Handbook of Research on Unemployment and Labor Market Sustainability in the Era of Globalization

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Chapter 20
Trade Openness and Unemployment in Transition Economies:
A Dynamic Heterogeneous Panel Data Analysis

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ABSTRACT

Liberalization of foreign trade and foreign exchange regimes of the countries in transition from planned economies to liberal economies, which are called transition economies in the literature, constitutes one of the crucial pillars of the process. The effect of foreign trade liberalization process on the workforce markets, however, has been a matter of ongoing dispute in the literature. For this reason, the long-term relationship between trade openness and unemployment in 17 transition economies between years 1998-2014 is researched in this study, using dynamic heterogeneous panel data analysis methods. As a result of the econometrical analysis, it has been found that there is a significant relationship between trade openness and the rate of unemployment and that trade openness has a reducing effect on unemployment.

INTRODUCTION

Transition economy is the technical term used for the economies in transition from centrally planned economy to liberal economy. Transition economies shift to an environment where the prices are determined by the free market instead of a central organization during the process of economic liberalization. In this process, removal of trade barriers, privatization of state-owned enterprises and trade liberalization policies will be applied. Though it may differ from country to country, this process either came to

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fruition or is still going on in China, former Soviet Union countries, former Warsaw members and many other developing countries.

The Central and Eastern European countries and former Union of Soviet Socialist Republics (USSR) countries take the dominant place in the International Monetary Fund (IMF) classification of transition economies. These countries and their classifications are as follows (Güler, 2012):

1. Central and Eastern European States: Albania, Bulgaria, Croatia, Czechia, Macedonia, Hungary, Romania, Slovak Republic, and Slovenia,
2. Baltic States: Estonia, Latvia, and Lithuania,
3. Former Soviet Union States: Russian Federation, Azerbaijan, Belarus, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Uzbekistan, Tajikistan, Turkmenistan, and Ukraine.

When the emergence process of transition economies - the definition and scope of which are given above – is analyzed; it can be seen that the breakthrough in Poland (the workers' strike in 1988, the change of the system of government and Poland's break from the influence area of the Soviet Union) had evolved into a gigantic movement. Following this example; other European countries' progress in the same direction, some with bloody conflicts (Romania) and some with peaceful means (Hungary), achieved similar results and they also switched to the market economy after the collapse of communism. The process did not stop there. With the Baltic States gaining their independence, which can be counted as European states rather than Soviet Republics, the Soviet Union became a federal structure. The final link in this chain was the establishment of the Commonwealth of Independent States (CIS), which took the place of the USSR after the gathering of the presidents of Russia, Kazakhstan, and Belarus on December 30, 1991. The CIS also fell apart later, and the member states applied for integration with the western institutions, just like the former members of the Warsaw Pact. All the economies which involved in this process are termed transition economies in the literature (Kutlu & Eşkinat, 2014, p. 197).

International institutions –World Trade Organization (WTO), IMF and the World Bank in particular – have engaged in promotive practices and gave training services and technical assistance in order to liberalize the foreign trade and exchange regimes of the transition economies which have adopted the western economy models (Seyidoğlu, 2015, pp. 231, 850). The purpose of these aids was the transition of the countries to an open market. These practices achieved significant results, as all of the transition countries adopted the free market economy model and started using the arguments of this model.

With the liberalization of foreign trade, which is one of the most important arguments of this model, a rapid increase was observed in the trade openness ratios of the transition economies. A country's openness ratio is generally calculated as the ratio of the foreign trade volume to the GDP. Another indicator that approximates trade openness is the foreign dependency ratio, which is the ratio of exports to the GDP. In the most general sense, it can be said that the higher these ratios are, the more open that economy is. To improve the trade openness, barriers to foreign trade -customs duties, quotas, non-tariff barriers, etc.- must be removed.

The liberalization process in the transition economies (especially the ones that are focused in this chapter), which has started post-1990, is going on rapidly. Though the economic growth of these countries varies, it is observed that the growth is bigger than the pre-1990 period. The growth rates, which were usually negative at the start of the 1990s, were seen to improve as the result of the rapid foreign expansion efforts in the second half of the 1990s and have passed the average rate of 5% before the last global economic crisis. Economic growth is associated with the increase in employment in the economic literature

(Okun's Law). With the economic growth expanding the labor markets during the periods when these countries follow open trade policies, significant drops took place in the unemployment rates. However, the theoretical and empirical literature on the relationship between trade openness and unemployment is open to debate at the point of the existence of this relationship and the direction of it, if it exists.

This chapter studies the relationship between trade openness and unemployment, using data from 17 transition economies between the period of 1998 and 2014 with dynamic panel data analysis methods. The chapter firstly touches upon the theoretical and empirical literature on the trade openness – unemployment relationship. Then, the variables and data analysis methods of the model used in the econometric analysis are introduced. The final part of the chapter covers the econometric analysis results and their interpretations.

TRADE OPENNESS AND UNEMPLOYMENT

The basis of the relationship between foreign trade and unemployment lies at the Heckscher-Ohlin Theory, which is based on David Ricardo's Comparative Advantages Theory. This theory suggests that the primary determinant of the foreign trade is different factor endowments of countries. The theory, which is also called the factor endowment theory, argues that foreign trade will be profitable when labor-abundant countries export labor-intensive products and the countries that have more capital export capital-intensive products. When a labor-abundant country opens up to foreign trade, the labor demand in the labor-intensive sectors will increase since most of the exports will be carried by these sectors. Because of this, the Heckscher-Ohlin Theory may be interpreted in a way that trade openness has a positive impact on the employment of the countries which have abundant labor.

The Heckscher-Ohlin Theory uses the assumption of full employment. By relaxing this assumption, Brecher (1974), studied the effects of trade liberalization on welfare and unemployment for a small country with a minimum wage (this practice may also cause unemployment in the economy) in a two-country and two-commodity Heckscher-Ohlin model. This study, in accordance with the deduction of Heckscher-Ohlin Theory, found that unemployment in the labor-abundant countries will decrease and unemployment in the capital-abundant countries, however, increases after trade openness. Another assumption of the Heckscher-Ohlin Theory is that there is perfect competition in the labor and good markets. Besides, Brecher's results on the trade liberalization-unemployment relationship are found under the assumption of a small country. Davis (1998), on the other hand, researched the effects of the trade flows between the flexible-wage U.S. and rigid-wage Europe (which are large enough to affect the terms of foreign trade) on unemployment within the frame of Brecher (1974) model. According to the results of this study, "in a benchmark case, a move from autarky to free trade doubles European unemployment" (Davis, 1998, p. 478). These studies put forth the connection between the findings of Heckscher-Ohlin Theory on the trade-unemployment relationship with the assumptions of the model.

Today, contrary to the implication of the Heckscher-Ohlin Theory, unemployment rates in the labor-abundant countries that have adopted a free trade regime are observed to be higher than the unemployment rates of capital-abundant countries. Krueger (1983, p. 9) states that the relationship between trade regime and unemployment can arise in three different ways:

1. A trade strategy with a rapid economic growth due to the optimal allocation of resources in the whole economy can raise the employment rates.

2. Whether an import substitution or export oriented strategy is followed, a trade strategy in which the growth in the labor-intensive sector is high will provide a larger increase in the employment rates.
3. The foreign trade regime in effect can change the capital/labor ratio and production techniques in the industries. For example, when a rigid import substitution policy on capital goods is followed, employment may be affected negatively because of the increase in the capital intensity.

This three-alternative relationship of Krueger (1983) also puts forth the uncertainty of the presence and the direction of trade openness-employment relationship. Carrere, Fugazza, Olarreaga, and Robert-Nicoud (2014), on the other hand, empirically shows the ambiguity of the trade-unemployment relationship using panel data analysis with the data from 98 different countries in the period of 1995-2009. According to the findings of the study, the determinant of the trade-unemployment relationship is the covariance between comparative advantage and sector level labor market frictions. In the case where the covariance is positive, trade liberalization has a reducing effect on unemployment.

The results of empirical studies on the trade-unemployment relationship in the literature also differ from one another. Especially, the studies on developed countries have found that trade openness reduces unemployment rates. Felbermayr, Prat, and Schmerer (2011) have found, in a panel data analysis they conducted on 20 OECD countries using different measures of trade openness, that a 10% increase in trade openness reduces unemployment by about 1%, directly by itself and indirectly by the effect of total factor productivity. Gözgör (2014), who has conducted an econometric analysis of the trade openness-unemployment relationship in the G7 countries using four different trade openness measures, has found that foreign trade openness reduces unemployment in the developed countries. However, studies on the U.S. generally find that trade increases unemployment. For example, Sachs, Shatz, Deardorff, and Hall (1994) has reached the conclusion that foreign trade increases skilled labor employment while decreasing unskilled labor employment. The findings of Janiak (2006) show, considering labor market with search frictions, that foreign trade in America creates job destruction rather than job creation. Pierce and Schott (2012) have stated that the sharp fall in the employment rates of the U.S. manufacturing sector that started in 2001 was the result of the lifting of import tariffs applied on China. Autor, Dorn, and Hanson (2013), from their analysis of the period of 1990-2007, have also reached the conclusion that 1/4 of the fall in the employment rates of the U.S. manufacturing sectors is because of the import substitution strategy of China.

The findings on the countries which have started their trade liberalization process later than the developed countries show that trade openness affects the labor demand rather negatively. Revenga (1997), states that the trade liberalization process in Mexico between 1985 and 1987 has reduced the industrial production and labor demand, resulting in a downside pressure on employment and wages. Moreira and Najberg (2000) have concluded that the trade openness process of the 1990-1997 period in Brazil, another country that is going through trade liberalization, has a low employment cost in the short term but high in the long term. Menezes-Filho and Muendler (2011) have also reached the conclusion that trade liberalization has increased unemployment in Brazil during the 1990s due to less workers employed in the comparative-advantage, and thus exporting, sectors than in the average businesses. Sandalcılar and Yalman (2012) have found in their econometric analysis on Turkey, which started its liberalization process in the 1980s, that the decrease in employment was the result of trade openness. Özel, Topkaya, and Kurt (2012) have concluded that there is no trade openness-unemployment relationship in the long run in Turkey, but that trade openness results in a decrease in the unemployment rates in the short run.

Though the trade openness-unemployment relationship in different countries with varying development levels has been studied; it is remarkable that the investigation of this relationship in the transition economies has not found itself a notable place in the literature, since these countries have taken radical trade liberalization steps in relatively shorter periods. Because of this, the study on trade openness-unemployment relationship focuses on the transition economies in this chapter. The following section will cover the introduction of the data and the econometric model that will be used in the research of this relationship in transition economies.

DATA AND MODEL

This study researches the relationship between trade openness and unemployment in 17 transition economies using the annual data from the period of 1998-2014. The countries that are included in the study on the base of data availability are given in Table 1. Some other transition economies like Azerbaijan and Belarus are excluded from the analysis due to lack of data.

The general form of the econometric model used in the study is given in equation (1).

$$unemp_{it} = \beta_0 + \beta_1 open_{it} + \beta_2 growthrate_{it} + \beta_3 lnpop_{it} + \beta_4 tfp_{it} + u_{it} \tag{1}$$

The *i* subscript denotes the country and *t* subscript denotes the time. β_0 is the constant, and u_{it} is the error term. Trade openness, which is shown with *open* in the general form, will be included in the analysis with two different openness measures, nominal trade openness (*nto*) and real trade openness (*rto*). *nto* is reached by the ratio of the foreign trade volume (export + import) to the nominal GDP. The export and import data and the current GDP of the 17 transition economies used to reach the nominal trade openness figures are in current USD and have been obtained from World Development Indicator.

The most commonly used traditional openness measures in the literature are import/nominal GDP (import trade intensity), export/nominal GDP (export trade intensity), and import+export/nominal GDP (trade intensity that is shown with *nto* in this study). For instance, Jin (2000) included import trade intensity to the empirical model in his study on the openness-growth relationship in the Eastern Asia countries. Heid and Larch (2012), Sandalcılar and Yalman (2012), Özel et al. (2012), Türedi (2013), Menyah, Nazlıoğlu, and Wolde-Rufael (2014), and Neogi (2016) are some of the recent studies that trade intensity is used as a measure of openness in econometric analysis. Yanıkkaya (2003), on the other hand, has used various trade liberalization measures like average tariff rates together with trade shares,

Table 1. Sample of countries

Baltics	Central Europe	CIS	Southeast Europe	Central Asia
Estonia	Czechia	Moldova	Bulgaria	Armenia
Latvia	Hungary	Russia	Croatia	Kazakhstan
Lithuania	Poland	Ukraine	Romania	Kyrgyz Republic
	Slovak Republic			
	Slovenia			

export shares, and import shares in GDP when studying the relationship between trade liberalization and economic growth. Alcalá and Ciccone (2001), however, have shown that when the demand for non-tradable goods is inelastic, the expected increase in the productivity of tradable goods via foreign trade may lower the nominal trade openness of the country concerned, since this increase in productivity may increase the relative prices of non-tradable goods. Accordingly, using *nto* as a trade openness measure in the econometric analysis may be misleading. Alcalá and Ciccone (2001, p. 614) propose the use of real openness rate which is calculated as import ($)+export ($)/GDP (purchasing power parity $) instead of nominal openness rate, in order to eliminate the relative differences in the price of non-tradable goods among various countries. Because of this, *rto* is used as a second measure of trade openness in the study. Gözgör (2014) also included real openness as a trade openness measure into the econometric model along with the nominal openness variable when researching the relationship between trade openness and unemployment in the G7 countries.

Data for unemployment rate, which is shown with *unemp* in the model, annual GDP growth rate (*growthrate*) and population (*pop*) used as control variables are obtained from World Bank World Development Indicator. Unemployment rate estimated by International Labor Organization (ILO) is calculated as the ratio of the unemployed people searching for work to the 15+ active population. The population variable takes place in the model in a logarithmic form.

Data for total factor productivity (*tfp*), another control variable used in the study, is obtained from Penn World Tables 9.0 and are created by Feenstra, Inklaar, and Timmer (2015). Feenstra et al. (2015, p. 3166) state that the values obtained by the ratio of the observed differences in real GDP between the countries to the Törnqvist quantity index of factor endowments[1] are significant measures for the productivity differences between countries. The total factor productivity value of the U.S. (at current PPPs) in the data created by Feenstra et al. (2015) is 1. In other words, the total factor productivity value is the relative productivity of a given country compared to the U.S., and thus is suitable for the comparisons between the countries in question.

The descriptive statistics for the data sets of the variables used in the study are given in Table 2.

Theoretical expectation regarding the sign of the β_2, which is the coefficient of the independent variable of *growthrate*, is negative – as pointed out by Okun's Law. In periods when economic growth is limited, the low economic growth will have an increasing effect on the unemployment rate since the demand for labor also decreases. An increase in population will also increase the unemployment rate, in a case where labor participation rate also increases with the population and the economy cannot create sufficient new job opportunities. Thus, the potential expectation for the sign of the β_3 coefficient will also be negative.

Table 2. Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
unemp	289	10.55536	5.027036	3.400000	35.90000
nto	289	104.2284	31.89762	48.43506	183.4276
rto	289	53.02816	29.86595	12.96299	127.4287
growthrate	289	3.725462	4.757814	-14.81416	14.04080
lnpop	289	15.88195	1.221894	14.08900	18.81050
tfp	289	0.527102	0.168827	0.157260	0.944424

There is not a clear theoretical expectation regarding the sign of the β_4, coefficient of the *tfp* variable, the coefficient may be negative or positive. In Pissarides and Vallanti (2007), where the effects of total factor productivity increase on steady-state unemployment are examined, it is stated that the direction of the relationship between total factor productivity and unemployment depends on the new technologies used in the new job opportunities created in the economy. The net effect of total factor productivity on unemployment is determined by the greater one of the following: "capitalization effect", in which the transition to a new technology creates an increase in labor demand, and "creative destruction effect", which takes place when the new technology cannot be implemented and thus reducing the demand for labor (Pissarides and Vallanti, 2007, p. 608). In a case where the sign of *tfp* coefficient is negative (positive), the conclusion will be that the effect of an increase in total factor productivity will reduce (increase) the unemployment rate.

The sign of β_1, coefficient of trade openness variable (*open*), and its statistical significance constitute the basic question of this study.

PANEL UNIT ROOT TEST AND METHODOLOGY

When the trade openness-unemployment relationship in 17 transition economies is researched in this chapter, a balanced panel data set that is composed of observations of the variables in the model between the years of 1998-2014 is used. In order to determine the method of the study using the relevant data set, first, it is needed to establish that whether the data set contains unit root or not. There are many panel unit root tests for this purpose, such as Harris and Tzavalis (1999), Maddala and Wu (1999), Hadri (2000), Levin, Lin and Chu, (2002), and Im, Pesaran, and Shin (2003). The common point of these tests, which are called first generation panel unit root tests, is that they use the hypothesis of cross-sectional independency as their base. However, second generation panel unit root tests that take into consideration cross-sectional dependence, defined as "the interaction between cross-sectional units" in Baltagi, Feng, and Kao (2012, p. 164), have been developed recently. Because of this, cross section dependence tests have been applied to the panel data set of this study before executing the panel unit root test.

For the purpose of testing the cross-sectional dependence of the data for the variables in the model, the general form of which was given in equation (1), CD test by Pesaran (2004) and bias-corrected scaled LM test by Baltagi et al. (2012) have been used. These cross section dependence tests are based on the correlation tests between error terms. In other words, these tests examine cross section dependence by testing the hypothesis of H_0: Corr$(u_{it}, u_{jt}) = \rho_{ij} = 0, i \neq j$ when the panel data model is $y_{it} = \alpha_i + \beta_i x_{it} + u_{it}$, where, *i* denotes cross sections, *t* denotes time-periods, and x_{it} denotes (k×1) explanatory variables vector. These tests may be applied on the error terms obtained from the model and also variables in the model.

The Pesaran (2004) CD test statistic is developed using the average of the correlation coefficient ρ_{ij}'s, as shown in equation (2).

$$CD = \sqrt{\frac{2}{N\left(N-1\right)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}T_{ij}\hat{\rho}_{ij}} \rightarrow N\left(0,1\right) \tag{2}$$

The test statistic for Baltagi et al. (2012) bias-corrected scaled LM test is as in equation (3):

$$LM = \sqrt{\frac{1}{N\left(N-1\right)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T_{ij}\hat{\rho}_{ij}^{2}-1)-\frac{N}{2T-1}\rightarrow N\left(0,1\right) \tag{3}$$

The null hypothesis for both tests is the existence of cross-sectional independency. Cross section dependence test results are given in Table 3.

According to the Pesaran CD and bias-corrected scale LM test results in Table 3, the null hypothesis is rejected for all the variables in equation (1). Thus, a unit root test that takes into consideration the existence of cross section dependence is also included into the study. Before deciding the methodology to be used in the research, panel unit root testing procedure is conducted using Maddala and Wu (1999) first generation unit root test and Pesaran (2007) cross-sectionally augmented Dickey-Fuller (CADF) second generation unit root test.

Pesaran (2007), developed a panel unit root test that takes into consideration the cross-sectional dependence, including the unobserved common effect into the Augmented Dickey-Fuller (ADF) unit root test model that will be applied for each cross section. The ADF unit root test model to be applied for each cross-section *i* in the panel dataset is given in equation (4).

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + u_{it},\ i = 1,2,\ldots,N; t = 1,2,\ldots,T \tag{4}$$

Pesaran (2007, p. 268) divides the error term u_{it} in the model into two parts: “unobserved common effect” and “individual-specific error”. Equation (4) is rewritten in equation (5), this time f_t showing the unobserved common effect and ε_{it} showing the individual-specific error.

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \theta f_t + \varepsilon_{it} \tag{5}$$

For the unobserved common effect in equation (5), when u_{it} is serially uncorrelated, cross section mean ($\overline{y}_{t-1}$) and its lagged values are used as proxy and a CADF model, which can be estimated by ordinary least squares (OLS) and shown in equation (6), is developed in Pesaran (2007, p. 269).

Table 3. Cross section dependence test results

Variables	Pesaran CD Test	Prob.	Bias-Corrected Scaled LM Test	Prob.
uemp	11.35288	0.000	25.49554	0.000
nto	18.00733	0.000	49.92684	0.000
rto	58.03968	0.000	145.8461	0.000
growthrate	31.98606	0.000	48.57946	0.000
lnpop	7.267984	0.000	128.8380	0.000
tfp	11.27152	0.000	73.53696	0.000

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \delta_i \overline{y}_{t-1} + \gamma_i \Delta \overline{y}_t + \varepsilon_{it} \tag{6}$$

The null hypothesis for the CADF panel unit root test is $\beta_i = 0$ for all *i*, and the alternative hypothesis is H_1: $\beta_i < 0$, $i = 1, 2, \ldots, N_1$ or H_1: $\beta_i = 0$, $i = N_1 + 1, N_1 + 2, \ldots, N$.

Maddala and Wu (1999) unit root test is a non-parametric Fisher-type test and uses the *P* values developed by combining probability (*p*) values from the unit root test applied to each cross section. The calculation of the *P* test statistic, where *N* denotes the number of the cross-section, is given in equation (7).

$$P = -2\sum_{i=1}^{N} \ln p_i \rightarrow \chi^2 \left(2N\right) \tag{7}$$

The advantage of this test is that it lets us individually determine the lag lengths in the Augmented Dickey-Fuller test that is used to obtain the p_i values for each cross section and that it is also suitable for the unbalanced panel data sets. In this test, the null hypothesis, each individual cross-section has a unit root, is tested against the alternative hypothesis of some cross sections without unit root.

In this study, the existence of unit root for the variables in the panel data set are tested with both trend and no trend models, using the Maddala and Wu and Pesaran CADF tests. Table 4 shows the unit root test results obtained using these two methods.

Table 4 shows that, according to Maddala and Wu unit root test applied using a trend model, all the variables are stationary, in other words, they do not have a unit root. No-trend model test resulted with all variables stationary, except for the *rto* variable. However, according to the cross section dependence test results in Table 3, cross-sectional dependence exists for all the variables in the model. According to the Pesaran CADF test results that take this into consideration, the no-trend model shows that all variables except *rto* are stationary. However, the trend model gives us different results. Graphs of the variables are used in order to determine which of the two models is suitable, and it was seen that the variables

Table 4. Unit root test results

Variables	Model I Maddala and Wu (No Trend)	Model II Maddala and Wu (Trend)	Model III Pesaran (CADF) (No Trend)	Model IV Pesaran (CADF) (Trend)	Unit Root
unemp	76.240***	102.532***	-1.735**	-0.228	I(1)
Δunemp	275.118***	209.386***	-8.406***	-6.219***	
nto	64.801**	90.433***	-3.198***	-0.495	I(1)
Δnto	246.381***	179.252***	-6.380***	-3.946***	
rto	18.962	57.187*	0.554	3.473	I(1)
Δrto	295.178***	204.224***	-7.828***	-6.212***	
growthrate	108.248***	96.046***	-4.437***	-1.319*	I(0)
lnpop	113.156***	168.376***	-2.346***	-3.396***	I(0)
tfp	26.246	50.398**	-2.064**	0.849	I(1)
Δtfp	216.012***	150.346***	-7.797***	-5.017***	

Note:*, **, and *** indicate significance at 10%, ** at 5% and *** at 1%.

unemp, nto, rto, and *tfp* have a significant trend. Thus, it is concluded that *growthrate* and *lnpop* are variables without unit root according to Pesaran CADF test results. The variables *unemp, nto, rto*, and *tfp* are non-stationary. When the test is repeated taking first differences of the variables with a unit root, all the variables became stationary. As a result, it can be said that the *growthrate* and *lnpop* variables are level stationary (I(0)), while other variables are first difference stationary (I(1)).

Because some of the variables are level stationary while others are first difference stationary, the study uses heterogeneous panel data methods as for the research. Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1997, 1999) provide dynamic heterogeneous panel data methods that can be applied in panel data sets that I(0) and I(1) regressors are both a part of. These methods are based on the calculation of long term parameters and the speed of adjustment toward equilibrium, i. e. error correction term, using the appropriate autoregressive distribution lag (ARDL(p, q_1, ..., q_k)) model. Pesaran and Shin (1998) show that whether the variables are I(0) or I(1) is not important in the application of ARDL technique.

Where i is cross-section unit, t is time, and X_{it} is (k×1) explanatory variable matrix, the basic form of ARDL (p, q_1, ..., q_k) model is given in equation (8) (Blackburne & Frank, 2007, p. 198).

$$y_{it} = \mu_i + \sum_{j=1}^{p} \theta_{ij} y_{i,t-j} + \sum_{j=0}^{q} \gamma_{ij}^{'} X_{i,t-j} + \varepsilon_{it}, i = 1,2,\ldots,N, t = 1,2,\ldots,T \qquad (8)$$

In equation (8), μ_i denotes group-specific effect and γ_{ij} denotes (k×1) coefficient vector. In the case where the variables in equation (8) are cointegrated, error terms obtained for each i cross section unit become I(0). This means that the short-run dynamics of the variables in the error correction model are affected from the deviations from equilibrium. Error correction form of equation (8) can be written as in equation (9).

$$\Delta y_{it} = \mu_i + \varphi_i \left(y_{i,t-1} - \delta_i^{'} X_{it} \right) + \sum_{j=1}^{p-1} \theta_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \gamma_{ij}^{*'} \Delta X_{i,t-j} + \varepsilon_{it}, i = 1,2,\ldots,N, t = 1,2,\ldots,T \qquad (9)$$

Here

$$\varphi_i = -\left(1 - \sum_{j=1}^{p} \theta_{ij} \right);$$

$$\delta_i = \sum_{j=0}^{q} \gamma_{ij} \,/\, (1 - \sum_{k} \theta_{ik});$$

$$\theta_{ij}^{*} = -\sum_{h=j+1}^{p} \theta_{ih}, j = 1,2,\ldots,p-1;$$

$$\gamma_{ij}^{*} = -\sum_{h=j+1}^{q} \gamma_{ih}, j = 1, 2, \ldots, q-1 .$$

φ_i, denotes the speed of adjustment toward equilibrium. In the case where $\varphi_i \neq 0$, it can be argued that there is a long-term relationship and it is expected for φ_i to result negative, indicating that the variables are directed toward long-term equilibrium (Blackburne & Frank, 2007, pp. 198-199).

In this study, the error correction model is estimated by using dynamic fixed effect (DFE), Mean Group (MG) developed by Pesaran and Smith (1995) and pooled mean group (PMG) developed by Pesaran et al. (1997, 1999) estimators. The maximum likelihood estimation method is used in all of these methods.

DFE carries the restrictions of all short-term and long-term coefficients (except for intercept) and the speed of adjustment toward equilibrium being the same for all cross-sections. MG, on the other hand, is a method that calculates the unweighted mean of coefficients that are estimated using separate estimations for each cross section in the panel dataset (Pesaran and Smith, 1995). This method lets both the short term and the long term coefficients to be heterogeneous for a cross section. In order to obtain consistent estimation, the data set for each cross section must be large enough. PMG lets the short term coefficients and error variances to be determined cross-section specific, but this method is limited in the way that long-term coefficients must be identical. "There are often good reasons to expect the long-run equilibrium relationships between variables to be similar across groups, due to budget or solvency constraints, arbitrage conditions or common technologies influencing all group in a similar way" (Pesaran et al., 1999, p. 621). When the short-term coefficients are allowed to be heterogeneous, a different dynamic specification can be established for each cross-section, so PMG is an intermediate estimator that includes the pooling procedure in DFE and the averaging procedure in MG. All three estimators are used for estimating error correction form of equation (1), in order to compare the results obtained from the econometric analysis conducted to establish the trade openness-unemployment relationship in the transition economies.

ECONOMETRIC ANALYSIS

In this chapter, where the relationship between trade openness and unemployment in the transition economies is researched, two alternative models that include either nominal trade openness (*nto*) or real trade openness (*rto*) as measures of openness are used. The control variables included in both models are the same. The models are estimated in ARDL (1,1,1,1,1) form. ARDL dynamic panel model specification was selected according to Akaike Information Criterion (AIC). For the model where *nto* is included as the measure of trade openness, results obtained using the PMG, MG, and DFE estimators are shown in Table 5.

Error correction term resulted negative and significant at %1 level, according to the estimation results obtained by using all three estimators in Table 5. This implies that the variables in the model show a return to a long-run equilibrium. Short term results indicate that the coefficient of *Δgrowthrate* variable is positive for all three models and statistically significant. A significant relationship between other variables and unemployment in the short term could not be found. In the long term relationships, the results of estimations using different estimators vary from each other. According to the DFE estimation

Table 5. PMG, MG and DFE estimation results (Trade openness measure: Nominal trade openness)

Dependent Variable: unemp	PMG		MG		DFE	
Variables	**Long Run**	**Short Run**	**Long Run**	**Short Run**	**Long Run**	**Short Run**
Error Correction		-0.179*** (0.027)		-0.575*** (0.094)		-0.285*** (0.042)
Δnto		0.0323 (0.045)		0.018 (0.053)		-0.012 (0.016)
Δgrowthrate		0.095** (0.047)		0.061** (0.029)		0.127*** (0.029)
Δlnpop		-54.711 (39.986)		218.295 (154.346)		-43.353 (28.668)
Δtfp		-13.134 (17.026)		-2.769 (9.176)		5.925 (5.277)
cons		-34.228*** (5.401)		1351.608 (1009.44)		-121.214** (59.825)
nto	-0.134*** (0.0233)		0.606 (0.838)		-0.058** (0.027)	
growthrate	-1.512*** (0.207)		-0.607*** (0.183)		-0.978*** (0.198)	
lnpop	15.195 (12.737)		-65.742 (131.444)		28.804** (13.784)	
tfp	-32.059*** (5.849)		-152.114 (128.803)		-24.148*** (5.447)	
Hausman Test	$\chi^2(4)=4.56$ Prob=0.336					

Note:*, **, and *** indicate significance at 10%, ** at 5% and *** at 1%.

results, all coefficients of the variables included in the model are statistically significant. The coefficient of *lnpop* variable is positive while other variable coefficients are negative, and the coefficient signs are consistent with the theoretical expectations. MG estimations have found that the variables other than economic growth have no significant relationship with the unemployment rate in the long term and the coefficient signs also diverge from theoretical expectations. This situation may be because that the cross-section dimensions in the panel dataset are inadequate for an efficient MG estimation. PMG estimation results show that long-term *growthrate and tfp* coefficients are statistically significant at 1% level and have negative signs; thus, it can be said that the increases in economic growth and total factor productivity decrease the unemployment rate. The *lnpop* coefficient, while positive in accordance with theoretical expectations, is not statistically significant. The coefficient of the *nto* variable, which denotes nominal trade openness, is also found to be negative and statistically significant at 1% significance level. According to these results, it can be seen that there is a negative relationship between nominal trade openness and unemployment in the long run.

The Hausman test has been applied in order to determine which of the PMG and MG estimates is consistent (even if the coefficients estimated with MG found to be divergent from the theoretical expectations) since the PMG estimation is made under the restriction of the long-term coefficients being homogenous. When the Hausman test results show the existence of long run slope homogeneity, the

PMG estimator is consistent and efficient. The Hausman test is used to examine the null hypothesis that the coefficients obtained from PMG and MG estimators are equal. In the case of the null hypothesis being rejected (prob<0.05), the assumption that the long-term coefficients that are obtained for cross sections are homogenous becomes invalid, and the cross sections need to be modeled separately. The probability value for Hausman test statistic in Table 5 is 0.336, then the null hypothesis cannot be rejected, and the assumption of homogeneity is valid. Because of this, it can be said - based on the PMG and DFE estimates - that there is a significant and negative relationship between nominal trade-openness and unemployment in the long run for transition economies.

For robustness check, the estimation procedure is repeated by using real trade openness (*rto*) proposed by Alcalá and Ciccone (2001), instead of nominal trade openness (*nto*), in the model. The results are shown in Table 6.

The results in Table 6 show that the error correction terms estimated with all three estimators are negative and statistically significant, just like the previous model. As a result of the estimations, the coefficient of the *Δgrowthrate* variable is also statistically significant at the significance level of 1%. The PMG estimation showed a weak relationship between *rto* and unemployment in the short run. Long run coefficients show that the PMG method has estimated statistically significant coefficients, which

Table 6. PMG, MG, and DFE estimation results (trade openness measure: real trade openness)

Dependent Variable: unemp	**PMG**		**MG**		**DFE**	
Variables	**Long Run**	**Short Run**	**Long Run**	**Short Run**	**Long Run**	**Short Run**
Error Correction		-0.248*** (0.034)		-0.651*** (0.097)		-0.301*** (0.042)
Δrto		-0.096* (0.056)		-0.651 (0.097)		-0.022 (0.019)
Δgrowthrate		0.142*** (0.035)		0.102*** (0.033)		0.119*** (0.026)
Δlnpop		-96.425* (52.486)		57.538 (108.601)		-42.373 (28.246)
Δtfp		-12.335 (15.119)		1.229 (8.400)		4.478 (5.241)
cons		-110.461*** (14.408)		1096.278 (842.041)		-103.509*** (60.634)
rto	-0.055*** (0.012)		-0.028 (0.134)		-0.061** (0.025)	
growthrate	-0.902*** (0.116)		-0.664** (0.312)		-0.873*** (0.181)	
lnpop	30.198*** (8.380)		-26.430 (103.304)		23.282* (13.146)	
tfp	-18.860*** (3.490)		2.721 (34.851)		-18.229*** (5.198)	
Hausman Test	$\chi^2(4)=0.76$ Prob=0.944					

Note:*, **, and *** indicate significance at 10%, ** at 5% and *** at 1%.

are in accordance with theoretical expectations, at the significance level of 1%. The DFE estimation also results in statistically significant and theoretically expected coefficients for all variables. The MG estimator could not determine a long-term relationship between *rto* and *lnpop* and unemployment. Since the results from Hausman test, which is applied to test long run slope homogeneity, cannot reject the null hypothesis, the homogeneity assumption is valid, and the PMG estimator is efficient and consistent. As a result, the model that uses real trade openness as a trade openness measure also points to a significant and negative relationship between trade openness and unemployment in the long run.

CONCLUSION

The countries which are in transition from a centrally planned economic structure to a free market economy, termed transition economies in the literature, also take steps toward the liberalization of foreign trade during this process. With the barriers to foreign trade like tariffs and quotas eliminated, there has been a rapid increase in the trade openness rates, which can be calculated as the ratio of the foreign trade volume to the GDP, of these countries. It was also observed that the unemployment rates in these countries have fallen during the course of economic liberalization. But while the Heckscher-Ohlin Theory points to the potential reducing effects of foreign trade on unemployment, the existence of trade openness and unemployment relationship and the direction of this relationship, if it exists, are ambiguous in the light of the findings from the theoretical and empirical literature on the subject.

This chapter investigated the relationship between trade openness and unemployment using dynamic heterogeneous panel data analysis with the data of 17 transition economies between 1998 and 2014. Two trade openness measures, those being nominal and real openness rate, have been used in the econometric analysis. The analysis results obtained by using pooled mean group, mean group and dynamic fixed effect estimators point to a statistically significant and negative relationship between trade openness and unemployment in the long run. In other words, increases in these countries' trade openness rates have a reducing effect on the unemployment rates. This can be interpreted as the positive effect of commercial liberalization on the labor market of transition economies in terms of employment.

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KEY TERMS AND DEFINITIONS

Cross-Section Dependence: The interaction between the cross-sections in a panel data set.

Dynamic Fixed Effect (DFE): The estimator that is restricted by the short-term (except for intercept) and long-term coefficients and the speed of adjustment toward equilibrium being the same for all cross-sections.

Heterogeneous Panel Data Model: The panel data model where the coefficients in the model differ for each cross-section in the panel dataset.

Mean Group (MG): The estimator that calculates the unweighted average of the estimated coefficients, making separate estimations for each cross-section in the panel dataset.

Nominal Openness Rate: Trade openness measure that is the ratio of the sum of export and import of a country to its nominal GDP.

Pooled Mean Group (PMG): The estimator that lets the short term coefficients and error variances to be determined cross-section specific, but this method is limited by the long-term coefficients being identical.

Real Openness Rate: Trade openness measure that is the ratio of the sum of export and import of a country to its purchasing power parity GDP.

Transition Economies: The technical term for the economies that are in transition from a centrally planned economy to a liberal economy.

Unemployment: Presence of active population that is ready to work at the current wage level and looks for work but is not employed in an economy.

ENDNOTE

1 For further information, please see Feenstra et al. (2015).