -0.199 and is highly significant ($p < 0.01$), indicating that a one percentage point increase in economic growth is associated with approximately a 0.2 percentage point decline in the unemployment rate. Column (2) restricts the sample to the pre-pandemic period (2006Q1–2019Q4). In this estimation, the coefficient rises to -0.268, and the model fit improves substantially, with R-squared increasing from 0.419 to 0.620. This suggests that the pandemic observations introduce considerable noise into the full-sample estimate. Column (3) returns to the full sample but incorporates two dummy variables (DUM20Q2 and DUM21Q2) to absorb the outlier quarters associated with the onset of the pandemic and its immediate aftermath. With these controls in place, the Okun coefficient is -0.262, nearly identical to the pre-pandemic estimate, and the R-squared rises to 0.532. The dummy coefficients are both large and highly significant: DUM20Q2 enters with a coefficient of -4.003 and DUM21Q2 with 3.543. This confirms that these two quarters represent genuine structural breaks in the unemployment-growth relationship that are not well captured by the standard linear specification. Given that Columns (2) and (3) yield very similar point estimates, the remainder of the analysis adopts the full-sample specification with pandemic dummies as the baseline.

Table 1.: Estimates of Aggregate Okun Relationship

	(1)	(2)	(3)
	Full Sample	Pre-pandemic	Full Sample with Dummies
DGDP	-0.199***	-0.268***	-0.262***
	(0.045)	(0.043)	(0.038)
DUM20Q2			-4.003***
			(0.602)
DUM21Q2			3.543***
			(0.679)
Constant	0.948***	1.623***	1.266***
	(0.327)	(0.271)	(0.268)
Observations	80	56	80
R-squared	0.419	0.620	0.532

Note: Newey-West HAC standard errors with 3 lags in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Full sample refers to: 2006Q1-2025Q4. Pre-pandemic refers to: 2006Q1-2019Q4

III.II. Sectoral Disaggregated Okun Relationship

Table 2 reports the results from the sectoral disaggregation of the Okun relationship. Columns (1) and (2) confirm that the aggregate Okun coefficient is essentially unchanged when GVA is substituted for GDP as the activity variable (-0.262 versus -0.262). This validates the comparability of the aggregate and disaggregated specifications. Column (3) introduces sector-specific coefficients for agriculture (AGRI), industry (IND), construction (CONS), and services (SER).

The results reveal considerable heterogeneity across sectors. The services sector has a coefficient of -0.300, statistically significant at the 1% level, while the construction sector has a larger coefficient in absolute value of -0.559, significant at the 5% level. By contrast, the agriculture and industry coefficients (-0.050 and -0.102, respectively) are small and statistically indistinguishable from zero. These findings indicate that growth originating in the services and construction sectors is considerably more effective in reducing unemployment than growth in agriculture or industry. However, a sector's unemployment intensity does not alone determine its contribution to aggregate unemployment dynamics; each sector's weight in total GVA also matters. Column (4) reports the average GVA share of each sector, and Column (5) presents the implied component elasticities, which measure the proportional responsiveness of the unemployment rate to growth in each sector. Services, with a GVA share of 63.8%, generates a component elasticity of -0.191. This is by far the largest in absolute terms, and broadly consistent with the aggregate Okun coefficient of -0.262. Construction, despite its higher unemployment-intensity coefficient, contributes only -0.039 because of its small share of GVA (7.0%). The sum of component elasticities across all sectors is -0.256, which closely replicates the aggregate estimate of -0.262 and confirms the internal consistency of the decomposition.

Table 2.: Results of the Sectoral Disaggregated Version of Okun Relationship

	(1)	(2)	(3)	(4)	(5)
	β	β	β_s	λ_{st}	$\beta_s\lambda_{st}$
DGDP	-0.262***				
	(0.038)				
DGVA		-0.262***			-0.256
		(0.037)			
AGRI			-0.050	0.073	-0.004
			(0.197)		
IND			-0.102	0.219	-0.022
			(0.162)		

CONS			-0.559** (0.244)	0.070	-0.039
SER			-0.300*** (0.101)	0.638	-0.191
DUM20Q2	-4.003*** (0.602)	-3.896*** (0.591)	-3.763*** (0.558)		
DUM21Q2	3.543*** (0.679)	3.511*** (0.646)	2.747*** (0.711)		
Constant	1.266*** (0.268)	1.270*** (0.280)	1.304*** (0.271)		
Observations	80	80	80		
R-squared	0.532	0.512	0.531		
P-value of F test (all coefficients are equal)			0.451		

Note: Newey-West HAC standard errors with 3 lags in parentheses. *** p<0.01, ** p<0.05, * p<0.1

To assess whether the sectoral composition of growth matters, an F-test of the null hypothesis that all sector-specific coefficients are equal is conducted. The p-value of 0.451 implies that we cannot reject this null at conventional significance levels. While the point estimates differ substantially across sectors – and the individual significance results suggest that services and construction do play a distinct role – the formal equality test indicates that the available data do not provide sufficient statistical power to reject a common coefficient. This result suggests caution in drawing strong policy conclusions from the sectoral decomposition alone and motivates the expenditure-side analysis that follows.

III.III. Expenditure Disaggregated Okun Relationship

Table 3 presents the results from the expenditure disaggregation of the Okun relationship. Column (1) restates the aggregate baseline coefficient for reference. Column (2) reports separate coefficients for private consumption (CON), government consumption (GOV), investment (INV), exports (EXP), and imports (IMP).

The results show a clear, economically interpretable pattern. Private consumption produces the largest coefficient in absolute value (-0.302) and is highly significant ($p < 0.01$). Given its dominant share in GDP (60.5%), it generates by far the largest component elasticity of -0.183. Investment carries a coefficient of -0.161 and is also significant at the 1% level, contributing a component elasticity of -0.041. Exports similarly enter with a significant coefficient of -0.165 and a component elasticity of -0.039. Government consumption, by contrast, has a near-zero and insignificant coefficient (0.032). This indicates that public expenditure growth has had no statistically discernible effect on the unemployment rate over the sample period. The import coefficient (0.117) is positive but insignificant. This suggests that import growth does exert upward pressure on unemployment, though the effect is not statistically discernible over the sample period.

The sum of component elasticities across all expenditure items is -0.232, again closely tracking the aggregate benchmark of -0.262. Critically, the F-test of the null hypothesis that all expenditure-specific coefficients are equal yields a p-value of 0.000, which means the null is decisively rejected. This finding contrasts with the sectoral decomposition result and provides strong statistical evidence that the expenditure composition of growth matters for unemployment outcomes in Türkiye. The disaggregated expenditure specification also fits the data better than the aggregate baseline, with R-squared rising from 0.532 to 0.608. This reinforces the conclusion that the aggregate Okun framework conceals important heterogeneity in the transmission of growth to labor market outcomes.

Table 3.: Results of the Expenditure Disaggregated Version of Okun Relationship

	(1)	(2)	(3)	(4)
	β	β_e	λ_{et}	$\beta_e\lambda_{et}$
DGDP	-0.262*** (0.038)			-0.232
CON		-0.302***	0.605	-0.183

		(0.051)		
GOV		0.032 (0.170)	0.139	0.004
INV		-0.161*** (0.059)	0.254	-0.041
EXP		-0.165*** (0.059)	0.238	-0.039
IMP		0.117 (0.114)	0.235	0.027
DUM20Q2	-4.003*** (0.602)	-3.736*** (0.595)		
DUM21Q2	3.543*** (0.679)	3.504*** (0.633)		
Constant	1.266*** (0.268)	1.158*** (0.285)		
Observations	80	80		
R-squared	0.532	0.608		
P-value of F test (all coefficients are equal)		0.000		

Note: Newey-West HAC standard errors with 3 lags in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Taken together, the results from both decompositions point to a consistent picture. Unemployment in Türkiye is driven primarily by demand-side components of growth – most notably private consumption, followed by investment and exports – while supply-side and public expenditure channels play a substantially more limited role. On the production side, the services sector is the dominant channel, reflecting both its high unemployment intensity and its large share of aggregate output.

III.IV. Robustness to Structural Breaks

The sample period includes several major shocks, such as the global financial crisis, the 2018 currency shock, the COVID-19 pandemic, and the subsequent disinflation program. Structural changes associated with these episodes may affect both the time-series properties of the variables and the stability of the estimated relationships. This section examines these issues in two steps.

First, Fourier unit root tests are applied to all variables. Unlike conventional tests, these tests allow for smooth breaks of unknown number and form by including trigonometric terms in the test equation. The results are reported in Appendix Table A3. The Fourier ADF test of Enders and Lee (2012) shows that the Fourier terms are jointly insignificant at the 5% level for all variables except services value added. According to the testing procedure of Enders and Lee (2012), the conventional unit root tests therefore remain appropriate for these variables. In addition, the Fourier KPSS test of Becker et al. (2006) does not reject stationarity at the 5% level for any variable. Taken together with the conventional tests, these results indicate that all variables are stationary, although the evidence for services value added is weaker.

Second, the equations are re-estimated with Fourier terms added to the intercept to capture smooth shifts in the relationship; the frequency k = 1 is selected by minimizing the sum of squared residuals. The pandemic-related outliers in 2020Q2 and 2021Q2 are controlled for by the two dummy variables, as in the baseline specification. Table 4 reports the results. The Fourier terms are jointly significant in all three equations, indicating that the relationship has shifted gradually over the sample period. Nevertheless, the aggregate Okun coefficient remains close to the baseline estimate (-0.278 versus -0.262).

Table 4.: Aggregate and Disaggregated Okun Relationships with Fourier Terms

	(1)	(2)	(3)
	β	β_s	β_e
	Aggregate	Sectoral	Expenditure
DGDP	-0.278***		

	(0.035)		
AGRI		-0.307	
		(0.208)	
IND		-0.186	
		(0.135)	
CONS		-0.551**	
		(0.227)	
SER		-0.281***	
		(0.092)	
CON			-0.310***
			(0.063)
GOV			-0.005
			(0.132)
INV			-0.210***
			(0.053)
EXP			-0.219***
			(0.057)
IMP			0.191
			(0.117)
sin(2πkt/T)	0.122	0.180	0.009
	(0.241)	(0.284)	(0.244)
cos(2πkt/T)	-0.649***	-0.673***	-0.533***
	(0.201)	(0.214)	(0.188)
DUM20Q2	-4.226***	-3.857***	-4.161***
	(0.689)	(0.789)	(0.776)
DUM21Q2	4.052***	3.412***	3.958***
	(0.576)	(0.661)	(0.557)
Constant	1.343***	1.363***	1.237***
	(0.223)	(0.263)	(0.270)
Observations	80	80	80
R-squared	0.624	0.625	0.662
P-value of F test (all coefficients are equal)		0.626	0.005
P-value of F test (Fourier terms)	0.005	0.004	0.020

Note: Newey-West HAC standard errors with 3 lags in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Fourier: Fourier terms with frequency k = 1, selected by minimizing the sum of squared residuals

In the sectoral equation, construction and services remain significant, and construction continues to have the largest coefficient (-0.551). The ranking of the remaining sectors, however, changes: agriculture now has a larger point estimate than services (-0.307 versus -0.281), although it remains insignificant. The hypothesis of equal sectoral coefficients is again not rejected (p = 0.626). In the expenditure equation, private consumption, investment, and exports remain negative and significant, while government consumption and imports remain insignificant. Private consumption retains the largest coefficient (-0.310), and the equality of expenditure coefficients is rejected (p = 0.005).

Overall, the main findings are robust to structural change. The aggregate Okun coefficient, the significant negative effects of private consumption, investment, and exports, the leading role of private consumption, and the insignificance of government consumption and imports all hold when Fourier terms are included. On the production side, only the high unemployment intensity of construction proves robust; the position of services relative to agriculture and industry depends on the specification.

CONCLUSION

This study examines the disaggregated Okun relationship for Türkiye using quarterly data over the 2006Q1–2025Q4 period. Departing from the standard aggregate framework, which treats GDP as a single variable, the analysis estimates the unemployment sensitivity of each sectoral and expenditure component of output separately. Three main findings emerge.

First, the aggregate Okun relationship holds robustly in Türkiye. A one-percentage-point increase in economic growth is associated with approximately a 0.26-percentage-point decline in the unemployment rate. This coefficient remains stable across the pre-pandemic subsample and the full sample once pandemic-period outliers are controlled for. This estimate is broadly consistent with the existing literature on Okun's Law in emerging economies.

Second, the sectoral decomposition reveals that growth in the services and construction sectors carries considerably higher unemployment intensity than growth in agriculture or industry. Services, in particular, dominates the aggregate result by virtue of both its high unemployment responsiveness and its large share in total gross value added. However, the formal F-test fails to reject the null hypothesis that all sector-specific Okun coefficients are equal. This means that while the direction of heterogeneity is informative, it does not reach conventional levels of statistical significance. This finding calls for caution in drawing firm policy conclusions from the sectoral results alone.

Third, and more decisively, the expenditure decomposition provides strong evidence that the composition of growth matters for unemployment outcomes in Türkiye. Private consumption has the largest effect, accounting for the bulk of the aggregate unemployment response, and is followed by investment and exports. Government consumption, on the other hand, has no statistically significant effect on unemployment over the sample period. The null hypothesis of equal expenditure coefficients is resoundingly rejected, and the disaggregated expenditure specification fits the data substantially better than the aggregate baseline.

These results are consistent with the mechanisms discussed in the Introduction. Private consumption is largely directed toward labor-intensive services, such as retail trade, accommodation, and personal services. Its expansion therefore translates more directly into hiring. Investment and exports, by contrast, are concentrated in relatively capital-intensive activities. They also rely partly on imported capital goods and intermediate inputs, which weakens their link to domestic employment. Government consumption consists mainly of public wages and salaries. Because these are set by administrative decisions rather than by the business cycle, it is not surprising that government consumption has no discernible effect on unemployment. The important role of private consumption is in line with the findings of Anderton et al. (2014) for the euro area, Andonova and Petrovska (2019) for North Macedonia, and Hashmi et al. (2021) for the BRICS economies. The importance of services also mirrors the results of Apap and Gravino (2017) and Kraim et al. (2023).

Collectively, these findings carry a clear message for economic policymakers in Türkiye: not all growth is equally effective in reducing unemployment. Growth driven by private consumption is the most reliable channel through which output expansion translates into job creation. Investment and export-led growth also contribute meaningfully, while public expenditure and import growth do not appear to exert a significant direct effect on the labor market. On the production side, policies that support services-sector expansion are likely to yield the largest employment returns. These findings have several practical implications for Türkiye. Employment projections in medium-term economic programs could take into account the composition of growth, not only its rate. The same growth rate is likely to reduce unemployment more when it is driven by private consumption rather than by investment or exports. Investment incentive schemes could give greater weight to job creation and domestic value added. Export promotion is also likely to yield larger employment gains if it is combined with policies that raise the domestic content of exports. By contrast, the results provide no evidence that public consumption expenditure is an effective tool against unemployment. The findings also suggest that demand-restraining policies, such as those adopted in disinflation programs, may carry a higher employment cost when they compress private consumption. Policymakers may therefore need to weigh this cost explicitly. Sector-specific recommendations, however, should be treated with caution, because the sectoral coefficients are not statistically different from one another.

Several caveats should be noted. The analysis is based on a single-country time series, which limits the results' generalizability. In addition, the estimates capture contemporaneous associations and should not be interpreted as causal effects. With 80 quarterly observations, the test of equal sectoral coefficients has limited statistical power. The failure to reject equality may therefore partly reflect the sample size rather than true homogeneity. Finally, the analysis does not distinguish between formal and informal

employment. Informality is likely to weaken the link between output growth and registered unemployment in Türkiye. The Fourier terms also indicate gradual shifts in the Okun relationship over the sample period. The main findings are robust to these shifts, but the ranking of services relative to agriculture and industry is not. The OLS difference equation, while standard in the literature, does not account for potential asymmetries in the Okun relationship – for instance, whether the unemployment response to contractions differs from its response to expansions. Future research could explore these asymmetries using nonlinear or threshold models. In addition, extending the disaggregated framework to sub-sectors – such as distinguishing between tradeable and non-tradeable services, or between public and private investment – could yield further insight into the mechanisms through which growth affects unemployment in Türkiye. Further research could also use regional data at the NUTS-2 level. Another promising direction is to examine whether the composition effects identified here vary with the stance of monetary and fiscal policy.

Ethics Statement	*The author(s) declare that all ethical principles and rules were strictly observed at every stage of this study. In case of any violation, ÖHÜİİBF Journal is under no responsibility, and all responsibility rests solely with the author(s).*
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APPENDIX

Table A1.: Raw Data and Sources

Variable	Data	Unit	Period	Source
UR	Unemployment rate	Percent	2005Q1-2025Q4	TURKSTAT
GDP	Real gross domestic product	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
AGRI	Real agriculture value added	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
IND	Real industry value added	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
CONS	Real construction value added	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
SER	Real services value added	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
CON	Real private consumption expenditure	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
GOV	Real government consumption expenditure	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
INV	Real investment expenditure (gross capital formation + changes in inventories)	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
EXP	Real exports of goods and services	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT
IMP	Real imports of goods and services	Million Turkish Lira, 2009 prices	2005Q1-2025Q4	TURKSTAT

Note: TURKSTAT refers to the Turkish Statistical Institute.

Table A2.: Unit Root Test Results

Variable	PP test statistics	KPSS test statistics	Conclusion
DUR	-3.298**	0.151	I(0)
DGDP	-4.667***	0.052	I(0)
DGVA	-4.552***	0.058	I(0)
AGRI	-6.989***	0.209	I(0)
IND	-4.658***	0.064	I(0)
CONS	-3.395**	0.290	I(0)
SER	-4.392***	0.158	I(0)
CON	-4.188***	0.280	I(0)
GOV	-6.731***	0.423*	I(0)
INV	-3.999***	0.118	I(0)
EXP	-4.838***	0.067	I(0)
IMP	-4.208***	0.049	I(0)

Note: PP: Phillips-Perron test; H0: unit root; bandwidth = 3 (Newey-West automatic). KPSS: Kwiatkowski-Phillips-Schmidt-Shin test; H0: stationarity; lag = 3 (same bandwidth as the PP test). Both tests include a constant. PP critical values (T~80): -3.524 (1%), -2.902 (5%), -2.588 (10%). KPSS critical values: 0.739 (1%), 0.463 (5%), 0.347 (10%). *p<0.10, **p<0.05, ***p<0.01. For PP, asterisks indicate rejection of the unit root null (i.e., stationarity). For KPSS, asterisks indicate rejection of the stationarity null (i.e., unit root). Conclusion is based on 5% significance level: a variable is classified as I(0) if PP rejects the unit root null and KPSS does not reject the stationarity null; I(1) if PP does not reject and KPSS rejects.

Table A3.: Fourier Unit Root Test Results

Variable	FADF k	FADF p	FADF τ	FADF F	FKPSS k	FKPSS test statistic	Conclusion
DUR	3	4	-2.240	2.816	4	0.306	I(0)
DGDP	2	3	-5.444***	2.900	4	0.098	I(0)
DGVA	5	4	-2.912*	2.318	4	0.121	I(0)
AGRI	4	0	-7.058***	2.063	1	0.046	I(0)
IND	5	4	-3.077**	1.725	4	0.057	I(0)
CONS	1	3	-4.273**	2.222	4	0.272	I(0)
SER	5	4	-2.710*	3.225**	4	0.384*	I(0)[a]
CON	5	4	-2.540	2.193	2	0.122	I(0)
GOV	4	3	-5.312***	3.234	4	0.367*	I(0)
INV	4	3	-6.650***	2.734	4	0.122	I(0)
EXP	4	3	-5.375***	2.666	4	0.047	I(0)
IMP	4	3	-5.832***	1.405	4	0.036	I(0)

Note: FADF: Fourier ADF test (Enders & Lee, 2012); H0: unit root. FKPSS: Fourier KPSS test (Becker et al., 2006); H0: stationarity. k: Fourier frequency selected by minimum SSR; p: number of lagged differences, selected by the general-to-specific method (maximum 4). F: test of the joint significance of the Fourier terms. Critical values were obtained by Monte Carlo simulation (20,000 replications). FADF τ critical values (1%, 5%, 10%): k=1: -4.48, -3.82, -3.49; k=2: -4.01, -3.26, -2.88; k=3: -3.77, -3.05, -2.69; k=4: -3.63, -2.97, -2.62; k=5: -3.57, -2.94, -2.59. FADF F critical values (5%): k=1: 7.24; k=2: 4.30; k=3: 3.48; k=4: 3.28; k=5: 3.18. FKPSS critical values (1%, 5%, 10%): k=1: 0.265, 0.181, 0.141; k=2: 0.630, 0.422, 0.326; k=4: 0.689, 0.455, 0.361. *p<0.10, **p<0.05, ***p<0.01. For FADF τ, asterisks indicate rejection of the unit root null; for FKPSS, rejection of the stationarity null; for F, significance of the Fourier terms (only the 5% level is reported). Where the Fourier terms are not significant, the conventional tests in Table A2 apply (Enders & Lee, 2012). FKPSS does not reject stationarity at the 5% level for any variable. [a] For SER, the Fourier terms are significant. The Fourier ADF test rejects the unit root at the 10% level, and the Fourier KPSS test does not reject stationarity at the 5% level. Together with the conventional tests in Table A2, this supports treating SER as I(0).