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EMPLOYMENT INTENSITY FOR THE MANUFACTURING AND SERVICE SECTORS IN TURKEY (*)

TÜRKİYE'DE İMALAT VE HİZMET SEKTÖRLERİNDE İSTİHDAM ESNEKLİĞİ

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Abstract: The main purpose of this study is to investigate the relationship between employment intensity and growth in Turkey's manufacturing and service sectors via taking into consideration the Eurostat technology classification for the period between 2003 and 2015. Relying on a - Constant Elasticity of Substitution (CES) production function, employment demand functions are estimated for different manufacturing sub sectors with different technology levels and service sectors with different information content. The results reveal that real wages are the main determinant of employment demand with a negative coefficient, in line with the related literature. Employment elasticities of output have been positive and statistically significant, except for the medium-low (ML) technology sub sectors. Manufacturing sub sectors has relatively low and insignificant coefficients which could be considered as a weak sign of jobless growth. The interest rate seems to be negative and statistically significant. On the other hand, we did not find any significant relationship between inflation (inf) and employment demand except for less knowledge-based service (LKIS) sectors.

Keywords: *Employment Intensity, Economic Growth, Jobless Growth.*

JEL: E24, J21, J23.

Öz: *Bu çalışmanın temel amacı, Türkiye'nin sanayi ve hizmet sektörlerinde büyüme ve istihdam talebi arasındaki ilişkiyi Euro-stat teknoloji içeriği sınıflamasını dikkate alarak 2003-2015 dönemi için incelemektir. Sabit İkame Esnekliğine (CES) sahip bir üretim fonksiyonundan hareketle farklı teknoloji seviyesine sahip imalat ve farklı bilgi içeriğine sahip hizmet sektörleri için emek talep fonksiyonlarını tahmin edilmiştir. Bulgular, reel ücretin katsayısının beklendiği gibi negatif ve istatistiksel olarak anlamlı olup, reel ücret emek talebinin en önemli belirleyicisi olarak bulunmuştur. İstihdam çıktı esnekliği istatistiksel olarak anlamlı ve pozitif katsayıya sahiptir. Orta düşük teknolojili imalat sektörlerinde ise görece düşük katsayıya sahip olup, anlamsız*

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bulunması bu sektörlerde istihdamsız büyüme olabileceğine dair zayıf bir işaret olarak değerlendirilebilir. Faiz istatistiksel olarak anlamlı ve istihdam talebi üzerine negatif etki etmektedir. Diğer yandan, düşük bilgi içerikli hizmet sektör grubu hariç enflasyon katsayıları anlamsız bulunmuştur.

Anahtar Kelimeler: *İstihdam Yoğunluğu, İktisadi Büyüme, İstihdamsız Büyüme*

1. Introduction

Achieving sustained and inclusive growth along with productive employment is at the top of the policy agenda for developing economies. For decades sustained high rates of growth seemed to be the only way of reducing poverty and increasing welfare of the society. Okun (1960) reveals the negative relationship between unemployment and growth. Therefore, high growth rates expected to reduce unemployment rates, while low or negative growth rates expected to raise unemployment rates. Recent studies, however, demonstrated that achieving high economic growth is necessary but not a sufficient condition for increasing employment and/or reducing unemployment and poverty (Bhorat and Oosthuizen, 2008). Moreover, these empirical research have proven that similar output growth rates could create different employment outcomes in different developing and developed countries. This type of empirical evidence brings the notion of “jobless growth” to the fore. However, the term jobless growth is closely related to employment intensity of growth. In many developing countries the employment intensity seems to be low and declining over time. For example, the Turkish economy has been growing constantly on average for the last one and a half decades. Despite these persistent growth rates, the inertia in unemployment rates has raised the debate of jobless growth. In this context examining employment intensity of growth and its relation to labor productivity in Turkey by analyzing the annual data of the manufacturing industry and service sectors of the Turkish economy may provide some clues about the real constraints of employment growth.

Analyzing aggregate output and employment demand might disguise the effects of the changing structure of the economy. Many studies estimating the employment intensity based on elasticity formulas or some simple decomposition techniques that decompose value added growth into employment and wage growth. However, the empirical estimate of employment intensity is extremely sensitive to the output elasticity of the production function and, as a result, to the substitution relationship between inputs namely labor and capital. In this study we employ a constant elasticity of substitution (CES) production function and exploit the Westerlund (2007) and Westerlund and Edgerton (2008) co-integration techniques to analyze employment intensity. Having determined the long run relationship between growth and employment, we follow Eberhardt and Bond (2009), Eberhardt and Teal (2010) and Eberhardt (2012) and use AMG (Augmented Mean Group) estimator to calculate sectoral employment elasticities for non-agricultural business industries of the Turkish economy. The estimated sectoral elasticities are used to compare manufacturing industries with different technology contents, namely high, medium, and low technology industries. By the same token services are compared according to their knowledge contents. By doing so, we try to make a connection between change in the structure of the economy, output, and employment growth with 2-digit data (NACE Rev.2[1]) for the period of 2003-2015.

The estimated sectoral elasticities are used to compare, high, medium, and low technology sectoral groups of manufacturing and knowledge based and, less knowledge-based service industries. The results indicate that the sign of real wages is negative as expected and in accordance with the literature. The coefficient of employment elasticity with respect to output is relatively low which could be considered as a signal of jobless growth or weak relationship between growth and employment intensity. On the other hand, we did not find any significant relationship between inflation rate and employment except for less knowledge-based service sectors, in which employment is affected negatively by inflation. Yet, employment intensity is negatively affected by the interest rates in all sectors.

The rest of the study is structured as follows. A very brief review of the related research is given and the relationship between growth, employment, and productivity is discussed in Section 2. Section 3 discusses the data and the model used in estimation of employment elasticities. The results and the concluding observations are given in section 4.

2. Literature

In neoclassical theory under the assumptions of perfect competition and flexible input and output prices, the market forces of supply and demand create full employment equilibrium in the labor markets. Most adjustments occur in terms of relative factor returns in these markets. In the Solow-Swan type growth models and a Cobb-Douglas type production function framework, firms can adjust their capital-labor ratios to be consistent with the relative price of capital and labor. For instance, if there exist an excess demand of labor in the market, the price of labor will increase prompting firms to choose a capital-intensive techniques of production and vice versa. Therefore, firms always choose factor endowment that creates sufficient employment to clear the labor market. So, lack of generating necessary employment is not possible in the long run. In the short run the only explanation for lack of necessary employment is the rigidities of prices in the markets. However, two tradition come to the fore about the relationship between output growth and employment growth. First, Okun's Law try to connect changes in the real GDP growth rates and the growth rate of unemployment. This tradition uses two functional forms. In the difference form of the model, the percentage change in unemployment rate was regressed on the percentage change in real GDP. This form of the model allows researchers to estimate the minimum change in output required to keep the rate of unemployment unchanged. Another functional form that frequently used in empirical research is the gap model. In this version of the

[1] The Statistical Classification of Economic Activities in the European Community. It is abbreviated as NACE from the French version of the term: “Nomenclature Statistique des Activités Économiques dans la Communauté Européenne." NACE is similar to SIC (Standard Industrial Classification and NAICS (North American Industry Classification System). NACE Rev.1, NACE Rev. 1.1 and NACE Rev. 2 updated versions of NACE and subsequent versions in the order given.

model, the deviation of real GDP from its potential level was connected to the deviation of the unemployment rate from its natural level[2] (Basu and Foley 2011, 4).

The theory does not take into consideration the characteristics such that heterogeneity, highly segmented structure, and a large informal segments of labor markets in developing countries (Basu and Foley, 2013).

However, empirical studies prove that different growth rates, creates different employment outcomes in different countries and periods. From theoretical point of view, three main factors seem to have considerable impact on employment intensity. First, the trends in the share of wages, in other words, the ratio of the wage bill to value added. Second, the change in relative prices that are proxied usually by the ratio of the increase in producer and consumer prices. Third, the trade-offs between employment growth and real wage growth. Clearly, the relative price is an exogenous variable to the labor market while value added share of wages and the wage employment tradeoffs are labor market variables. Based on the factor supply functions, recently neoclassical and Keynesian economists have long ago recognized the importance of expectations in determination of wage rates and wage shares. Nevertheless, for equilibrium the created value added must be sufficient to compensate both the wage bill and the profit share to finance the required investment (Mazumdar and Sarkar, 2004).

In the empirical studies researchers usually incorporate inflation or other price indices along with the wage share and interest rates. For example, for the purpose of translating the growth into wage in real terms, Mazumdar (2005) draw together the producer and the consumer price indexes and make use of a constant behavioral parameter in decomposition of the factors determining employment elasticity. Econometric models are also used to measure output elasticities of employment that helps to understand the primary determinants of these elasticities themselves. For example, Kapsos (2006) examined employment elasticities of the three major sectors namely agriculture, industry, and services of 160 countries for the period of 1991-2003. The results assert low employment elasticities as well as decline in these elasticities overtime for developing countries. This outcome usually interpreted as a reflection of poor employment performance following the global economic slowdown. Ajilore and Yinusa (2011) explored the employment intensity of sectoral output growth for the period of 1990-2008. The study used both simple calculations and estimated elasticities based on some econometric procedures. The results indicate low labor absorptive capacity and jobless growth at both aggregate and industry level for Botswana. Bhad, Haq, Bhat and Megits (2022), also found that the employment elasticity of output growth has declined at both aggregate and sectoral levels, signaling jobless growth for Kazakhstan.

Tuncer and Altıok (2012) search for employment intensity of value-added growth for the Turkish economy at the NACE (Rev.1) 2-digit manufacturing industries. A simple decomposition procedure is used for manufacturing industries in Turkey for the period of 2003-2008. The results indicate a positive relationship between growth of value-

[2] Okun worked with the US data for the period from 1947 to 1960 and make use of the difference model and found that a 1 percent rise in GDP was associated with a 0.3 percent decline in unemployment. Similarly, in the gap model, he assuming a 4 percent full employment level and estimated that when output was lower than potential output by 2.8 percent the unemployment rate rose by 1 percent for the US economy.

added and employment creation at the industry level. The rise in both the labor force and the participation rates lead to inertia in reduction of unemployment. However, the results indicate another problem about sustaining output growth in the economy. Employment mainly created in relatively low productivity industries, while high productivity industries created very few or no new jobs.

Altuntepe and Güner (2013) was another study focused on growth and employment in the Turkish economy for the period between 1988 and 2011. The result points out that growth in the service sectors generate new employment while the manufacturing sectors capacity utilization and population growth reduce total employment. Concurrently, growth in agriculture and industry seems to have no effect on employment creation. Hence, employment growth is reinforced by the service industries only. On the other hand, Murat and Eser (2013) predicted employment elasticities and thresholds for the overall economy in the period between 1970 and 2011 for Turkey. Based on their results the authors claim 1993, 2000, 2002, 2003 and 2004 as the years of jobless growth in Turkey.

Slimane (2015) examined the impact of demographic and macroeconomic variables on employment and GDP elasticities for 90 developing countries for the period between 1991 and 2011. Three findings deserve attention for employment outcomes of output growth. First, employment elasticities differ significantly from country to country. Second, employment elasticities tend to be higher in countries with larger service sector shares, relatively developed and/or closed economies. Third, countries with high macroeconomic volatility or a higher share of urban population, have significant and large employment elasticities. Songur (2015) examined the elasticity of substitution for 90 developed and developing countries for the period of 1970-2011 in a CES production function framework. The outcomes suggest a positive relationship between elasticity of substitution and income levels. On the other hand, Songur and Saraç (2017) points out that the frequently used OLS method in estimating Cobb-Douglas type production functions give biased results compare to the Augmented Mean Group (AMG) or Common Correlated Effects Mean Group (CCEMG) estimators. Moreover, instead of using nonlinear methods, usually the OLS estimator is used in CES type production function estimations in the literature which gives biased results too. A study by Mkhize (2019) scrutinized the sectoral employment intensity of output growth of the non-agricultural sectors of the South African economy for the period between 2000 and 2012. A CES type production function is used to obtain the labor demand functions. The results indicate that non-agricultural aggregate employment and GDP did not move together in the long run, indicating a sign of jobless growth for the South African economy.

Abdioğlu and Albayrak (2017) examined the notion of jobless growth for the Turkish economy both for the whole economy and for the main sectors during the period between 1988 and 2015. The results point out that the construction industry has the largest employment elasticity coefficient and sectoral output gaps seem to have no effect on sectoral employment. Hence, the empirical studies provide mixed results about growth of real value added or GDP and employment intensity. The relationship proved to change over time, countries, and the sectors. Ali Ghazı, and Msadfa (2018) investigated the employment-GDP elasticities for a sample of emerging and developing economies for the years of 1990-2010. Their results revealed that most of the elasticity estimates cluster between 0.4 and 0.7. Thus, empirical studies focusing on Turkey use vastly different methods, cover different periods, and naturally report mixed results. Some studies focus on the manufacturing sector reveal a decline in employment intensity of growth overtime, providing support for jobless growth. Other studies, on the other hand, highlight the low productivity outcome of the sectors that create employment and underline the difficulties of sustaining output growth in the long run. Tarı Özgür (2022) investigated the validity of the jobless growth for Province of Çanakkale/Turkey for the periods 2010-2015, 2015-2020 and 2010-2020. The results revealed that the employment elasticity of the economic growth in Çanakkale is less than the average of Turkey, however there is no clue about jobless growth. Total employment elasticity, female employment elasticity and male employment elasticity were calculated and analyzed by Altuntepe (2022) separately using the employment elasticity formula for each year in the 2010-2020 period. Findings revealed that employment growth is negative and productivity growth is positive for each variable, since GDP growth is positive and elasticity coefficients are less than zero.

The main objective of this study is to address the relationship between growth and employment by analyzing the data of the manufacturing industry and services sub industries of the Turkish economy. We employ a constant elasticity of substitution (CES) production function and utilize co-integration tests to investigate jobless growth hypothesis. Having found co-integration relation, we estimate industrial employment elasticities for the non-farm business sectors of the Turkish economy for the period of 2003-2015. This study contributes to the current literature in two ways. First, the OECD technology classification was taken into account while investigating employment intensity in the manufacturing and service sectors. The second novelty of this study is lying in estimating employment elasticities of output by using up to date panel data analysis for the model produced from the CES production function following Upender (2006) and Mkhize (2019).

3. The Model and Data

In analyzing the employment-output relationships at highly disaggregated or industry level, one of the two broad methods are usually utilized in the empirical literature. First, simply calculating the percentage change in employment that is associated with a percentage change in output. These simple elasticity calculations usually provide very volatile measures over time and across sectors. Second, employment elasticity is estimated by making use of some sort of linear or log-linear regression methods. This study employs a Constant Elasticity of Substitution (CES) production function to derive the sectoral labor demand functions. Starting with the following constant elasticity of substitution (CES) production function,

$$GVA_{it} = A\left\{\alpha K_{it}^{-\rho} + (1-\alpha)E_{it}^{-\rho}\right\}^{-\eta/\rho} \tag{1}$$

where A is the efficiency parameter (A>0), K represents the capital used, GVA is the industry Gross Value Added, E is employment of the industry, η is a returns to scale parameter (η >1), α is the distribution parameter (1> α >0), ρ is the extent of substitution between capital and labor, $\sigma = 1/(1+\rho)$, i shows the sub-sector and t indicates time. Marginal product of employment (MP_L) from the CES function can be derived as:

$$\frac{\partial GVA_{it}}{\partial E_{it}} = \left((1-\alpha)\eta A^{-\rho/\eta}\right).GVA_{it}^{\{1+\rho/\eta\}}.E_{it}^{-\rho-1} \tag{2}$$

Letting, MP_L denote the marginal product of labor, in perfectly competitive markets firms maximize profits by equating the marginal product of each input to its relative price in terms of output. In the case for labor, firms will equate the wage (w) to the marginal revenue product of labor ($MRP_L = MP_L \, xP$). Normalizing the output price to unity, *w* now represents the real wage[3]. Hence,

$$\frac{\partial GVA_{it}}{\partial E_{it}} = MRP_L = w \quad (3)$$

Setting the partial derivative equal to real wage and solving the equation for employment, we can obtain the following employment demand function.

$$E_{it} = \left((1-\alpha)\eta A^{-\rho/\eta}\right)^{1/(\rho+1)} \; GVA_{it}^{(1+\frac{\rho}{\eta})/(\rho+1)} \; w_{it}^{-1/(\rho+1)} \quad (4)$$

Setting $\beta_0 = \ln\left[\eta(1-\alpha)/A^{\rho/\eta}\right]^{1/\rho+1}$, $\beta_1 = (1+\rho/\eta)/(\frac{1}{\rho+1})$, $\beta_2 = -1/(\rho+1)$ and taking the log transformation of equation (4) will give us the following equation (5).

$$lnE_{it} = \beta_0 + \beta_1 lnGVA_{it} + \beta_2 lnw_{it} \quad (5)$$

Even though, equation 1 is nonlinear in nature, the log transformation of the function in equation 5 is linear. Following the lines of Upender (2006), Mkhize (2016) and the empirical literature we extended this function by adding some control variables that potentially affect employment and output relationships. In the empirical estimations the following equation (6) is employed:

$$ln\, E_{it} = \beta_0 + \beta_1\, ln\, w + \beta_2\, ln\, GVA_{it} + \beta_3 r_{it} + \beta_4\, inf_{it} + \varepsilon_{it} \quad (6)$$

where *w* is the real wage and GVA is the real gross value added as indicated earlier, and *r* is the commercial interest rates in nominal terms obtained from Central Bank of the Turkish Republic, and *inf* is the inflation rate.

Table 1. Eurostat Indicators on High-tech Industry and Knowledge Intensive Services

Model Name	Classification	NACE Rev.2- 2 digit codes
H-MH/Dataset 1	High tech and Medium High Tech	20, 21, 26, 27, 28,19, 30
ML/Dataset 2	Medium Low Tech	19, 22, 23, 24, 25
L/Dataset 3	Low Tech	10, 11, 12, 13, 14, 15, 16, 17, 18, 31, 32
Manu/Dataset 4	All Manufacturing sectors	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32
KIS/Dataset 5	Knowledge base Service Sectors⸸	50, 51, 58, 59, 61, 62, 63, 69, 70, 71, 73, 74, 75, 78, 80,85, 86, 87, 88, 90, 93
LKIS/Dataset 6	Less Knowledge Base Service Sectors†	45, 46, 47, 49, 52, 53, 55, 56, 68, 77, 79, 81, 82, 95, 96

Source: Eurostat.
⸸ 84 to 93 are knowledge base Service Sectors but we eliminate some of them due to the lack of data.
†94 is eliminated due to the lack of data.

[3] The price of the product is normalized to one in the maximization process. Arrow et. al. (1961) has further information about the subject.

Inflation rates are compiled from the domestic producer price indexes for the manufacturing and services industries using the relevant GDP deflators. This study employs the Turkish Statistical Institute (TURKSTAT) 2-digit annual Industry and Services Statistics database that is classified according to the Statistical Classification of Economic Activities in the European Community (NACE Rev.2) for the period of 2003–2015. Since the data on salaries and wages ended in 2015, the analysis range covers the period between 2003 and 2015. In classification of sub sectors (NACE Rev. 2) into technology and knowledge-based content we rely on the Eurostat classification given in Table 1. Therefore, in this study, we used six different datasets to estimate employment elasticities. Average of the lnw, lnE and lnGVA values (except macroeconomic variables in the models) according to the Eurostat classification for the period of 2003–2015 are in Figure 1. According to Figure 1, the graphs of employment, wage and value added series differ by technology levels or knowledge content.

Figure 1. Average Values of the Variables

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4. Empirical Results

To investigate the determinants of employment demand and output growth relationship for the industry and services of the Turkish economy, we estimate equation 6, for different sets of industries with different technology and knowledge contents. The manufacturing industries aggregated as high and medium technology industries (H-MH / Dataset 1); industries with medium technology content (ML/ Dataset 2)); and industries with low technology (L / Dataset 3). Also, the whole manufacturing is analyzed as a different group (MANU / Dataset 4). Similarly, the service industries aggregated under two group depending on knowledge contents, as knowledge based (KIS / Dataset 5) and Less knowledge based (LKIS /Dataset 6) industries. Equation 6 is estimated by using dynamic panel data methods. As a first step, the time series properties of the data and then the long run relationships, in other words the existence of any co-integration relationships among the variables are investigated.

Naturally, there are several ways used in testing the stationarity properties of the data pending on the heterogenous slopes and cross-sectional dependency. First, we test for cross sectional dependency and slope homogeneity of the panels for each variable using Peseran (2004) and Peseran and Yamagata (2008). Results are given in Tables 7 through 9 in the appendix.[4] Then, we utilize the Bai and Ng (2004) PANIC unit root

[4] Table 8, Table 9, and Table 10 indicates Delta and CD test results of the variables. The null hypotheses of CD and CDLM tests state that there is no cross-sectional dependency among the panels (Pesaran, 2004). Pesaran & Yamagata (2008), on the other hand, propose a test to determine the slope homogeneity of panels. Under the null of the test all slope coefficients are equal while under the alternative at least one of the slope coefficients is different from others.

tests. Null hypothesis of the PANIC unit root test states that variables are not stationary in level. The results in the appendix (Table 12, Table 13, and Table 14) indicate that the series are not stationary in levels but stationary in their first differences. Since the level variables are integrated, testing for co-integration relationships is necessary before estimating the models. However, cross sectional dependency and slope homogeneity in the possible long-run relationship should also be investigated again before testing for the existence of co-integration relationships. The results illustrated in the appendix (Table 7, Table 8, and Table 9)

Table 2. Delta and CD Test Results of the Models

Model		CD test	CD-LM Test	Delta	Delta-tilda	Slope of Homogeneity	Cross Sectional Depend.
H-MH (Dataset 1)	Test statistic	3.41	3.499	2.709	3.455	Heterogenous	Yes
	p-value	0.000	0.000	0.002	0.000		
ML (Dataset 2)	Test statistic	4.187	3.588	2.354	3.009	Heterogenous	Yes
	p-value	0.000	0.000	0.003	0.000		
L (Dataset 3)	Test statistic	7.723	4.680	3.074	3.913	Heterogenous	Yes
	p-value	0.000	0.000	0.000	0.000		
Manu (Dataset 4)	Test statistic	17.081	16.196	5.806	7.403	Heterogenous	Yes
	p-value	0.000	0.000	0.000	0.000		
KIS (Dataset 5)	Test statistic	2.469	7.161	7.28	9.30	Heterogenous	Yes
	p-value	0.000	0.000	0.000	0.000		
LKIS (Dataset 6)	Test statistic	6.619	14.010	8.622	6.764	Heterogenous	Yes
	p-value	0.000	0.000	0.000	0.000		

Table 2 summarizes the results of the slope homogeneity and cross-sectional dependence tests namely, Delta and CD tests, respectively for the cointegration relationship. The CD and Delta tests results indicate cross sectional dependency and heterogeneity in the models. Therefore, Westerlund (2007) and Westerlund and Edgerton (2008) tests are preferred in testing co-integration relationships. Westerlund (2007) [ECM] co-integration test has a good small-sample property and takes into account both cross sectional dependency and slope heterogeneity, while the Westerlund and Edgerton (2008) test additionally accounts for the level shift and the regime shift in the model. Hence, we use the two tests together, expecting to get more accurate and refined outcomes.

Table 3 illustrates the Westerlund (2007) ECM results. Since all models have cross sectional dependency, we use, and report bootstrap critical values instead of asymptotic critical values in Westerlund (2007) [ECM]. As well, since we reject slope of homogeneity (Table 2), we need to use group mean statistics instead of panel statistics for all models. Therefore, we report group mean statistics in Table 3. According to Westerlund (2007) [ECM] results, the null hypothesis of no cointegration relationship cannot be rejected in the H-MH sectors for all models (none, with a constant, and with a constant and a trend). On the other hand, none and constant models indicate that there exist a cointegration relationship for Low tech (L) industries. However, there is no cointegration relationship for Low tech (L) group with trend. For the whole manufacturing group (MANU), the none-model displays a cointegration relationship. Moreover, constant model for KIS sectors and trend model for LKIS sectors indicate the existence of cointegration relationship in the results.

Table 3. Westerlund (2007) ECM Co-integration Test Results of the Models

	None	Bootstrap	Constant	Bootstrap	Constant Trend	Bootstrap
H-MH	Test stat.	p-val	Test stat.	p-val	Test stat.	p-val
g_tau	-5.732	0.255	-11.822	0.330	-19.731	0.621
g_alpha	1.435	0.671	1.479	0.474	3.495	0.775
ML						
g_tau	-3.221	0.373	0.481	0.777	-50.578	0.375
g_alpha	-1.689	0.042**	0.651	0.302	2.621	0.465
L						
g_tau	-18.043	0.082*	-49.360	0.199	-89.891	0.500
g_alpha	-4.660	0.000***	-2.239	0.021**	1.677	0.290
MANU						
g_tau	-12.262	0.189	-12.254	0.562	-44.931	0.654
g_alpha	-0.899	0.050**	1.485	0.231	5.587	0.772
KIS						
g_tau	-10.712	0.186	-25.300	0.132	-758.85	0.285
g_alpha	1.411	0.409	0.132	0.080*	1.042	0.151
LKIS						
g_tau	-4.185	0.465	-24.110	0.243	-1688.964	0.265
g_alpha	-1.973	0.587	1.765	0.405	-0.997	0.053**

Table 4. Westerlund and Edgerton (2008) Co-integration Test Results

	H-MH			ML			L		
	noshift	Level shift	Rejime Shift	noshift	Level shift	Rejime Shift	noshift	Level shift	Rejime Shift
tau_n	-4.650	-1.644	-5.250	-0.850	-2.349	0.132	-1.322	0.058	-1.193
p-value	0.000	0.050	0.000	0.197	0.009	0.552	0.093	0.523	0.116
phi_n	-1.438	-2.23	-4.72	-1.836	-1.346	-0.132	0.070	0.253	-0.571
p-value	0.075	0.012	0.000	0.033	0.089	0.447	0.472	0.599	0.283
Factornum.	2	2	2	2	2	2	3	2	3
	Manu			KIS			LKIS		
	noshift	Level shift	Rejime Shift	noshift	Level shift	Rejime Shift	noshift	Level shift	Rejime Shift
tau_n	-1.588	-3.246	-1.588	-10.019	-3.961	-3.396	-2.151	-1.819	-5.146
p-value	0.000	0.000	0.056	0.000	0.000	0.000	0.015	0.034	0.000
phi_n	-3.613	-1.573	-3.613	-11.989	-3.547	-3.028	-1.115	-1.778	-3.151
p-value	0.000	0.057	0.000	0.000	0.000	0.001	0.132	0.037	0.000
Factornum.	3	2	3	2	2	2	2	3	2

Table 5. Summary of the Decisions

Model	Westerlund and Edgerton (2008) Decision	Westerlund (2007) Decision
H-MH	Cointegration relation	Cointegration relation is rejected
ML	Cointegration relation	Mixed Results
L	Mixed Results	Mixed Results
Manu	Cointegration relation	Mixed Results
KIS	Cointegration relation	Mixed Results
LKIS	Cointegration relation	Mixed Results

Table 6. AMG Results of Models

Depended Variable: lnE						Model						
Coef.	H-MH	H-MH	ML	ML	L	L	MANU	MANU	KIS	KIS	LKIS	LKIS
lnw	-0.5388	-0.466	-0.086	-0.040	-0.560	-0.371	-0.521	-0.358	-0.485	-0.442	-0.503	-0.409
	-0.013	0.004	-0.039	0.274	-0.001	0.008	0.000	0.000	0.000	0.000	0.000	0.000
lngva	0.333	0.298	0.111	0.0490	0.302	0.301	0.260	0.256	0.501	0.476	0.335	0.299
	0.000	0.000	-0.108	0.397	-0.024	0.008	0.000	0.000	0.000	0.000	-0.001	0.001
r	-0.010	-0.013	-0.022	-0.024	-0.010	-0.012	-0.010	-0.012	-0.008	-0.009	-0.014	-0.014
	0.000	0.000	0.000	0.000	-0.004	0.000	0.000	0.000	-0.001	0.003	0.000	0.000
inf	-0.003	-0.002	-0.000	-0.000	-0.000	-0.000	-0.002	-0.001	0.000	0.000	-0.004	-0.002
	-0.024	0.080	-0.200	0.305	-0.891	0.981	-0.01	0.305	-0.719	0.939	-0.002	0.001
dum		-0.092		-0.023		-0.118		-0.095		-0.041		-0.077
		0.004		0.324		0.101		0.012		0.154		0.194
constant	8.286	8.550	10.369	11.321	8.679	7.857	9.292	8.650	4.750	4.9131	8.661	9.001
	-0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
cdp	0.981	1.030	0.921	0.979	1.023	0.748	1.035	0.839	0.552	0.626	1.020	0.807
	0.000	0.001	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.001	0.000	0.000

Westerlund and Edgerton (2008) proposed a test to investigate cointegration relationship with taking into consideration structural breaks. Westerlund and Edgerton (2008) co-integration test results illustrated in Table 4. The null of no cointegration relationship cannot be rejected at the 5 percent significance level for dataset 1 (H-MH) and dataset 2 (ML). On the other hand, dataset 3 (L), overall manufacturing sectors (dataset 4 / Manu), dataset 5 (KIS) and dataset 6 (LKIS) models are co-integrated. Table 5 comprises summary of the co-integration test results. AMG results of the models are illustrated in Table 6. The variable denoted by c.d.p refers to the common dynamic process and dum is the heterogenous dummy variable which is determined by Westerlund and Edgerton (2008) for the level shift model. We use Westerlund and Edgerton (2008) co-integration test's break dates heterogeneously in AMG estimator. Heterogenous dummy dates are in Tables 10 and 11 in the appendix. The result of the AMG model revealed that the Turkish industry and service sectors have relatively high employment elasticity with respect to wage rates compare to employment elasticity of output.

One percentage increase in wages seems to reduce employment by 0.54 percent in the H-MH sectors. Whereas the structural shifts dummy variable was used, one percent increase in wages seems to decrease employment by 0.47 percent in the H-MH sectors. The wage coefficients as well as the dummy variable are statistically significant at the 1 percent significance level. For the ML sectors, the coefficient of wage is statistically significant at the 5 percent level and one percentage increase in the wage decreases employment by 0.09 percent. In this model, the wage has the lowest coefficient among other industry groups. Besides, the coefficient of wage for the ML sectors with dummy is not statistically significant at 10 percent level in the contrary to L sectors in which wage coefficients and the dummy variable are statistically significant at the 1 percent significance level. The absolute value of the real wage coefficient has the highest magnitude for L sectors without dummy.

One percentage increase in wages reduces employment by 0.56 percent and 0.37 percent for L model and L model with break, respectively. The result of the whole manufacturing (MANU) sectors indicates that one percentage increase in the wage rates reduces employment by 0.52 percent and 0.36 percent for MANU with breaks. After break dates, for the KIS and LKIS sectors the coefficients of wage are statistically significant at 1 percent level as in MANU. Likewise, dummy variables in LKIS and KIS are not statistically significant at 10 percent level and a percentage increase reduces employment by 0.49 and 0.44 percent for KIS and KIS model with break, respectively. As well, a percentage increase in the wage reduces employment by 0.50 and 0.41 percent in KIS and KIS model with break, respectively. In almost all the sector groups, the real wage coefficient has the largest magnitude in absolute terms. The AMG results provide evidence that wages are the main determinant of employment demand except for ML and KIS sector groups. The wage coefficient represents the elasticity of employment with respect to price of labor (wages). Higher wages expected to reduce the demand for labor. Therefore, the negative wage coefficient means that an increase in nominal wages creates downward pressures on the employment demand.

Real wage coefficients are expected to be negative due to extra cost per unit of production causing employers to reduce their labor demand. Analogous to other empirical studies, the coefficients of the real wages are negative in all the estimations. The coefficients of the gross value added (GVA) and the dummy variables are statistically significant. For H-MH and H-MH with break, L with break, MANU and

MANU with break, LKIS and LKIS with break, KIS and KIS with break, the coefficients of GVA and the dummy variables are statistically significant at the 1 percent level and L sectors without break is statistically significant at 5 percent level. A percentage increase in the GVA rises employment by 0.33 and 0.30 percent in H-MH sector groups without and with the dummy variable, respectively. A 1 percent increase in GVA leads to 0.3 percent increase in L group with and without break. Similar results also found for the whole manufacturing (MANU) sector group. Likewise, a percentage increase in the GVA rises employment by 0.50 percent and 0.48 percent in KIS and KIS model with break, respectively. As well, an increase in the GVA of 1 percent leads to an increase in employment of 0.34 percent and 0.30 percent for KIS and KIS model with break, respectively. In almost all the sector groups, the real wage coefficient has the largest magnitude in absolute terms. The AMG results provide evidence that wages are the main determinant of employment demand except for ML and KIS sector groups.

The wage coefficient represents the elasticity of employment with respect to price of labor (wages). Higher wages expected to reduce the demand for labor. Therefore, the negative wage coefficient means that an increased percentage change in nominal wages creates downward pressures on the employment demand. Real wage coefficients are expected to be negative due to extra cost per unit of production causing employers to reduce their labor demand. Analogous to other empirical studies, the coefficients of the real wages are negative in all the estimations.

The coefficients of the gross value added (GVA) and the dummy variables are statistically significant. For H-MH and H-MH with break, L with break, MANU and MANU with break, LKIS and LKIS with break, KIS and KIS with break, the coefficients of GVA and the dummy variables are statistically significant at 1 percent level and L sectors without break is statistically significant at 5 percent level. A percentage increase in the GVA rises employment by 0.33 and 0.30 percent in H-MH sector groups without and with the dummy variable, respectively. A 1 percent increase in GVA leads to 0.3 percent in L group with and without break. Similar results also found for MANU sector group. Likewise, a percentage increase in the GVA rises employment by 0.50 percent and 0.48 percent in KIS and KIS model with break, respectively. As well, an increase in the GVA of 1 percent leads to an increase in employment of 0.34 percent and 0.30 percent for KIS and KIS model with break, respectively.

The second important determinant of employment demand at the industry level is the gross value added. The results reveal that percentage increase in gross value added is enhancing employment demand. An increase in sectoral real gross value-added leads to an increase in current and future demand for workers since it might cause an increase in consumer demand for the final goods and services in the future (Mkhize, 2019:8). Thus, firms' demand for labor might have increased for satisfying future consumption as well. Kapsos (2005) asserts that employment and productivity growth realized together if the elasticities are between 0 and 1 and the coefficient of GDP is positive. In line with the related literature, the impact of GVA on employment demand is positive and statistically significant except for ML sectors. However, the magnitude of the coefficients for gross value added are relatively low compare to the current literature, which means that growth in output cannot create sufficient demand for employment in ML sectors. Ali, Ghazı, and Msadfa (2018) find the overall point estimates of elasticities are ranging between 0.4 and 0.7. The KIS sectors has the largest coefficient magnitude (0.50). However, in other sectors, it was observed that the majority of coefficient is ranging between 0.3 and 0.34, which are relatively low with respect to the current related literature. These findings are also compatible with the results of Slimane (2015). It is asserted that employment elasticities tend to be higher in more advanced and closed countries or in countries with a relatively larger service sector. Therefore, employment elasticities tend to be lower in developing countries or countries that less specialized in the services sectors.

The expected sign for the coefficient of interest rate may be either positive or negative. If capital is a substitute for labor, then an increase in the interest rate leads to an increase in employment demand. A negative interest rate coefficient means that high interest rates can lead to low capital demand by employers, resulting in low labor productivity. In this case, the demand for consumer goods and services may decrease (Mkhize, 2019:8). Our findings reveled that interest rates are statistically significant at 1 percent level and negative for all the sector groups. The result of our study shows that an increase in the interest rates reduce employment demand of all sector groups in Turkey. Therefore, there seems to be an inverse relationship between interest rates and employment rates in Turkey.

Similarly, from theoretical point of view the coefficient of the inflation rate may be negative or positive. Mkhize (2019:8) highlights that if the coefficient of inflation rate is positive, then an increase in inflation as measured by CPI denotes higher marginal revenue products of workers. Thus, there will be an increase in demand for labor by firms. Our findings point out to mixed outcomes for different sector groups. For instance, the inflation rate coefficient is positive but not statistically significant at the 10 % level for the knowledge-based service industries (KIS) with and without break. However, the coefficient of inflation rates is negative and statistically significant for all other industry groups. The results support the idea that an increase in inflation reduce the demand for goods and services and hence the derived demand for labor would also declines. Moreover, our results indicate a reallocation of labor from high technology and high knowledge content groups of industries to low technology and knowledge content industry groups.

5. Conclusion

In the wake of the 21st century the Turkish economy faced with a deep financial crisis. Capital outflows from the country led to the collapse of the financial system and spread to the real economy. In the aftermath of the 2001 crisis under the auspices of the IMF and the World Bank the Turkish economy initiated a new economic program. After the crisis (2001) the Turkish economy experienced high growth rates of real GDP and productivity improvements along with relatively low inflation rates. However, the employment and unemployment consequences of this period were extremely poor. The main objective of this study is to address the relationship between growth and employment intensity by analyzing the annual data of the non-farm business industries of the Turkish economy. For this purpose, we make use of a constant elasticity of substitution (CES) production function and solve it for the labor demand equation, and add some control variables namely, inflation and the interest rate. Then, we utilize Westerlund (2007) and Westerlund and Edgerton (2008) co-integration techniques to test for the cointegration relationships and estimating the elasticities by using AMG estimator. The elasticities are estimated for the period from 2003 to 2015 and six different groups of industries aggregated according to their technology and knowledge contents which is known technology level following Eurostat classification. These groups are high and medium high tech. manufacturing industries, medium low tech. manufacturing industries, low tech. manufacturing industries, and the overall manufacturing industries, and for service industries, knowledge based and less knowledge-based industries.

The AMG results provide evidence that wages are the main determinant of employment demand in all industry groups except ML and KIS. Higher wages expected to create downward pressures on the employment demand because it rises per unit cost of production. This finding is parallel to the results of other empirical studies. GVA seems to be one of the main determinants of employment demand subsequent to wage rates. As a result, an increase in long term sectoral output will increase the demand for labor and employment intensity in manufacturing industries. The output employment elasticity found to be positive and statistically significant for all industry groups. One percentage increase in the GVA rises employment by around 0.33, 0.30, and 0.30 percent in H-MH, ML and L manufacturing sectors with or without dummy variable respectively while one percentage increase in the GVA rises employment by around 0.11 and 0.05 percent in ML with and without dummy variable. A percentage increase in GVA rises employment demand by around 0.26 percent for overall manufacturing sectors which is relatively low according to the current related literature. As a result, in line with the related literature, the impact of GVA on employment demand is positive and statistically significant except for ML sectors. However, the magnitude of the coefficients for gross value added are relatively low compared to the current literature, which indicates jobless growth in Turkey for the period from 2003 to 2015. However, a percentage increase in the GVA increases the employment demand by 0.5 and 0.48 percent in knowledge-based and less knowledge-based service industries, respectively. On the other hand, we did not find any significant relationships between inflation and employment in knowledge-based service groups while interest rate, which is an indicator of the rental cost of capital, has affected all sectors negatively. Thus, an increase in inflation and interest rates negatively impacts labor demand of firms.

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Appendix

Table 7. Delta and CD Test Results for H-MH and ML

Model	H-MH				ML			
Test/Variable	lne	lngva	lnw	inf	lne	lngva	lnw	inf
Delta	2.33	1.21	-1.09	0.33	-1.09	1.07	-0.91	-0.68
prob	0.01	0.11	0.86	0.36	0.86	0.14	0.81	0.75
Deltatilda	2.66	1.38	-1.24	0.38	-1.24	1.22	-1.04	-0.77
prob	0.00	0.08	0.89	0.35	0.89	0.11	0.85	0.78
CD	-0.92	-1.36	-0.68	-2.018	-1.71	-0.72	-1.162	-1.6
prob	0.17	0.09	0.24	0.02	0.04	0.23	0.12	0.05
CDlm	3.32	1.77	2.03	3.48	2.95	-0.55	3.73	4.34
prob	0.00	0.04	0.01	0	0	0.29	0	0

Table 8. Delta and CD Test Results for L and MANU

Model	L				MANU			
Test/Variable	lne	lngva	lnw	inf	lne	lngva	lnw	inf
Delta	2.61	1.78	2.96	-1.024	1.79	2.51	2.21	-0.1
prob	0.01	0.03	0	0.85	0.04	0.01	0.01	0.53
Deltatilda	2.98	2.03	3.37	-1.16	2.04	2.86	2.51	-0.11
prob	0	0.02	0	0.89	0.02	0	0	0.54
CD	-1.47	-1.57	-1.22	-1.15	0.33	-0.49	-0.01	1.03
prob	0.07	0.06	0.11	0.13	0.34	0.31	0.49	0.15
CDlm	5.17	4.02	4.82	3.43	7.14	6.1	9.75	7.31
prob	0	0	0	0	0	0	0	0

Table 9. Delta and CD Test Results for the KIS and LKIS

Model	KIS			LKIS		
Test/Variable	lne	lngva	lnw	lne	lngva	lnw
Delta	3.49	4.12	2.94	2.05	1.18	1.91
prob	0	0	0.02	0.02	0.03	0.02
Deltatilda	3.97	4.7	3.35	2.34	2.15	2.18
prob	0	0	0	0.01	0.02	0.01
CD	-0.08	-1.64	-1.59	0.14	-1.19	-0.55
prob	0.46	0.05	0	0.44	0.12	0.28
CDlm	6.37	6.08	6.65	10.11	5.52	7.13
prob	0	0	0	0	0	0

Table 10. Level Shift Break Dates for H-MH, ML and L

	H-MH		ML		L
Sector	break date	Sector	break date	Sector	break date
20	2005	19	2007	10	2011
21	2006	22	2008	11	2004
26	2006	23	2007	12	2009
27	2008	24	2008	13	2008
28	2008	25	2008	14	2008
29	2008			15	2008
30	2009			16	2004
				17	2008
				18	2004
				31	2006
				32	2008

Table 11. Level Shift Break Dates for MANU, KIS and LKIS

	MANU		KIS		LKIS
Sector	break date	Sector	break date	Sector	break date
10	2005	50	2011	45	2008
11	2006	51	2007	46	2004
12	2006	58	2008	47	2008
13	2008	59	2004	49	2004
14	2008	61	2011	52	2008
15	2008	62	2005	53	2004
16	2009	63	2005	55	2004
17	2010	69	2006	56	2008
18	2006	70	2007	68	2006
19	2008	71	2006	77	2005
20	2008	73	2008	79	2006
21	2008	74	2004	81	2004
22	2005	75	2006	82	2005
23	2012	78	2010	95	2004
24	2009	80	2008	96	2010
25	2008	85	2011		
26	2008	86	2009		
27	2009	87	2006		
28	2004	88	2012		
29	2008	90	2009		
30	2004	93	2010		
31	2004				
32	2008				

Table 12. PANIC Unit Root Test Results

HMH	inf	prob	dinf	prob	lne	prob	dlne	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	3.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		2.00		1.00
PCe_Choi	-0.07	0.53	0.86	0.19	-1.13	0.87	1.14	0.13	-1.50	0.93	1.37	0.09	1.37	0.09	-0.56	0.71	-1.87	0.96	-0.10	0.54
PCe_MW	13.64	0.48	18.57	0.18	8.04	0.89	20.03	0.13	6.04	0.97	21.24	0.10	21.24	0.10	10.98	0.68	4.06	0.99	13.46	0.49
constant	N.ofFac.	3.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
PCe_Choi	-0.45	0.67	2.29	0.01	-0.59	0.72	1.43	0.08	-0.29	0.61	1.58	0.06	-0.29	0.61	1.58	0.06	-0.11	0.74	1.51	0.07
PCe_MW	11.62	0.64	26.11	0.03	10.87	0.70	21.57	0.09	12.48	0.57	22.38	0.07	12.48	0.57	22.38	0.07	13.41	0.72	22.00	0.06
trend	N.ofFac.	3.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		4.00		2.00
PCe_Choi	-0.49	0.69	2.37	0.01	0.45	0.33	2.03	0.02	-0.01	0.50	1.82	0.03	-0.01	0.50	1.82	0.03	1.18	0.02	-0.16	0.56
PCe_MW	11.42	0.65	26.53	0.02	16.38	0.29	24.72	0.04	13.97	0.45	23.64	0.05	13.97	0.45	23.64	0.05	23.97	0.05	13.11	0.51

ML	inf	prob	d(inf)	prob	lne	prob	d(lne)	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00		2.00		2.00
PCe_Choi	-1.22	0.89	-0.88	0.81	-0.90	0.82	0.47	0.32	-0.83	0.80	2.99	0.00	-1.78	0.96	1.57	0.06	0.52	0.30	0.58	0.28
PCe_MW	4.55	0.92	6.07	0.81	5.98	0.82	12.12	0.28	6.28	0.79	23.37	0.01	2.02	1.00	14.27	0.08	12.54	0.26	12.60	0.24
constant	N.ofFac.	2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00		1.00		1.00
PCe_Choi	0.56	0.29	1.17	0.12	-1.57	0.94	0.20	0.42	-1.32	0.91	3.42	0.00	1.17	0.12	3.97	0.00	0.28	0.38	3.17	0.04
PCe_MW	12.50	0.25	15.24	0.12	2.96	0.98	10.89	0.37	4.11	0.94	25.28	0.00	15.23	0.12	23.90	0.00	11.28	0.33	24.21	0.00
trend	N.ofFac.	2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00		2.00		1.00
PCe_Choi	-0.13	0.55	2.86	0.00	-0.44	0.67	3.13	0.00	0.22	0.41	2.71	0.00	1.35	0.09	5.32	0.00	-0.68	0.75	3.21	0.00
PCe_MW	9.41	0.49	22.79	0.01	8.04	0.63	24.01	0.01	10.98	0.36	22.12	0.01	13.41	0.10	33.79	0.00	6.92	0.73	24.36	0.00

Table 13. PANIC Unit Root Test Results

L	inf	prob	d(inf)	prob	lne	prob	d(lne)	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	1.00		1.00		2.00		2.00		2.00		2.00		1.00		1.00		2.00		2.00
PCe_Choi	0.46	0.32	1.22	0.11	-1.63	0.95	0.66	0.25	-1.80	0.96	1.35	0.09	-2.88	1.00	-2.45	0.99	-1.84	0.96	1.14	0.12
PCe_MW	25.04	0.30	30.11	0.12	11.22	0.97	26.40	0.23	10.03	0.99	30.93	0.10	2.87	1.00	5.78	1.00	9.75	0.98	29.60	0.12
const	N.ofFac.	1.00		1.00		2.00		2.00		2.00		2.00		1.00		1.00		2.00		2.00
PCe_Choi	4.71	0.00		0.00	-0.99	0.84	2.16	0.02	0.85	0.20	1.28	0.10	-0.12	0.55	-2.02	0.98	-2.31	0.99	4.77	0.00
PCe_MW	53.22	0.00	64.58	0.00	15.46	0.84	36.33	0.03	27.65	0.19	30.49	0.11	21.20	0.51	8.60	1.00	6.65	0.99	53.68	0.00
trend	N.ofFac.	4.00		1.00		2.00		2.00		2.00		2.00		1.00		1.00		2.00		2.00
PCe_Choi	1.69	0.05	3.44	0.00	-0.99	0.84	1.84	0.03	-0.44	0.67	2.10	0.02	1.29	0.10	1.88	0.03	1.15	0.12	3.40	0.00
PCe_MW	33.18	0.06	44.79	0.00	15.40	0.84	34.23	0.05	19.07	0.64	35.95	0.03	30.55	0.11	34.47	0.04	29.67	0.12	44.61	0.01
Manu.	inf	prob	d(inf)	prob	lne	prob	d(lne)	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	4.00		4.00		2.00		3.00		2.00		2.00		4.00		2.00		2.00		2.00
PCe_Choi	-1.64	0.95	-0.45	0.67	-2.15	0.98	0.89	0.19	-2.69	1.00	0.80	0.21	-1.66	0.95	2.51	0.01	-0.65	0.74	0.83	0.20
PCe_MW	30.29	0.96	41.70	0.65	25.38	0.99	54.51	0.18	20.17	1.00	53.66	0.20	28.43	0.97	67.50	0.01	39.76	0.73	53.97	0.20
constant	N.ofFac.	4.00		4.00		2.00		3.00		2.00		2.00		4.00		2.00		2.00		2.00
PCe_Choi	1.08	0.14	4.56	0.00	-0.75	0.77	2.50	0.01	-1.26	0.90	3.07	0.00	0.31	0.38	5.61	0.00	0.60	0.27	2.97	0.00
PCe_MW	56.34	0.14	89.73	0.00	38.84	0.76	69.97	0.01	33.93	0.91	75.49	0.00	46.95	0.35	96.59	0.00	51.78	0.26	74.45	0.01
trend	N.ofFac.	4.00		4.00		2.00		3.00		2.00		2.00		3.00		2.00		2.00		2.00
PCe_Choi	1.12	0.13	3.03	0.00	-0.09	0.54	4.28	0.00	1.13	0.13	2.02	0.02	-0.81	0.79	4.82	0.00	-0.13	0.55	2.79	0.00
PCe_MW	56.73	0.13	75.06	0.00	45.09	0.51	87.02	0.00	56.79	0.13	65.33	0.03	36.41	0.78	89.20	0.00	44.76	0.52	72.74	0.01

Table 14. Panic Unit Root Test Results

KIS	inf	prob	d(inf)	prob	lne	prob	d(lne)	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		2.00		2.00
PCe_Choi	-1.09	0.86	0.50	0.31	-0.72	0.77	0.38	0.35	-0.68	0.75	-0.38	0.65	-1.06	0.85	13.75	0.00	-2.80	0.99	0.63	0.26
PCe_MW	31.97	0.87	46.54	0.29	35.36	0.76	45.48	0.33	35.81	0.74	38.56	0.62	32.32	0.86	168.00	0.00	16.25	0.99	47.85	0.24
constant	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00
PCe_Choi	-0.06	0.52	5.51	0.00	-1.09	0.86	6.45	0.00	0.88	0.19	1.48	0.07	-2.33	0.99	3.78	0.00	-2.64	0.99	3.17	0.00
PCe_MW	41.45	0.49	92.53	0.00	32.04	0.87	101.07	0.00	50.07	0.18	55.54	0.08	20.64	1.00	76.60	0.00	17.75	0.99	71.13	0.00
trend	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00
PCe_Choi	-0.46	0.68	9.38	0.00	0.11	0.46	11.13	0.00	-0.37	0.65	3.90	0.00	0.78	0.22	2.24	0.01	-2.12	0.98	3.18	0.00
PCe_MW	37.82	0.66	128.00	0.00	42.98	0.43	144.00	0.00	38.58	0.62	77.71	0.00	49.17	0.21	62.50	0.02	22.49	0.99	71.20	0.00
LKIS	inf	prob	d(inf)	prob	lne	prob	d(lne)	prob	lngva	prob	dlngva	prob	lnr	prob	dlnr	prob	lnw	prob	dlnw	prob
none	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00
PCe_Choi	-0.75	0.77	0.26	0.40	-1.29	0.90	0.26	0.40	-1.32	0.91	-0.32	0.63	-0.84	0.80	-3.87	1.00	-1.05	0.14	0.62	0.26
PCe_MW	24.22	0.76	31.99	0.37	20.02	0.92	31.99	0.37	19.76	0.92	27.51	0.60	23.48	0.80	0.00	1.00	51.62	0.14	47.68	0.25
constant	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		1.00		1.00
PCe_Choi	-0.86	0.80	2.26	0.01	-1.39	0.92	5.40	0.00	0.84	0.20	2.97	0.00	-0.79	0.79	0.43	0.33	1.52	0.06	3.43	0.00
PCe_MW	23.35	0.80	47.54	0.02	19.23	0.94	71.79	0.00	36.52	0.19	53.03	0.01	23.88	0.78	33.32	0.31	55.97	0.07	73.47	0.00
trend	N.ofFac.	2.00		2.00		2.00		2.00		2.00		2.00		1.00		1.00		3.00		1.00
PCe_Choi	-1.38	0.92	2.26	0.01	1.53	0.06	2.18	0.01	0.56	0.29	2.84	0.00	1.08	0.14	4.36	0.00	-0.89	0.81	8.25	0.00
PCe_MW	19.34	0.93	47.53	0.02	41.87	0.07	46.87	0.03	34.31	0.27	51.99	0.01	38.40	0.14	63.75	0.00	33.82	0.81	117.67	0.00