Reconsidering the Stolper–Samuelson Theorem: Empirical Evidence from Developing Countries

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Abstract. Studies measuring the impacts of the COVID-19 pandemic remain limited in the empirical literature. For this reason, this study estimated the determinants of income distribution for labor and non-labor production factors in the period 2014-2022 within the framework of the Stolper-Samuelson (SS) Theorem. Regarding the sample and methodology, developing and labor-intensive countries were selected, and panel data analysis was employed. The results indicated that income distribution in the reference countries changed in the disadvantage of the labor factor. In addition, the inflation rate also declined the income share of labor in the Gross Domestic Product. Contrary to this, while trade openness and inflation data increased the income share of other production factors; no significant effect was found from foreign direct investments. Although the findings did not fully support the Theorem, they aligned with the realities of an exceptional period. Therefore, to protect labor welfare during inflationary periods, it is recommended that economic policies consider the relative income share of labor, while taking its real value into account.

Keywords: The Stolper Samuelson theorem, ıncome distribution, trade openness, developing countries, COVID-19 outbreak.

1. Introduction

In recent decades, research on the long-term trends of income inequality has garnered increasing attention and has become a central focus of economic discourse (Roikonen, 2022, p. 234). Reduction of income inequality is among the most important agendas to achieve the goals of sustainable development (Barak, 2022, p. 62) and income distribution is a critical issue of concern for countries across all levels of development. Thus, the distribution of total income among production factors has been a prominent topic of debate among researchers and policymakers (Artan Kalaycı, 2014, p. 69). Fundamental issue driving these discussions is a growing concern worldwide regarding the declining share of income allocated to labor factor as compared to other production factors. While the income share of labor has increased in certain periods with the specific social policies,

the prevailing trend remains that the growth in labor income lags behind other production factors. Statistically, although income inequality between countries has improved since the 1990s, income inequality within countries has become worse. What concerns the current situation, 71 percent of the people world population still live in countries where income inequality has increased. Since 1990, income inequality has risen in many developed nations as well as in some middle-income countries, such as China and India (The United Nations, 2020, p. 1). As inference, poverty and income insecurity remain prevalent challenges in contemporary societies (Gabnytė-Baranauskė, 2024, p. 6).

Recent studies examining the effects of changes in economic and structural conditions on income inequality continue to keep the dynamism of this discourse alive within the academic literature as the issue directly influences societal wealth and highlights a fundamental tension between two key economic forces. Fair distribution of income is as crucial as ensuring sustainability in production and economic growth. While income inequality was relatively less pronounced between individuals and regions in agricultural societies, it has progressively increased since the Industrial Revolution (Artan & Kalaycı, 2014, p. 70). In economics, while there are numerous factors contributing to the prominence of income distribution inequality, some of them are particularly influential. For example, the relationship between economic growth and income distribution, as a concept, articulated by Kuznets (1955), was introduced into the economic literature within the 'Kuznets Curve'. One of the key factors driving the observed trends in inequality is the disproportionate growth in labor market returns (Garcia-Luzao & Tarasonis, 2021, p. 31; Černiauskas et al., 2020).

The theoretical background of the topic actually points out to more factors which have significant impacts on income distribution. One of the most significant and robust trends since the 1980s has been the increase in income inequality observed in both developed and developing nations (Heimberger, 2020, p. 2960). While numerous factors affect the income inequality, the changes toward commercial liberalization in the 1980s and financial liberalization in the 1990s intensified global interconnections, such that economic crises originating in one country now have the potential to affect economies worldwide. This process made trade openness/international trade one of the key factors affecting income distribution (İşcan & Demirel, 2024, p. 2). Traditionally, the studies about economy clarified the benefits of trade openness (Nami et al., 2024; Dollar & Kraay, 2003; Helpman & Krugman, 1987). As an addition to this advocating, there is another reality that the richest countries in the world are also the countries which have the highest trade volumes (The World Bank, 2023), which is not a coincidence. However, despite the benefits of globalization, some studies emphasized that trade openness accelerated income inequality, and the gains from globalization will not be evenly shared (Milanovic, 2016, p. 239). Therefore, the central question in this context is how the new income level, generated under open economy conditions, will be distributed between labor and non-labor factors' income. The Heckscher-Ohlin model, one of the Classical theoretical approaches, examines the relationship between trade openness and the distributional outcomes within markets. This approach explains the inequality effects of international trade based on differences

in productivity and the relative factor endowments of countries, as well as the degree to which individuals rely on income from these factors. Countries tend to specialize in the production of goods that utilize their abundant factors of production, and subsequently export these goods when they engage in international trade (Dorn et al., 2022, p. 203; Ohlin, 1933). The Stolper–Samuelson Theorem, derived from the Heckscher-Ohlin model, explains that trade-induced changes in relative product prices lead to an increase in the real returns to factors that are intensively used in the production of export goods that are abundant in a given economy, while reducing the returns to other factors. Consequently, the factors of production that are abundant in a country stand to gain from international trade, while scarce factors tend to lose. In advanced economies, where capital and skilled labor are relatively abundant, trade is expected to exacerbate income inequality and concentrate the income at the top. Conversely, in developing countries, where unskilled labor is more intensively employed in domestic production, trade liberalization is anticipated to raise wages for this group (Stolper & Samuelson, 1941). The liberalization of the economy through international trade will lead to a higher demand for unskilled labor, which is relatively abundant in the economy. As the specialization in trade boosts factor-intensive industries that typically rely on abundant resources, this will result in higher real wages for unskilled workers and help reduce income inequality (Cengiz & Demir, 2023, p. 17).

In light of the foregoing discussions, *the primary goal of this study* is to explore the relationship between trade openness and income distribution. Also, the research aims to provide two significant contributions to the existing literature. Firstly, it utilizes a sample of six developing countries for the period from 2014 to 2022 and incorporates the global COVID-19 pandemic. The impact of the outbreak is accounted in the reference model by using a dummy variable. The second contribution attempts to fill the gap in literature regarding income distribution by considering the role of two distinct production factors. While most previous empirical models relied on the *Gini* coefficient to measure income inequality, this metric fails to capture the dynamics of income distribution. Contrary to this, by examining the income shares of labor and non-labor factors as percentages of the *Gross Domestic Product* (GDP), this study offers a more nuanced understanding of how the income levels of production factors are affected by international trade and how their shares change.

The general design of the study is outlined as follows: The introduction provides an overview of the significance of this research and a review of relevant theoretical frameworks. The second section presents a review of previous empirical studies and identifies gaps in the existing literature. In the third section, the empirical analysis is examined by comprising the model, methodology, and key findings. Finally, the fourth section concludes with a discussion of the results and offers recommendations.

2. Empirical Literature Review

The empirical literature consists of numerous studies which examined the effects of various factors on income distribution. Development of welfare-enhancing discourses in international trade with the factor endowments caused that income distribution appeared as a

significant area of inquiry. Empirical studies on this topic are largely focused on testing the theoretical frameworks previously outlined. Consequently, the relationship between trade openness and income distribution has become a central and prominent subject.

A literature review can be categorized into two distinct groups, with further subdivisions based on their specific content. Before this decomposition, it should be indicated that almost all studies in empirical literature utilized the Gini coefficient as the dependent variable. Although the Gini coefficient is widely regarded as the most prominent indicator of income inequality, it includes some limitations. One major limitation is its lack of detailed information, which introduces uncertainty even when changes in income inequality are measured. The Gini coefficient can be influenced by various factors, both positively and negatively, but it only provides a general indication of whether inequality is increasing or decreasing. However, it does not allow for the identification of how income inequality is specifically affected by labor or other factors.

As for the evaluation of empirical studies, it can be indicated that there is no perspective that would present consensus for the validity of a significant relationship between trade openness and income inequality/distribution. There are many studies which do not support this theoretical background. This inconsistency can be justified with many reasons such as the country type, reference years, variables, or short-long run. *The first group papers* which supported the Stolper–Samuelson Theorem, here represented by Axel and Noel (2006), researched the globalisation and income inequality nexus for developed and developing 156 countries. Results of the study showed that industrial wage inequality (the Gini coefficient) in OECD countries rises with globalisation, but no significant evidence can be generated for other countries. In another study, Artan and Kalaycı (2014) investigated the same issue by using a dataset for developing and developed countries. Findings from panel data analysis presented that trade openness decreased income inequality in developing countries. Roser and Cuaresma (2016) showed with their study that trade openness increases income inequality for developed countries, Furthermore, Acaravcı et al. (2018) indicated that a causality relationship between income distribution and trade openness is possible in Balkan countries. For Türkiye, similarly, Ercan (2020) obtained a strong causality relationship between trade openness and income inequality. Another study looking into Turkish economy by Akıncı (2021) rejected the validity of the SS Theorem for the period of 1980–2019. Other studies which provided coherent results for the SS Theorem (or did not reject it) can be listed as Dorn et al. (2022), Naanwaab (2022), Cengiz and Demir (2023), Cota et al. (2024), İşcan and Demirel (2024), and Nami et al. (2024).

In the *second group of studies*, both significant-reverse and insignificant results were obtained. From those studies, Milanovic and Squire (2005) clarified that tariff reduction leads to higher inter-occupational and inter-industry inequality in poorer countries during the years covering the period of 1980–2020. This is unexpected evidence for reference countries. Also, Meschi and Vivarelli (2009) tested the SS Theorem for 65 developing countries and unveiled the result that income distribution worsens as a result of international trade. Furthermore, Artan and Kalaycı (2014), in a study from the first group, indicated

another finding: they concluded that trade openness decreased the income inequality in the reference developed countries. According to Agusalim and Pohan (2018)'s results, trade openness had no significant effect on income inequality in Indonesia, albeit it affected income inequality negatively in the short run. Moreover, Topuz and Dağdemir (2020) focused on the 1987–2016 period for Türkiye and determined that income inequality was reduced by trade openness, yet, nevertheless, trade openness had a significant and positive effect on the income inequality in the long run. With this regard, other studies of interest are Cornia (2003), Dorn et al. (2022), Xu et al. (2021), Naanwaab (2022), Cota et al. (2024), Sarıgül (2024), İşcan and Demirel (2024), and Nami et al. (2024) in terms of empirical literature.[1]

In the literature review, two distinct groups of studies were examined, which were categorized based on the general summaries of the results from previous research. The Stolper–Samuelson Theorem, which forms the central hypothesis of this study, demonstrates variability in its validity across different time periods and countries of reference. The complex nature of income distribution, influenced by various economic factors, suggests that determinants of income distribution are not solely shaped by economic variables. Moreover, differences in measurement methodologies can help to clarify the divergent findings in the literature. A key gap in the existing body of research is the lack of studies that investigate the relationship between income distribution and trade openness separately, while considering the income shares of labor and non-labor factors by considering the COVID-19 outbreak. Until today, no research appears to have employed factor decomposition in this context, and the current empirical literature does not provide specific insights into changes in income distribution. In response to this gap, this study aims to analyze the re-distribution of income between labor and non-labor factors in several developing countries. Furthermore, it also seeks to determine the impact of the COVID-19 pandemic, which significantly disrupted global economies in 2020 as well as income sharing.

3. Empirical Analysis: Models, Procedures, Findings and Discussions

This section covers the empirical analysis of trade openness and the income distribution nexus with an extended model for developing countries. For this purpose, firstly, a reference model was introduced, and, for this model, all procedures that were required for an empirical model that showed reliable and unbiased estimation results were applied.

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[1] Some of the previous studies were shown twice in the literature review. The reason why they were placed into two groups was related to the contents of the papers. Some papers, for example, Dorn et al. (2022), Naanwaab (2022), and İşcan and Demirel (2024) investigated the SS approach for different types of countries or groups and they found different results according to reference samples. Additionally, Nami et al. (2024) found different results in the short and long run. On the other hand, the current classification was chosen to construct a concise and effective literature review on the subject. In case of the need to access details about previous studies, the references section can help to find more content of relevance.

3.1. Empirical Model

To assess the validity of the assumptions underlying the Stolper–Samuelson approach, two empirical models were constructed, incorporating four variables across six developing countries. The countries included in the study are Türkiye, Mexico, Brazil, Belarus, Georgia, and Ecuador, all of which are classified as developing economies (Worlddata. info, 2015). Furthermore, with respect to their endowments, the reference countries are predominantly labor-intensive economies. These factors collectively justify their inclusion in the model, given their shared economic characteristics. In empirical models, the first variable is a dependent variable symbolizing the income share of labor and non-labor factors in the total income. Other variables are trade openness, foreign direct investments, inflation, and dummy – they are independent variables. Foreign direct investments, inflation and dummy variables are used as *control variables*. The selection of control variables is motivated by their prevalence in the empirical literature, where they are widely regarded as the most common indicators.

Table 1. Name, Source and Definition of Variables in the Empirical Model

Variable Name	Data Source	Variable Definition
Labor income share as a percent of GDP (%)	The International Labour Organization (ILO) (2024)	It is derived from Sustainable Development Goals (SDG) indicators.
Non-labor factors' income share as a percent of GDP (%)	Author's calculation with the International Labour Organization (ILO) (2024)	It is derived from Sustainable Development Goals (SDG) indicators and represents the remaining part of total income after labor's share.[2]
Trade (% of GDP)	The World Bank (2024)	*"Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product"*
Foreign direct investment, net inflows (% of GDP)	The World Bank (2024)	*"Foreign direct investment are the net inflows of investment to acquire a lasting management interest in an enterprise operating in an economy"*
Inflation, consumer prices (annual %)	The World Bank (2024)	*"Inflation, as measured by the consumer price index"*
COVID-19$_{dummy}$	Author's compilation	It represents the effects of the COVID-19 outbreak.

Source: The table was prepared by the author.

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[2] The statistics provided by the **International Labour Organization (ILO–2024)** do not include capital share as a percentage of GDP. As far as it can be reasonably known, the **World Wealth and Income Database (WID)**, which provides these data, has not updated its dataset beyond 2017. Consequently, another income cluster called non-labor factors' income was created, and income data for other production factors were employed as the remaining portion of GDP after labor's share. Namely, in order to prevent any doubt, the distinction for income types was classified as labor and non-labor factors.

In the model, the labor income share as a percent of GDP (%), non-labor factors' income share as a percent of GDP (%), trade (% of GDP), foreign direct investment, net inflows (% of GDP) and Inflation, consumer prices (annual %) variables were symbolized with LBR, NLBR, TROP, FDI and INF, respectively. Furthermore, the model included the COVID-19 indicator as a dummy variable. In this manner, the values of all variables were transformed into their logarithmic forms to ensure homogeneity in the model for analysis. In this context, final forms of the empirical models and their hypothesis were obtained as shown in Equations 1 and 2, and the descriptive statistics for the variables of the model are given in Table 2.

Model 1: $LLBR_{it} = a + bLTROP_{it} + cLFDI_{it} + dLINF_{it} + COVID\text{-}19_{dummy} + u_t.$ (1)

$i = 1…..6$
$t = 2014….2022$

Null Hypothesis: Trade openness increases the income share of the labor factor in GDP.
Alternative Hypothesis: Trade openness decreases or does not affect the income share of the labor factor in GDP.

Model 2: $LNLBR_{it} = a + bLTROP_{it} + cLFDI_{it} + dLINF_{it} + COVID\text{-}19_{dummy} + u_t.$ (2)

$i = 1…..6$
$t = 2014….2022$

Null Hypothesis: Trade openness decreases the income share of the non-labor factors in GDP.
Alternative Hypothesis: Trade openness increases or does not affect the income share of non-labor factors in GDP.

Table 2. Descriptive Statistics for the Variables

Variable	Observation number	Mean	Standard Deviation	Minimum Value	Maximum Value
LBR	54	47.87489	9.659423	28.879	61.416
NLBR	54	52.12511	9.659423	38.584	71.121
TROP	54	74.32773	33.49305	24.31973	139.3934
FDI	54	3.27772	2.795194	.6036827	11.71837
INF	52	7.788659	10.10911	-.3388724	72.30884

Note. Values are shown in a non-logarithmic form.[3]

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[3] The presence of a negative value in the original inflation data is noteworthy. Also, it is well-known that data with negative values cannot be transformed logarithmically. As a result, two years of inflation data for Ecuador were excluded from the model. However, since these values were not consecutive, and as their removal did not reduce the total sample size below the minimum required for analysis, this exclusion did not cause any problem for the application of the model.

The descriptive statistics reveal that the minimum value for the income share as a percentage of GDP is 28.87%, observed in Türkiye, while the maximum value is 61.41%, as recorded in Brazil. In contrast, the distribution of non-labor income share of GDP is reversed. Belarus exhibits the highest level of trade openness, while Brazil's economy ranks the lowest in this regard. Foreign direct investment inflows are highest in Georgia, with Ecuador is receiving the smallest share. Regarding inflation rates, Türkiye leads the group, while Ecuador is positioned at the lowest end. When considering trade openness and income share of GDP together, it is notable that Brazil, which is the least open economy, has the highest labor income share as a percentage of GDP. This observation *intuitively* suggests a potential negative relationship between trade openness and labor income share in certain economies. However, this alternative hypothesis absolutely requires empirical validation.

3.2. General Evaluation of Empirical Procedure

An empirical analysis must demonstrate the ability to assess the validity of various assumptions to yield reliable results. It is essential to select the proper methods and tests before evaluating these assumptions. In this study, panel data analysis was employed, and its advantages can be summarized with several titles. Firstly, panel data analysis includes both time series and cross-section analysis. It also considers individual heterogeneities and provides more examination in terms of the tuning dynamics and unveils effects that cannot be detected in only time series or cross-sectional data. Additionally, panel data models answer the requirement of applying complex behavioral models (Baltagi, 2005, p. 4–7). Finally, the panel data analysis increases the efficiency of econometric results by making corrections between explanatory variables in research (Hsiao, 2003, p. 3).

In the next step, the reference model was subjected to various diagnostic tests to ensure the reliability and robustness of the analysis. They consist of (i) the presence of unit and/ or time effect, (ii) the selection of an effective model, (iii) the validity of normal distribution assumption, (iv) multicollinearity, and (v) autocorrelation, heteroscedasticity and cross-section dependency tests. The presence of unit and/or time effect was checked by the F test (Güriş, 2018, p. 36). For autocorrelation, Durbin-Watson and Baltagi-Wu, and for heteroscedasticity, Levene, Brown and Forsythe tests were applied, respectively, while the cross-section dependency test was chosen as Friedman-Pesaran-Frees (Yerdelen Tatoğlu, 2020, p. 250–259). In the condition of validity of the normality assumption, D'Agostino et al. (1990) and for detecting the multicollinearity problem Variance Inflation Factor (VIF) approach was utilized (Yerdelen Tatoğlu, 2020, p. 260). In the final process, regression analysis results were estimated by Driscoll-Kraay (1990) and Prais-Winsten (1954) standard errors estimators.

3.3. Empirical Findings

In the empirical analysis, firstly, the F test results were obtained. The F-test checks whether the reference model contains unit and/or time effects or not. In this context, under the assumption that the model does not contain unit and/or time effects, the F test statistics and results are shown in Table 3.

Table 3. F Test Results

Model	Test Statistics	Probability Values	Results
$LLBR_{it} = a + bLTROP_{it} + cLFDI_{it} + dLINF_{it} + COVID\text{-}19_{dummy} + u_t$ - (Model 1)	15.56	0.0000***	Rejection
$LNLBR_{it} = a + bLTROP_{it} + cLFDI_{it} + dLINF_{it} + COVID\text{-}19_{dummy} + u_t$ - (Model 2)	24.20	0.0000***	Rejection

Note. *** indicates that the test statistic exceeds the value at %5 critical level.

According to the F test results, the model did not show classical model characteristics and included time and/or unit effects. Therefore, the Rhausman test was used to choose one of the fixed and random effects models, whichever is effective. In Table 4, Rhausman test results are illustrated.

Table 4. Rhausman Test Results

Rhausman hypothesis	Test statistics	Probability Values	Results
Model 1	0.0000	1.0000	Unrejectable
Model 2	0.0000	1.0000	Unrejectable

Note. Both random and fixed effects confirmed the consistency assumption. The Rhausman test was used to determine the effective model.

The Rhausman test findings, which are robust to deviations from standard assumptions in the model, approved that the random effects model is effective for both models. Therefore, the analysis will proceed with the random effects model. In this direction, results from the diagnostic tests are revealed in Table 5.

Table 5. Diagnostic Analysis Results

Test Assumptions	Test Statistics	Results
The model is normally distributed	Skewness: 0.97 – Kurtosis: 0.10 Skewness: 0.99 – Kurtosis: 0.06	Unrejectable
There is no heteroscedasticity in the model	W_{10}: 0.0030 W_{10}: 0.0577 (Unrejectable)	Rejected
There is no autocorrelation in the model	Durbin Watson – Baltagi Wu: 0.78-1.26<2 (Durbin Watson – Baltagi Wu 1.02-1.42)<2	Rejected
There is no cross-sectional dependency in the model	Pesaran 0.13, Frees: <0.05 (Pesaran: 0.14, Frees<0.05)	Rejected[4]
No multicollinearity problem in the model	VIF: 1.06 (1.06)	Unrejectable

Note. The values in parentheses correspond to Model 2.

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[4] According to the Friedman test, no cross-section dependency was determined, but the Frees test indicated cross-section dependency for the two models. Therefore, in choosing regression analysis, the presence of cross-section dependency is consciously considered.

After all evaluations, the models did not include classical model features and detected time and/or unit effects, and Model 1 has autocorrelation, heteroscedasticity, and cross-sectional dependency. In Model 2, only autocorrelation and cross-sectional dependency were observed. In this case, proceeding with the Driscoll-Kraay regression analysis, which is robust against autocorrelation, heteroscedasticity and cross-sectional dependency problems, is appropriate for Model 1. Also, the Prais-Winsten regression analysis should be implemented for Model 2. Coefficients obtained from the analysis are indicated in Table 6.

Table 6. Driscoll-Kraay and Prais-Winsten Regression Analysis Results

	Model 1 Driscoll-Kraay Findings			Model 2 Prais-Winsen Findings		
	Dependent Variable: LLBR Prob>chi2: 0.0000			Dependent Variable: LNLBR Prob>chi2: 0.0041		
Indep. Variable	Coefficients	Standard Error	Prob. Values	Coefficients	Standard Error	Prob. Values
LTRD	-0.1375978	0.0356793	0.005***	0.1260973	0.0383987	0.001***
LINF	-0.0198478	0.0072445	0.025**	0.0126608	0.0069568	0.069*
LFDI	-0.0133532	0.0120536	0.300	-0.0234872	0.0186909	0.209
CVD	-0.0071826	0.0070068	0.335	0.0083653	0.0113698	0.74
Constant	4.467575	0.1393726	0.000***	3.397994	0.1537097	0.000***

Note. ***, ** and * represent the significance level at %1, %5 and %10, respectively.

The regression analysis results from Model 1 and Model 2 indicate that both models are statistically significant. The obtained Prob>chi^2 (F-statistic) values strongly reject the null hypothesis that the models are not significant. In examining the coefficients, it is evident that the labor income share of GDP is negatively associated with trade openness, whereas the income share of non-labor factors is positively associated with trade openness. In other words, an increased trade openness leads to a reduction in the share of labor in national income while simultaneously increasing the income share of other production factors. Inflation emerges as another significant factor, exhibiting effects similar to those of trade openness. Although foreign direct investment and COVID-19 data show negative and positive effects on labor and capital incomes, respectively, these effects were not found to be statistically significant. International trade elasticity of the labor income share is -0.13, and this elasticity data is 0.12 for the non-labor factors' income share. Also, a 1% increase in the inflation rate decreases the labor income share by 0.019 and increases the non-labor income share by 0.12.

It is understood that the Stolper–Samuelson approach is not valid in the context of this study, and the results supported the second group studies, such as Milanovicand Squire (2005), Meschi and Vivarelli (2009), Akıncı (2021), İşcan and Demirel (2024), etc. This conclusion is not unexpected, as the Theorem was formulated within the dynamics of a past economic period, whereas contemporary economies exhibit much greater complexity. Furthermore, the Theorem relies on assumptions that are not fully consistent with the real-

ities of modern economies. When these assumptions are set aside, it becomes evident that the research period under consideration represents an extraordinary situation. Therefore, it is anticipated that the already established theories may not hold in such periods, as the most widely accepted economic models are typically designed for more stable conditions. Furthermore, Akıncı (2021) informed that international migration and technology are a potential mechanism of increasing inequality against the labor factor in Türkiye, which is one of the reference countries of this study. International migration was defined as more labor supply, whereas technology was pointed out as a fundamental factor in the creation of a relative surplus value as an exploitation tool which was used by capital class. Therefore, the empirical literature needs more applications for models expanded with the specified factors. After all, particular attention must be devoted to the COVID-19 period, and a rigorous discussion is necessary to clarify the reference period of the study.

Economic conditions during the COVID-19 period caused a range of consequences. In particular, in order to create a recovery effect in the slowing economy, governments implemented expansionary policies in both monetary and fiscal decisions. Although these policies were useful in solving some problems, they initiated a very prominent inflation process. In fact, even if the opinion that the inflationary process was temporarily created under an optimistic atmosphere in terms of the economy, in practice, it caused the problems to deepen. It brought about emphatically more serious problems, especially in economies experiencing capital shortages. Income distribution is directly affected by inflationary environment in developing countries. Additionally, inflation data per country do not reflect the increase in the prices of goods and services consumed by the majority of its consumers. This causes an inconsistency between perceived and real inflation rates. For example, some labor unions indicated that the perceived inflation in Türkiye was twice the official/announced inflation in 2023 (Confederation of Progressive Trade Unions of Turkey (DİSK), 2024, p. 1). This issue is not only a challenge in developing economies, but it is also manifested in developed countries. One of the justifications for the gap between the perceived and the official inflation rates is that consumers do not feel the *Consumer Price İndex* (CPI) as a proper consumption basket including the goods and services consumed by buyers. In other words, they accept that the prices of productions that they consume rose more than the average of the basket which is created for the consumer price index (Schembri & Ontario, 2020, p. 1). Perceived inflation refers to an increase in the price level of goods and services; however, if the official inflation rate is reported as lower and wage adjustments are made based on the announced inflation (CPI), the income share of labor in GDP declines. The remaining share of income is then transferred to other factors of production. The findings from the empirical analysis supported this assessment. Inflation was identified as a factor that reduces labor's share of GDP while increasing the share of other production factors in GDP.

Another factor causing the decline in labor's share of income is time inconsistency. Inflation rates typically rise on a monthly, weekly or even daily basis in some countries, while wage adjustments are generally made on a semi-annual or annual basis. Since income updates are largely based on the inflation that has already occurred, labor's purchasing

power and/or share of income tends to decrease during the period between income updates. In addition, although earnings from foreign trade have significantly increased in many economies, labor wages are predominantly determined by increases in consumer prices. Furthermore, some countries face the issue that minimum wage turns into the average salary. For instance, in Türkiye, according to data of Social Security Institution (SSI, 2024) approximately 50% of employees worked for the minimum wage or wages closely aligned with the minimum wage in 2023. As more justification, a noteworthy observation is the significant increase in e-commerce during the COVID-19 period. In this context, the share of labor in national income may have declined due to a reduction in labor demand. According to statistics from Statista (2024), China's e-commerce revenue amounted to 644 billion dollars in 2018 before the COVID-19 outbreak. This figure increased to 1.35 trillion dollars by 2022.

Discussions can be expanded from various perspectives; however, the final evaluation of this analysis will be on the impact of the COVID-19 crisis on trade openness. During this period, international trade experienced significant disruptions, and foreign direct investments (FDI) were notably affected. In response to these disruptions, many economies exhibited characteristics of closed economies. Contrary to the prevailing assumptions, however, countries with strong property rights experienced a comparatively mitigated decline in FDI. In contrast, countries with weak property rights appeared to avoid substantial reductions in FDI (Moon et al., 2024, p. 1). This can be shown as a reason why the foreign direct investments variable was found to be insignificant in the pandemic period. In a nutshell, the findings of this study which examined the COVID-19 period as a novel phenomenon, indicated that the Theorem of the 20th century is invalid in the 21st century.

4. Conclusions and Recommendations

This study aimed to investigate the relationship between trade openness and income distribution within the framework of the Stolper–Samuelson Theorem. To achieve this objective, two distinct models were employed by using panel data analysis for the period encompassing the years of the COVID-19 pandemic. The results indicated that trade openness decreased labor's income share in GDP. For non-labor production factors, the income share in GDP increased during the reference years. Namely, the findings also implied that the Stolper–Samuelson Theorem did not hold for the selected economies during the outbreak years. Additionally, the inflation variable was found to be an indicator that affected labor's income share in GDP negatively.

Although this study presented many potential reasons to justify the findings, additional explanations on the subject can be found in the existing literature. One of them, Dorn et al. (2021) attributed this situation to the fact that the development of the labor market lagged behind the pace of liberalization of foreign trade. Another plausible explanation for the absence of a relationship between the relative labor abundance and a reduced inequality was proposed by Jacobsson (2006). This study argued that increased employment opportunities generated by international trade did not benefit the poorest segments

of the population. In this regard, Acaravcı (2018) recommended that, in the challenge against income inequality, specific and appropriate measures to the structure of each country should be considered instead of a single prescription. In this context, this study highlights that labor market rigidities should be re-evaluated, with a particular focus on the effects of trade openness on the sector. Secondly, to increase the share of labor in the total income, it is necessary to support domestic production rather than liberalize trade for certain products that rely on labor-intensive production techniques. Moreover, the necessary social and economic policies should be implemented to distribute foreign trade earnings more fairly among all income groups. On the other hand, due to the significant impact of inflation on the income share during the outbreak period, policy instruments and interventions should prioritize protecting labor income against inflation and wage-setting mechanism should be indexed to inflation rate over a shorter term (for example, monthly). But firstly, the consumer price-inflation basket of goods and services should be revised with the appriorate contents to provide correct weights of products. Otherwise, the weight of products that most consumers prefer not to purchase in the inflation calculation may increase, and this may cause problems in income levels adjusted according to inflation. As for production, supporting labor-intensive industries with tax exemption and subsidies can provide protection for labor wages. The final recommendation is the creation of educational programs aimed at raising awareness in the working class. Because, even if labor's income increases in nominal value, the purchasing power of the higher income layer may decline, and these consumers will buy fewer products. This often leads to a reduction in the employee's share of income and causes an increased income inequality. On the other hand, education and training programs to rise workforce adaptability and specialization in the face of the liberalization are together suggestions of this study for policymakers.

Similar to previous studies, this research was conducted within a few specific limitations. It concentrated on a defined time period and utilized a theoretical framework that builds upon the model proposed by SS. However, the content of this model can still be developed and refined. For example, conducting separate analyses across different sectors and in micro level could provide more nuanced insights. Additionally, distinguishing between low-skilled and high-skilled labor could contribute to empirical literature with another point of view. Furthermore, data related to COVID-19 would be better represented with a dataset containing more detailed indicators, rather than relying on a dummy variable. Finally, studies employing methods that account for endogeneity tend to yield more robust results, and consequently, it is advisable to utilize approaches that explicitly address endogeneity. All of these suggestions try to offer guidance for research and researchers in the future.

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