Sectoral Linkages and Labor Productivity: Panel Data Analysis for Turkey

Aykut ŞARKGÜNEŞİ[1] and Necla AYAŞ[2]

Abstract

Aim of the study is to investigate the relation between sectoral linkages and labor productivity. To achieve this aim; values of the both dependent and independent variables were calculated from Turkey National Input Output Tables (from 1995 to 2009 years) which have been published by World Input Output Database (WIOD). 35 sectors in the National Input Output Tables aggregated to 20 sector groups with regard to input output methodology and coefficients calculated on this aggregation. Panel data analysis has been used to detect relations between industrial/inter industrial linkages and productivity. If sectoral linkage have significant impacts on labor productivity tested in the study. While labor productivity has been chosen as dependent variable in the study, backward and forward linkage coefficients were added to model as independent variable.

We have used balanced panel data model to detect relations between industrial/inter industrial linkages and productivity. Possible cross-section dependency and heterogeneity problems are taken into account in the model and the best estimation methods were preferred in the study. As we researched it is not found any study in this field using these methods and findings of our study are expected to understand determinants of labor productivity that is one of the major source of economic growth. With respect to empirical finding; results are changing cross the sector groups. Relation between all sectoral linkages (forward, backward and intra) and labor productivity have been found statistically significant for textile and communication sectors. If the model evaluated for throughout the economy, statistically significant relations with productivity have been found for backward linkages and intra industry linkages in this period. For forward linkages, statistically significant relation with productivity could not be found.

Key Words: Heterogeneous Panel Data, Sectoral Linkages, Labor Productivity

[1]Asist. Prof., Bulent Ecevit University, Faculty of Economic and Administrative Sciences, Department of International Trade and Business , 67100 Zonguldak, TURKEY. [aykutsarkgunesi@beun.edu.tr]
[2] Assoc. Prof., Bulent Ecevit University, Faculty of Economic and Administrative Sciences, Department of Economics , 67100 Zonguldak, TURKEY. [necla.ayas@beun.edu.tr]

1. Introduction

Since intermediate goods used in one sector are produced in other sectors, there are complex connectivity between sectors. Sectoral linkages consists of inter and intra sectoral relations and inter sectoral linkages are dived into forward and backward linkages. If features of competitive economies are evaluated, it is observed that strong input output linkages and high productivity are important in these economies. Therefore some approaches has been introduced to analyze input output linkages and labor productivity.

The approaches related to both sectoral linkages and productivity can be ordered as; the Economic Distance, Geographic Distance and Infrastructure-driven Approaches. Economic Distance Approach which focused on relation between sectoral linkages and productivity directly has been tested in the study. The Economic Distance Approach assumes that sectoral linkages are the main determinant of productivity. With regard to this approach; sectoral linkages are main source of productivity and they accelerate agglomeration which having positive influence on productivity both in firm and sectoral level (Tirole, 1988).

The Geographic Distance Approach attributes labor productivity to geographic agglomeration (Peng and Hong 2012; Martinez, Paluzie, and Pons, 2007). Impacts of agglomeration on productivity is explained by the effects of both labor and intermediate input market arising from specialization (Krugman, 1991, Fujita and Thisse, 2003). According to Infrastructure-driven Approaches; more importance attached to the sectoral allocation of public investment as a major factor in the growth of labor productivity (Baffes and Shah, 1993).

Because of great importance of social relations between economic agents in modern economies, the aim of this paper is to analyze the relation between inter/intra-sectoral linkages and productivity with a panel dataset of 20 sectors from in Turkey during the period 1995–2009.

The productivity accepted indicator of performance is measured as both partial productivity of each inputs and total factor productivity exhibiting ratio of outputs to inputs (Andersson and Lööf, 2009). While labor productivity has been chosen as dependent variable in the study, intra sectoral linkage coefficients and inter sectoral linkage coefficients (backward and forward) were added to model as independent variable. Values of the both dependent and independent variables calculated from Turkey National Input Output Tables from 1995 to 2009 years which have been published by World Input Output Database (WIOD). 35 sectors in the National Input Output Tables aggregated to 20 sector groups with regard to input output methodology and coefficients calculated on this aggregation. Panel data analysis has been used to detect relations between industrial/inter industrial linkages and productivity. Possible cross-section dependency and heterogeneity problems are taken into account in the model and the best estimation methods were preferred in the study. As we researched it is not found any study in this field using these methods and findings of our study are expected to understand determinants of labor productivity that is one of the major source of economic growth. This paper continues with literature summary in section two, section three present data and variables, there are primarily analysis and model specification in section four, section five introduces the empirical model and results section 6 provides conclusion for the research.

2. Literature Summary

There are a little literature on relation between sectoral input output linkages and productivity. Rigby and Essletzbichler (2002) noted that metropolitan areas where have strong input output linkages also have high average labor productivity. Bartelsman, Caballero and Lyons (1994), emphasizes the importance of the forward linkages of the sector for productivity. Moretti (2004) emphasizes the importance of input output linkages and geographical distance for productivity. Hayami (1991) examined impact of inter-sectoral information sharing on productivity. Holly and Petrella (2012) emphasized the importance of the backward linkages of the sector for productivity. With regard to Holly and Petrella (2012); forward linkages of the sectors increased productivity by reducing product price while backward linkages of the sectors increased productivity by reducing marginal cost of products. Peng and Hong (2013) examined relation between inter sectoral linkages and productivity.

3. Data and Variables

With regard to Industrial Organization Approach; sectoral and inter sectoral linkages have been taken into account as a main source of productivity and it asserts that agglomeration influences productivity positively both in firm and sectoral level (Tirole, 1988). Thus we chose labor productivity (LnPoL) as dependent variable in the study, intra sector linkages (LnISL), sectoral backward linkages (LnSBL) and sectoral forward linkages (LnSFL) were added to model as independent variables. All variables were transformed into logarithm for analysis. In this study we used annual data from 1995 to 2009 for Turkish Economy on the basis of 20 sectors. Whole data set is compiled from World Input-Output Database (WIOD).

Table 1: Summary Statistics of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
LnPoL	300	3.878606	0.945746	1.166139	7.342926
LnISL	300	4.699928	0.145597	4.605252	5.419696
LnSFL	300	4.933491	0.308134	4.637437	6.301238
LnSBL	300	4.947739	0.284504	4.617747	6.056080

4. Preliminary Analysis

We try to determine the most suitable estimation method by a model selection procedure based on the panel data. Firstly, possible cross-section dependency and heterogeneity problems were investigated. Then, in order to avoid spurious regression, the unit roots of the relevant variables were investigated by the methods that congruous with first step's results. After detecting that our model is not stationary, we try to find a co-integration relationship between depended an independent variables. After this procedure, we pick a suitable estimation method.

4.1 Cross-sectional Dependence and Homogeneity

It is typically assumed that disturbances in panel data models are cross sectional independent. However in panel data models cross section dependence can arise due to spatial or spillover effects, or could be due to unobserved common factors. Cross sectional dependence is important in fitting panel-data models. Otherwise the estimation results might be inconsistent, inefficient and estimated standard errors might be biased.

To test for cross-sectional dependence, Breusch and Pagan (1980) propose the Lagrange multiplier (LM) test statistic. Pesaran (2004) states that this test is not applicable when N is large. For large panels where $T \rightarrow \infty$ first and then $N \rightarrow \infty$, Pesaran (2004) proposes the scaled version of the LM test. CD test may present substantial size distortions when N is large and T is small. Pesaran (2004) develops a test for panels where $T \rightarrow \infty$ and $N \rightarrow \infty$ in any order. Pesaran et al. (2008) denote that the CD test will lack power in certain situations where the population average pair wise correlations are non-zero. Therefore, for large panels where $T \rightarrow \infty$ first and then $N \rightarrow \infty$, Pesaran et al. (2008) suggest a bias adjusted version of the LM test that uses the exact mean and variance of the LM statistic (the bias-adjusted LM test). The null hypothesis of cross-section independence is tested against the alternative hypothesis of cross-section dependence for all statistics.

Table 3: Cross-section Dependence and Homogeneity Tests Results

Test	Statistic	p-value
Cross-sectional dependence tests		
LM	1124.222	0.00*
CD_{LM}	47.925	0.00*
CD	32.166	0.00*
LM_{adj}	54.321	0.00*
Homogeneity tests		
$\tilde{\Delta}$	18.6188	0.00*
$\tilde{\Delta}_{adj}$	23.5511	0.00*

Note: * denotes 1% statistical significance.

In panel-data models, homogeneity is assumed among the regression coefficients. Pooled methods can only applicable if homogeneity is valid. Otherwise serious deviations may be seen in the estimates. To test for slope homogeneity, Pesaran and Yamagata (2008) follow delta ($\tilde{\Delta}$) tests. The null hypothesis of slope homogeneity (H_0: $\beta_i=\beta$ for all i) is tested against the alternative hypothesis of slope heterogeneity (H_1: $\beta_i \neq \beta$ for a non-zero fraction of pair-wise slopes for $i \neq j$). When the error terms are normally distributed, the $\tilde{\Delta}$ tests are valid as (N,T) $\rightarrow \infty$ without any restrictions on the relative expansion rates of N and T.

Our model's cross-section dependence and homogeneity tests results are presented in Table 3. As seen there, both null hypothesis are rejected at %1 significance level. According to this sections are dependent and parameters slope are heterogeneous. These results are determining for the methods used for unit root testing, co-integration testing and model estimating.

4.2 Unit Root Test

Dependence in the cross-sections of data set is the main problem encountered in the panel unit root tests. At this point, panel unit root tests are divided into first and second generation test. First-generation tests are also divided into homogeneous and heterogeneous models. While Levin, Lin and Chu (2002), Breitung and Das (2005) and Hadri (2000) assumes homogeneity, Im, Pesaran and Shin (2003), Maddala and Wu (1999), Choi (2001) is applicable for heterogeneous models.

The first generation unit root tests are based on the assumption that all sections forming the panel are independent and all sections are affected at the same level from the shocks to one section. If the complexity of economic relations considered, it more is realistic to think the impact of the shocks has to be differ according to sections. To correct this deficiency, the second generation unit roots test, that taking into account the cross-section dependence, has been developed. Major second-generation unit root tests are MADF (Taylor and Sarno, 1998), SURADF (Breuer, Mcknown and Wallace, 2002), Bai and Ng (2004), CADF (Pesaran, 2007) and PANKPSS (Carrion-I Silvestre etal. 2005).

Table 4: Unit Root Test Results

Model		Level			1^{st} Diff.		
	Variables	**t-bar**	**ztbar**	**P Value**	**t-bar**	**ztbar**	**P Value**
Without Trend	LnPoL	-1.301	1.677	0.953	-3.188	-6.065	0.000*
	LnISL	-1.835	-0.511	0.305	-3.099	-5.699	0.000*
	LnSFL	-1.390	1.315	0.906	-2.653	-3.869	0.000*
	LnSBL	-1.031	2.784	0.997	-2.779	-4.386	0.000*
With Trend	LnPoL	-2.242	0.034	0.513	-3.132	-3.553	0.000*
	LnISL	-1.938	1.259	0.896	-3.436	-4.779	0.000*
	LnSFL	-1.465	3.163	0.999	-2.710	-1.853	0.032*
	LnSBL	-1.224	4.135	1.000	-2.950	-2.819	0.002*

Note: * denotes 1% statistical significance.

In this study, according to the results obtained in preliminary analysis, we used the panel unit root test (CADF), which takes into both heterogeneous slope parameters and cross-section dependence, developed by Pesaran (2007). Statistical values of this tests is compared with the Pesaran (2006) CADF critical table values. The null of unit root is rejected if CADF critical table values is higher than CADF statistical values. As all the variables of the model is stationary at the first level, the necessary assumption of co-integration test is provided.

4.3 Cointegration Analysis

Once variable have been classified as integrated of order I(0), I(1), I(2) etc. is possible to set up models that lead to stationary relations among the variables, and where standard inference is possible. The necessary criteria for stationarity among non-stationary variables is called cointegration. Testing for cointegration is necessary step to check if you're modelling empirically meaningful relationships. If variables have different trends processes, they cannot stay in fixed long-run relation to each other, implying that you cannot model the long-run, and there is usually no valid base for inference based on standard distributions (Sjö, 2008).

Table 5: Panel Co-integration Test Results for Dependent Variable

Statistics	Value	Z-Value	P-Value
LnISL			
G_t	-4.132	-9.889	0.000^{*}
G_a	-13.712	-1.220	0.111
P_t	-11.223	-2.067	0.019^{**}
P_a	-11.003	-1.534	0.063^{***}
LnSFL			
G_t	-5.431	-17.121	0.000^{*}
G_a	-5.383	4.380	1.000
P_t	-11.010	-1.819	0.035^{**}
P_a	-6.238	2.033	0.979
LnSBL			
G_t	-4.312	-10.890	0.000^{*}
G_a	-5.031	4.617	1.000
P_t	-11.316	-2.175	0.015^{**}
P_a	-4.914	3.024	0.999

Note: *, **, *** denotes respectively 1%, 5%, 10% statistical significance.

Westerlund (2007) developed four panel cointegration tests that are based on structural rather than residual dynamics and, therefore, do not impose any common-factor restriction. The idea is to test the null hypothesis of no cointegration by inferring whether the error-correction term in a conditional panel error-correction model is equal to zero. The new tests are all normally distributed and are able to accommodate to accommodate unit-specific short-run dynamics, unit-specific trend and slope parameters, and cross-sectional dependence. Two tests are designed to test the alternative hypothesis that the panel is co-integrated as a whole, while the other two test the alternative that at least one unit is co-integrated.

We have used Westerlund (2007) co-integration test as it is strong and applicable in the case of heterogeneous slope parameters and cross-sectional dependence. Results are presented in Table 5. G_t and P_t statistics are quite robust to the cross-sectional correlation (Westerlund, 2007). According to this statistics the null of no co-integration is rejected. Therefore our model is co-integrated as a whole so with appropriate estimator, our model could reach empirically meaningful relationships.

5. Empirical Model and Results

The estimator implemented in our study form part of the panel time-series (or nonstationary panel) literature, which emphasizes variable nonstationarity, cross-section dependence, and parameter heterogeneity (in the slope parameters, not just time-invariant effects). Our empirical model is;

(1) $y_{it} = \beta_i x_{it} + u_{it}$

(2) $u_{it} = a1_i + \Lambda_{ift} + E_{it}$

(3) $x_{it} = a2_i + \Lambda_{ift} + \Gamma_{igt} + e_{it}$

Where x_{it} and y_{it} are observables, β_i is the country-specific slope on the observable regressors, and u_{it} contains the unobservable and the error terms e_{it}. The unobservable in (2) are made up of standard group-specific fixed effects $a1_i$, which capture time-invariant heterogeneity across groups, as well as an unobserved common factor ft with heterogeneous factor loadings Λ_i, which can capture time-variant heterogeneity and cross-section dependence. The factors ft and gt are not limited to linear evolution over time; they can be nonlinear and nonstationary, with obvious implications for cointegration. Additional problems arise if the regressors are driven by some of the same common factors as the observables: the presence of ft in equations (2) and (3) induces endogeneity in the estimation equation (Eberhardt and Teal, 2011). E_{it} and e_{it} are assumed white noise. For simplicity, the model here includes only one covariate and one unobserved common factor in the estimation equation of interest. This model is developed by Eberhardt and Teal (2010) and it is based on Pesaran and Smith (1995) MG estimator and The Pesaran (2006) CCEMG estimator.

Table 6: Panel Model Estimation Results

Observations	300					
Groups	20					
Wald chi2 (3)	11.71					
Prob > chi2	0.0085					
Dependent Variable	LnPoL					
Independent Variables	**Coefficients**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
LnISL	20.22241	11.92941	1.70	0.090***	-3.158816	43.60363
LNSFL	-.2400521	.5273549	-0.46	0.649	-1.273649	.7935444
LNSBL	1.816255	.7167509	2.53	0.011**	.4114489	3.221061
CONS	-97.11291	54.22773	-1.79	0.073***	-203.3973	9.171479

Panel model result are presented in Table 6. As seen from the table, the model as a whole is statistically significant at %1 level. Also two of dependent variable are significant. But as we found pre-estimation test, these coefficient are not valid for all sector because of heterogeneity problem. Therefore we chose to interpret all sectors individually. Sectoral results are presented in appendix A.

Agriculture (Group 1): Only backward linkages are statistically significant with respect to relation between sectoral linkages and productivity. For forward and intra sectoral linkages, statistically significant relations could not be found. According to empirical finding, productivity impacted positively from backward linkages in agriculture in this period.

Mining (Group 2): For mining sector relations between intra sectoral linkages and productivity is statistically significant. Backward and forward linkages are not statistically significant for this sector. Statistical coefficients show that, intra sectoral linkages has positive impacts on productivity in mining industry.

Food (Group 3): Relations between productivity and both forward and intra sectoral linkages are statistically significant in food sector. While intra sectoral linkages have negative effect, forward linkages have positive impact on productivity. Relations between productivity and backward linkages are not statistically significant in this sector.

Textile (Group 4): All sectoral linkages (backward, forward and intra sectoral linkages) and productivity relations are statistically significant in textile sector. This result implies that productivity impacted from both inter and intra sectoral linkages in textile sector. While intra sectoral linkages has negative impacts on productivity, sectoral productivity has been impacted positively from both forward and backward linkages in the sector.

Petrol (Group7): Only backward linkages are statistically significant with respect to relation between sectoral linkages and productivity in petrol industry. According to backward linkage coefficient, productivity impacted positively from backward linkages in petrol in this period.

Other Minerals (Group 10): Relations between productivity and both forward and intra sectoral linkages are statistically significant in other minerals. While intra sectoral linkages have positive effects, forward linkages have negative impacts on productivity in the sector.

Metal (Group 11): Relations between productivity and forward linkages are statistically significant in metal sector. According to coefficient, productivity impacted positively from forward linkages in the sector.

Energy (**Group 13**): Both backward linkages and intra sectoral linkages are statistically significant with respect to relation between sectoral linkages and productivity in energy sector. While productivity impacted positively from intra sectoral linkages, backward linkages has negative impacts on productivity in energy in this period.

Transportation (Group 17): Relations between productivity and backward linkages are statistically significant in transportation sector. Productivity impacted positively from backward linkages in transportation.

Communication (Group 18): Relations between all kind of the sectoral linkages (backward, forward linkages and intra sectoral) and productivity are statistically significant in communication sector. This result shows, productivity in communication sector impacted from both inter and intra sectoral linkages like textile sector. Forward linkages has negative impacts on productivity while productivity has been impacted positively from both backward and intra sectoral linkages in the sector.

Finance and public services (Group 19-20): Only backward linkages are statistically significant with respect to relation between sectoral linkages and productivity in these sectors. According to calculated coefficients, productivity impacted positively from backward linkages in finance and public services in this period.

For some of the 20 sector, none of the linkages are statistically. These sectors are; wood (Group 5), press and publican (Group 6), chemical products (Group 8), plastic products (Group 9), machine(Group 12), construction(Group 14), trade (Group 15) hotel and restaurant (Group 16).

With another aspect, intra sectoral linkages are significant for 5 sectors, forward linkages are significant for 6 sectors and backward linkages are significant for 7 sectors and backward linkages have positive effect in 6 sector of 7. This may interpret as productivity improvements comes from backward linkages.

6. Conclusion

Productivity is one of the most important structural element in the economy. We investigated if the sectoral linkages effect this structural element. Because interactions between sectors can actuate technology transfers or provide some cost advantages to each other. Detecting these link can help to find key sectors that provide more advantages to other sectors and implicitly to whole economy. Further some policy implementation to strengthen these links can help to improve productivity of economy. According to our study, for Turkish Economy, the most effective linkages are backward linkages. In other word the productivity improvements in a sector comes from input provider sectors.

References

Andersson, M. and Lööf, H. (2009). "Agglomeration and Productivity-evidence from firm-level data", CESIS Electronic Working Paper Series, Paper No.170.

Baffes, J., Shah, A. and Mundial, B. (1993). "Productivity of public spending, sectoral allocation choices, and economic growth", Public Economic Division, Policy Research Department, World Bank, 1178.

Bartelsman, E. J., Caballero, R. J. and Lyons, R. K. (1994). "Customer-and supplier-driven externalities", The American Economic Review, *84*(4), pp: 1075-1084.

Bai, J. and Ng, S. (2004). "A panic attack on Unit Roots and Cointegration," Econometrica, Vol:72. No:4, pp:1127-1177.

Breitung, J. and Das, S. (2005). "Panel unit root tests under cross-sectional dependence", Statistica Neerlandica, 59 (4), pp:414-433.

Breuer, McNown R, and Wallace M (2002) "Series-specific Unit Root tests with Panel Data", Oxford Bullertin of Economics and Statistics, 64(5), pp:527-545.

Breusch, T.S. and Pagan, A.R. (1980). "The Lagrange multiplier test and its applications to model specification in econometrics", Review of Economic Studies, 47 pp:239-53.

Carrion-i-Silvestre, J. Ll., del Barrio, T. and López-Bazo, E. (2005). "Breaking the Panels: An Application to GDP per capita", Econometrics Journal, 8, pp:159-175.

Choi, I. (2001). “Unit root tests for panel data”, Journal of International Money and Finance, 20, pp:249-272.

Eberhardt, M. and Francis T. (2011). “Econometrics for Grumblers: A New Look at the Literature on Cross-Country Growth Empirics”, Journal of Economic Surveys, Vol: 25(1), pp: 109-155.

Eberhardt, M. and Francis T. (2010). “Mangos in the Tundra? Spatial Heterogeneity in Agricultural Productivity Analysis”, Centre for the Study of African Economies, University of Oxford, unpublished working paper.

Fujita M. and Thisse J. (2003). “Economics of Agglomeration: Cities, Industrial Location, and Regional Growth”, Annals of the Association of American Geographers, 93 (3), pp: 778-779.

Hadri, K. (2000). “Testing for Stationarity in Heterogeneous Panel Data”, The Econometrics Journal, 2(3), pp: 148-161.

Hayami, H. (1991). “Dynamic properties of inter-industry wages and productivity growth”, Working paper.

Holly, S. and Petrella, I. (2012). “Factor demand linkages, technology shocks and the business cycle”, The Review of Economics and Statistics, 94(4), pp: 948–963.

Im, K.S., Pesaran, M.H. and Shin, Y. (2003). “Testing for unit roots in heterogeneous panels. J. of Econometrics”, 115, pp: 53-74.

Krugman, P. (1991). Geography and Trade, Cambridge: MIT Press.

Levin, A., Lin, C.F. and Chu, C.S.J. (2002). “Unit root tests in panel data: asymptotic and finite sample properties”, Journal of Econometrics, 108, pp: 1-24.

Maddala G.S and Wu, S. (1999) “A comparative study of unit root tests with panel data and new simple test”, Oxford Bulletin of Economics and Statistics, Special issue, 631-652.

Martinez-Galarraga, J., Paluzie, E. and Pons, J. (2007). “Agglomeration and labour productivity in Spain over the long term”, Cliometrica, 2(3), pp:195–212.

Moretti, E. (2004). “Workers' education, spillovers, and productivity: Evidence from plant-level production functions”, American Economic Review, 94(3), pp:656–690.

Peng, L. and Yongmiao, H.(2013). "Productivity spillovers among linked sectors," China Economic Review, 25, pp:44-61.

Pesaran, M. H. (2004). “General diagnostic tests for cross section dependence in panels”, CESifo Working Paper Series No: 1229.

Pesaran, J. and Smith, R. (1995). “Estimating long-run relationships from dynamic heterogeneous panels”, Journal of Econometrics, 68(1), pp: 79-113.

Pesaran, M. H. (2006). “Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure”, CESifo Working Paper Series No: 1331.

Pesaran, M. H. (2007). “A Simple Panel Unit Root Test In The Presence of Cross-Section Dependence, Journal of Applied Econometrics”, 22, pp:265-312.

Pesaran, M.H., Ullah A. and Yamagata T. A. (2008). “Bias-adjusted LM Test Of Error Cross-Section Independence”, Economic Journal, 11, pp:105-27.

Pesaran, M.H. and Yamagata T. (2008). “Testing slope homogeneity in large panels”, Journal of Economics, 142, pp: 50-93.

Rigby, D. and Essletzbichler J. (2002). “Agglomeration Economies and Productivity Differences in US Cities”, Journal of Economic Geography, 2, pp: 407-432.

Sjö, B. (2008). “Testing for Unit Roots and Cointegration”, http://www.iei.liu.se/nek/ekonometrisk-teori-7-5- hp-730a07/labbar/1.233753/dfdistab7b.pdf.

Taylor, M. and Lucio, S. (1998). “The Behavior of Real Exchange Rates during the Post Bretton Woods period.” Journal of International Economics, 46, pp: 281-312.

Tirole, J. (1998). *The Theory of Industrial Organization*, The MIT Press, London England.

WIOD (World Input Output Database), Socio Economic Accounts 1995-2011. http://www.wiod.org/new_site/database/seas.htm.

WIOD (World Input Output Database), World Input Output Tables 1995-2011. Turkey National Input-Output table in current prices for 1995-2011, http://www.wiod.org/new_site/database/niots.htm.

Westerlund, J. (2007). “Testing for error correction in panel data”, Oxford Bulletin of Economics and Statistics, 69, pp: 709-748.

Appendix A: Model Estimation Results by Sectors

	COEF.	STD.ERR.	Z	P > |Z|	[95% CONF. INTERVAL]	
GROUP 1						
LNISL	1.578848	3.50609	0.45	0.652	-5.292962	8.450658
LNSFL	.7109285	.8875911	0.80	0.423	-1.028718	2.450575
LNSBL	3.2965	1.48745	2.22	0.027	.381152	6.211847
CONS	-25.87358	16.98683	-1.52	0.128	-59.16715	7.419989
GROUP 2						
LNISL	190.5017	82.56932	2.31	0.021	28.66885	352.3346
LNSFL	-3.269043	3.282387	-1.00	0.319	-9.702403	3.164316
LNSBL	5.35124	5.733426	0.93	0.351	-5.886069	16.58855
CONS	-883.6422	361.891	-2.44	0.015	-1592.936	-174.3489
GROUP 3						
LNISL	-8.66052	4.410886	-1.96	0.050	-17.3057	-.0153429
LNSFL	6.533084	2.532118	2.58	0.010	1.570224	11.49594
LNSBL	.4322885	.4102774	1.05	0.292	-.3718405	1.236417
CONS	11.13931	11.25112	0.99	0.322	-10.91247	33.19109
GROUP 4						
LNISL	-3.328761	1.535899	-2.17	0.030	-6.339068	-.3184534
LNSFL	1.677243	.9338128	1.80	0.072	-.1529967	3.507482
LNSBL	1.549531	.3346888	4.63	0.000	.8935534	2.205509
CONS	3.207079	1.682232	1.91	0.057	-.0900363	6.504194
GROUP 5						
LNISL	5.587078	9.461466	0.59	0.555	-12.95706	24.13121
LNSFL	-3.873069	10.53515	-0.37	0.713	-24.52159	16.77545
LNSBL	10.71332	6.895151	1.55	0.120	-2.800928	24.22757
CONS	-54.66386	25.44277	-2.15	0.032	-104.5308	-4.796934
GROUP 6						
LNISL	13.19084	13.70892	0.96	0.336	-13.67815	40.05984
LNSFL	.4633758	1.894051	0.24	0.807	-3.248896	4.175648
LNSBL	-1.109625	2.114874	-0.52	0.600	-5.254701	3.035452
CONS	-54.24464	57.99429	-0.94	0.350	-167.9114	59.42208
GROUP 7						
LNISL	-9.724425	7.415389	-1.31	0.190	-24.25832	4.80947
LNSFL	1.923021	1.900565	1.01	0.312	-1.802018	5.648059
LNSBL	5.02748	1.48767	3.38	0.001	2.111702	7.943259
CONS	17.77496	23.72489	0.75	0.454	-28.72497	64.2749
GROUP 8						
LNISL	3.543458	7.198739	0.49	0.623	-10.56581	17.65273
LNSFL	-.0269271	1.186231	-0.02	0.982	-2.351898	2.298043
LNSBL	1.835712	1.325657	1.38	0.166	-.7625279	4.433952
CONS	-20.72481	29.68126	-0.70	0.485	-78.89901	37.4494
GROUP 9						
LNISL	-11.45457	21.10851	-0.54	0.587	-52.82649	29.91735
LNSFL	.584177	1.409331	0.41	0.679	-2.17806	3.346414
LNSBL	.1174086	1.344469	0.09	0.930	-2.517703	2.75252
CONS	53.20041	93.04876	0.57	0.567	-129.1718	235.5726
GROUP 10						
LNISL	10.76789	5.88394	1.83	0.067	-.7644238	22.3002
LNSFL	-2.419324	1.151519	-2.10	0.036	-4.676259	-.1623882
LNSBL	3.2458	2.021629	1.61	0.108	-.7165198	7.208121
CONS	-49.93231	23.18172	-2.15	0.031	-95.36764	-4.496984
GROUP 11						
LNISL	-1.111387	1.3001	-0.85	0.393	-3.659537	1.436762
LNSFL	1.038831	.5802116	1.79	0.073	-.0983631	2.176024
LNSBL	-.4763094	.3614575	-1.32	0.188	-1.184753	.2321343
CONS	6.132641	5.291926	1.16	0.247	-4.239343	16.50462
GROUP 12						
LNISL	5.29449	3.617207	1.46	0.143	-1.795106	12.38409
LNSFL	-1.270613	1.327723	-0.96	0.339	-3.872902	1.331677
LNSBL	-.0823072	.3987507	-0.21	0.836	-.8638441	.6992298
CONS	-14.57865	13.02912	-1.12	0.263	-40.11527	10.95796
GROUP 13						
LNISL	10.29331	3.605967	2.85	0.004	3.225743	17.36087
LNSFL	1.236897	.9339073	1.32	0.185	-.5935277	3.067322
LNSBL	-4.588093	2.080617	-2.21	0.027	-8.666027	-.5101589
CONS	-27.95177	5.969349	-4.68	0.000	-39.65148	-16.25206
GROUP 14						
LNISL	9.035695	15.70356	0.58	0.565	-21.74271	39.8141

LNSFL	.7980326	2.299094	0.35	0.729	-3.70811	5.304175
LNSBL	.6655022	.6984757	0.95	0.341	-.7034849	2.034489
CONS	-45.64006	64.26542	-0.71	0.478	-171.598	80.31784
GROUP 15						
LNISL	-.4881833	1.212117	-0.40	0.687	-2.863888	1.887522
LNSFL	-.400196	.5895141	-0.68	0.497	-1.555622	.7552304
LNSBL	1.266475	.9955681	1.27	0.203	-.6848028	3.217752
CONS	1.648609	2.540923	0.65	0.516	-3.331508	6.628726
GROUP 16						
LNISL	155.9958	138.9567	1.12	0.262	-116.3544	428.3459
LNSFL	-2.163863	4.345522	-0.50	0.619	-10.68093	6.353205
LNSBL	-.9272803	.7019539	-1.32	0.187	-2.303085	.448524
CONS	-700.935	621.7545	-1.13	0.260	-1919.551	517.6814
GROUP 17						
LNISL	1.24741	.873746	1.43	0.153	-.4651006	2.959921
LNSFL	-.9186853	.6711705	-1.37	0.171	-2.234155	.3967847
LNSBL	1.259945	.4863823	2.59	0.010	.3066532	2.213237
CONS	-3.666416	2.002272	-1.83	0.067	-7.590797	.2579661
GROUP 18						
LNISL	27.362	11.63427	2.35	0.019	4.559253	50.16475
LNSFL	-3.471838	1.050773	-3.30	0.001	-5.531314	-1.412361
LNSBL	5.812645	.9827595	5.91	0.000	3.886472	7.738819
CONS	-133.1819	49.47748	-2.69	0.007	-230.156	-36.20785
GROUP 19						
LNISL	.9150124	.8670548	1.06	0.291	-.7843838	2.614409
LNSFL	-.4622117	.6175809	-0.75	0.454	-1.672648	.7482246
LNSBL	1.59054	.8591447	1.85	0.064	-.0933532	3.274432
CONS	-5.035639	2.570175	-1.96	0.050	-10.07309	.0018101
GROUP 20						
LNISL	3.902425	3.72286	1.05	0.295	-3.394247	11.1991
LNSFL	-1.490863	2.018972	-0.74	0.460	-5.447975	2.466249
LNSBL	1.344326	.5675285	2.37	0.018	.231991	2.456662
CONS	-15.29046	13.7774	-1.11	0.267	-42.29366	11.71273