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Does foreign trade eliminate inequality among factor incomes? The test of the Stolper-Samuelson Theorem on Turkish economy*

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Abstract

The main motivation of the paper is to investigate the validity of the Stolper-Samuelson theorem using non-linear (asymmetric) ARDL (NARDL) analysis in the period from 1980 to 2019 in Turkish economy. The results of short and long-term analysis show that the Stolper-Samuelson theorem is not valid in Turkey. In other words, it is observed that foreign trade increases the income of capital, scarce factor, while it decreases the income of labor, abundant factor. Therefore, it has been noted that foreign trade gradually increases the income gap among factors in favor of capital. In this context, it can be said that while the capital class gets richer, the labor class gets poorer through foreign trade. In addition, the findings of the analysis showing that public policies increase the inequalities among factor incomes reflect that economic globalization process, foreign direct investments, migration inflows, inflation level and total factor productivity have an increasing effect on the income gap.

Key words: The Stolper-Samuelson Theorem, Income Inequality, Foreign Trade, Non-Linear ARDL Analysis.

JEL classification: C32, E25, F11, F14, F16.

1. Introduction

Income inequalities and distributions between nations, regions, economic agents and factor owners have been at the top of the issues that have attracted the attention of economists for many years. D. Ricardo, who carries out the basic theoretical studies on economic growth and foreign trade, is known for his

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pioneering work on income inequality and distribution. Explaining the importance of the increases in the profit of capital for economic growth, this study[1] have highlighted how income distribution would change with growth and which social class should get more share from the national income.

Following the pioneering work by Ricardo, the most fundamental study examining the relationship between foreign trade and income distribution is done by Stolper and Samuelson (1941). Trying to create a new income distribution theorem based on the Heckscher-Ohlin foreign trade mechanism, Stolper and Samuelson (1941) examine the effects of protectionism trends on factor incomes and distributions. In general, the Stolper-Samuelson theorem, which is based on the assumption of two commodities, two factors and two countries, examines the effects of an ad-valorem import tariffs on factor incomes and distribution. The theorem suggests that an import tariff increases the income of the abundant factor in an industry, whereas it decreases the income of the scarce factor in that industry. According to the theorem, if the import of a country is relatively capital-intensive (labor-intensive), imposing tariffs to import increases the income of capital (labor) and decreases the income of labor (capital).

Tariffs on imported capital-intensive (labor-intensive) commodities cause the price of capital-intensive (labor-intensive) commodities and capital (labor) to rise in the domestic market. Domestic producers want to produce more of these capital-intensive (labor-intensive) commodities due to rising commodity prices in the domestic market. The increase in the demand for capital (labor) in order to produce more capital-intensive (labor-intensive) commodities causes an increase in the price of capital (labor) and therefore its income level. On the other hand, domestic producers will have to use more labor (capital) in the production process due to the increase in the price of the capital (labor) factor. Such a situation, which causes a decrease (increase) in the amount of capital per labor force, leads to the income of capital (labor) to increase more and the income of labor (capital) to decrease.

The main Stolper-Samuelson theorem is widely discussed in today's literature with the aim of examining the effects of foreign trade on income inequality and distribution. In this context, the main thesis of the theorem is that free foreign trade increases the price and income of the abundant factor of a country, whereas it decreases the price and income of the scarce factor in that country. Despite this proposition, Heckscher (1919) stated that with foreign trade, factor incomes will be equalized absolutely between countries, whereas Ohlin (1933) stated that equality cannot be mentioned in absolute terms, but there may be tendencies towards equality.

[1] For more information see Ricardo (1817 [2015]).

The main motivation of this paper is to investigate the validity of the Stolper-Samuelson theorem using non-linear (asymmetric) ARDL (NARDL) analysis in the period from 1980 to 2019 in Turkish economy. Export-oriented development policies have gained a great importance for Turkish economy since the 1980s. By increasing the export volume, it was desired to reach foreign trade surplus on the one hand, and to increase the national income on the other hand. Increases in national income undoubtedly directly affected the income shares of factor owners. However, the unstable economic structure of the country due to both structural problems stemming from internal dynamics and fluctuations in the world economy paved the way for foreign trade to remain in a volatile structure. The instability of foreign trade, on the other hand, affected both national income and the share of factor owners from national income. This situation triggered the inequalities between the incomes of factor owners under the positive and negative economic conjuncture of foreign trade. Hence, it is of great importance to determine how foreign trade affects the incomes of factor owners under different conjuncture conditions. Therefore, the main point that distinguishes this study from other studies in the literature is to examine the effects of foreign trade on both capital and labor income. Studies in the literature generally focus on the effects of foreign trade on wage incomes or focus on the effects of foreign trade on income inequality measured by the Gini coefficient. Therefore, the distinctive feature of this study is that it examines the response of capital and labor incomes to foreign trade, and hence, comments on income inequality and distribution. For this purpose, this paper consists of six sections. Following the introduction section, summary information about some studies in the relevant literature will be presented in the second section, and in the third section, the methodological information that is the subject of the application part of the study will be given. Following the fourth chapter, in which the econometric application findings will be presented, the conclusion section will be represented in the fifth chapter and the study will be concluded with the sixth chapter, where the paper is compared with other papers in the literature.

2. Literature review

One of the most striking issues of the economics is to investigate the factors affecting income inequality and distribution. Following Ricardo's pioneering work, many economists have worked on determining the factors affecting income inequality and distribution and have emphasized the effects of social, political, institutional and cultural factors as well as economic factors on income inequality and distribution. Studies handling of various variables that are thought to affect foreign trade directly and indirectly point out different results depending on the country sample.

One of the striking factors in this regard is in which countries the goods subject to trade are produced. In today's trade conditions, commercial goods are generally produced in poor countries and are directed to world markets by rich countries by changing their composition and quality. Therefore, goods produced by rich and poor countries cease to be substitutes for each other, and in some circumstances they turn into a category of non-tradable goods. In this context, the effect of foreign trade on income distribution between countries and production factors can be explained by the differences in the quality of goods (Davis and Mishra, 2007). Taking into account the production process in terms of rich and poor countries, the basis of studies suggesting that foreign trade will disrupt the functional income distribution between the two country groups is developed under the leadership of Krugman (1979). Krugman (1979) stated that the way to eliminate foreign trade disadvantages of poor countries in order to compete with rich countries with high wage levels and working with capital-intensity is to keep wage levels low. Therefore, it has been implied that foreign trade necessarily increases the inequalities between factor incomes. The advanced version of the dynamic technological open model by Krugman (1979) is introduced by Acemoglu *et al.* (2015). This paper links trade to inequality, whereby inequality is reflected in the differential compensation of two homogeneous groups of workers, low- and high-skilled.

Referring to the distinction between developed and underdeveloped countries, the argument that foreign trade disrupts the income distribution between the two groups of countries is also presented by Singer (1950) and Prebisch (1959). Stating that developed countries produce capital-intensive goods and underdeveloped countries produce labor-intensive goods, the authors stated that the foreign trade between these two country groups will deteriorate the income distribution in favor of developed countries as a result of supply-demand and market rigidities.

In addition to basic theoretical studies expressing the relationships between foreign trade and income distribution, many empirical studies have tried to explain the linkages between related variables with the help of various factors. Various studies, which indicate that the wage differences of countries will affect foreign trade and hence income distribution (Chiquiar, 2004) have been supported by the evidence of some kind of studies examining the distribution of skilled and unqualified workforce among sectors (Shinkai, 2000; Ghazali, 2009; Topuz and Dağdemir, 2020; Basco *et al*., 2020). On the other hand, various studies indicating that the wage skill premium will affect the comparative advantages in foreign trade and income distribution have also investigated the effects of custom duties on trade (Amiti and Cameron, 2012).

Some studies in the literature have taken into account the effects of trade liberalization on income distribution between countries (Davis, 1996; Chakrabarti,

2000; Gonzaga *et al*. 2006; Topalova, 2010; Huang *et al*., 2011; Hazama, 2017; Ercan, 2020) and investigated the reflections of globalization on this process (Goldberg and Pavcnik, 2007; Dorn *et al*., 2017). Studies have shown different results due to the differences in country characteristics, the differentiation of countries' levels of internationalization, and the diversity of sampling periods.

Relationships between foreign trade and income distribution have been investigated in terms of technology levels of countries. Some studies show that technological differentials among trading partners are important in determining the distributional impacts of trade (Meschi and Vivarelli, 2007), the others claim that if the negative effect of technology progress is eliminated on labor income share, the effect of trade liberalization becomes significantly positive (Huang *et al*., 2011). In addition, Roser and Cuaresma (2016) point out that democratization, the interaction of technology and education and changes in the relative power of labor unions affect inequality dynamics robustly. Besides, as stated by Lehman (2004), the fact that technological developments are not neutral and their marginal productivity is different on each type of labor stands out as an important factor in explaining intra-labor income inequalities. Grossman and Helpman (2018) find an evidence that within-country income inequality is exacerbated by the knowledge sharing, because the knowledge spillovers make innovation more productive and so create incentives for expansion of the idea-generating portion of economies worldwide.

Undoubtedly, there are many variables that focus on explaining the causes and nature of income inequality through the foreign trade channel and the limitations of this study cannot be sufficient to examine the effects of these variables. In this context, Table 1 presents summary information of some studies in the literature.

Table 1

Literature Review Summary

Author	Country	Time Span	Method	Main Findings
Workforce Ability-Skill Premium-Foreign Trade-Income Inequality				
Shinkai (2000)	Latin American Countries	1980-1995	Cross-Section Analysis	The results of the analysis support the validity of the Stolper-Samuelson theorem, when educated workers are defined as the specific factor for Latin American countries from the 1980s to the 1990s.
Ghazali (2009)	Tunisia	1975-2002	Panel Data Analysis	The paper focusing on the wage inequality between skilled and unskilled workers provides the evidence that trade openness widens wage inequality among different kind of labors.
Jakel and Smolka (2011)	47 Countries	2007	Naïve Probit Model and HOS Linear Probit Model	The results show the validity of the Stolper-Samuelson effects. It is noted that in the United States, being high-skilled increases an individual's probability of favoring free trade by up to twelve percentage points, while in Ethiopia, the effect amounts to eight percentage points, but in exactly the opposite direction.
Basco *et al*. (2020)	China-France Trade Linkage	1997-2015	Panel Data Analysis	The paper points out that there is a negative correlation between occupation exposure to Chinese competition and change in worker earnings. It is also shown that workers initially employed in occupations more intensively used in hard-hit industries experience larger declines in earnings.
Technology-Foreign Trade-Income Inequality				
Meschi and Vivarelli (2007)	70 Countries	1980-1999	LSDVC Estimator Analysis	The findings suggest that the aggregate trade flows are weakly connected with inequality. However, disaggregate total trade flows are found that trade with high income countries worsen income distribution in DCs. This finding is interpreted that technological differentials among trading partners are important in determining the distributional impacts of trade.
Huang *et al*. (2011)	29 Provinces in China	1987-2006	Panel Data Analysis	The results of the analysis show that the overall effect of trade liberalization on labor income share is insignificant. However, it is also claimed that if the negative effect of technological progress is eliminated on labor income share, the effect of trade liberalization becomes significantly positive.
Roser and Cuaresma (2016)	32 Developed Countries	1960-2007	Panel Data Analysis	The results of the analysis support the Stolper-Samuelson theorem if the paper concentrates on imports from developing countries as a trade measure. The paper also find that democratization, the interaction of technology and education and changes in the relative power of labor unions affect inequality dynamics robustly.

Table 1 (Continue)

Trade Liberalization-Foreign Trade-Income Inequality				
Chakrabarti (2000)	73 Countries	1985	Cross-Section Analysis	The paper shows that openness significantly decreases income inequality. Besides, it is also found that growth process provides a channel through which trade lowers inequality by increasing both initial income and subsequent growth.
Chiquiar (2004)	Mexico	1990-2000	Panel Data Analysis	The results of the findings support the presence of the Stolper-Samuelson theorem. The paper also claims that regions more exposed to foreign trade appear to have exhibited an increase in wage levels.
Author	Country	Time Span	Method	Main Findings
Trade Liberalization-Trade Volume-Foreign Trade-Income Inequality				
Değer (2006)	Less-Developed and Developing Countries	1975-2002	Cross-Section Analysis	The findings of cross section regression analyses based on the averages of the data belong to the period of 1975-2002 support the Stolper-Samuelson's income distribution hypothesis.
Dorn *et al.* (2017)	140 Countries	1970-2014	2SLS	The results show that globalization and income inequality are positively correlated with each other. Besides, it is also found that the positive relationship is mainly driven by trade openness, foreign direct investments and social globalization.
Hazama (2017)	70 Lower Income and 36 Higher Income Countries	1971-2012	Unbalanced Panel Data Analysis	The results of the paper show that the openness ratio has a negative impact on income inequality for lower-income countries, however any significant impacts of foreign trade on income inequality has been detected for higher-income countries.
Barusman and Barusman (2017)	The USA	1970-2014	Time Series Analysis	The paper indicates that trade increases income inequality. The paper also shows that an increase in trade volume brings about to a wider income gap as more income goes to the top 10% wealthiest people. In other words, the papers does not find any evidences to support the Stolper-Samuelson theorem.
Ercan (2020)	Turkey	1987-2018	Toda-Yamamoto Causality Analysis	The results of the econometric analysis show that a one-way causality is determined from the real commercial openness to the income distribution inequality.

Table 1 (Continue)

Regional and Sectoral Differences-Foreign Trade-Income Inequality				
Gourdon (2011)	68 Developing Countries	1976-2002	Panel Data Analysis	The results of the paper show that increasing wage inequality is more owing to the South-South trade liberalization than to the northern countries. It is noted that increasing wage inequality owing to S-S trade comes from the improvement of N-S trade linkage in S-S trade that increases wage inequality in middle income developing countries. Nevertheless, S-S trade raises wage inequality for all developing countries.
Bensidoun *et al*. (2011)	53 Developed and Developing Countries	1976-1999	Panel Data Analysis	The findings of the paper indicate that a change in the factor content of trade has a significant effect on distribution of income. It is also found that an increase in the labor content of trade increases inequality in poor countries, however decreases it in rich countries. In general, the paper notes that international trade might have contributed to widening inequalities in developing countries.
Topuz and Dağdemir (2020)	Turkey	1987-2016	ARDL	The results of the analysis point out that there is a non-linear U shaped linkage between trade and inequality. Besides, it is also shown that when income gap between agriculture and industry sectors increases, there has been a rising trend in overall inequality.
Growth-Population-Inflation-Foreign Trade-Income Inequality				
Bhanu and Ekta (2014)	India	1992-2010	Multiple Regression Models	The findings of the analysis points out that the foresight of the Stolper-Samuelson theorem does not occur in the case of India and it is the Wholesale Price Index which actually shows a favorable effect on factor-price ratio.
Amjad (2015)	Pakistan	1980-2010	OLS	The results show that trade has a negative impact on income distribution and income inequality is negatively affected by remittances, and GDP, however the growth of population level has a negative impact on income inequality.

3. Data set, methodology and econometric model

The main aim of this paper is to examine the validity of the Stolper-Samuelson theorem using NARDL analysis in the period from 1980 to 2019 in Turkish economy. In other words, the paper examines the effects of foreign trade on both capital and labor income and therefore, it investigates the income distribution impact of trade. Therefore, it will be assumed that there are only two production factors in the analysis and the effects of foreign trade on the income level of these two factors will be analyzed. The year of 1980 is taken into consideration as the starting year, since the export-oriented foreign trade policy has been begun to implement in Turkey in this year and therefore, from this date on, the effects of foreign trade policy on factor incomes are wished to investigate.

In determining the dependent variables of the analysis, GDP calculations with income approach are taken into account and the income shares of labor and capital from national income are used. The main independent variables of the analysis are the openness ratio, which is measured as the ratio of foreign trade volume to GDP, and net barter terms of trade. Besides, the robustness of analyzes is investigated by adding various control variables to the models as well as the main independent variables. The economic globalization index is used to examine the effects of globalization on factor incomes. Neo-classical theory suggests that the welfare of every country participating in foreign trade will increase and that increasing welfare will ensure the justice of income distribution. Heckscher and Ohlin predicted that as a result of foreign trade, factor prices between countries would equalize and therefore, justice in income distribution could be achieved. In order to test whether the predictions of the neo-classical theory are valid or not, the globalization variable has been included in the analysis. The economic globalization index introduced by KOF Swiss Economic Institute is measured with a scale ranging from 0 to 100, and it is stated that the level of globalization increases as the index value approaches 100.

On the other hand, one of the main factors associated with the globalization process is foreign direct investment. The main expectation from inward foreign direct investments is to increase the productivity of the production factors and to increase employment. For the realization of this expectation, it is of great importance that foreign direct investments are in the form of green field investments. However, it can be said that foreign direct investments in the form of brown field investments are far from ensuring effective use of factors. Not being able to use the factors effectively means that justice cannot be achieved in functional income distribution. In addition, the technology adopted by inward foreign direct investments is one of the main determinants of income distribution. In particular, it is clear that foreign direct investments using labor-saving

technologies cannot provide justice in income distribution. In this manner, to examine the effects of foreign direct investments on income distribution, the ratio of inward foreign direct investments to GDP is taken into consideration.

One of the main variables that can affect income distribution is immigration. Migration flows to the country cause an increase in the labor supply and therefore a decrease in its share from the national income. In addition, the quality of migrant labor is another important issue. Immigrant workers with low-skill level may cause distortion of the income distribution both within labor and between labor-capital by increasing the existence of unskilled labor supply in the country. Highly skilled migrant workers, on the other hand, may lead to a distortion of the income distribution within labor and between labor and capital due to their high marginal productivity levels. Therefore, in order to determine the effects of migration on factor incomes, the ratio of immigration to the total population is used.

Another factor that creates inequality in income distribution is inflation. Inflation, which reduces the purchasing power of those whose incomes remain constant over time, but increases the income level of the capitalist class, which benefits from the increases in the general level of prices, distorts the distribution of income among classes. In this context, to examine the effects of inflation on the shares of economic classes from national income, the annual percentages of average consumer prices are taken into consideration.

Tax rates are one of the important factors in determining whether efficiency in income distribution is achieved. The fact that the tax rates are not determined at a rate that can reduce the income gap between the poor and rich classes leads to an increase in social stratification. In accordance with the understanding of the social state, determining the optimum tax rates to reduce the income separation between social classes gains importance in the context of income redistribution. Hence, taxes are not only a tool that the state can use to finance public expenditures, but also provide the establishment of social justice. In this manner, income tax rates are taken into account to determine whether tax burden have a detrimental effect on income distribution. A similar situation occurs for public expenditures. There are many economic policy tools that the state can use to ensure justice in income distribution. The inevitable consequence of market economies is that the distribution of income is distorted in favor of certain social classes. In order to eliminate the income inequality, it is of great importance that the state directs the income from the groups with low consumption tendency to the groups with high consumption tendency. At this point, the use of public expenditures in an efficient and effective manner to restore income distribution between social classes is a basic criterion for income distribution justice. Therefore, the ratio of public expenditures to GDP is included in the analysis in order to observe the effects of the fiscal policies implemented by the state on income distribution.

Technology is one of the main factors affecting income distribution among social classes. The fact that technological developments are not neutral and their marginal productivity is different on each type of labor stands out as an important factor in explaining income inequalities within labor and between labor and capital. The fact that technological innovations are particularly suitable for qualified labor causes an increase in the demand for this type of labor and therefore the level of wages. On the other hand, due to the fact that technological developments require less unskilled labor with a low level of education means that the marginal productivity of unskilled labor gradually decreases. This process, which causes the increase in income inequalities within labor, leads to the acceleration of labor-capital income inequalities. In addition, the use of technology by the capitalist as an element that increases the relative surplus value leads to an increase in income inequalities. In this context, total factor productivity is used to determine the effects of technological developments on factor incomes. Total factor productivity is calculated with the help of growth accounting procedure systematized by Solow (1956) for the first time. In addition, the calculation of the capital stock required for the growth accounting procedure was made based on the methodology presented by Kolsuz and Yeldan (2014) and Saygılı *et al*. (2005). The data set subject to the analysis is obtained from the official website of Turkstat, World Bank-World Development Indicators, Central Bank of the Republic of Turkey, International Monetary Fund, KOF Swiss Economic Institute, the Presidency of the Republic of Turkey Presidency of Strategy and Budget and Republic of Turkey Ministry of Interior Directorate General of Migration Management and the paper done by İçduygu *et al*. (2014).

It should be noted that the income shares of labor and capital from national income are presented by Turkstat for the period 1998-2019. Therefore, it is necessary to estimate the factor incomes and income shares for the period 1980-1997. This calculation can be done using the following forecast equation numbered (1):

$$I_{K_{t-1}} = \frac{I_{K_t}}{e^{g_{K_t}}} \quad \text{and} \quad I_{L_{t-1}} = \frac{I_{L_t}}{e^{g_{L_t}}} \tag{1}$$

where, I is the income of the factors, K and L are capital and labor respectively, g is the income growth rate of labor and capital, e is the natural logarithm and t is time. In addition, to calculate the value of g, the following equation numbered (2) can be taken into account:

$$g_{K_t} = \left(\frac{I_{K_t}}{I_{K_{t-1}}} \right)^{1/n} - 1 \quad \text{and} \quad g_{L_t} = \left(\frac{I_{L_t}}{I_{L_{t-1}}} \right)^{1/n} - 1 \tag{2}$$

where, n is the number of years from the start period to the end period. The calculations are done in the US dollar terms, taking into account the average USA dollar exchange rate of the relevant year. The volatile macro-economic structure of Turkey's economy between 1980 and 2019 is also taken into consideration and Hodrick-Prescott filter technique is applied after forecasting the past period values of labor and capital shares from national income. The main reason for the application of Hodrick-Prescott filter technique is to take into account the short-term fluctuations of the factor income share series and to create a non-linear (asymmetric) income share growth trend.

Before the implementation of the analysis, the factor endowment structure of Turkey is tried to be determined and therefore, the methodology introduced by Heckscher-Ohlin theorem is used in this context. For this purpose, the ratio of the income obtained by capital from national income $\left(I_K\right)$ to the income obtained by labor from national income $\left(I_L\right)$ is taken into account and the factor endowment of the country $\left(I_K / I_L \right)$ is calculated. As a result of the calculations, three different situations may arise: **i)** If $\frac{I_K}{I_L} > 1$, it can be said that the income of capital is high due to the its scarcity and the income of labor is less due to its abundance. In such a case it can be argued that Turkey is a labor-abundant country. **ii)** If $\frac{I_K}{I_L} < 1$, it can be said that the income of capital is less due to the its abundance and the income of labor is high due to its scarcity. In such a case it can be argued that Turkey is a capital-abundant country. **iii)** If $\frac{I_K}{I_L} = 1$, it can be said that labor and capital shares of the national income are same, and therefore any comments can be made about Turkey's factor endowment structure. Factor endowment calculations have shown that the share of capital from national income is higher than that of labor since 1980, and it has been determined that the values of I_K / I_L are greater than 1. In this regard, it can be noted that Turkey is a labor-abundant country and according to the Stolper-Samuelson theorem, foreign trade is expected to increase the income of labor.

The effects of a macroeconomic indicator used as an independent variable on the dependent variable do not occur only in a linear (symmetric) form. The effects of changes in the value of the independent variable on the dependent variable can manifest themselves in a non-linear (asymmetric) form in the real world. In economic relations where asymmetrical linkages arise, taking linear (symmetric) forms into consideration may mean that robust results regarding economic observations cannot be reached. Therefore, the use of non-linear (asymmetric) relationship patterns may be more realistic in terms of interpreting real world experiences. NARDL analysis is an expanded form of standard ARDL analysis introduced by Shin *et al*. (2014). NARDL analysis enables the examination of short and long term non-linear (asymmetric) relationships between dependent and independent variables and decomposes independent variables on the basis of positive and negative partial sums. NARDL analysis, which allows econometric models to be established even under weak endogeneity conditions, predicts that models established with appropriate lag lengths without autocorrelation problems may reflect real-world experiences. In this context, the effect of foreign trade on income distribution within the scope of NARDL analysis can be demonstrated using the following regression equations numbered (3) and (4).

$$I_{K_t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 I_{K_{t-i}} + \sum_{i=0}^{n} \left(\beta_i^{+} Trade_{t-i}^{+} + \beta_i^{-} Trade_{t-i}^{-} \right) + \varepsilon_t \tag{3}$$

$$I_{L_t} = \gamma_0 + \sum_{i=1}^{m} \gamma_1 I_{L_{t-i}} + \sum_{i=0}^{m} \left(\beta_i^{+} Trade_{t-i}^{+} + \beta_i^{-} Trade_{t-i}^{-} \right) + \varepsilon_t \tag{4}$$

where, *i* is optimum lag length and ε_t is the white noise error term. On the other hand, $Trade_t$ reflects the *kx1* dimensional regressor vectors defined as $Trade_t = Trade_0 + Trade_t^{+} + Trade_t^{-}$. In this equation, $Trade^{+}$ and $Trade^{-}$ emphasize the partial sum of positive and negative changes in $Trade_t$. In other words, they can be defined as follows:

$$Trade^{+} = \sum_{i=1}^{t} \Delta Trade_i^{+} = \sum_{i=1}^{t} max\left(\Delta Trade_i, 0\right)$$

$$Trade^{-} = \sum_{i=1}^{t} \Delta Trade_i^{-} = \sum_{i=1}^{t} min\left(\Delta Trade_i, 0\right)$$

In this context, β_i^+ and β_i^- parameters are called as asymmetrically distributed lag parameters. The regression equations numbered (3) and (4) with the additional control variables can be written as NARDL form stemming from the original ARDL model introduced by Pesaran *et al*. (2001) as follows:

$$\begin{aligned}\Delta I_{K_t} = {} & \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta I_{K_{t-i}} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta Glob_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta FDI_{t-i} \\ & + \sum_{i=0}^{n} \alpha_{5i} \Delta Migration_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta Inflation_{t-i} + \sum_{i=0}^{n} \alpha_{7i} \Delta Tax_{t-i} + \sum_{i=0}^{n} \alpha_{8i} \Delta Public_{t-i} \\ & + \sum_{i=0}^{n} \alpha_{9i} \Delta Technology_{t-i} + \sum_{i=0}^{n} \left(\beta_i^+ \Delta Trade_{t-i}^+ + \beta_i^- \Delta Trade_{t-i}^- \right) + \alpha_{10} I_{K_{t-1}} + \alpha_{11} TOT_{t-1} \\ & + \alpha_{12} Glob_{t-1} + \alpha_{13} FDI_{t-1} + \alpha_{14} Migration_{t-1} + \alpha_{15} Inflation_{t-1} + \alpha_{16} Tax_{t-1} + \alpha_{17} Public_{t-1} \\ & + \alpha_{18} Technology_{t-1} + \alpha_{19} Trade_{t-1}^+ + \alpha_{20} Trade_{t-1}^- + \varepsilon_t \end{aligned} \tag{5}$$

$$\begin{aligned}\Delta I_{L_t} = {} & \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} \Delta I_{L_{t-i}} + \sum_{i=0}^{m} \gamma_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{m} \gamma_{3i} \Delta Glob_{t-i} + \sum_{i=0}^{m} \gamma_{4i} \Delta FDI_{t-i} \\ & + \sum_{i=0}^{m} \gamma_{5i} \Delta Migration_{t-i} + \sum_{i=0}^{m} \gamma_{6i} \Delta Inflation_{t-i} + \sum_{i=0}^{m} \gamma_{7i} \Delta Tax_{t-i} + \sum_{i=0}^{m} \gamma_{8i} \Delta Public_{t-i} \\ & + \sum_{i=0}^{m} \gamma_{9i} \Delta Technology_{t-i} + \sum_{i=0}^{m} \left(\beta_i^+ \Delta Trade_{t-i}^+ + \beta_i^- \Delta Trade_{t-i}^- \right) + \gamma_{10} I_{L_{t-1}} + \gamma_{11} TOT_{t-1} \\ & + \gamma_{12} Glob_{t-1} + \gamma_{13} FDI_{t-1} + \gamma_{14} Migration_{t-1} + \gamma_{15} Inflation_{t-1} + \gamma_{16} Tax_{t-1} + \gamma_{17} Public_{t-1} \\ & + \gamma_{18} Technology_{t-1} + \gamma_{19} Trade_{t-1}^+ + \gamma_{20} Trade_{t-1}^- + \varepsilon_t \end{aligned} \tag{6}$$

Within the scope of NARDL analysis, the regression equations numbered (5) and (6) are estimated using OLS method and the lag length shown as "n" and "m" is determined. While determining the optimum lag lengths, information criteria such as AIC, SBC, FPE and HQ are taken into account and the lag length with the smallest critical value is selected as the optimum lagged value for the model. Also, in order for the *F* test to give a robust result, there should be no autocorrelation in error terms. The null hypothesis, which states that there is no long-term relationship, is tested by assigning zero constraints to the coefficients of the lagged variables at the level in models (5) and (6). The coefficients of the level values of the variables in models (5) and (6) are tested by taking into account the $\left(H_0 : \alpha_{10} = ... = \alpha_{20} = 0 \right)$

and $\left(H_0 : \gamma_{10} = ... = \gamma_{20} = 0\right)$ hypotheses with the F test. The calculated *F* statistic value is compared with the lower and upper critical values introduced by Pesaran *et al*. (2001). If the calculated *F* statistic is above the upper critical value, it is decided that there is a cointegration relationship between the series, and if it is below the lower values, it is decided that there is no cointegration relationship. If the calculated *F* statistic is between the lower and upper critical values, a definite comment cannot be made about the cointegration linkage (Taban, 2008: 157; Akıncı and Yılmaz, 2012: 12-13).

Short and long term coefficients of the variables can also be calculated using NARDL analysis. Short-term coefficients are the coefficients of the current-period differences of the independent variables. In NARDL analysis, the short-term relationship among the variables is investigated with an error correction model based on ARDL approach. In this context, short-term coefficients can be estimated using regression equations numbered (7) and (8):

$$\begin{aligned}\Delta I_{K_t} = {} & \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta I_{K_{t-i}} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta Glob_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta FDI_{t-i} \\ & + \sum_{i=0}^{n} \alpha_{5i} \Delta Migration_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta Inflation_{t-i} + \sum_{i=0}^{n} \alpha_{7i} \Delta Tax_{t-i} + \sum_{i=0}^{n} \alpha_{8i} \Delta Public_{t-i} \\ & + \sum_{i=0}^{n} \alpha_{9i} \Delta Technology_{t-i} + \sum_{i=0}^{n} \left(\beta_i^{+} \Delta Trade_{t-i}^{+} + \beta_i^{-} \Delta Trade_{t-i}^{-} \right) + \alpha_{10} EC_{t-1} + \varepsilon_t \end{aligned} \tag{7}$$

$$\begin{aligned}\Delta I_{L_t} = {} & \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} \Delta I_{L_{t-i}} + \sum_{i=0}^{m} \gamma_{2i} \Delta TOT_{t-i} + \sum_{i=0}^{m} \gamma_{3i} \Delta Glob_{t-i} + \sum_{i=0}^{m} \gamma_{4i} \Delta FDI_{t-i} \\ & + \sum_{i=0}^{m} \gamma_{5i} \Delta Migration_{t-i} + \sum_{i=0}^{m} \gamma_{6i} \Delta Inflation_{t-i} + \sum_{i=0}^{m} \gamma_{7i} \Delta Tax_{t-i} + \sum_{i=0}^{m} \gamma_{8i} \Delta Public_{t-i} \\ & + \sum_{i=0}^{m} \gamma_{9i} \Delta Technology_{t-i} + \sum_{i=0}^{m} \left(\beta_i^{+} \Delta Trade_{t-i}^{+} + \beta_i^{-} \Delta Trade_{t-i}^{-} \right) + \gamma_{10} EC_{t-1} + \varepsilon_t \end{aligned} \tag{8}$$

where, EC_{t-1} is one-period lagged value of the series o error terms obtained from the cointegration relationship.

Besides, long-run coefficients are coefficients representing the lagged values of the independent variables. The long-run coefficients are calculated by taking the lagged values of the independent variables. In addition, the long-term coefficients are estimated as the ratio of the coefficients of the independent variables with

lagged values to the coefficient of the dependent variable with a period lag. Therefore, long-term coefficients are analyzed by considering the optimal lag lengths of the variables. In this context, long-term coefficients can be estimated as follows:

$$I_{K_t} = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} I_{K_{t-i}} + \sum_{i=0}^{n} \alpha_{2i} TOT_{t-i} + \sum_{i=0}^{n} \alpha_{3i} Glob_{t-i} + \sum_{i=0}^{n} \alpha_{4i} FDI_{t-i} + \sum_{i=0}^{n} \alpha_{5i} Migration_{t-i} + \sum_{i=0}^{n} \alpha_{6i} Inflation_{t-i} + \sum_{i=0}^{n} \alpha_{7i} Tax_{t-i} + \sum_{i=0}^{n} \alpha_{8i} Public_{t-i} + \sum_{i=0}^{n} \alpha_{9i} Technology_{t-i} + \sum_{i=0}^{n} \beta_{1i}^{+} Trade_{t-i}^{+} + \sum_{i=0}^{n} \beta_{2i}^{-} Trade_{t-i}^{-} + \varepsilon_t \quad (9)$$

$$I_{L_t} = \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} I_{L_{t-i}} + \sum_{i=0}^{m} \gamma_{2i} TOT_{t-i} + \sum_{i=0}^{m} \gamma_{3i} Glob_{t-i} + \sum_{i=0}^{m} \gamma_{4i} FDI_{t-i} + \sum_{i=0}^{m} \gamma_{5i} Migration_{t-i} + \sum_{i=0}^{m} \gamma_{6i} Inflation_{t-i} + \sum_{i=0}^{m} \gamma_{7i} Tax_{t-i} + \sum_{i=0}^{m} \gamma_{8i} Public_{t-i} + \sum_{i=0}^{m} \gamma_{9i} Technology_{t-i} + \sum_{i=0}^{m} \beta_{1i}^{+} Trade_{t-i}^{+} + \sum_{i=0}^{m} \beta_{2i}^{-} Trade_{t-i}^{-} + \varepsilon_t \quad (10)$$

In NARDL model, SIC is used to determine lag lengths and it is calculated for each lag by taking the maximum lag length as 9. In determining lag lengths, the method stated by Kamas and Joyce (1993) is used. Accordingly, the dependent variable is regressed with its own lagged values over the largest lag length and the number of lags with the smallest SIC value is selected. Then, the optimum lag length of the dependent variable is kept constant, regression process is run with all lags of the first independent variable and the minimum SIC value is assigned as the optimum lag length of this independent variable. The same lag length estimation process is repeated for the other independent variables.

4. The results of the econometric analysis

The Turkish economy, which has adopted export-oriented development and industrialization policies since 1980, aimed to increase its openness rates in parallel with this policy target. However, the unstable economic structure of the country due to both structural problems originating from internal dynamics and volatilities in the world economy has made foreign trade to remain unstable. The instability of

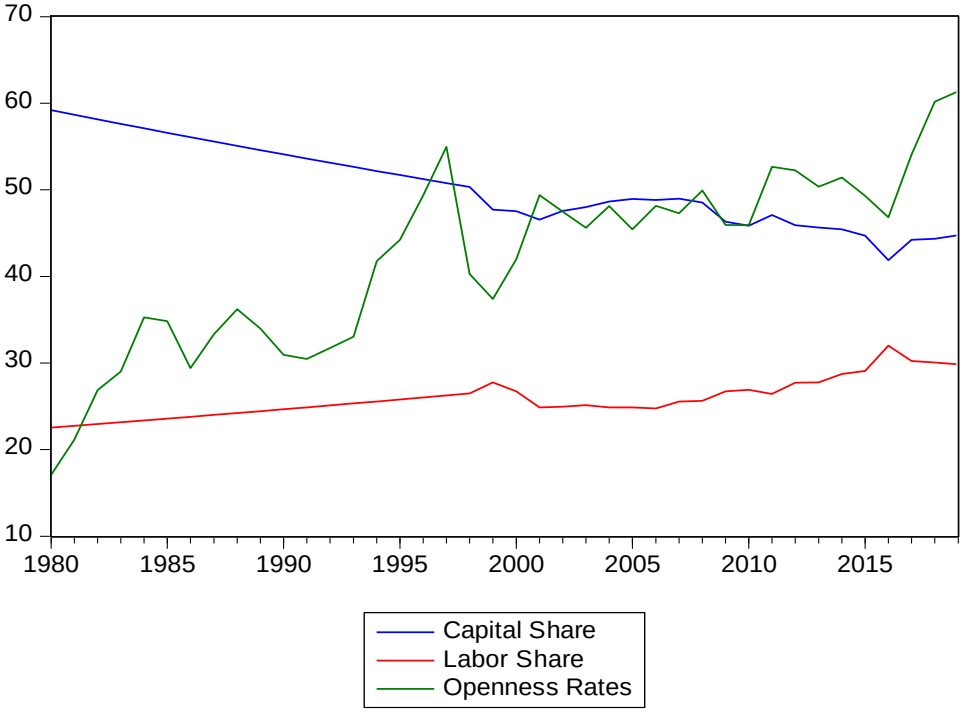
foreign trade, on the other hand, has affected both national income and the share of factor owners from national income. The rise of finance-capital, which is the new institution of the neoliberal order since the 1990s, has led to further increase in market instabilities. The deregulation in the financial markets in order to establish the effective functioning of capitalism has brought the deregulation of the goods and labor markets. Especially the transformation of labor markets with mottos such as precarious employment, flexible working conditions and piece-rate wages has started to disrupt the income distribution between labor and capital in favor of capital. In this context, deregulation of labor markets has been included in the potential impact of foreign trade on income distribution.

The historical process of openness ratios and the shares of labor and capital from national income are shown in Graph 1. The Turkish economy, which has increased its participation in foreign trade since the 1980s, has a volatile openness rate pattern due to the unstable market conditions caused by both domestic and foreign conjuncture. Besides, graph 1, which shows that the income inequality between labor and capital is in a decreasing trend until 2000, points out that the functional income distribution has started to deteriorate in favor of capital since the early 2000s. The deterioration of income distribution between labor and capital in the period from 2000 to 2009 started to reverse relatively with the Global Financial Crisis in 2009, which made its effects felt for many years. Since 2016, the economic problems arising from Turkey's own structural dynamics, the dilemmas of finance-capitalism, economic policy practices that do not coincide with the market and socio-economic conditions, acceleration of neo-liberal transformation in the labor markets, the negative effects of the global epidemic and the deterioration in economic relations with the world economy has led to an increase in income inequality between labor and capital in favor of capital.

However, since this graph shows the trends among the variables in the period of 1980-2019, it does not directly explain the effects of foreign trade on the share of labor and capital in national income. In this context, it can be said that various econometric applications are needed to clearly understand the effects of foreign trade on functional income distribution.

Graph 1

National Income Shares of Capital and Labor and Openness Rates in Turkey



Before the analysis results, descriptive statistics of the variables used in the models are determined and the results are presented in Table 2. When the descriptive statistics are evaluated in terms of the main dependent and independent variables that constitute the basic motivation of the study, it is possible to say that the dependent variables have very small standard deviation values and exhibit normal distribution processes. In this context, it can be noted that the variables in question can be distributed with the smallest possible variance values. On the other hand, the fact that the main independent variables fluctuate with high standard deviation and variance levels is an indicator that the effect they may have on the dependent variables can be significant. In this context, it is clear that using asymmetric estimation models to estimate the effects of independent variables on dependent variables may be meaningful.

Table 2

Descriptive Statistics of the Variables

	I_K	I_L	Trade	ToT	Glob.	FDI	Migra.	Inf.	Tax	Public	Tech.
Mean	0.503	0.259	42.124	101.79	48.665	0.961	0.002	40.368	16.998	27.322	-0.318
Med.	0.489	0.254	45.519	98.561	51.000	0.536	0.001	35.490	15.268	28.833	-0.018
Max.	0.591	0.319	61.394	120.40	56.300	3.653	0.008	110.63	25.800	44.100	0.725
Min.	0.418	0.225	17.088	88.897	32.400	0.026	0.001	6.251	10.800	13.669	-5.153
Std.D.	0.047	0.022	10.356	8.479	6.948	0.896	0.002	31.356	4.655	9.240	1.361
Skew.	0.240	0.903	-0.393	0.362	-0.880	1.253	0.684	0.522	0.578	-0.053	-3.032
Kurt.	1.956	3.333	2.535	2.040	2.500	4.028	2.468	2.094	2.138	1.535	10.711
JB	2.197	5.622	1.392	2.413	5.584	12.244	3.594	3.188	3.469	3.592	16.042
Prob.	0.333	0.160	0.498	0.299	0.061	0.002	0.165	0.203	0.176	0.165	0.000
Obs.	40	40	40	40	40	40	40	40	40	40	40

Time series analyzes generally begin with unit root tests in which variables are investigated whether they are stationary or not. Since regression estimates obtained by using non-stationary data set may cause spurious regression problems, it is very important to perform unit root tests. In addition, the variables used in analyzes are expected to be stationary at different levels in order to conduct NARDL analysis. In this context, Table 3 shows the results of ADF and PP unit root tests.

The results of the ADF and PP unit root tests shown in Table 3 point out the different levels of stationary of the variables. The fact that the variables are stationary at different levels indicates that NARDL analysis can be applied to test whether long-term relationships are valid or not. In this analysis, optimum lag lengths should be determined. Since the data set of the study consists of annual periods, the maximum lag length is taken as 9 and the SIC values for each lag are calculated. In order to obtain robust results, the Breusch-Godfrey test is employed for determining the presence of autocorrelation in the error terms. In this context, Table 4 shows the calculated SIC values to determine the appropriate lag lengths and autocorrelation test results.

Table 3

The Results of ADF and PP Unit Root Test

ADF Unit Root Test

Variable	Constant		Constant&Trend		Without Constant&Trend	
	Level	First Difference	Level	First Difference	Level	First Difference
I_K	-1.007(0)	-6.806(0)***	-2.701(0)	-6.739(0)***	-2.969(0)***	-
I_L	-0.226(0)	-7.092(0)***	-1.681(0)	-7.099(0)***	1.775(0)	-6.549(0)***
Trade	-1.915(0)	-5.730(0)***	-4.426(1)***	-	1.100(0)	-5.525(0)***
ToT	-2.136(0)	-6.772(0)***	-2.718(0)	-5.013(2)***	-0.582(0)	-6.852(0)***
Globalization	-2.711(0)*	-	-3.253(0)*	-	-1.911(0)*	-
FDI	-2.177(0)	-5.770(0)***	-2.806(0)	-5.702(0)***	-1.208(0)	-5.840(0)***
Migration	0.789(0)	-5.649(0)***	-1.505(0)	-5.994(0)***	1.884(0)	-5.268(0)***
Inflation	-2.446(0)	-8.489(0)***	-2.493(0)	-8.268(0)***	-2.241(0)**	-
Tax	-1.509(0)	-6.025(0)***	-1.555(0)	-5.963(0)***	-0.274(0)	-6.109(0)***
Public	-1.014(0)	-5.342(0)***	-2.067(0)	-5.275(0)***	0.577(0)	-5.262(0)***
Technology	-6.828(0)***	-	-6.785(0)***	-	-6.520(0)***	-
Critical Values	*: -2.606 **: -2.936 ***: -3.605	*: -2.606 **: -2.936 ***: -3.605	*: -3.198 **: -3.533 ***: -4.219	*: -3.198 **: -3.533 ***: -4.219	*: -1.611 **: -1.949 ***: -2.624	*: -1.611 **: -1.949 ***: -2.624

PP Unit Root Test

Variable	Constant		Constant&Trend		Without Constant&Trend	
	Level	First Difference	Level	First Difference	Level	First Difference
I_K	-0.987(3)	-6.887(2)***	-2.658(2)	-6.817(2)***	-3.687(2)***	-
I_L	-0.034(3)	-7.092(0)***	-1.512(2)	-7.116(0)***	2.255(2)	-6.545(3)***
Trade	-1.795(2)	-7.146(0)***	-3.398(2)*	-	2.050(2)	-5.630(0)***
ToT	-2.069(2)	-8.173(2)***	-2.689(3)	-8.615(1)***	-1.032(3)	-7.851(1)***
Globalization	-2.628(3)*	-	-3.251(2)*	-	-1.626(3)*	-
FDI	-2.045(2)	-9.415(3)***	-2.638(1)	-9.972(1)***	-1.065(3)	-7.770(3)***
Migration	1.186(5)	-5.630(0)***	-1.507(3)	-6.040(2)***	2.475(4)	-5.268(2)***
Inflation	-2.562(3)	-8.971(2)***	-2.783(3)	-8.425(1)***	-2.224(2)**	-
Tax	-1.535(2)	-6.025(0)***	-1.636(2)	-5.963(0)***	-0.274(0)	-6.109(0)***
Public	-1.015(0)	-5.345(0)***	-2.250(1)	-5.277(0)***	0.577(0)	-5.262(0)***
Technology	-6.824(0)***	-	-6.788(0)***	-	-6.519(1)***	-
Critical Values	*: -2.607 **: -2.938 ***: -3.611	*: -2.609 **: -2.941 ***: -3.615	*: -3.196 **: -3.529 ***: -4.211	*: -3.199 **: -3.535 ***: -4.220	*: -1.612 **: -1.951 ***: -2.625	*: -1.615 **: -1.953 ***: -2.627

Note: In ADF test, the values in parentheses reflect the optimum lag length of the variable and these values are obtained according to the SIC over a maximum of 9 lag lengths. In the PP test, the values in parentheses show the Bandwith values and these values are the optimum lag lengths which are determined based on Newey-West criteria. *, ** and *** show that the variable is stationary at 10%, 5% and 1% significance level, respectively.

Table 4

Optimum Lag Lengths of the Regression Models

The Regression Equation Numbered (5)						The Regression Equation Numbered (6)					
n	**SIC**	**BG(p)**	**n**	**SIC**	**BG(p)**	**m**	**SIC**	**BG(p)**	**m**	**SIC**	**BG(p)**
1	-5.537	0.074*	6	-4.738	0.191	**1**	**-6.000**	**0.418**	6	-5.617	0.014*
2	**-5.593**	**0.704**	7	-5.484	0.001***	2	-6.019	0.036**	7	-5.496	0.005***
3	-5.162	0.007***	8	-5.072	0.008***	3	-5.418	0.025**	8	-5.010	0.004***
4	-5.096	0.002***	9	-4.563	0.001***	4	-5.894	0.003***	9	-4.990	0.007***
5	-5.457	0.001***				5	-5.203	0.083*			

Not: The n and m terms refer to the lag lengths in the regression models numbered (5) and (6), respectively. SIC and BG are Schwarz Information Criteria and Breusch-Godfrey LM Autocorrelation Test, respectively. BG test results show the probability values of BG coefficients. *, ** and *** reflect autocorrelation in models at 10%, 5% and 1% significance level, respectively.

The analysis results shown in Table 4 point out that the optimum lag length for regression model numbered (5) is 2 and that of 1 for regression model numbered (6). The absence of autocorrelation in these lag lengths shows that cointegration analysis based on these lag lengths can provide robust results. In this context, the findings of NARDL cointegration analysis are shown in Table 5.

Table 5

The Results of NARDL Cointegration Analysis

The Regression Equation Numbered (5)						The Regression Equation Numbered (6)					
k	***F* Statistic**	**%5 Critical Values**		**%1 Critical Values**		***k***	***F* Statistic**	**%5 Critical Values**		**%1 Critical Values**	
		Lower Bound	**Upper Bound**	**Lower Bound**	**Upper Bound**			**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**
11	4.031***	2.06	3.24	2.54	3.86	11	3.252**	2.06	3.24	2.54	3.86

Note: k represents the number of independent variables in regression equations numbered (5) and (6). The critical values are obtained from the Table CI(iii) in the paper done by Pesaran *et al*. (2001). ** and *** show that *F* statistics are significant at 5% and 1% significance level, respectively.

The results of NARDL cointegration analysis shown in Table 5 point out that long-term linkages are valid among variables at 1% significance level in regression model numbered 5 and at 5% significance level in regression model numbered 6. In this context, it can be noted that NARDL analysis can be applied to determine short and long-term coefficients.

The short-term linkages among the variables are estimated based on the regression equations numbered (7) and (8), and the long-term linkages are estimated based on the regression equations numbered (9) and (10) using NARDL analysis and the results are presented in Table 6.

Table 6

The Results of Short and Long-Term NARDL Analysis

Short-Term Regression Model Numbered (7) NARDL(3, 0, 0, 0, 0, 2, 0, 3, 0, 0, 0)			**Short-Term Regression Model Numbered (8) NARDL(1, 0, 0, 0, 0, 0, 3, 0, 1, 0, 0, 0)**		
Variable	**Coefficient**	***t*-Stat (Prob)**	**Variable**	**Coefficient**	***t*-Stat (Prob)**
Constant (C)	-0.003	-1.369 (0.186)	Constant (C)	0.012***	3.978 (0.000)
$\Delta I_K(-1)$	0.425***	2.586 (0.003)	$\Delta I_L(-1)$	-0.379**	-2.244 (0.038)
$\Delta I_K(-2)$	0.443***	2.247 (0.008)	$\Delta Trade^+$	-0.149***	-3.128 (0.006)
$\Delta I_K(-3)$	-0.348	-1.636 (0.118)	$\Delta Trade^-$	-0.200*	-1.761 (0.093)
$\Delta Trade^+$	0.874***	2.771 (0.000)	ΔToT	0.284	0.673 (0.509)
$\Delta Trade^-$	0.192*	1.759 (0.094)	ΔGlobalization	-0.175*	-2.086 (0.052)
ΔToT	0.113**	2.211 (0.022)	ΔFDI	-0.636***	-3.175 (0.005)
ΔGlobalization	0.084*	1.763 (0.092)	ΔFDI(-1)	-0.349**	-2.097 (0.049)
ΔFDI	0.326*	1.814 (0.085)	ΔFDI(-2)	-0.188	-1.163 (0.260)
ΔFDI(-1)	-0.062	-0.337 (0.739)	ΔFDI(-3)	-0.225	-1.274 (0.223)
ΔFDI(-2)	0.004*	1.877 (0.075)	ΔMigration	-0.115**	-2.239 (0.041)
ΔMigration	0.335***	2.591 (0.002)	ΔInflation	-0.251*	-2.018 (0.059)
ΔInflation	0.240*	1.856 (0.079)	ΔInflation(-1)	-0.045	-0.975 (0.343)
ΔInflation(-1)	-0.209	-1.667 (0.111)	ΔTax	-0.126*	-1.860 (0.085)
ΔInflation(-2)	-0.302	-1.656 (0.115)	ΔPublic	0.045*	1.775 (0.091)
ΔInflation(-3)	-0.313	-1.661 (0.113)	ΔTechnology	-0.229***	-3.001 (0.007)
ΔTax	-0.116**	-2.198 (0.027)	EC(-1)	-1.379***	-3.162 (0.000)
ΔPublic	0.228**	2.226 (0.019)			
ΔTechnology	0.441***	2.663 (0.000)			
EC(-1)	-2.217***	-5.142 (0.000)			
Statistics of the Model			**Statistics of the Model**		
R^2: 0.663			R^2: 0.741		
F (Prob): 2.493**(0.031)			*F* (Prob): 5.661*** (0.000)		
DW: 1.766			DW: 1.711		
BG(2): 2.172 (0.337)			BG(3): 3.229 (0.120)		
ARCH(2): 3.307 (0.411)			ARCH(3): 4.248 (0.235)		

Long-Term Regression Model Numbered (9) NARDL(2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0)			**Long-Term Regression Model Numbered (10) NARDL(4, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0)**		
Variable	**Coefficient**	***t*-Stat (Prob)**	**Variable**	**Coefficient**	***t*-Stat (Prob)**
Constant (C)	0.550***	4.240 (0.000)	Constant (C)	-0.150***	-2.958 (0.008)
$I_K(-1)$	0.310**	2.127 (0.044)	$I_L(-1)$	0.206***	3.573 (0.000)
$I_K(-2)$	-0.232	-1.325 (0.198)	$I_L(-2)$	0.236*	1.874 (0.077)
$Trade^+$	0.387**	2.500 (0.020)	$I_L(-3)$	-0.402	-1.028 (0.317)
$Trade^-$	0.121*	1.861 (0.077)	$I_L(-4)$	0.133	0.978 (0.331)
ToT	0.151**	2.131 (0.042)	$Trade^+$	-0.193***	-3.843 (0.000)
Globalization	0.116*	1.759 (0.094)	$Trade^-$	-0.893*	-1.754 (0.096)
FDI	0.572**	2.257 (0.033)	ToT	0.115	1.093 (0.288)
Migration	0.412***	2.641 (0.002)	Globalization	-0.111*	-1.843 (0.079)
Inflation	-0.301***	-3.316 (0.000)	FDI	-0.103**	-2.232 (0.041)
Tax	-0.111**	-2.249 (0.037)	FDI(-1)	-0.122	-3.157 (0.000)
Public	0.318***	3.114 (0.000)	FDI(-2)	-0.049*	-1.839 (0.082)
Technology	0.585***	3.525 (0.000)	FDI(-3)	0.074	0.251 (0.803)
			FDI(-4)	0.007	0.192 (0.886)
			Migration	-0.182*	-1.886 (0.075)
			Inflation	-0.346**	-2.315 (0.032)
			Inflation(-1)	-0.303***	-3.049 (0.006)
			Tax	-0.167**	-2.299 (0.035)
			Public	0.094	0.248 (0.826)
			Technology	-0.313**	-2.776 (0.016)

Statistics of the Model	Statistics of the Model
R^2: 0.778	R^2: 0.870
F (Prob): 4.273***(0.000)	*F* (Prob): 3.022***(0.000)
DW: 1.895	DW: 2.011
BG(2): 2.159 (0.341)	BG(1): 0.277 (0.598)
ARCH(2): 0.941 (0.624)	ARCH(2): 0.836 (0.360)

Note: Δ is the difference operator. The values in parentheses represent the lag lengths of the variable. Regression models are analyzed by considering SIC criteria over maximum 9 lag lengths. BG refers to the Breusch-Godfrey autocorrelation test and ARCH stands for the White variance test, and the values in parentheses of these test statistics show the probability values. EC is the error correction mechanism obtained from the cointegration analysis. *, ** and *** show that the variable is statistically significant at the 10%, 5% and 1% significance level, respectively.

The short-term analysis results shown in Table 6 indicate that increases in the previous period income of capital increase the current period income. However, increases in labor's income in the previous period reduce the current period income. This phenomenon can be interpreted as the income gap between capital and labor increases in favor of capital. On the other hand, an increase in trade volume raises the income of capital (0.874), while it decreases the income of labor (-0.149). This result point out that the Stolper-Samuelson theorem, suggesting the idea that liberalized foreign trade increases the income of the abundant factor in a country, is not valid in the case of Turkey. The result expected from the theorem is that foreign trade raises the income of labor which is the abundant factor in Turkey and decreases the income of capital which is the scarce factor. In this context, it can be said that foreign trade increases the income gap among factors in favor of capital owners and that the result contradicts the predictions of the theorem. In addition, a decrease in trade volume raises the income of capital (0.192), while it decreases the income of labor (-0.200). This result can be expressed as the difference between factor incomes gradually increases with foreign trade in favor of capital. Besides, the positive effect of an increase in terms of trade on the income of capital can be considered that foreign trade increases the inequality among factor incomes.

The results of the analysis showing that economic globalization increases the inequality among factor incomes in favor of capital reveal that foreign direct investments accelerate the inequality process. It has been observed that migrations, which cause the labor supply to increase and the wage level to decrease, increase the size of income inequality and inflation has been found to reduce the income level of fixed income earners and to increase the income of capital owners. In this context, it can be said that migration and inflation are the main factors that create inequality among factor incomes. Furthermore, while an increase in tax rates decreases the income of both factors, it gives rise to the further decrease in the income of labor can be considered that it causes the increase in dimensions of income inequality. Similarly, while an increase in government expenditures increases the income of both factors, it gives rise to the further increase in the income of capital can be interpreted that it causes the increase in income inequality.

Lastly, the fact that increases in total factor productivity decrease labor income and increase capital income can be interpreted as technology is a dominant factor in creating surplus value. In this context, it can be said that the technology which is a fundamental factor in the creation of relative surplus value is as an exploitation tool which is used by capital class. The fact that the coefficients of the error correction mechanism of the regression models numbered (7) and (8) are negative and statistically significant indicates that short-term imbalances can be eliminated in the long-term.

The long-term analysis results shown in Table 6 point out that increases in the previous period income of both factor increase the current period income levels. However, income equality continues to increase in the long run as the increase in the income of capital is much higher than that of labor. On the other hand, an increase in trade volume raises the income of capital (0.387), while it decreases the income of labor (-0.193). This result notes the invalidity of the Stolper-Samuelson theorem in the long-term in Turkish economy. In addition, a decrease in trade volume raises the income of capital (0.121), while it decreases the income of labor (-0.893). When moving from the short-term to the-long term, the negative effect of foreign trade on labor income intensifies and it can be interpreted as the extent of income inequalities exacerbates in the long-term. On the other hand, the persistence of the positive effect of terms of trade on capital income in the long-term is an indicator that the inequality among factor incomes continues.

The analysis findings showing that economic globalization and foreign direct investments increase income inequality in favor of capital reflect that inflation is the other factor that increases the dimension of income inequality. In addition, it has been observed that migration has increased the inequality among factor incomes and that the destructive effect of increases in tax rates on labor income is dominant in the long-term. The analysis findings showing that increases in government expenditures raise the income of the capital class reflect that technological development is one of the main factors which increases the relative surplus-value and therefore income inequalities.

In summary, it can be said that the inequality between capital and labor incomes has increased in favor of capital both in the short and long run, and foreign trade exacerbates this process. However, the fact that public policies are not used in a way to eliminate the inequality among factor incomes can be emphasized as a result of the domination of the capital class over the economic and political structure. Therefore, as can be seen from the analysis results, it can be emphasized that the policy proposals of the Marxist school regarding trade, technology and public policies are much more valid than those of the classical school.

5. Conclusion

The main motivation of the paper is to investigate the validity of the Stolper-Samuelson theorem, suggesting the idea that foreign trade increases the price and income of the abundant factor and decreases that of the scarce factor, using NARDL analysis in the period of 1980-2019 in Turkey. The results of short and long-term analysis show that the Stolper-Samuelson theorem is not valid in Turkey. In other words, it is observed that foreign trade increases the income of capital, scarce factor, while it decreases the income of labor, abundant factor. This result is a great contrast to the theorem's predictions. In addition, it has been determined that foreign trade gradually increases the income gap among factor incomes. In this context, it can be said that while the capital class gets richer, the labor class gets poorer through foreign trade. On the other hand, it has been observed that immigration and foreign direct investments, which have been manifested themselves with globalization process, have increased the income gap among factor owners in favor of capital class. Besides, the use of technical developments as a means of increasing the relative surplus value has been identified as another factor that increases the income gap. It has also been found that public policies are not used in a way to reduce the income gap among factors.

Invalidity of the Stolper-Samuelson theorem in Turkey may stem from the reversal of factor densities. Substitution of labor, which is a low-cost factor, instead of capital in different sectors, may cause a decrease in the capital per labor force and therefore the income of labor. Increasing labor-intensity in different sectors, on the other hand, can increase the demand for capital-intensive commodities in foreign trade markets and this process may result in an increase in the income of capital. Moreover, the increasing export of labor-intensive commodities to foreign markets may cause the world price of labor-intensive commodities to decline compared to that of capital-intensive commodities. In other words, the Rybczynski effect and the immiserizing growth process first proposed by Bhagwati (1958) may have occurred. Besides, an increase in demand for capital-intensive commodities in domestic and foreign markets may lead to raise the income of capital. In addition to all these findings, the insufficiency of unionization rates and the ineffectiveness of existing labor unions in Turkey may be the reason for the negative effect of foreign trade on the share of labor from national income. Also, the concentration on certain commodity groups in foreign trade and the high relative weight of intra-industry trade in terms of these commodity groups may have affected the share of labor from national income.

Besides, the fact that foreign trade increases the income gap among factors may reveal the possibility of realization of the predictions of Marxist theories. Especially in foreign trade with developed countries, the sale of high labor-intensive

commodities at low world prices and the purchase of low labor-intensive commodities at high world prices proves the emergence of unequal change. This finding can be confirmed from the analysis results which show the fact that terms of trade indicate a process decreasing the income of labor and increasing the income of capital. In addition, deregulation of markets with the globalization process and the ability of capital to freely direct investments that can generate the highest profit may widen the income gap between labor and capital. In this context, the rearrangement of deregulated markets within the framework of certain trade rules may be important in terms of ensuring justice in income distribution. Moreover, the exploitation of labor force through the migration channel, which is the main product of capitalist hegemony, requires the structuring of labor markets. Therefore, preventing the use of flexible and deregulated labor markets as capitalist exploitation tools is of great importance in preventing income injustice. Furthermore, ensuring tax justice and applying taxes in a way to close the income gap between labor and capital may be considered as a factor that can prevent income injustice. Likewise, not using public expenditures to protect the interests of the capital class, and therefore, public policies that are carried out independently of the capital class can be effective practices in eliminating income inequality. Finally, the use of technology as a tool to allow the overall development of society and the abolition of ruthless growth, rather than as a factor that promotes labor exploitation, may improve functional income distribution. Otherwise, technology will continue to reveal the gravediggers of capitalism, as Marx stated.

6. Discussion

This study showing that foreign trade decreases the income of labor, which is the abundant factor, and increases the income of capital, which is the scarce factor, point out the invalidity of the Stolper-Samuelson theorem in Turkey. It can be noted that there are many studies in both national and international literature that test the validity of this theorem. However, it is seen that the findings obtained in some studies in the literature correspond with the results of this study. The results of the studies conducted by Meschi and Vivarelli (2007), Ghazali (2009), Gourdon (2011), Huandg *et al*. (2011), Bensidoun *et al*. (2011), Bhanu and Ekta (2014), Oransay (2016), Dorn *et al.* (2017), Barusman and Barusman (2017), Basco *et al*. (2020), Ercan (2020) and Topuz and Dağdemir (2020) show that the Stolper-Samuelson theorem is invalid, and these findings are similar to those of this paper.

However, the studies by Shinkai (2000), Chakrabarti (2000), Chiquiar (2004), Değer (2006), Jakel and Smolka (2011), Amjad (2015), Roser and Cuaresma (2016) and Hazama (2017) concluding that the Stolper-Samuelson theorem are valid contradict the results of this paper. One of the main reasons for the differentiation

of results is due to the econometric methods considered. Studies in the literature differing from the findings of this paper, generally used various kinds of econometric methods such as panel data, cross-section and probit analysis. In this study, focusing on time series analysis to test the theorem may have caused the results to differ. In addition, the fact that the time period considered in the applied studies in the literature is different than that of in this paper can be considered as the reason for the differing findings. While studies in the literature, which differ from the results of this paper, focus on the period of 1960-2010, this paper concentrates on the period of 1980-2019. Besides, some of the control variables used by the studies in the literature to test the theorem may have caused the findings to vary. In these studies, the separation of skilled and unskilled labor, including the economic growth variable in the analysis, focusing on regional differences in the context of foreign trade, concentrating on population growth rates, taking into account democratization tendencies, examining the education level of the labor force, considering the power of labor unions and investigating the structure of foreign trade according to country groups may be the basis of the differences in econometric results.

As emphasized before, the advantage of this study compared to other studies in the literature is that it examines the effect of foreign trade on both labor and capital incomes separately. In addition, examining the asymmetric effect of foreign trade on factor incomes due to cyclical fluctuations is one of the distinctive features of this study. In particular, on the contrary to this paper, not to have been discussed of the theorem inclusively before, can be assessed as a direct contribution to the literature. In this context, this study can be a guide for future studies that take into account the asymmetric relationships between variables. Besides, in the light of examining the relationships between foreign trade and income distribution, adding enough control variables to detail the subject can be a reference for future studies. However, it should be noted at this point that the results of the analysis may differ according to the country, country groups, time period, data set and econometric models. In this context, expanding the scope of this study by adding new data set and variables such as social and political as well as economic indicators, and applying new econometric techniques may be useful in terms of explaining the theorem in a more comprehensive way.

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Özet

Dış ticaret faktör gelirleri arasındaki eşitsizliği ortadan kaldırır mı? Stolper-Samuelson Teoremi'nin Türkiye ekonomisi üzerine testi

Bu çalışmanın temel amacı, Stolper-Samuelson teoreminin geçerliliğini Türkiye ekonomisi itibariyle 1980-2019 dönemi için lineer-olmayan (asimetrik) ARDL analizini kullanarak incelemektir. Kısa ve uzun dönemli analiz sonuçları, Türkiye'de Stolper-Samuelson teoreminin geçerli olmadığını göstermiştir. Bir diğer ifadeyle, dış ticaretin, bol faktör olan emeğin gelirini azaltırken, kıt faktör olan sermayenin gelirini artırdığı gözlenmiştir. Bu nedenle, dış ticaretin faktörler arasındaki gelir açığını sermaye lehine olacak şekilde gittikçe artırdığı belirtilmiştir. Bu kapsamda, dış ticaret kanalıyla birlikte sermaye sınıfının gittikçe zenginleşeceği, işgücü sınıfının ise gittikçe yoksullaşacağı söylenebilmektedir. İlaveten, kamusal politikaların faktör gelirleri arasındaki eşitsizliği artırdığını gösteren analiz bulguları, ekonomik küreselleşme süreci, doğrudan yabancı yatırımlar, ülkeye yönelen dış göçler, enflasyon seviyesi ve toplam faktör verimliliğinin gelir açığı üzerinde artırıcı bir etkiye sahip olduğunu yansıtmıştır.

Anahtar kelimeler: Stolper-Samuelson Teoremi, Gelir Eşitsizliği, Dış Ticaret, Doğrusal-Olmayan ARDL Analizi

JEL sınıflandırması: C32, E25, F11, F14, F16.