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The Causal Relationship Between Knowledge Spillovers and Economic Growth: The Turkish Case[1]

Introduction

It has been discussed for a long time that technological differences between countries are one of the important determinants of economic growth. In the neoclassic growth model starting with Solow (1956), technological progress is the main determinant of economic growth. However, technological progress which is determined exogenously in the model has been kept out of the interest of economics discipline. Neoclassic growth theory has linked the economic growth which is beyond the one achieved through the existing inputs with the exogenous technological progress and this uncalculated part is called "Solow residual". It is called residual because it is the part of growth that cannot be explained through capital accumulation and labor. Neoclassic growth theory does not provide an explanation concerning the reasons of technological progress; it only analyzes the effects of technological progress included in the model exogenously on economic growth in the long run. According to this, as long as there is technological progress, economy will continue to grow in the long run. Nevertheless, policy makers will not be able to apply a policy aiming at increasing the exogenous technological progress.

In neoclassic growth theory, technology is like manna from heaven which enters economy automatically and which is free from other elements of economy. Endogenous growth theories pioneered by Romer (1986) and Lucas (1988) is the assumption by neoclassic growth theory that technological progress is exogenous is criticized. In the model, it is stated that technological growth occurs in the sys-

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[1] The first version of this paper has been presented in the "SSEM-EuroConference 2011: Crises and Recovery in Emerging Markets", 27–30 June 2011, Izmir, Turkey.

tem. Therefore, in endogenous growth theories, knowledge accumulation, human capital and knowledge spillovers have vital importance for economic growth.

According to Romer (1986), knowledge is seen as the basic form of capital and "the creation of new knowledge by one firm is assumed to have a positive external effect on the production possibilities of' other firms because knowledge cannot be perfectly patented or kept secret. Most important, production of consumption goods as a function of the stock of knowledge and other inputs exhibits increasing returns: more precisely, knowledge may have an increasing marginal product" (Romer 1986: 1003). The use of knowledge emerging as a result of innovations in economy cannot be prevented, knowledge cannot be hidden and weak patent protection system lead to knowledge spillovers. According to endogenous growth theories, knowledge spillover is very important for long run economic growth especially in high income countries.

In the literature, the role of knowledge spillovers has been discussed in micro and macro levels. On micro level, effects of emerging knowledge on firms are analyzed. On macro level, knowledge spillovers among countries and its effects on the country's productivity level are analyzed. In this regard, the channels of international knowledge spillovers have been an important controversy. In the studies conducted it is stated that knowledge spreads internationally and has effects on countries' economic growth following the intermediate goods imports, high technology product imports, capital movements, skilled labor movements, scientists movements, foreign direct investment (FDI), foreign technology payments and international R&D collaboration channels. Recently, the effects of especially R&D, international trade, and FDI channels on knowledge spillovers have been analyzed. Controversies on which channel is more effective and whether knowledge really spillovers or not are still continuing.

Coe and Helpman (1995, henceforth CH) used panel data of 21 OECD countries plus Israel to test international R&D spillovers through trade flows. They found that R&D spillovers work via intermediate goods trade. Coe et al. (2009) reanalyzed the study of CH by using new econometric techniques and including new countries. The results obtained support the study of CH. In addition, it has been found out that strong patent protection causes international R&D spillovers. Lee (2005) who is following CH used non-stationary panel data of 17 countries from 1970–2000 and showed that the effect of international R&D spillovers via intermediate goods import is significantly positive. Xu and Wang (1999) investigated the significance of capital goods trade as a conduit for R&D spillovers for OECD countries and they found that capital goods trade is a significant channel of R&D spillovers.

Eaton and Kortum (2001) developed a model of trade in capital goods to assess its role in spreading the benefits of technological advances. They found that about 25% of cross-country productivity differences are due to variation in the relative price of capital equipment. Jacob and Szirmai (2006) examined the importance of international knowledge spillovers from imports and exports for productivity performance in the Indonesian manufacturing industries. They found that imports are important for learning and the contribution of spillovers from exports is less important than imports.

Borensztein et al. (1998) analyzed FDI flows from industrial countries to 69 developing countries and argue that FDI is an important vehicle in technology transfer. Branstetter (2000) analyzed Japan's FDI in the United States and found evidence that FDI increases the flow of knowledge spillovers. Nonetheless, Lichtenberg and van Pottelsberghe de la Potterie (1996) found that inward FDI flows are not a significant channel of technology transfer in OECD countries. Lee and Tan (2006) analyzed the role of technology transfer in selected ASEAN countries coming through import of machinery and FDI and reached mixed results. Bitzer and Geishecker (2006) found that trade generates positive knowledge spillovers.

Coe and Helpman (1995), Keller (1998), Xu and Wang (1999), Kao et al., (1999), Eaton and Kortum (2001), Lee (2005), Xu and Wang (1999), Lumenga-Neso et al., (2005), Lee and Tan (2006), Bitzer and Geishecker (2006), and Jacob and Szirmai (2006) used different estimation techniques, data and models, but almost all of them state that trade is important for knowledge spillovers.

The aim of this study is to investigate the long-run and causal relationship between the capital goods imports, economic activities, foreign direct investments, domestic investments, exports and imports for Turkish economy over the 1992:Q1–2007:Q3 period. This relationship will be analyzed in two steps: First, we will define the order of integration in series by using weighted symmetric ADF (ADF-WS) unit root test and then explore the long run relationships between the variables by using autoregressive distributed lag (hereafter ARDL) bounds testing approach of cointegration test. Second, we will test causal relationship between variables by error-correction based causality procedures. The rest of the paper is organized as follows. The next section presents the methodology and data. The third section reports the empirical results. The last section concludes the paper.

1. Methodology and Data

Following the empirical literature, the standard log-linear functional specification of long-run relationship between capital goods imports, economic activities, foreign direct investments, domestic investments, exports and imports may be expressed as:

$$cim_t = \theta_1 + \theta_2 y_t + \theta_3 fdi_t + \theta_4 di_t + \theta_5 ex_t + \theta_6 im_t + \varepsilon_t, \qquad (1)$$

where *cim* is the real capital goods imports, *y* is the real gross domestic product as a proxy of real economic activity, *fdi* is the inflows of foreign direct investments, *di* is the real domestic investments, *ex* is the real exports and *im* is the real imports.

Turkish quarterly time series data (fixed at 1987 prices) are avaiable for 1989:1–2007:3 period at the Central Bank of the Turkish Republic electronic data delivery system (http://evds.tcmb.gov.tr). When the effects of the First Gulf War are taken into consideration, 1992:1–2007:3 period is preferred for econometric analysis. Foreign Trade Broad Economic Categorization (BEC) (TURKSTAT) classifies the real imports into four parts: intermediate goods, capital goods, consumption goods and other. Because only such aggregate data is avaiable, the analyisis is not carried out at lower level aggregation or micro level.

All series are seasonally adjusted to remove the seasonal effects by using Census X-12 seasonal adjustment method. Then, they are transformed with their natural logarithms to reduce heteroscedasticity and to obtain the growth rate of the relevant variables by their differenced logarithms. Descriptive statistics of variables used are presented in Table 1.

Table 1

Descriptive statistics of variables

	Log levels					Growth rates (%)				
	Mean	Median	Max	Min	S.D.	Mean	Median	Max	Min	S.D.
cim	7.47	7.46	8.15	6.61	0.40	2.18	2.62	43.10	–26.64	11.81
y	10.27	10.26	10.61	9.98	0.17	0.95	1.82	4.93	–11.63	2.81
fdi	5.47	5.12	8.72	3.36	1.09	3.72	9.32	366.10	–286.87	91.37
di	8.93	8.91	9.43	8.51	0.24	1.23	2.48	17.22	–21.29	7.66
ex	9.11	9.11	9.89	8.27	0.49	2.60	2.11	16.43	–7.03	4.53
im	9.21	9.20	10.02	8.38	0.45	2.59	3.51	19.16	–29.66	8.13

1.1. Integration Analysis

In order to overcome the low power problems associated with conventional unit root tests, especially in small samples, we prefer the weighted symmetric ADF test (ADF-WS) of Park and Fuller (1995). Park and Fuller assert that the weighted symmetric least squares estimator of the autoregressive parameters generally have smaller mean square error than that of the ordinary least squares estimator, particularly when one root is close to unity in absolute values. For the model with an estimated intercept, the one-sided weighted symmetric least squares test is the most powerful test. Leybourne et al. (2005) have recently noted that ADF-WS has good size and power properties when it is compared with the other tests. Therefore, it requires much shorter sample sizes than conventional unit root tests to attain the same statistical power.

1.2. Autoregressive Distributed Lag (ARDL) Cointegration Analysis

This study also employed recently developed ARDL bounds testing approach of cointegration developed by Pesaran (1997), Pesaran and Shin (1999) and Pesaran et al. (2001). Due to the low power and other problems associated with other test methods, the ARDL approach to cointegration has become popular in recent years. The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods such as Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) procedures: (i) there is no need for all the variables in the system to be of equal order of integration, (ii) it is efficent estimator even if samples are small and some of the regressors are endogenous, (iii) it allows that the variables may have different optimal lags, and (iv) it employs a single reduced form equation (see Pesaran and Shin 1999; Pesaran et al. 2001).

The ARDL model for the standard log-linear functional specification of long-run relationship between variables may be as follows:

$$\Delta cim_t = \beta_1 + \sum_{a=1}^{f} \beta_{2a} \Delta y_{t-a} + \sum_{b=0}^{g} \beta_{3b} \Delta fdi_{t-b} + \sum_{c=0}^{h} \beta_{4c} \Delta di_{t-c} + + \sum_{d=0}^{i} \beta_{5d} ex_{t-d} + \sum_{e=0}^{j} \beta_{6e} ex_{t-e} + \delta_1 cim_{t-1} + \delta_2 y_{t-1} + \delta_3 fdi_{t-1} + + \delta_4 di_{t-1} + \delta_5 ex_{t-1} + \delta_6 im_{t-1} + \varepsilon_{1t}, \quad (2)$$

where ε_{1t} and Δ are the white noise term and the first difference operator, respectively.

The bounds testing procedure is based on the joint F-statistic or Wald statistic that is testing the null hypothesis of no cointegration, $H_0 : \delta_n = 0$, against the alternative of $H_1 : \delta_n \neq 0, n = 1, 2, 3, 4, 5, 6$. Two sets of critical values that are reported in Pesaran et al. (2001) provide critical value bounds for all classifications of the regressors into purely $I(1)$, purely $I(0)$ or mutually cointegrated. If the calculated F-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated F-statistics is below the lower critical value, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. Recently, Narayan (2005) argues that Pesaran's et al. (2001) critical values based on large sample sizes cannot be used for small sample sizes. Narayan regenerated the set of critical values for the limited data ranging from 30–80 observations by using the Pesaran's et al. GAUSS code. With the limited quarterly time series data this study employs the critical values of Narayan (2005) for the bounds F-test rather than those of Pesaran et al. (2001).

However, if the order of integration of any of the variables is greater than one, for example an $I(2)$ variable, then the critical bounds provided by Pesaran et al. (2001) and Narayan (2005) are not valid. Therefore, it is necessary to test for unit roots to ensure that all the variables satisfy the underlying assumption of the ARDL bounds testing approach of cointegration methodology before proceeding to the estimation stage.

1.3. The Vector Error Correction Causality Approach

Although cointegration relationship implies the existence of Granger causality, it does not point out the direction of the causality relationship. Granger (1988) emphasizes that a vector error correction (hereafter VEC) modeling should be estimated rather than a VAR as in a standard Granger causality test, if variables in model are cointegrated. Following Granger (1988), to test for Granger causality in the long-run relationship, we employed a two step process: The first step is the estimation of the long-run model for equation (1) in order to obtain the long-run relationship as error-correction term (ECT) in the system. The next step is to estimate the Granger causality model with the variables in first differences and including the ECT in the systems. In our case, the VEC multivariate systems take the following forms:

$$\begin{bmatrix}\Delta cim_t\\ \Delta y_t\\ \Delta fdi_t\\ \Delta di_t\\ \Delta ex_t\\ \Delta im_t\end{bmatrix}=\begin{bmatrix}\mu_1\\ \mu_2\\ \mu_3\\ \mu_4\\ \mu_5\\ \mu_6\end{bmatrix}+\begin{bmatrix}\pi_{11,1} & \pi_{12,1} & \pi_{13,1} & \pi_{14,1} & \pi_{15,1} & \pi_{16,1}\\ \pi_{21,1} & \pi_{22,1} & \pi_{23,1} & \pi_{24,1} & \pi_{25,1} & \pi_{26,1}\\ \pi_{31,1} & \pi_{32,1} & \pi_{33,1} & \pi_{34,1} & \pi_{35,1} & \pi_{36,1}\\ \pi_{41,1} & \pi_{42,1} & \pi_{43,1} & \pi_{44,1} & \pi_{45,1} & \pi_{46,1}\\ \pi_{51,1} & \pi_{52,1} & \pi_{53,1} & \pi_{54,1} & \pi_{55,1} & \pi_{56,1}\\ \pi_{61,1} & \pi_{62,1} & \pi_{63,1} & \pi_{64,1} & \pi_{65,1} & \pi_{66,1}\end{bmatrix}\begin{bmatrix}\Delta cim_{t-1}\\ \Delta y_{t-1}\\ \Delta fdi_{t-1}\\ \Delta di_{t-1}\\ \Delta ex_{t-1}\\ \Delta im_{t-1}\end{bmatrix}+\ldots \tag{3}$$

$$+\begin{bmatrix}\pi_{11,k} & \pi_{12,k} & \pi_{13,k} & \pi_{14,k} & \pi_{15,k} & \pi_{16,k}\\ \pi_{21,k} & \pi_{22,k} & \pi_{23,k} & \pi_{24,k} & \pi_{25,k} & \pi_{26,k}\\ \pi_{31,k} & \pi_{32,k} & \pi_{33,k} & \pi_{34,k} & \pi_{35,k} & \pi_{36,k}\\ \pi_{41,k} & \pi_{42,k} & \pi_{43,k} & \pi_{44,k} & \pi_{45,k} & \pi_{46,k}\\ \pi_{51,k} & \pi_{52,k} & \pi_{53,k} & \pi_{54,k} & \pi_{55,k} & \pi_{56,k}\\ \pi_{61,k} & \pi_{62,k} & \pi_{63,k} & \pi_{64,k} & \pi_{65,k} & \pi_{66,k}\end{bmatrix}\begin{bmatrix}\Delta cim_{t-k}\\ \Delta y_{t-k}\\ \Delta fdi_{t-k}\\ \Delta di_{t-k}\\ \Delta ex_{t-k}\\ \Delta im_{t-k}\end{bmatrix}+\begin{bmatrix}\psi_1\\ \psi_2\\ \psi_3\\ \psi_4\\ \psi_5\\ \psi_6\end{bmatrix}ECT_{t-1}+\begin{bmatrix}e_{2t}\\ e_{3t}\\ e_{4t}\\ e_{5t}\\ e_{6t}\\ e_{7t}\end{bmatrix}$$

Residual terms, ε_{2t}, ε_{3t}, ε_{4t}, ε_{5t}, ε_{6t} and ε_{7t}, are independently and normally distributed with zero mean and constant variance.

The VEC modeling approach allows us to distinguish between "short-run" and "long-run" Granger causality. The Wald-tests of the "differenced" explanatory variables give us an indication of the "short-term" causal effects, whereas the "long-run" causal relationship is implied through the significance or other wise of the t test(s) of the lagged error-correction term that contains the long-term information since it is derived from the long-run cointegrating relationship. Non-significance or elimination of any of the "lagged error-correction terms" affects the implied long-run relationship and may be a violation of theory. The nonsignificance of any of the "differenced" variables that reflects only short-run relationship, however, does not involve such violations because theory typically has little to say about short-term relationships (see Masih and Masih 1996).

Using equation (3), causal relationships can be examined in two ways: i) Short-run or weak Granger causalities are detected through the *F*-statistics or Wald test for the significance of the relavant π coefficients on the first differenced series. Masih and Masih (1996) and Asafu-Adjaye (2000) interpreted the weak Granger causality as ‘short run’ causality in the sense that the dependent variable responds only to short-term shocks to the stochastic environment. ii) Masih and Masih (1996) point out that another possible source of causation is the ECT in equations. The coefficients of the ECT’s represent how fast deviations from the long run equilibrium are eliminated following changes in each variable. The long-run causalities are examined through the *t*-test or Wald test for the significance of the relavant ψ coefficients on the lagged error–correction term. For example, if ψ_1 is zero, *cim* does not respond to the deviations from the long-run equilibrium in the previous period. $\psi_i = 0, i = 1, 2, 3, 4, 5, 6$ for all i is equivalent to both Granger non-causality in the long-run and the weak exogeneity (Hatanaka 1996).

2. Empirical Results

Results of the weighted symmetric ADF test (ADF-WS) are presented in Table 2. The null hypothesis is unit root and the alternative hypothesis is level stationary. The Dickey-Fuller regressions include an intercept and a linear trend in the levels, and include an intercept in the first differences. The numbers of optimal lags are based on Schwarz Bayesian Criterion (SBC). 95% critical values for several observations computed by stochastic simulations. Findings indicate that capital goods imports, economic activities, foreign direct investments, and domestic investments variables have unit root or are non-stationary in levels but they are stationary in first differences. On the other hand, exports and imports variables are stationary in levels on around a linear trend.

Table 2

Weighted symmetric ADF (ADF-WS) unit root test results

	Levels	1st differences
cim	–2.1732 (4) [–3.3937]	–6.7067 (3) [–2.6069]
y	–2.3119 (0) [–3.1878]	–7.3380 (0) [–2.6560]
fdi	–1.5584 (4) [–3.3937]	–4.3559 (4) [–2.6371]
di	–2.3190 (1) [–3.2715]	–5.3635 (0) [–2.6069]
ex	–3.2724 (0) [–3.1878]	
im	–3.4384 (1) [–3.2715]	

Notes: The Dickey-Fuller regressions include an intercept and a linear trend in the levels, and include only an intercept in the first differences. The numbers of optimal lags are based on Schwarz Bayesian Criterion (SBC). Numbers of lags are in ( ). The 95% simulated critical value are in [ ]. They are computed by stochastic simulations for relevant numbers of lags using 58 observations and 1000 replications.

The ADF-WS unit root test results allow that we confidently apply the ARDL methodology to determine the long run relationships between the variables and then derive the error correction terms if variables are cointegrated. According to Pesaran and Shin (1999), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. With the limited observations, this study used the SBC to select an appropriate lag for both unrestricted VAR model and ARDL model. Results from ARDL bounds testing approach of cointegration indicate that there is an evidence of a long-run relation between the variables at 1% significance level (see Table 3). For the bounds *F*-test for cointegration test, critical values used are taken from and Narayan (2005).

Table 3

Estimated coefficients from ARDL model (1,0,0,1,0,1)

Variables		Short-Run		Long-Run	
Constant		5.6497 [0.053]		9.1621 [0.052]	
cim(–1)		0.3834 [0.000]			
y		–1.1288 [0.019]		–1.8306 [0.014]	
fdi		–0.0207 [0.066]		–0.0335 [0.054]	
di		1.0105 [0.000]		0.6384 [0.000]	
di(–1)		–0.6168 [0.000]			
ex		–0.1034 [0.354]		–0.1676 [0.370]	
im		0.4830 [0.003]		1.4582 [0.000]	
im(-1)		0.4162 [0.004]			
R^2	0.9803	LM	6.7130 [0.152]	*ECM*	–0.6166 [0.000]
SEE	0.1874	HET	4.2860 [0.369]	*F*	7.9326

Notes: RSS is the residual sum of squares; LM is the Lagrange multiplier test for serial correlation with a χ^2 distribution with four degrees of freedom; HET is test for heteroskedasticity with a χ^2 distribution with only one degree of freedom; ECM is the estimated coefficient of error correction term. *p*-values for the estimated coefficients and statistics are in [ ].

F is the ARDL cointegration test. The critical values for the lower *I*(0) and upper *I*(1) bounds are 3.451 and 4.764 for 1% significance levels, respectively (Narayan 2005, Appendix: Case II).

This study also explores causal relationship between variables within a VEC modelling approach (see Table 4 and Figure 1). The results can be summarized as follows: i) There is a long-run Granger causality running from the independent variables to capital goods imports variable, ii) there is an unidirectional short-run causal relationship from capital goods imports to domestic investments, iii) there is an unidirectional short-run causal relationship from exports to GDP.

Table 4

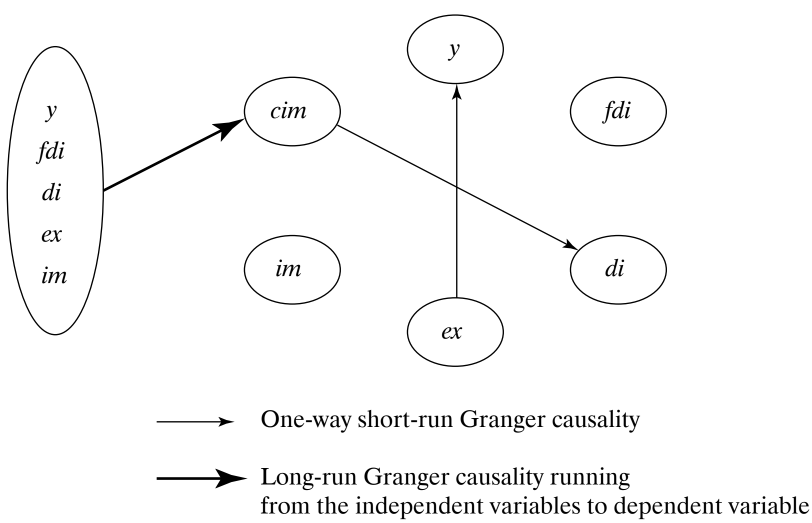
Granger causality test results

Variables	Short-run						Long-run
	Δcim	Δy	Δfdi	Δdi	Δex	Δim	ψ_i
Δcim	---	0.0011 (0.9730)	0.0479 (0.8268)	1.0991 (0.2945)	0.6127 (0.4338)	0.0074 (0.9312)	13.9067 (0.0002)*
Δy	1.3292 (0.2490)	---	0.1117 (0.7382)	2.2356 (0.1349)	4.5210 (0.0335)**	0.5238 (0.4692)	0.6913 (0.4057)
Δfdi	0.0095 (0.9222)	0.3704 (0.5428)	---	1.0107 (0.3147)	0.7224 (0.3953)	0.5658 (0.4519)	0.011 (0.9732)
Δdi	3.0277 (0.0819)***	0.0940 (0.7591)	0.0005 (0.9817)	---	2.6173 (0.1057)	0.0036 (0.9519)	2.1692 (0.1408)
Δex	1.2363 (0.2662)	0.5055 (0.4771)	0.6187 (0.4315)	0.0310 (0.8603)	---	0.0062 (0.9377)	0.3594 (0.5488)
Δim	1.2646 (0.2608)	0.1391 (0.7092)	0.9266 (0.3358)	0.0761 (0.7827)	1.3907 (0.2383)	---	0.0021 (0.9633)

Notes: The null hypothesis is that there is no causal relationship between variables. Values in parentheses are p-values for Wald tests with a χ^2 distribution. Δ is the first difference operator. *, ** and *** are 1%, 5% and 10% significance levels, respectively.

Figure 1

Granger causality relationship flows



Conclusion

The literature on knowledge spillovers-growth nexus has emphasized the links between productivity or output growth and foreign knowledge. This study has pointed out the long run determinants of the foreign knowledge and it spillovers effects, which come from capital goods imports. For this purpose, we explored both short-run and long-run causal relationships between foreign knowledge spillovers and their main determinants for Turkish economy over 1992:Q1–2007:Q3 period.

Results from ARDL bounds testing approach of cointegration indicate that there is an evidence of a long-run relation between the variables in model at 1% significance level. In addition, we also investigated the causality relationship between economic growth and foreign knowledge spillovers by using Granger causality models augmented with a lagged error-correction term. According to results from causality models, there is a long-run Granger causality running from the independent variables to capital goods imports. According to these results, Turkish economic activities about foreign direct investment inflows, GDP, domestic investments, exports and imports have long run effects on the foreign knowledge spillover, which come from capital goods imports.

In addition, there is an evidence of unidirectional short-run causal relationship from capital goods imports to domestic investments, and a unidirectional short-run causal relationship from exports to GDP. This result shows that foreign knowledge has spillover effect on Turkish domestic investments level and it means that national investors have been affected positively from foreign knowledge which comes from capital goods imports.

Received: 29 June, 2013.

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ZALEŻNOŚĆ PRZYCZYNOWO-SKUTKOWA POMIĘDZY PRZEPŁYWEM WIEDZY A WZROSTEM GOSPODARCZYM: PRZYPADEK TURCJI

Streszczenie

Artykuł analizuje determinanty międzynarodowych przepływów wiedzy za pośrednictwem importu dóbr inwestycyjnych i bezpośrednich inwestycji zagranicznych oraz ich wpływ na wzrost gospodarczy na przykładzie Turcji. W tym celu zbadane zostały krótko- i długookresowe zależności przyczynowo-skutkowe pomiędzy transferami wiedzy i głównymi wskaźnikami makroekonomicznymi opisującymi rozwój gospodarki Turcji w okresie od 1 kw. 1992 r. do 3 kw. 2007 r. (tzn. w okresie 15 lat poprzedzających wybuch globalnego kryzysu finansowo-ekonomicznego). Wyniki testu kointegracji ARDL wskazują na istnienie długookresowej zależności pomiędzy zmiennymi modelu (import dóbr inwestycyjnych, zagraniczne inwestycje bezpośrednie, PKB, akumulacja kapitału trwałego, eksport i import) na poziomie istotności 1%. Artykuł bada także zależność między transferem wiedzy a wzrostem gospodarczym, wykorzystując do tego celu testy przyczynowości. Grangera z opóźnioną korektą błędu. Wyniki wskazują, że występouje tu długookresowa zależność przyczynowo-skutkowa w sensie Grangera pomiędzy zmiennymi niezależnymi modelu a importem dóbr inwestycyjnych, jednokierunkowa zależność krótkookresowa między importem dóbr inwestycyjnych i wielkością krajowych inwestycji oraz jednokierunkowa krótkookresowa zależność między eksportem i PKB.

Słowa kluczowe: efekty wiedzy, przepływ technologii, przyczynowość, test ARDL, Turcja

Kody JEL: C30, F30, O30

THE CAUSAL RELATIONSHIP BETWEEN KNOWLEDGE SPILLOVERS AND ECONOMIC GROWTH: THE TURKISH CASE

Abstract

This study has pointed out the long run determinants of the foreign knowledge and it spillovers effects, which come from capital goods imports. For this purpose, we explored both short-run and long-run causal relationships between foreign knowledge spillovers and its main determinants for Turkish economy over the 1992:Q1–2007:Q3 period. Results from ARDL bounds testing approach of cointegration indicate that there is an evidence of a long-run relation between the variables (capital goods imports, foreign direct investment, GDP, fixed capital formation, exports and imports) in the model at 1% significance level. This study also investigates the causality relationship between knowledge spillovers and economic growth by using Granger causality models augmented with a lagged error-correction term. According to the results from causality models, there are a long-run Granger causality running from the independent variables to capital goods imports variable, and an unidirectional short-run causal relationship from capital goods imports to domestic investments, and an unidirectional short-run causal relationship from exports to GDP.

Key words: knowledge spillovers, technology transfer, causality, ARDL bounds testing approach, Turkey

JEL Code: C30, F30, O30

ПРИЧИННО-СЛЕДСТВЕННАЯ СВЯЗЬ МЕЖДУ ТРАНСФЕРТОМ ЗНАНИЙ И ЭКОНОМИЧЕСКИМ РОСТОМ НА ПРИМЕРЕ ТУРЦИИ

Резюме

В статье анализируются детерминанты международных трансфертов знаний, осуществляемых посредством импорта инвестиционных благ и прямых иностранных инвестиций, а также их влияние на экономический рост на примере Турции. С этой целью были исследованы кратко- и долгосрочные причинно-следственные зависимости между трансфертами знаний и главными макроэкономическими показателями, описывающими развитие экономики Турции в период с первого квартала 1992 г. до третьего квартала 2007 г. (т.е. в период 15 лет, предшествующих всплеску глобального финансово-экономического кризиса). Результаты теста коинтеграции ARDL указывают на существование долгосрочной зависимости между переменными модели (импорт инвестиционных благ, прямые иностранные инвестиции, ВВП, накопление постоянного капитала, экспорт и импорт) на уровне существенности в 1%. В статье исследуется зависимость между трансфертом знаний и экономическим ростом, с использованием для этой цели теста Гренджера на причинность с лагами корректировки ошибок. Результаты указывают на наличие долгосрочной причинно-следственной зависимости по Гренджеру между независимыми переменными модели и импортом инвестиционных благ, односторонней краткосрочной зависимости между импортом инвестиционных благ и величиной отечественных инвестиций, а также односторонней краткосрочной зависимости между экспортом и ВВП.

Ключевые слова: эффекты знаний, трансферт технологии, причинность, тест ARDL, Турция