

OUTPUT–EMPLOYMENT RELATIONSHIP ACROSS SECTORS: A LONG- VERSUS SHORT-RUN PERSPECTIVE

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ABSTRACT

This paper investigates the nature of the output–employment relationship by using the Turkish quarterly data for the period 1988–2008. Even if we fail to find a long-run relationship between aggregate output and total employment, there are long-run relationships for the aggregate output with non-agricultural employment and sectoral employment levels for seven of nine sectors that we consider. However, a further investigation for the output and employment relationship within a short-run perspective does not reveal statistically significant relationships for either total employment or non-agriculture employment, or eight of the nine sectors that we consider. Although there are various long-run relationships between output and employment, the short-run links between demand and employment are weak. The various implications of this for the economy and the labour market are discussed. As a result, maintaining high levels of output in the long-run creating demand is essential for employment generation.

Keywords: employment, output, seasonal cointegration

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I. INTRODUCTION

Unemployment constitutes a large component of the cost of business cycles. Thus understanding the dynamics of unemployment and its relation to the overall economic performance is vital. ‘Jobless growth’ is one of the features of the recent global financial crisis in the world. It seems that recovery in output does not bring higher employment or lower unemployment (see, for example, for the USA: Bernanke, 2003; Groshen and Potter, 2003; Khemraj *et al.*, 2006; and for developing countries: Bent, 1991; Fox and Sekkel, 2006; Verme, 2006; World Bank, 2007, 2008; Nabli *et al.*, 2007). This paper provides evidence on the relationship between employment

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and output from Turkey by imposing long-run versus short-run distinction on this relationship using quarterly data from 1988 to 2008.

Turkey is an important predominant emerging market with small-open economy features and relatively well developed markets. Turkey ranked as the seventeenth largest economy in the world in terms of its GDP as of 2009 (PWC, 2010, p. 3). Thus, it is a relevant case study for other emerging economies. Moreover, Turkey provides a unique laboratory environment to assess any relationship between output and employment. First, Turkey has high output and employment volatilities,¹ therefore the probability of committing a *type II error* (not rejecting the null when it is not true) will be lower. In other words, any relationship between output and employment will be easier to detect. Second, even if Turkey has a relatively tight formal labour market, its high population growth, high real wage flexibility thanks to high inflation,² high informal labour market share earning less than the formal workers (see Baltagi *et al.*, 2012, p. 2), and its high internal migration makes its labour market flexible. Thus, assessing the relationship between output and employment is meaningful in such a flexible labour market. Moreover, Turkey is an important emerging economy and any conclusion drawn from this study can be valuable for other emerging economies.

The relationship between employment and output may differ depending on the framework considered. Morrison and Berndt (1981) and the references cited therein argue that the short-run output elasticity of demand is smaller than unity and is less than that of the long-run. There might be various reasons for this. First, higher aggregate demand may encourage firms to increase their production, but this increase may not lead to a higher number of people in work (employment). It may only lead to an increase in the number of hours worked for each worker. This might be due to the fact that new workers need to be trained and oriented before engaging in production, and during the learning process the productivity of workers is likely to be lower. Therefore, firms may rely on overtime work rather than increasing employment in the short-run. Once this increase in aggregate demand is perceived permanent, the firms may increase the number of workers in order to increase production and bear the cost of new employment. Conversely, firms may not lay off workers as the aggregate demand decreases because decreasing employment may be costly due to firing costs as the economy falls into a slump. Firms may reduce overtime work, but not reduce the number of workers if the aggregate demand decrease is perceived temporary, but they may reduce employment if the decrease in aggregate demand is perceived permanent.

Second, the effects of the shocks to the labour market may die out later than the effects of the shocks to the output in the short-run because of the rigidities in the labour market. The elimination of the difference between actual and long-run employment rate may take more time than the elimination of the output gap as mentioned in Layard *et al.* (1991, p. 77). Labour market movements are smaller than the movements in the goods market and the changes in output are accompanied by smaller changes in employment. Therefore, the problem of creating employment may be structural in the economy and the employment generation ability of the

¹ The mean and standard deviation of real GDP growth between 1989 and 2008 is as follows: Egypt (4.6%; 1.58), Greece (2.90%; 1.83), Italy (1.40%; 1.25), Jordan (4.79%; 5.74), Peru (3.56%; 5.55), Portugal (2.40%; 2.19), Syria (4.43%; 4.53), and Turkey (4.12%; 4.67) according to the USDA database. The total unemployment rate (% of total labour force) and its standard deviation for this period is as follows: Egypt (9.51%; 1.22), Greece (9.27%; 1.31), Italy (9.73%; 1.89), Jordan (14.84%; 2.28), Peru (8.47%; 1.48), Portugal (5.91%; 1.44), Syria (8.64%; 3.12), and Turkey (8.76%; 1.51) according to World Development Indicators data.

² Turkey is the only country that had a high inflation without running into hyperinflation. The mean and standard deviation of the annual inflation for our sample period was 54.26% and 30.22, compared to Egypt (9.87%; 6.33), Greece (8.04%; 5.92), Italy (3.54%; 1.64), Jordan (5.82%; 6.12), Peru (579.42%; 1747.82), Portugal (5.17%; 3.66), and Syria (8.27%; 8.71) according to the World Development Indicators, Consumer Price Index (2005 = 100).

supply side of the economy may be weaker in the short-run. However, goods and labour markets nearly clear in the long-run with a possible interaction between them.³

On the other hand, a possible relation between employment and output may not be the same across different sectors of the economic activity. Sawtelle (2007) argues that the employment elasticities among the five sectors that she considers for the US economy are different. Berman and Pfleeger (1997), Echevarria (1997), Bhalotra (1998), Bhorat and Hodge (1999), Goodman (2001), Dasgupta and Singh (2005), and Tregenna (2008) also argue that the employment generation in response to the aggregate supply shocks across the sectors of the economy might be different. The reason for this can be the cyclical behaviour of the sectors, deregulation of the industry and trade, purchasing postponements of the firms, different wages, productivity differences, different employment multipliers, different labour or technological intensities, and inter-sectoral outsourcing of each sector.

The purpose of this paper is twofold. It first examines the possible relationship between output and employment for the whole economy, and next considers the employment in each sector and total output to assess the employment creation capacity of each sector to changes in total output. Two different timeframes are used in carrying out this analysis: short-run versus long-run. In this analysis, we could use employment and the corresponding output in each sector. Unfortunately, output in each sector that matches the employment definition is not available for the country that we study – Turkey. However, using the employment in each sector in relation to the total output allows us to assess an important question regarding how the total employment and the sectoral employments react to the changes in aggregate demand.

There are several studies that investigate the possible relationship between output and employment (or unemployment). One of the earliest studies that investigated the relationship between output and employment disaggregated by sector is by Madden and Tuckwell (1975). They consider various sectors in the Australian industry and claim that in most of these sectors, the short-run fluctuations in sectoral and total output have no relation to the fluctuations in sectoral and aggregate employment. Wah (1997) investigated the employment effects of output and technological progress in the Malaysian manufacturing sector. He claims that the domestic demand and export expansion improve the total industrial employment creation. Lewis-Wren (1986) investigated the effect of expected output on UK manufacturing employment and found a significantly positive effect of output expectations on employment. Smyth (1986) studied the cyclical effects of output changes on manufacturing employment in the USA. He differentiates between the employment of production and non-production workers and finds that his adjustment speed model works for production workers where the cost of increasing employment is higher if unemployment rate is lower. Pehkonen (2000) investigated the effect of cyclical total output growth on total employment and unemployment in Finland and observed a stable relation. According to his study, the effect of the changes in the rate of total output growth on total employment takes a considerable lag.

There are several papers analysing the effect of output on employment in Turkey. For instance, Akçoraoğlu (2010) investigated the long-run relationship between employment and the real GDP using Johansen cointegration and Engle–Granger cointegration methods. The dynamic error correction model he employs results in a short-run relationship with a lagging negative effect of real GDP on employment. He also finds a bi-causality between real GDP and employment. Aydınler-Avşar and Onaran (2010) find a positive long-run effect of total manufacturing industry output on employment in Turkey. It is interesting that this effect is lower for the high and medium skilled workers compared to low skilled workers. Akan *et al.* (2008) benefit from the causality analysis and claim that the economic growth does not affect the employment rate in Turkey.

³ Wilson (1960) and Brechling (1965) elaborate similar issues as early as the 1960s.

However, they do not reject the reverse hypothesis. Tatoğlu (2011) finds a long-run and short-run relationship between unemployment and output which varies among the countries, including Turkey. There are also papers emphasizing the issue of jobless growth and the low employment creation capacity of the Turkish economy, such as Telli *et al.* (2006) and Yeldan (2010). Some of the papers consider the asymmetric relationship between output and the employment market. Tiryaki and Özkan (2011) and Tari and Abasız (2010) investigated the asymmetric case for the Okun's law for Turkey. The sectoral analysis of employment for the Turkish economy was also considered by several authors. Berument *et al.* (2009) claim that the responses of the sectoral unemployment rates are not the same; they depend on the type of shocks. Günçavdı *et al.* (2004), using input–output tables, show that the openness in trade of the intermediate goods creates a demand for workers in the Turkish economy.

The main contribution of this paper is analysing the possible relationship between employment and output by distinguishing its long-run versus short-run nature. The possible relationship is investigated by employing seasonal integration, cointegration, and error-correction models. We initially consider the relationship between output and unemployment as inspired by the works of Okun (1962, 1970). Okun's law postulates that the fall of about 3 percent in the growth rate of real gross national product leads to a 1 percent increase in the unemployment rate. This specifies the cost of unemployment in terms of output. This proposition is empirically verified by several studies, such as Hamada and Kurosaka (1984) in Japan; Kaufman (1988) in the USA, Canada, Japan, the UK, Sweden, and Germany; Blanchard (1989), Prachowny (1993), Weber (1997), Freeman (2000), Cuaresma (2003), and Holmes and Silverstone (2006) in the USA; Moosa (1997) in G7 countries; Attfield and Silverstone (1998) in the UK; Sögner (2001) in Austria; Sögner and Stiasny (2002) in 15 OECD countries; and Villaverde and Maza (2009) in Spain.

In our investigation we failed to find a statistically significant relationship between output and unemployment in Turkey.⁴ We believe that this failure is due to the nature of the data used on which we elaborate in the data section. We then switched to specifying a model whereby the activities in the labour market as measured by the employment rate are related to the activities in the goods market as measured by the aggregate output. A number of authors such as Akerlof and Shiller (2009, p. 2) point out that when evaluating the labour market, it may be more meaningful to use the employment rates rather than the unemployment rates. Similarly, in the case of Turkey, it is argued that the unemployment rate and the employment rate are not mirror images of each other as indicators of the labour market conditions. Employment rate may better reflect the slack or the boom in the labour market than the unemployment rate in Turkey (World Bank, 2006, p. 13). Accordingly, we focus on the employment rate rather than the unemployment rate in the analysis in this paper. We first investigate the effect of an increase the aggregate output on the aggregate employment rate. Next, we investigate the effect of the same increase on the employment rates in the various sectors of economic activity.

The focus of this paper is a 20-year period of economic expansion in the Turkish economy although with periods of volatility. During the period of study from 1988 to 2008, the real GDP increased by 4 percent while total employment grew by 1 percent annually. There have been several major economic and financial shocks since the year 1988. The first negative shock to the economy occurred in 1991 and was due to the Gulf War. The second crisis occurred in 1994 when GDP dropped by about 6 percent along with a devaluation of the Turkish Lira by 70 percent against the US dollar. The third crisis occurred in 1999 and was due to both the two major earthquakes in the industrial heartland of the country and the aftermath of the Russian crisis. The fourth crisis occurred during 2000–01. The per capita GDP declined by

⁴ The level of significance is at the 5% level unless otherwise stated.

9.6 percent in 2001 but recovered quickly, with an 8 percent increase in 2002 and subsequent high growth rates. However, unemployment increased during the last crisis and remained high in spite of the subsequent high rates of output growth. This is referred to as a ‘jobless growth’ phenomenon. Finally, the Turkish economy is affected by the global economic crisis. The effect of the global crisis started to be felt in the second quarter of 2008. The GDP growth rate declined to 2.6 percent and 0.9 percent in the second and third quarters of 2008, respectively. The GDP declined by 7 percent in the last quarter of 2008. The annual growth rate averaged only 0.7 percent in 2008. The effect of the global crisis was most severe in 2009 when GDP declined by 4.7 percent. The economy recovered in 2010, with growth rates reaching about 10–11 percent in the first two quarters of 2010. The total and non-agricultural unemployment rates were very high in 2009 but returned to pre-crisis levels in 2010. Recently the topic of jobless growth has been an important concern in the USA (Bailey and Lawrence, 2004) and other developed countries. In this paper, we also provide an insight to the ‘jobless growth’ phenomenon experienced in the Turkish economy by examining the responsiveness of the aggregate and sectoral employment to aggregate demand as proxied by aggregate output.

There are some surprising, as well as expected, interesting results in this paper. First, we fail to find a long-run relationship between aggregate output and total employment. The long-run relationship exists for the aggregate output and non-agricultural employment and for the aggregate output and sectoral employment levels for seven of the nine sectors that we consider. Second, a further investigation of the aggregate output and employment within a short-run perspective reveals the following. There is no statistically significant short-run relationship between aggregate output on the one hand and total employment on the other. Further, aggregate output is not related to the non-agricultural employment and to eight of the nine sectoral employments that we consider. Our results provide an insight to the ‘jobless growth’ phenomenon. Agriculture and construction are the two sectors that show neither a long-run or a short-run relationship to total output, displaying the ‘jobless growth’ characteristics. Further, we find statistically significant short-run relationships only for the wholesale and retail trade sectors. Therefore, all but the wholesale and retail trade sectors exhibit ‘jobless-growth’ characteristics in the short-run.

This paper is structured as follows. Section II introduces the data utilized in this paper and notes their sources. The methodology employed in the analysis is presented in Section III. Section IV presents and discusses the estimation results. Concluding remarks appear in Section V.

II. DATA

The data used in this study are taken from the Central Bank Republic of Turkey (CBRT) electronic data delivery system (EDDS). It is quarterly data pertaining to the period 1988Q4–2008Q4. Using the quarterly data has two advantages. First, the quarterly data rather than the monthly data increases the probability of indicating a relation between output and employment as indicated, for example, by Wilson (1960) because ‘the shorter the run, the less stable is the output–employment relationship’. So the short-run is marked by the adjustment processes and extracting the signal from the quarterly data may be easier. Second, by using the quarterly data rather than the annual data, it is possible to increase the number of observations and we may detect a richer array of integration with quarterly data when we use the seasonal cointegration method. Real Gross Domestic Product (GDP) is used as a measure of output. It is measured in terms of Turkish Liras (TL) in 1987 prices and computed by using the expenditure approach. After 2007Q4 there was a change in the methodology of computation of GDP. For the period after this date we imputed the data by taking quarterly percentage changes in order to preserve conformity with the data of the previous period.

Employment data are also taken from the EDDS of the CBRT. The Turkish Statistical Institute (TurkStat) published labour market data based on Household Labour Force Surveys which had been conducted semi-annually during the years from 1988 to 1999. The employment data consist of the number of people rather than the number of working hours. After 2000 these surveys have been conducted quarterly. We transformed the semi-annual data of the pre-2000 period to the quarterly data by using the methodology of Chow and Lin (1971) in order to use the quarterly data for the entire period of analysis. The same methodology is applied both to the total employment data and to the employment data disaggregated by the sectors of main economic activity. The nine sectors of economic activity considered in this paper are described in the Appendix, Table A1. All variables are used in their logarithms in the analyses.

III. METHODOLOGY

We first analyse the possibility of seasonal integration following Hylleberg, Engle, Granger, and Yoo (1990) (HEGY) and Hamori and Tokihisa (2001), which is applicable to quarterly data.⁵

Assume that the string $\{x_t\}, t = 1, 2, \dots, T$, is transformed into four parts for capturing seasonal behaviour of the data.⁶ Therefore equations (1)–(4) are the observed series adjusted for the seasonal unit roots at $\theta = 0, \pi, (\pi/2 \text{ and } 3\pi/2)$ frequencies where B is defined as a lag operator:⁷

$$x_{1,t} = (1 + B)(1 + B^2)x_t = (1 + B + B^2 + B^3)x_t \tag{1}$$

The second string is observed series adjusted for the unit roots at $\theta = 0, \pi/2, \pi, 3\pi/2$:

$$x_{2,t} = -(1 - B)(1 + B^2)x_t = -(1 - B + B^2 - B^3)x_t \tag{2}$$

The third string is observed series adjusted for the unit roots at $\theta = 0, \pi$:

$$x_{3,t} = -(1 - B^2)x_t \tag{3}$$

And the fourth one is defined by equation (4):

$$x_{4,t} = -(1 - B^4)x_t \tag{4}$$

An auxiliary regression is utilized to the effects of first three series on the fourth sequence, so we estimate equation (5) to obtain HEGY unit root statistics for different frequencies:

$$x_{4,t} = C + \Lambda_1 x_{1,t-1} + \Lambda_2 x_{2,t-1} + \Lambda_3 x_{3,t-1} + \Lambda_4 x_{3,t-2} + \sum_{i=1}^p \phi_i x_{4,t-i} + e_t \tag{5}$$

Deterministic parts of equation (5) are expressed by the parameter C which has four possible differentiated cases: {Intercept (I)}, {Intercept (I), Seasonal Dummies (SD)}, {Intercept (I), Trend (Tr)}, and {Intercept (I), Seasonal Dummies (SD), Trend (Tr)}. The significances of

⁵ In this paper we investigate both the short- and the long-run dynamics. The Engle–Granger cointegration methodology allows us to do so. However, the Johansen multi-equation cointegration methodology uses the rank of the matrices to judge for a long-run relationship and does not permit us to observe any uniquely identified short-run dynamics within a multi-equation framework.

⁶ HEGY (1990) claim that when the economic data contain substantial seasonality, there is a high possibility that there can be unit roots at other frequencies such as the seasons besides the annual frequency.

⁷ Note that, π refers to the six-month cycle when we consider it with a unit circle.

the parameters Λ_1 to Λ_4 are tested by t - and F -statistics. If the Ordinary Least Square (OLS) estimate results for Λ_1 is equal to zero, then we may claim that there is a non-seasonal unit root. If Λ_2 is equal to zero, then there is one seasonal unit root. If the last two parameters are both equal to zero, which is tested by F -statistics, we then claim that there is a conjugate pair of complex unit roots.

IV. EMPIRICAL EVIDENCE

IV.1 Aggregate employment and output

The unit root tests for the aggregate output and total employment variables in their logarithms are performed and the test statistics are reported in Table 1. Since production and employment in the agricultural sector depend on various periodic elements and shocks such as rainfall, weather conditions, yield levels, and government support (see, for example, Şahin *et al.*, 2007; Şahin, 2008; Dudu and Çakmak, 2011), we also report the results with non-agricultural employment by excluding agricultural employment. The auxiliary regressions are run with (a) an intercept term, (b) an intercept term and seasonal dummies, (c) an intercept term and a time trend, and (d) an intercept term, seasonal dummies, and a time trend. We considered lag orders of four, six, and eight in equation (5) for the robustness of our test results. Table 1 suggests that all three series have unit roots at zero frequency. The unit roots can be rejected in the output series at π , $\pi/2$, and $3\pi/2$ frequencies, and in the non-agricultural employment series at π frequency. However, the aggregate employment series has a unit root at all the frequencies that we consider.

Next, we carried out the residual based cointegration test developed by Engle *et al.* (1993). For the zero frequency case, equation (6) is estimated:

$$(1 + B + B^2 + B^3) \text{employment}_t = C + \beta_1[(1 + B + B^2 + B^3)y_t] + u_t \quad (6)$$

C is the deterministic part of the equation consisting of constant, three seasonal dummies and the intercept dummy for 2005Q1–2008Q4. We include the intercept dummy in order to account for the change in the calculation method of GDP in 2005. Here, we specified the same deterministic term for all types of cointegrating regressions. u_t is the residual of the cointegrating equation. Equation (7) is the auxiliary regression of Δu_t on its lagged values:

$$\Delta u_t = \tau_1 u_{t-1} + \sum_{i=1}^{\rho} \psi_i \Delta u_{t-i} + \varepsilon_{1,t} \quad (7)$$

We utilized four lags in equation (7). Similar to the Augmented Dickey–Fuller unit root test, we make inference on the estimated coefficient of u_{t-1} . If we reject the null of the unit root, we claim that in the long-run, there is a cointegration between output and employment. The critical values of the coefficient for u_{t-1} are obtained from Engle and Granger (1987). We use the same procedure for other frequencies at π , $\pi/2$, and $3\pi/2$.

For biannual (π) frequency, the following equation is estimated:

$$-(1 - B + B^2 - B^3) \text{employment}_t = C + \beta_2[-(1 - B + B^2 - B^3)y_t] + v_t \quad (8)$$

Then, the auxiliary regression is specified as:

$$v_t + v_{t-1} = \tau_2(-v_{t-1}) + \sum_{i=1}^{\rho} \Gamma_i(v_{t-i} + v_{t-1-i}) + \varepsilon_{2,t} \quad (9)$$

TABLE 1
HEGY unit root test results: output and employment

Variables	C	Lags	$t(\Lambda_1)$	$t(\Lambda_2)$	$F(\Lambda_3 \cap \Lambda_4)$	
Output	I	4	-0.911	-1.635	1.883	
		6	-0.669	-1.059	2.496	
		8	-1.118	-0.790	3.743*	
	I, SD	4	-0.903	-3.547*	0.364	
		6	-0.676	-2.032	0.075	
		8	-1.071	-1.804	0.141	
	I, Tr	4	-2.261	-1.659	1.779	
		6	-3.093	-1.082	2.795	
		8	-2.723	-0.807	3.359*	
	I, SD, Tr	4	-2.307	-3.587*	0.446	
		6	-3.115	-2.107	0.113	
		8	-2.686	-1.862	0.205	
Total employment		I	4	-1.958	-1.764	0.505
			6	-1.493	-1.194	0.321
			8	-1.266	-0.814	0.204
	I, SD	4	-1.949	-2.454	1.841	
		6	-1.450	-1.812	1.438	
		8	-1.266	-1.405	1.277	
I, Tr	4	-1.212	-1.793	0.529		
	6	-1.302	-1.225	0.279		
	8	-0.931	-0.834	0.213		
I, SD, Tr	4	-1.266	-2.482	1.859		
	6	-1.267	-1.834	1.312		
	8	-0.922	-1.415	1.271		
	Non-agricultural employment	I	4	0.934	-3.146**	0.934
			6	0.400	-3.192**	0.756
			8	0.901	-2.450*	0.516
I, SD		4	0.809	-3.330*	2.914	
		6	0.405	-3.416*	2.489	
		8	0.761	-2.740	1.669	
I, Tr		4	-1.332	-3.183**	0.944	
		6	-1.754	-3.267**	0.669	
		8	-1.071	-2.530**	0.486	
I, SD, Tr		4	-1.399	-3.376*	2.988	
		6	-1.703	-3.487*	2.278	
		8	-1.161	-2.829*	1.742	

Notes: I, intercept; SD, three seasonal dummies; Tr, trend. $\Lambda_1, \Lambda_2, \Lambda_3$ and Λ_4 are explained in the text.

*The null hypothesis is rejected at the 5% significance level.

**The null hypothesis is rejected at the 1% significance level.

In equation (9) we test the null of unit root by the coefficient τ_2 . The null hypothesis of no cointegration at frequencies $(\pi/2), (3\pi/2)$ is tested by the cointegrating equation (10) and auxiliary regression (11).

$$-(1 - B^2) employment_t = C + \beta_3[-(1 - B^2)y_t] + \beta_4[-(1 - B^2)y_t]_{t-1}w_t \tag{10}$$

TABLE 2
Cointegration test results for output and employment relationship

Panel A				
Four lags				
Frequencies	0	π	$(\pi/2 \text{ and } 3\pi/2)$	
Variables	β_1	β_2	β_3	β_4
Total employment	0.3368	0.0789	– 0.3220	0.3421
Test statistics for cointegration	[– 2.6594]	[– 2.6219]	[4.4916]	
Six lags				
Total employment	0.3368	0.0789	– 0.3220	0.3421
Test statistics for cointegration	[– 3.0303]	[– 1.8875]	[3.6284]	
Eight lags				
Total employment	0.3368	0.0789	– 0.3220	0.3421
Test statistics for cointegration	[– 2.6546]	[– 1.5183]	[2.9453]	
Panel B				
Four lags				
Non-agricultural employment	0.6250	0.0357*	0.5570	0.3527
Test statistics for cointegration	[– 2.2407]	[– 3.4521]	[4.7034]	
Six lags				
Non-agricultural employment	0.6250	0.0357*	0.5570	0.3527
Test statistics for cointegration	[– 2.3682]	[– 3.5023]	[4.5538]	
Eight lags				
Non-agricultural employment	0.6250	0.0357	0.5570	0.3527
Test statistics for cointegration	[– 2.8158]	[– 2.9257]	[3.8108]	

Notes: Test statistics are reported in brackets. Critical values are gathered from Engle and Granger (1987, table III) and Engle *et al.* (1993, table A5).

*The null hypothesis is rejected at the 5% significance level.

**The null hypothesis is rejected at the 1% significance level.

$$w_t + w_{t-2} = \tau_3(-w_{t-2}) + \tau_4(-w_{t-1}) + \sum_i^{\rho} \lambda_i(w_{t-i} + w_{t-2-i}) + \varepsilon_{3,t} \quad (11)$$

We test the null of unit root in the residuals by using the joint F-statistics. If $\tau_3 \neq \tau_4$, then we reject the conjugate pair of complex unit roots and claim that there is cointegration between the variables aggregate output and total employment.

Table 2 reports the test statistics for the cointegration tests at the 0, π , $\pi/2$, and $3\pi/2$ frequencies. Panel A reports the statistics for the aggregate output–total employment and Panel B reports the same for the aggregate output–non-agricultural employment. Note that the estimated parameters are from equations (6), (8), and (10) and the test statistics are from equations (7), (9), and (11). The former equations are insensitive to different lag orders but the latter equations are not. Therefore, Table 2 reports similar estimates of the parameters but for different values

of the test statistics. These results suggest that there is no statistically significant cointegration relationship between aggregate output and total employment at the 1% and 5% significance levels at all of the frequencies. Therefore, we fail to find a statistically significant long-run relationship between aggregate output and total employment. This is not in line with what is reported for other countries, such as China (He *et al.*, 2009), Greece (Milas, 2000), and Scotland (Bell, 1981). However we cannot reject the null of no-cointegration for aggregate output and non-agriculture employment at π frequency at the 5% significance level. Thus, we find a long-run relationship between aggregate output and non-agricultural employment. This is in line with the existing theoretical and empirical studies such as Shepherd and Dixon (2008). As for the differences between agricultural and non-agricultural employment, Kuznets (1973) claims that non-agricultural employment increases as the economy develops. This transformational change in the economy is documented by Chenery and Syrquin (1975). The structural change from agricultural intense to non-agricultural intense economy is also verified by other empirical papers. Ateşoğlu (1993) claims that Kaldor's law, which suggests a high correlation between living standards and the share of resources devoted to industrial activity, is valid for the US economy. Chletsos and Kollias (1997) report a long-run relationship between the non-agricultural sector output and employment for Greece. Upender (2011) calculates the output elasticities of employment for several sectors and finds support for the positive relationship between the non-agricultural sector output and employment. Similar results for Turkey are found by Berument *et al.* (2009), Aydiner-Avşar and Onaran (2010), Akçoraoğlu (2010), and Tatoğlu (2011). Thus our results on the non-agricultural sector are mostly in line with the existing literature.

IV.2 Sectoral employment and output

As a next step, we investigate the relationship between aggregate output and sectoral employment levels in each of the nine main sectors of economic activity. This investigation is warranted because as aggregate demand increases, the sectors may differ in terms of their employment generation. The sectoral employment generation may differ for the following reasons. First, the sectors may differ in terms of their labour intensity. For example, the Agriculture, Mining, and Construction sectors are more labour intensive than Electricity, Transportation, and Finance. For this reason, as the aggregate demand increases, employment generation might be higher in these labour intensive sectors than in the other sectors. Second, the increase in aggregate demand might be due to external factors outside of the domestic economy. For a small open economy such as Turkey, shocks may come from the rest of the world and export oriented manufacturing sectors may experience output and employment increases. Third, even if each sector has the same labour intensity and aggregate demand shocks hit the sectors in a uniform fashion, the qualifications of labour in each sector might be different. For example, increasing employment in agriculture as a result of an increase in demand for labour will be easier than in the finance sector. This is because hiring new people in agriculture is easier since it involves hiring relatively abundant unqualified workers. Historically, because of structural change and the migration from rural to urban areas, agricultural employment diminished persistently. However, during the global crisis of 2008–09 the declining trend in the agricultural employment is reversed. Gürsel and İmamoğlu (2011) claim that this increase in the share of agricultural employment in Turkey is due to the increasing world agricultural prices and diminishing non-agricultural job opportunities due to the global crisis. Fourth, the labour market in some of the sectors might be non-competitive. For example, the labour demand of family owned businesses may not be sensitive to economic fluctuations or shocks. If family owned businesses are concentrated in sectors such as agriculture or construction, change in aggregate demand may not change the employment in these sectors. For these reasons we repeat the analysis for each sector of economic activity separately.

Table 3 reports the HEGY seasonal unit root tests for each sector. The test statistics for $t(\Lambda_1)$ suggest that we cannot reject the null hypothesis of unit root for Agriculture, Mining, Manufacturing, Construction, Wholesale trade, Transportation, Finance and Community Services. We can reject the null of unit root for Electricity when we have an Intercept $\{I\}$, and Intercept and Seasonal Dummies $\{I, SD\}$, but we cannot reject it when we have Intercept and Trend $\{I, Tr\}$ and Intercept, Seasonal Dummies and Trend $\{I, SD \text{ and } Tr\}$. Therefore, we can safely assume that all of the sectoral employment series that we consider are non-stationary.⁸

We next investigate the cointegration relationship for the disaggregated data. Table 4 reports the cointegration test results for the aggregate output and the different sectoral employment variables. We find cointegration relations in the following sectors: Mining (π , for four lags), Manufacturing (0, for six lags; $\pi/2$ & $3\pi/2$, for four and six lags), Electricity, Gas, and Water (0, for eight lags; π , for four lags; $\pi/2$ & $3\pi/2$, for four, six, and eight lags), Wholesale and Retail Trade (π , for four, six, and eight lags), Transportation, Communication, and Storage ($\pi/2$ & $3\pi/2$, for six lags), Finance, Insurance, Real Estate, and Business Services (π , for four lags; $\pi/2$ & $3\pi/2$, for four, six, and eight lags), and Community, Social, and Personal Services (0, for six lags; $\pi/2$ & $3\pi/2$, for four and six lags). Therefore, we may claim that when output increases, the employment in seven of the nine main sectors of economic activity also increases. The two sectors for which we could not find a long-run relationship between aggregate output and sectoral employment are the Agriculture and Construction sectors. The differences in the responses of sectoral employment to the changes in output make sense because economic shocks affect employment across different educational backgrounds of the labour force as well as across sectors differently (Berument *et al.*, 2006, 2009). Overall, Table 4 suggests a set of cointegration relationships between aggregate output and most of the sectoral employment. Thus, we can claim that there is a long-run relationship between output and employment in seven of the nine sectors we considered at different frequencies. These results are mostly in line with the existing literature that reports a long-run relationship between output and non-agricultural employment that we cited above. The asymmetric effect of output on employment is also well documented. For example, Basu and Foley (2011) consider the difference between service and non-service employments for the USA. Palangkaraya and Yong (2011) consider various sectors across different productivity levels for Australia, and He *et al.* (2009) do the same for China. Aydiner-Avşar and Onaran (2010) consider the effect of income on employment for the high- and medium-skilled sectors for Turkey. Thus, our results across the sectors are similar.

At this point, we would like to comment on a few characteristics of the agriculture and construction sectors. Although the share of the agricultural sector in the total employment is relatively large, its contribution to the total GDP is not significant. Table A2 in the Appendix shows that the employment share of agriculture in the total was about 47 percent in 1988. It has declined substantially during the past 20 years. It was about 27 percent in 2007. However, agriculture contributed only 10 percent to real GDP in 2007, which is down from 19 percent in 1988. Thus, agriculture is a declining sector both in terms of employment and in terms of its contribution to GDP. Employment in the agricultural sector in particular for women is in the form of unpaid family workers. Educational attainment of the labour force in agriculture is very low. About 84 percent of the labour force in agriculture has only primary schooling or less and 87 percent of the labour force is informally employed. The construction sector is a rather small sector in terms of both employment and its contribution to GDP. The share of the construction sector in the total employment has not changed much over the past 20 years. It remained around 6 percent in 1988 and 2007. The relatively small contribution of this sector to real GDP was

⁸ For completeness, we also perform conventional unit root tests of ADF, PP, and KPSS for the sectoral employment series. These tests are reported in Table A2 of the Appendix. Some of the test statistics reveal contradictory results. However, overall we can claim that these series are at best difference stationary.

TABLE 3
HEGY unit root test results: output and sectoral employment

Var.	C	Lags	$t(\Lambda_1)$	$t(\Lambda_2)$	$F(\Lambda_3 \cap \Lambda_4)$	Var.	C	Lags	$t(\Lambda_1)$	$t(\Lambda_2)$	$F(\Lambda_3 \cap \Lambda_4)$
Agriculture	I	4	0.761	-2.354*	0.629	Electricity	I	4	-1.814	-2.636**	14.629**
		6	0.306	-2.271*	0.439			6	-3.833**	-2.854**	16.629**
	I, SD	8	0.699	-1.452	0.496	Transportation	I, SD	8	-1.747	-2.556	15.733**
		6	0.630	-2.882	2.211			6	-4.061**	-2.986	22.498**
	I, Tr	8	0.269	-2.857	1.867	Finance	I, Tr	8	-1.842	-2.638**	14.443**
		6	0.578	-2.020	1.607			6	-1.185	-2.271*	0.419
I, SD, Tr	8	-1.070	-2.347*	0.612	Wholesale	I, SD, Tr	8	-5.323	-3.336**	5.632**	
	6	-1.185	-2.271*	0.419			6	-1.188	-2.863	1.782	
Mining	I	4	-1.147	-2.889	2.190	Construction	I	4	-2.215	-1.658	0.634
		6	-1.188	-2.863	1.782			6	-2.873	-1.168	0.211
Manufacturing	I	8	-0.684	-2.035	1.600	Community	I	8	-4.965**	-3.089*	6.872*
		6	-1.611	-3.282	4.647*			6	-2.256	-0.801	0.074
I, SD	8	-1.862	-2.501*	6.524**	I, SD, Tr	8	-2.169	-2.353	2.141		
	6	-1.212	-1.991*	6.689**		6	-2.822	-2.034	0.887		
I, Tr	8	-1.583	-3.199*	4.498	I, SD, Tr	8	-2.249	-1.820	0.920		
	6	-1.810	-2.441	6.211		6	-1.092	-3.119**	4.376*		
I, SD, Tr	8	-1.177	-1.925	6.184	I, Tr	8	-2.148	-1.648	0.627		
	6	-1.593	-3.305**	4.745**		6	-2.805	-1.161	0.209		
I, SD, Tr	8	-0.780	-2.456*	6.492**	I, SD, Tr	8	-2.256	-0.801	0.074		
	6	-0.739	-1.976*	6.518**		6	-2.169	-2.353	2.141		
I	8	-0.716	-1.909	6.014	I	8	-2.249	-1.820	0.920		
	6	-0.761	-2.397	6.173		6	-2.822	-2.034	0.887		
I, SD	8	-1.642	-2.105*	7.376**	I, SD	8	-1.092	-3.119**	4.376*		
	6	-1.138	-1.844	5.259**		6	-0.899	-2.835**	3.024		
I, Tr	8	-1.112	-2.027	2.856	I, SD	8	-1.137	-2.440*	2.312		
	6	-1.157	-1.873	9.577**		6	-1.021	-3.530*	4.292		
I, SD	8	-1.098	-1.898	5.140	I, Tr	8	-0.834	-3.492*	3.238		
	6	-1.373	-2.147*	7.832**		6	-1.053	-3.224*	2.212		
I, SD, Tr	8	-1.990	-1.900	4.655**	I, SD, Tr	8	-1.649	-2.882	2.628		
	6	-1.238	-2.047*	2.981*		6	-1.308	-2.462*	2.352		
I, SD, Tr	8	-1.512	-2.007	13.118**	I, SD, Tr	8	-1.189	-3.580*	4.449		
	6	-1.608	-1.906	8.092**		6	-1.704	-3.568*	2.795		
	8	-1.273	-1.919	5.310		8	-1.345	-3.266*	2.234		

Notes: I, intercept; SD, three seasonal dummies; Tr, trend. $\Lambda_1, \Lambda_2, \Lambda_3$ and Λ_4 are explained in the text.

*The null hypothesis is rejected at the 5% significance level.

**The null hypothesis is rejected at the 1% significance level.

TABLE 4
Cointegration test results for output and sectoral employment relationship

Frequencies Variables	Four lags				Six lags				Eight lags			
	0	π	β_3	β_4	0	π	β_3	β_4	0	π	β_3	β_4
Agriculture	-0.2881 [-2.5957]	0.0384 [-3.0105]	-0.8807 [3.6948]	0.6881	-0.2881 [-2.5748]	0.0384 [-2.9855]	-0.8807 [3.8503]	0.6881	-0.2881 [-2.8146]	0.0384 [-2.2393]	-0.8807 [3.6537]	0.6881
Mining	-1.3620 [-2.2443]	0.0972* [-3.3179]	-0.0337 [4.8328]	0.5826	-1.3620 [-2.5361]	0.0972 [-2.6638]	-0.0337 [9.0034]	0.5826	-1.3620 [-2.4007]	0.0972 [-2.0116]	-0.0337 [6.9686]	0.5826
Manufacturing	0.7422 [-2.0072]	0.0316 [-2.2299]	-0.0781 [18.1952]**	0.2150	0.7422* [-3.3431]	0.0316 [-1.9186]	-0.0781 [15.4753]**	0.2150	0.7422 [-2.1646]	0.0316 [-2.0466]	-0.0781 [8.6972]	0.2150
Electricity	2.7281 [-2.3836]	1.0382** [-4.1267]	0.6698 [26.9265]**	0.3424	2.7281 [-2.9267]	1.0382 [-2.3799]	0.6698 [24.0534]**	0.3424	2.7281* [-3.3546]	1.0382** [-3.8185]	0.6698 [16.5389]**	0.3424
Construction	0.2889 [-2.1927]	0.9378 [-2.737]	-0.8224 [5.6623]	1.0949	0.2889 [-2.8100]	0.9378 [-2.2208]	-0.8224 [2.9088]	1.0949	0.2889 [-2.1223]	0.9378 [-2.0779]	-0.8224 [2.0407]	1.0949
Wholesale	1.3012 [-2.0680]	0.0591** [-3.7949]	0.0134 [7.4451]	0.1992	1.3012 [-2.5484]	0.0591* [-3.5943]	0.0134 [4.9380]	0.1992	1.3012 [-1.9960]	0.0591* [-3.4992]	0.0134 [3.8674]	0.1992
Transportation	0.4433 [-2.1574]	-0.1812 [-3.1087]	-0.0811 [9.3800]	0.1992	0.4433 [-2.3833]	-0.1812 [-3.1385]	-0.0811 [10.8362]**	0.1992	0.4433 [-1.8640]	-0.1812 [-2.6200]	-0.0811 [6.1438]	0.1992
Finance	1.1355 [-1.6700]	-0.1722* [-3.5854]	-0.0035 [19.2128]**	0.2818	1.1355 [-2.2084]	-0.1722 [-2.3372]	-0.0035 [14.1983]**	0.2818	1.1355 [-1.9095]	-0.1722 [-2.4831]	-0.0035 [9.8959]**	0.2818
Community	0.4792 [-3.0086]	0.2191 [-2.3800]	0.1289 [15.0543]**	-0.0616	0.4792* [-3.4303]	0.2191 [-1.6016]	0.1289 [13.2542]**	-0.0616	0.4792 [-1.7529]	0.2191 [-1.4996]	0.1289 [3.1497]	-0.0616

Notes: Test statistics are presented in brackets. Critical values are gathered from Engle and Granger (1987, Table III) and Engle et al. (1993, Table A5). The test statistics for seasonal cointegration are reported in brackets.

*The null hypothesis is rejected at the 5% significance level.

**The null hypothesis is rejected at the 1% significance level.

about 7 percent in 1988 and declined to 5 percent in 2007. Work in the construction sector is labour intensive and seasonal. Human capital intensity is rather low where almost 60 percent of the employed have only primary schooling or less and 62 percent are informally employed.

The existence of the long-run relationship between aggregate output and employment in different sectors does not imply the existence of a short-run relationship. As we elaborated earlier, these two series may have different dynamics in the long- and the short-runs. Thus, next we assess if there is a short term relationship between aggregate output and employment in each of the different sectors. Following the methodology of Engle *et al.* (1993), we specify the following error correction model in equation (12):

$$\begin{aligned} \Delta_4 \text{ employment} = & \sum_{j=1}^q \delta_j \Delta_4 y_{t-j} + \sum_{i=1}^q \beta_i \Delta_4 \text{ employment}_{t-j} + \gamma_{11}(\text{employment}_{1,t-1} \\ & - \alpha_{12} y_{1,t-1} - C) + \gamma_{12}(\text{employment}_{2,t-1} - \alpha_{22} y_{2,t-1} - C) \\ & - (\gamma_{13} + \gamma_{14} B)(\text{employment}_{3,t-2} - \alpha_{32} y_{3,t-2} - \alpha_{41} \text{employment}_{3,t-3} \\ & - \alpha_{42} y_{3,t-3} - C) + C + \varepsilon_t \end{aligned} \quad (12)$$

The estimated coefficients for the output differences (δ_j) are for the short-run relationship. Among the error correction terms, $(\text{employment}_{1,t-1} - \alpha_{12} y_{1,t-1} - C)$ is at 0 frequency, $(\text{employment}_{2,t-1} - \alpha_{22} y_{2,t-1} - C)$ is at π frequency, and $(\text{employment}_{3,t-2} - \alpha_{32} y_{3,t-2} - \alpha_{41} \text{employment}_{3,t-3} - \alpha_{42} y_{3,t-3} - C)$ is at the $\pi/2$ and $3\pi/2$ frequencies. The estimates also include a constant term, seasonal dummies, and the time trend. We include the error correction terms only if there is cointegration for a particular frequency. If there is no cointegration relationship at 0, π , $\pi/2$, and $3\pi/2$ frequencies, then none of the error correction terms are included. The estimates for total employment, non-agricultural employment, and sectoral employments are reported in Table 5. The table suggests that there is no statistically significant short-run relationship between output and employment in any one of the sectors except in the wholesale and retail trade sector. Not finding a short-run relationship is meaningful for the following reasons. First, the OECD's Employment Protection Index is the highest for Turkey out of the 40 countries that the study considers for the year 2008 (OECD, 2008). Thus, employment is not sensitive to output in the short-run for most of the sectors. More importantly, in the error-correction specifications, the estimated coefficients of the error correction terms are negative and statistically significant. This implies that higher employment in one particular sector compared to its long-run level lowers employment generation for the next period. Therefore, there is a long-run relationship between employment and output.

Here a few words about the wholesale trade sector are in order. Table A2 in the Appendix shows that this is one of the sectors that make a large contribution to real GDP. This contribution has increased from 20 percent in 1988 to 24 percent in 2007. However, there was a striking increase in the employment share of this sector from 11 percent in 1988 to 21 percent in 2007. This sector was the second largest employer in 2007 after agriculture. In this sector the workers are relatively well educated. The proportion of those with primary school education or less is about 40 percent. However the proportion of those with high school or more is about 39 percent. Nearly 42 percent of the employed are working informally. The economic activity in the wholesale sector (i.e., wholesale, retail trade, and restaurants and hotels) includes tourism activities. This sector has the potential for generating employment since it is responsive to output changes in both the long-run and the short-run as our results indicate.

In order to assess how change in output level affects employment levels, we cannot employ parameter estimates from equations (6)–(12). The reason for this is that these equations allow us to estimate the sum of the employment elasticity of the output across quarters rather than

TABLE 5
Seasonal error correction model estimation results

Variables	Four lags			Six lags			Eight lags					
	$\sum_{j=1}^q \delta_j$	γ_{11}	γ_{12}	$(\gamma_{13} + \gamma_{14}B)$	$\sum_{j=1}^q \delta_j$	γ_{11}	γ_{12}	$(\gamma_{13} + \gamma_{14}B)$	$\sum_{j=1}^q \delta_j$	γ_{11}	γ_{12}	$(\gamma_{13} + \gamma_{14}B)$
Employment	0.0146 [0.2880]				-0.0141 [0.4981]				0.0772 [0.7108]			
Non-agriculture	0.0182 [0.8160]	-0.6166** [-2.9071]			0.0988 [0.9703]		-0.7133** [-2.7911]		0.05712 [0.8681]		-0.5901* [-1.8669]	
Agriculture	0.0473 [0.4107]				-0.1385 [0.7189]				0.0424 [0.7096]			
Mining	0.6400 [0.4054]	-0.5522** [-2.9932]			1.6417 [1.2211]				1.9337 [1.2080]			
Manufacturing	0.0661 [1.0898]			-0.9275** [-4.7663]	-0.1708 [0.4898]	-0.1538 [1.3403]		-1.0336** [-3.8109]	0.1446 [0.9214]			
Electricity	-0.4708 [0.4347]	-0.6884* [-2.5316]		-0.4766** [-3.6777]	-0.7735 [0.3207]			-0.9666** [-5.6599]	-0.2429 [0.5382]	-0.0731** [-5.1344]	-0.5891** [-2.8110]	-0.5706** [-3.0289]
Construction	0.6414 [1.9306]				0.7646 [1.7488]				0.9846 [1.6185]			
Wholesale	-0.3987** [4.6772]	-0.6778** [-3.0758]			-0.3030** [3.0260]		-0.6833* [-2.4951]		-0.3108** [2.8513]		-0.7154* [-2.2073]	
Transportation	-0.0020 [1.1705]				0.0135 [1.4801]			-0.7455** [-3.7778]	-0.1355 [1.3181]			
Finance	-0.1268 [0.9139]	-0.4754** [-3.2214]		-0.6476** [-4.2482]	-0.3575 [0.7402]			-0.8767** [-4.3520]	-0.1986 [0.8742]			-0.8209** [-3.1693]
Community	-0.0975 [0.3872]			-0.7858** [-4.6989]	0.1837 [0.8290]	-0.3671* [-0.5181]		-0.6077** [-3.8174]	0.2436 [1.6079]			

Notes: Test statistics are reported in brackets.

*The null hypothesis is rejected at the 5% significance level.

**The null hypothesis is rejected at the 1% significance level.

The table presents estimates of the following equation:

$$\Delta_4 \text{employment} = \sum_{j=1}^q \delta_j \Delta_4 \psi_{t-j} + \sum_{i=1}^q \beta_i \Delta_4 \text{employment}_{t-j} + \gamma_{11}(\text{employment}_{1,t-1} - \alpha_{12} \psi_{1,t-1} - C) + \gamma_{12}(\text{employment}_{2,t-1} - \alpha_{22} \psi_{2,t-1} - C) - (\gamma_{13} + \gamma_{14}B)(\text{employment}_{3,t-2} - \alpha_{32} \psi_{3,t-2} - \alpha_{41} \text{employment}_{3,t-3} - \alpha_{42} \psi_{3,t-3} - C) + C + \epsilon_t$$

TABLE 6
Estimation of Engle and Granger's error correction model

Variables	Panel A	Panel B	
	y_t	Total employment effect	Error correction term
Employment	0.3231** [10.9965]	- 0.2419 [- 1.0559]	- 0.4163** [- 3.3419]
Non-agriculture	0.5895** [16.3591]	- 0.2980 [- 0.7945]	- 0.2358* [- 2.0782]
Agriculture	- 0.2664** [- 5.2497]	0.1614 [0.3145]	- 0.4555** [- 3.0877]
Mining	- 1.3183** [- 10.1847]	1.6738 [1.2612]	- 0.3593** [- 2.6625]
Manufacturing	0.7108** [18.5302]	- 0.4263 [- 1.1119]	- 0.3446* [- 2.4678]
Electricity	2.5362** [8.6788]	- 1.3637 [- 0.7836]	- 0.1139 [- 1.6962]
Construction	0.2281* [2.2007]	1.5865 [1.8595]	- 0.0748 [- 0.7782]
Wholesale	1.2643* [18.0891]	- 0.7547* [- 2.4369]	- 0.0649 [- 1.3192]
Transportation	0.4533** [12.3056]	0.0784 [0.2090]	- 0.2991* [- 2.2584]
Finance	1.0512** [13.8155]	0.0502 [0.1039]	- 0.1016 [- 1.3807]
Community	0.4660** [15.6823]	- 0.2980 [- 0.9255]	- 0.3852* [- 2.4923]

Notes: Test statistics are reported in brackets.

*Indicates the level of significance at the 5% level.

**Indicates the level of significance at the 1% level.

the conventional elasticity estimates. Therefore, we employ Engle and Granger (1987) type non-seasonal cointegration/error correction specifications. Estimates are reported in Table 6. Panel A reports the estimates of the coefficient of the output. Here, we did not report the estimated coefficients of the constant term, three seasonal dummies, a dummy variable for the post-2005 period, and the trend term in order to save space. The estimated coefficient for total employment is 0.3231 and statistically significant at the 1% level. This suggests that as output increases by 1 percent, employment increases by 0.3231 percent. However, the increase in output by 1 percent increases the non-agricultural employment by a larger amount, 0.5895 percent. The remaining rows repeat the exercise for the disaggregated employment categories. These suggest that as output increases, employment in agriculture and mining decreases. When the economy expands, the traditional sectors get a lower share of employment from the total. Therefore in these traditional sectors, the employment creation ability weakens.⁹ Lewis (1954) and Rostow (1960), among many others, stress this economic transformation and transition

⁹ The agricultural employment may not be responsive to the changes in the total output. The prevalence of small family organizations in agriculture and of the unpaid family member type of employment may be the reasons for our not finding a relationship between total employment and total output. There is migration from agriculture to urban areas. Turkish economy as a developing country has undoubtedly undergone structural changes with a decline in agricultural employment and an increase in the services employment over the past two decades as seen in Table A2. To control and distinguish between the employment-output relationship on

process. Thus a larger response of employment in the non-agriculture sector is in line with the previous literature. More importantly, the estimated coefficient for the non-agriculture sector is negative and statistically significant. This clearly suggests that higher output decreases agriculture employment and increases the other types of employment.¹⁰

The largest increases in employment are observed in the Electricity, Wholesale trade, and Finance sectors. However, these are less than the increase in employment in the Construction sector. Panel B reports the estimates of the specification in the second stage. Here, we regress the employment growths on a constant, seasonal dummies, intercept dummy for 2005Q1, four lags of employment growth, four lags value of output growth, and a lag value of the residual term obtained from the first stage regression. Panel B reports the sum of the estimated coefficients of output growth (Total Employment Effect) and the lag value of the residual term (Error Correction Term). The estimated coefficient for the total employment effect is not statistically significant for the aggregate employment, non-agriculture employment, and all the sectoral employment levels except for the wholesale trade sector. Thus, we can claim that the estimates account for seasonality with seasonal dummies only. They do not suggest a short-run effect for the total employment. The estimates for short-run effects are in line with the seasonal cointegration tests in Table 5. The Error Correction Term is negative as expected for the total employment and employment for each sector.

Wilson (1960, p. 37) cites Hansen (1953, p. 68) for the positive short-run relationship between employment and output. Ireland and Smyth (1970) derive a short-run employment function and write the reverse of the traditional production function as employment as a function of output. They claim that the amount of capital to be acquired is a long-term decision but the change in the amount of capital in the short-run is problematic. They find that the marginal unit of labour is more productive than the average unit of labour. However, Hart and Sharot (1978, p. 299) indicate that hours of work adjusts to output changes in the short-run but in the long-run men adjust to movements in output. They distinguish between man-hours and the number of men in studying the output effects. In this study we measure employment with the number of men rather than with man-hours due to data unavailability. It is possible to obtain a different result if man-hours are used. Caporale and Skare (2011), for the 119 countries, find a positive effect of employment growth on output growth in both the short- and the long-run using Granger causality. Pierluigi and Roma (2008) study the response of employment to output growth in both aggregate and sectoral levels for Germany, France, Italy, Spain, and the Netherlands by using the annual data of 1970–2006. For aggregate employment, they find a positive coefficient. For the manufacturing, services, and construction sectors they also observe a positive effect. Moreover, they estimate the short-run elasticities of total and sectoral employments to the output gap and find positive but small coefficients. According to their analysis, employment follows a pro-cyclical pattern. In our analysis we did not find similar short-run effects. This may be due to the fact that either there is no short-run effect or the time span we consider is too short in order to detect this relationship. However, since we find such a relationship for the long-run but not for the short-run, it is likely that there is no such short-run relationship. The results in Table 6 suggest that increases in output increase aggregate employment and non-agricultural employment but decrease agriculture employment. This suggests that higher output increases migration from low productivity sectors such as agriculture to non-agricultural sectors, reducing agricultural employment, as well as increases non-agricultural employment.

the one hand and structural economic change on the other, in the estimated relationships we also included a trend variable.

¹⁰ We also observe a similar negative coefficient for the mining sector, but due to this sector's small role in the Turkish economy we do not elaborate on this issue further here.

Although we cannot find a long-run relationship between total output and total employment, we do find a relationship between total output and non-agricultural employment and a set of long-run relationships between total output and employment in different sectors. He *et al.* (2009) find positive short- and medium-run multiplier effects of demand shock (fiscal stimulus) on employment for China using input–output tables. They also report corresponding different effects for different sectors. Milas (2000) finds a long-run relationship between output and employment for the Greek economy with the Johansen cointegration method for tradable and non-tradable sectors. Although they did not look at the short-run dynamics between output and employment, they report that political decisions affect employment. Bell (1981) explores the short- and long-run effects of excess demand on unemployment in Scotland using OLS and multiplier analysis. The long-run effects of excess demand are higher than those of the short-run effects. These results are all in line with our estimates.

IV.3 Caveats

In this study, we examine the relationship between total output on the one hand and various measures of employment on the other in Turkey. The various measures of employment include total employment, non-agricultural employment, and employment in the various sectors of economic activity. While examining employment in various sectors of economic activity, we do not use the output or export volume corresponding to these various sectors. There are two reasons for this. First, the output data comparable to the employment data for each of the sectors of economic activity are not available. Second, our aim is to measure the effect of aggregate demand which is proxied by total output on employment. To this end, we note that it is aggregate demand that is more likely to be influenced, controlled, or monitored by government policies rather than sectoral outputs.

Another feature of our study is that we used the number of people employed as our measure of employment rather than man-hours worked. This is partly because data on man-hours worked by sectors of economic activity are not available, and partly because the number of people employed or unemployed is more relevant to social concerns, such as social loss of unemployment¹¹ and the social tensions that may arise as a result, than man-hours worked.

V. CONCLUSION

This paper investigates the long-run and the short-run relationships, first between aggregate output and total employment, next between aggregate output and non-agricultural employment, and then between aggregate output and disaggregated employment by sectors of main economic activity. Quarterly data is used for the period 1988Q4–2008Q4. Recent time series techniques are employed in investigating the seasonal unit roots, cointegration properties, and error correction models. The main findings are as follows. We fail to find a long-run relationship between aggregate output and total employment; however, we find a long-run relationship between aggregate output and non-agricultural employment. We propose that aggregate output as a proxy for aggregate demand may affect employment in a non-homogenous fashion across different sectors of economic activity. Upon investigation of the relationship between aggregate output and sectoral employments, we find statistically significant long-run relationships for seven of the nine sectors of economic activity that we considered. However, we do not find a significant short-run relationship between aggregate output and non-agricultural employment.

¹¹ One can visit Cengiz and Şahin (2011) for a brief interpretation of unemployment as a measure of market inefficiency and its costs in terms of welfare losses.

Further, we find significant short-run relationships for only two of the nine sectors. These are wholesale and retail trade activities, which are important parts of the services sector. These findings are related to the various characteristics of the sectors. Further, these findings are consistent with the limited employment generating capacity of the Turkish industry and better employment generating capacity of the services sector in general. The negative coefficient for the agricultural employment elasticity of output suggests that higher output increases migration from sectors such as agriculture to non-agricultural sectors.

We can say that in general we find long-run but not short-run relationships. This has various implications for the economy and labour market. First, increasing employment needs to be maintained with the sustainable income policies rather than the short-term stimulus measures. Second, employment generation may require a set of policies besides income policies to be implemented, such as tax breaks and social security premium assistance for the newly hired labour. In fact, the latter two policies were implemented recently before the onset of the global crisis as part of a programme to fight unemployment. Third, government sponsored training programmes for youth and women may help to lower firms' costs for newly hired labour and this might be arranged with the long-term perspectives of various sectors. Fourth, in order to help overall employment growth, targeted sectoral policies may be implemented. For instance, employment in the wholesale and the retail trade sector, which includes tourism activities, could increase employment both in the long-run and in the short-run in response to aggregate demand policies. In order to reduce unemployment and increase employment, cross-sector labour mobility could be improved by encouraging reallocation of workers from declining employment sectors to expanding employment sectors especially to help sectors exhibiting 'jobless-growth' properties. Such policies may complement broad monetary and fiscal policies to increase the employment level.

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APPENDIX

TABLE A1

Data definitions for the employment by branch of economic activity

<i>Variables</i>	<i>Definition</i>
Employment	Total employment
Agriculture	Agriculture, forestry, hunting, and fishing
Non-agriculture	Employment – agriculture
Mining	Mining and quarrying
Manufacturing	Manufacturing
Electricity	Electricity, gas, and water
Construction	Construction
Wholesale	Wholesale and retail trade, restaurants and hotels
Transportation	Transportation, communication, and storage
Finance	Finance, insurance, real estate, and business services
Community	Community, social and personal services

Notes: We could seasonally adjust the series by using propositions such as X-11, X-12 or Tramo Seats. However, following comments of Ghysels and Perron (1993), we preferred seasonally unadjusted data in our analysis. They suggest using seasonal cointegration from seasonally unadjusted data. We prefer to analyse the long-run dynamics without losing information and by considering seasonality. The seasonally adjustment methods may affect the mean of the series.

TABLE A2

Sectoral shares in total employment and real GDP and rates of growth

<i>Sectors</i>	<i>Share in total employment</i>		<i>Share in real GDP</i>		<i>Rates of growth in employment</i>		<i>Rates of growth in real GDP</i>	
	<i>1988</i>	<i>2008</i>	<i>1988</i>	<i>2008</i>	<i>1988–2008</i>	<i>2001–08</i>	<i>1988–2008</i>	<i>2001–08</i>
Agriculture	46.4	26.8	18.9	11.0	– 1.7	– 3.2	0.2	0.9
Mining	1.3	0.5	1.9	1.3	– 1.2	6.9	0.4	0.3
Manufacturing	14.4	18.6	21.8	27.3	2.2	1.1	3.5	3.6
Electricity, gas, and water	0.2	0.5	2.2	3.7	7.1	0.6	5.5	6.9
Construction	5.7	5.8	6.8	5.4	1.0	– 0.5	0.5	0.4
Wholesale	11.4	21.0	20.2	25.5	3.7	1.8	3.6	3.8
Transportation	4.4	5.3	11.5	13.7	1.8	0.6	3.2	4.0
Finance	2.4	4.8	8.9	5.9	4.8	5.5	0.5	1.7
Community	13.8	16.7	7.8	6.2	2.1	2.2	1.2	2.2
Total	100.0	100.0	100.0	100.0	19.8	15.0	18.6	23.8

TABLE A3
Conventional unit root test results

Variables	With constant			With constant and trend		
	ADF	PP	KPSS	ADF	PP	KPSS
Output	-0.4325	-4.4699***	1.2047***	-2.4473	-8.3793	0.1565
Total employment	-1.6151	-3.8330***	1.1590***	-2.4111	-6.3123***	0.2663
Agriculture	-0.3237	-3.8752***	0.9495***	-1.9935	-5.5495***	0.2896***
Mining	-1.9474	-2.6223*	0.8343***	-1.9336	-3.4531**	0.1891*
Manufacturing	-1.1560	-1.3714	1.2609***	-6.5740	-6.5375***	0.1925*
Electricity, gas, and water	-2.0299	-2.0559	0.6510**	-1.9683	-2.0297	0.2177**
Construction	-2.3845	-5.2261***	0.2770	-2.3792	-5.2980***	0.1587**
Wholesale	-1.0886	-1.1991	1.1136***	-3.0334	-3.0334	0.1184
Transportation	-1.1071	-1.5250	1.2049***	-5.4016***	-5.3347***	0.0923
Finance	-0.1416	0.7122	1.2253***	-3.0925	-2.8293	0.2661***
Community	-1.1979	-1.1312	1.2443***	-5.9456***	-5.9155***	0.0566
Critical values: 1%	-3.5229	-3.5133	0.7390	-4.0753	-4.0753	0.2160
Critical values: 5%	-2.9018	-2.8977	0.4630	-3.4662	-3.4662	0.1460
Critical values: 10%	-2.5883	-2.5861	0.3470	-3.1598	-3.1598	0.1190

*The null hypothesis is rejected at the 10% significance level.

**The null hypothesis is rejected at the 5% significance level.

***The null hypothesis is rejected at the 1% significance level.