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GLOBALIZATION, STRUCTURAL TRANSFORMATION, AND THE LABOR INCOME SHARE

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Abstract

This paper provides novel empirical evidence on the role of trade and structural transformation as potential drivers of the labor income share. Using cross-country data, both at the national and sectoral level, we find that trade openness is negatively correlated with the labor income share. The findings are robust across national and disaggregated levels, and across different model specifications. However, the relationship between the process of structural transformation and labor income share is at best mixed. We also find weak evidence that skill-biased structural transformation is likely to be positively correlated with the share of labor income predominantly in the services sectors.

Keywords: labor income share, structural transformation, globalization

JEL Classification: E24, E25, N10, O14

Contents

1. INTRODUCTION

This paper provides empirical evidence of the role of trade openness and structural transformation as the drivers of the labor income share. The downward trend in the labor income share as documented by many studies (Elsby, Hobijn, and Sahin 2013; Karabarbounis and Neiman 2014; Piketty 2014; Piketty and Zucman 2014) has important implications for economic growth and income distribution. The burgeoning literature on the labor income share highlights the role of trade and structural transformation as important drivers of the secular decline in the global labor income share (Karabarbounis and Neiman 2013; Piketty 2014). However, the scattered evidence from cross-country studies and country case studies, mostly on the developed economies, confuses our knowledge on the drivers of the labor income share for the developing countries. This study aims to bridge this knowledge gap by providing empirical evidence using two novel cross-country data sets on labor income share at the (1) national and (2) sectoral levels.

Globalization has been broadly defined as including everything from falling prices for goods made by low-skill labor (such as garments) to increasing outsourcing by multinationals (Harrison 2002). The owners of capital have greater bargaining power over laborers, ostensibly because capital is footloose and can quickly relocate to wherever it can find the highest returns (Harrison 2002; Rodrik 1997). Slaughter (2001) argues that trade can make labor demand more elastic in two main ways: by making output markets more competitive and by making domestic labor more substitutable with foreign factors. Trade can generate these effects without also generating product-price changes and, via the Stolper-Samuelson theorem, factor price changes.[1]

Classical trade theories predict patterns of specialization and specific factor demand drive relative factor endowment. Factor reallocation in the production function induced by trade also crucially depends on the wage flexibility/rigidity regimes as shown by Decreuse and Maarek (2011). Decreuse and Maarek (2011) assume a frictional labor market with productive heterogeneity and claim that foreign direct investment (FDI) has two opposite effects on the labor income share. The first is a negative effect originated by technological advancement and then a positive effect due to an increasing labor market competition between firms. Using data from 98 developing countries over the period from 1980 to 2000, they find a U-shape relationship between labor income share and the proportion of foreign firms. Furthermore, they argue that the magnitude of the relationship is governed by the technological gap between foreign and local firms. In addition, the effect of trade openness on the labor income share also depends on the elasticity of substitution between different types of labor and capital (Guscina 2006; EC 2007;). Foreign direct investment (FDI), or offshoring, can also have a negative effect on the labor income share by providing firms with an outside option with decreasing workers' bargaining power (especially for the low-skilled workers) (Guscina 2006; Harrison 2002; Jaumotte and Tytell 2007; Jayadev 2007).

[1] For example, in a Heckscher-Ohlin trade model, if an economy's autarky relative endowment equals that of the rest of the world then when that country opens to trade it experiences no change in product prices and thus (via the Stolper-Samuelson theorem) no change in wages. But this opening can make foreign factors more substitutable with domestic ones. If product markets are imperfectly competitive in autarky, opening can also make product markets more competitive.

New trade theories emphasize the role of firm heterogeneity in production. Factors such as capital intensity and skills, among others, drive productivity and determine the impact of increasing openness on the labor income share of different types of workers. Elsby, Hobijn, and Sahin (2013) noted that increased import penetration would be expected to depress the labor share of domestic income if imported intermediates were more substitutable with labor than with capital from the perspective of an aggregate production technology (2013). The same authors argue that the more labor-intensive part of US production, the remaining production in the US economy, would be expected to become more capital intensive by offshoring. If, in addition, capital is more than unit elastic with respect to labor, then, applying the concept of Hicksian elasticity (Hicks 1932), this will imply that the labor income share in the US will fall.

The literature on the relationship between structural transformation and labor income share can be classified as follows. First, some studies highlighted the usefulness of a disaggregated analysis of structural transformation and provide empirical evidence of its benefit (Herrendorf, Valentinyi, and Rogerson 2014; Jorgenson and Timmer 2011; Duarte and Restuccia 2012). Buera, Kaboski, and Rogerson (2015) took this mandate forward and used the EU KLEMS database to compare the labor income shares for high-skilled labor (college graduates and above) for six key manufacturing sectors.

The second group of literature uses the standard drivers of labor income share to explain the differences in labor income share trends across sectors. For example, differences in the elasticity of substitution between capital and labor between sectors may result in different sectoral labor income share trends. In a recent study on the US, Alvarez-Cuadrado, Long, and Poschke (2015) showed that a larger decline in labor income share in manufacturing relative to that in services is partly driven by a larger elasticity of substitution between capital and labor in manufacturing than in services. In another paper, Buera and Kaboski (2012) argue that this rising return to skill is intimately connected to the structural transformation of economic activity towards services. They document that there is a threshold for per capita income at which the value-added share for services increases. At the same threshold level, they also find an increase in the fraction of the workforce that becomes skilled and part of the skill premium. If other sectors do not experience any such increases in the returns to skill, this is likely to widen the differences in labor income share between services and other sectors such as manufacturing.

The third group of studies (Lawrence 2015; Elsby, Hobijn, and Sahin 2013; Rodriguez and Jayadev 2013) examine the role of structural transformation in the changes in the labor income share over time using a decomposition framework. In a recent study, Dao et al. (2017) found that almost 10% of the changes in the aggregate labor income shares in the People's Republic of China (PRC) came from structural transformation. De Serres et al. (2002), using data on US industries, found that about 50% of the variation in the labor share is due to structural transformation. Structural transformation could also affect the share of labor income through other channels. In the absence of modern technology in agriculture, some countries continue to have low productivity in this area. This implies more labor for agriculture and less labor for nonagriculture, which may also lead to a lower level of aggregate production given that nonagricultural sectors are more productive than agriculture sectors. Gollin (2002) show that cross-country differences in the share of employment in agriculture can account for a large proportion of the cross-country differences in aggregate output. This also leads to differences in labor income share both at the sectoral and national level. Rogerson (2008), using a model of structural transformation, compared the evolution of hours worked per working-age person in the US to that in an aggregate of five continental European economies (Belgium, France, Germany, Italy, the Netherlands) since the

1950s. His paper found that the hours worked were about 5% higher in Europe in 1956, but in 2003 they were more than 30% lower.

Moving on, we next discuss the shift-share decomposition framework to highlight the role of structural transformation as a driver of the sectoral labor income shares and the aggregate labor income share. Following a variant of the canonical shift-share decomposition methodology (see Fabricant (1942) for the original decomposition and de Vries, Timmer, and de Vries (2013) and Arpaia, Perez, and Pichelmann (2009) for the variant) we write changes in the aggregate labor income share between t and $t+1$ as follows:

$$\Delta LIS = \sum_i (\theta_i^t)(\Delta LIS_i) + \sum_i (\Delta\theta_i)(LIS_i^t),$$

where LIS_i is the labor income share in sector *i*, and LIS denotes the aggregate labor income share. Labor is reallocated across sectors between two points in time, t and $t+1$, and θ_i^t denotes the sectoral labor share of sector *i* in period *t*. The first term on the right-hand side of equation (1) measures the contribution of the within-sector effect (changes in the labor income share within a sector) whereas the second term measures the contribution of the between-sector effect (changes in the weights of the sector) or structural transformation. In the absence of structural transformation, the aggregate labor income share trend would simply be a weighted average of the sectoral labor income share trends. Many studies (Lawrence 2015; Elsby, Hobijn, and Sahin 2013; Rodriguez and Jayadev 2013) find that the change in the aggregate labor income share is driven by declines in within-industry labor shares rather than the process of structural transformation through an increasing flow of activities from high to low labor share industries. In another study, Dao et al. (2017) find that almost 90% of the changes in the aggregate labor income shares in the PRC come from within-industry changes rather than sectoral reallocation. Arpaia, Perez, and Pichelmann (2009) examine the role of structural transformation for a panel of OECD countries and find similar evidence of the dominance of within-sector effects. However, in a separate paper, de Serres et al. (2002) estimate that about 50% of the variation in the labor share is due to structural transformation in the US.

In this paper, we analyze cross-country data both at the country and sectoral level. For the country-level data, we use the Penn World Tables (PWT) data set as it has a broad coverage in terms of both country and year. The data set is also preferable because it uses the most plausible adjustment approach for each country and year, not resorting to a one-size-fits-all approach. In addition, the Penn World Tables (PWT) expands the coverage of self-employed-income adjusted labor income shares by using proxy variables for countries whose mixed-income data were not available. As most self-employed workers in low- and middle-income countries are active in agriculture, the PWT uses value added in agriculture recorded in the World Input-Output Database (WIOD) as a proxy for self-employed income. At the sectoral level, we use the disaggregated data from Oishi and Paul (2018) following the 10-sector level classification of the Groningen Growth and Development Centre (GGDC). They primarily use three data sources: the GGDC 10-Sector Database, Socio-Economic Accounts (SEA), and ILOSTAT.

The time series plots of the labor income share for most of the countries suggest a downward trend following the episode of trade liberalization. However, for some countries the labor income share started declining before they embraced the trade reform measures. The regression outcomes at the country level suggest that trade liberalization seemed to have a negative impact on the labor income share. Moreover, over the course of liberalization, the negative effects of opening to trade would have emerged in the period following several years after the liberalization. The empirical evidence at the sectoral level does not allow us to claim any strong causal relationship between trade and labor income share. We find support for a negative correlation between trade openness and sectoral labor income share; however, the evidence on the relationship between the process of structural transformation and labor income share is at best mixed. Skill-biased structural transformation is likely to be positively correlated with the share of labor income predominantly in the services sectors. A case study on Japan suggests a limited role of structural transformation in the movement of labor income share in Japan, and the direction of changes in certain sectors is driven by part-time employment. Overall, while the support for a negative correlation between trade openness and sectoral labor income share is somewhat robust, the evidence on the relationship between the process of structural transformation and labor income share is at best mixed.

The paper is structured as follows. We provide a description of the data sources in Section 2. Section 3 provides descriptive evidence on the relationship between trade openness and labor income share trends both at the country and sectoral levels. Section 4 examines the role of structural transformation in the labor income share movements by using two data sets, EU KLEMS on 16 developed countries and Japan Industrial Productivity (JIP) data, which is followed by an analysis of cross-country regression outcomes in Section 5. We provide some cross-country regression results to unfold the multivariate relationship between trade, structural transformation, and labor income share both at the country and the sectoral level. Section 6 presents concluding remarks.

2. DATA

In contrast to its simple definition of the labor income share, which is the share of labor income in national income, measuring it with available data is not so straightforward. While national income is easily found in national accounting statistics in the form of GDP, labor income equivalent is not as it involves both income earned by wage employees and income earned by the self-employed. National accounting statistics in many countries usually record the total wage bill of employees as “compensation of employees.” However, these statistics often do not record self-employed income, and even if they do, it is generally difficult to isolate a labor income component as self-employed income consists of compensation for both the labor and capital that self-employed workers own.

Several approaches have been proposed for estimating the labor income share using available data (Table 1). A conventional approach divides the total compensation of employees by GDP without taking self-employed income into consideration (denoted as LS_{unadj}). This may be a reasonable approximation of the labor income share in developed countries where the share of the self-employed in the total number of employees is low, but this is likely to underestimate the labor income share in developing countries where self-employment in the informal sector is prevalent. To include self-employed income in the labor income, Gollin (2002) proposes three adjustment approaches, relying on three different assumptions. Two of Gollin’s (2002)

approaches use mixed income, which is the total income earned by self-employed workers, to extrapolate self-employed income: The first adds the entire amount of mixed income to the compensation of employees, assuming that self-employed workers do not possess capital (denoted as LS_{G1}), while the second assumes that the labor income share of self-employed workers is the same as that of wage employees (denoted as LS_{G2}). Instead of mixed income, Gollin's (2002) third approach uses the employment structure of a country to estimate the labor income share. It assumes that self-employed workers earn the same average wage as employees (denoted as LS_{G3}).

Table 1: Estimation Approaches

$$LS_{unadj} = \frac{CoE}{GDP}$$

$$LS_{G1} = \frac{CoE + MI}{GDP}$$

$$LS_{G2} = \frac{CoE}{GDP - MI}$$

$$LS_{G3} = \frac{\frac{CoE}{E} \times TE}{GDP}$$

CoE: compensation of employees, MI: mixed income, E: the number of wage employees, TE: the number of total employees.

All currently available data sets that cover low- and middle-income countries have estimated the labor income share using these approaches. van Treeck (2017) reviews labor income share data and compares them by dividing them into six groups in terms of their coverage, adjustment approaches, and data sources (Table 2). As each data set uses different adjustment approaches and data sources, estimated labor income shares differ from one another.

The first group of data sets primarily rely on data from the United Nations System of National Accounts (UN SNA) for estimating the labor income share. It records GDP for almost all countries around the world as well as data on compensation of employees for about two-thirds of low- and middle-income countries. The computed unadjusted labor share covers 93 low- and middle-income countries with an average time span of 15.3 years per country and 1421 observations (denoted as SNA unadj.). For countries with mixed income data available, mixed-income adjusted labor income shares are computed (denoted as SNA G1 and SNA G2). As only about one third of developing countries reported mixed income, these adjustments result in a reduction in the number of countries to only 38. The adjusted labor share using the employment structure of a country is also calculated with ILO's data of Key Indicators of the Labour Market (KILM), which produces estimates for 73 countries (denoted as SNA G3). The second group of data sets extend the coverage of data from UN SNA and KILM by including additional national data sources. A group of researchers at ILO add data from OECD statistics and from the PRC's and Brazil's statistical offices, which produces estimates of the labor income share for 73 countries (denoted as ILO unadj./adj.).

The Penn World Tables (PWT) expands the coverage of self-employed-income adjusted labor income shares by using proxy variables for countries whose mixed-income data are not available. As most self-employed workers in low- and middle-income countries are active in agriculture, the PWT uses value added in agriculture recorded in the World Input-Output Database (WIOD) as a proxy for self-employed income. To construct a "best estimate" labor share, it utilizes the most plausible

adjustment approach for each country and year. When mixed income data are available, the PWT computes the LS_{G2}-definition labor income share. For a few anomalous countries whose unadjusted labor share exceeds 0.7, the PWT directly uses the unadjusted labor share as it seems reasonable that this share already includes self-employed labor income. For the remaining countries where mixed income data are not available, the PWT calculates LS_{G3}-definition labor income share and LS_{G1}-definition labor income share where value added in agriculture is used in place of mixed income and adopts the lower one as the labor share of the country.[2] Trapp (2015) also uses proxy variables of agriculture to compute the labor income share. She obtains data of the share of agricultural employment in total employment from FAOSTAT and the WB World Development Indicators and uses this as proxy for the share of self-employment. Her data set is also a combination of different adjustment approaches comprising LS_{G3} (68%), LS_{G2} (21%), LS_{unadj} (6%), and LS_{G1} (4%).

The Socio-Economic Accounts (SEA) from the WIOD and INDSTAT databases from the UN's Industrial Development Organization (UNIDO) can be used to calculate the labor income share by sector and by other characteristics. The WIOD project gathers data on employment, labor compensation, and value added from several national statistics offices. The WIOD provides not only aggregated data but also disaggregated data by 35 sectors or skills (low-, medium-, and high-skilled). The UNIDO INDSTAT is a large industrial statistics database that covers only the corporate manufacturing sector. It provides both aggregated and disaggregated data from 23 industries. In the database, 96 low- and middle-income countries are covered from the 1970s.

In our analyses, we primarily rely on the PWT data set as it has a broad coverage in terms of both country and year. The data set is also preferable because it uses the most plausible adjustment approach for each country and year, not resorting to a one-size-fits-all approach. While the UNIDO data set has the largest coverage in terms of country, this data set is not preferable for our analysis as the database includes only the corporate manufacturing sector. As mentioned above, the PWT employs four adjustment methods to calculate labor income share. This may cause bias, therefore we denote for the value calculated by the difference adjustment method in the graphical analysis in Section 3. And we use the labor income share data, which are calculated using the same adjustment approach for each country for our regression analysis in Section 5, to eliminate the effect of applying a different adjustment approach for different years.

At the sectoral level, we use the data set that Oishi and Paul (2018) put together following the 10-sector level classification of the Groningen Growth and Development Centre (GGDC). They primarily use three data sources: the GGDC 10-Sector Database, Socio-Economic Accounts (SEA), and ILOSTAT. The denominator of the labor income share, estimated value added, is obtained from the GGDC and SEA. The mean nominal monthly earnings of employees and number of employments are obtained from ILOSTAT. This data set contains sectoral labor income shares for 54 countries across five regions based on the most recent World Bank classification of countries (nine from East Asia and the Pacific, 28 from Europe and Central Asia, 8 from Latin America and the Caribbean, 2 from the Middle East and North Africa, 2 from North America, and 5 from sub-Saharan Africa). Out of 54 countries, 20 are developing countries (based on the World Bank classification).

[2] For a few cases where the chosen labor income share is less than 40% and the share of GDP going to fixed assets is larger than 50%, the PWT adopts the larger of the two.

3. TRADE LIBERALIZATION AND THE LABOR INCOME SHARE: DESCRIPTIVE EVIDENCE

3.1 Evidence at the Country Level

The recent protectionist trade policies of some industrialized countries have provoked a debate on the impact of globalization on income inequality within countries. The neoclassical trade theory predicts that trade will benefit all countries, but this does not mean that individual income always increases. There could be both winners and losers from trade. In this section, we explore the dynamics of the labor income share over the course of trade liberalization. This sheds light on whether the production factor is key in determining the fate among individuals within countries. Theoretically, there is no consensus on how trade liberalization affects the labor income share. Two possible channels have been proposed through which trade liberalization impacts the dynamics of the labor income share: the traditional trade theory and the bargaining game framework. The traditional trade theory, the Heckscher-Ohlin model, predicts that a country will have comparative advantages in industries where a relatively abundant production factor is intensively utilized. When a country opens up to trade, the country specializes in industries with comparative advantages. Accordingly, trade changes the relative factor price such that the abundant factor gains, and the scarce factor loses. Therefore, the theory predicts that trade will reduce the labor income share in capital-abundant advanced economies but raise it in labor-abundant developing economies.

On the other hand, the bargaining framework predicts that the income share between labor and capital will depend on the bargaining power of population groups. Reductions in trade and FDI barriers after liberalization would increase the relative bargaining power of capital owners as they can relocate their resources to destinations with higher returns. Moreover, reductions in migration barriers would make it possible to substitute imported labor for domestic labor, leading to further decreases in the bargaining power of workers. Under this framework, liberalization decreases the labor income share in both developed and developing countries.

As a measure of trade openness, we use a binary indicator from Wacziarg and Welch (2008). Their indicator was initially constructed by Sachs and Warner (1995) and later extended, updated, and revised by Wacziarg and Welch (2003, 2008). This indicator regards a country closed in any given year if at least one of the following conditions is satisfied: (a) average tariffs exceed 40%; (b) nontariff barriers cover more than 40% of its imports; (c) it has a socialist economic system; (d) the black-market premium on the exchange rate exceeds 20%; and (e) many of its exports are controlled by a state monopoly. Wacziarg and Welch (2008) cover the years from 1950 to 2001. Therefore, we exclude the data after 2001 from our sample for the countries recorded as closed as of 2001, since they might liberalize their economy after 2001, but we cannot know whether it happens, and if so, when. In terms of the countries that opened their economy before 2001, we assume that they did not close the country after 2001. We keep the data for 80 countries that have neither extrapolated nor interpolated labor income share data after 2001.

Table 2: Overview of Labor Share Measures for Low- and Middle-income Countries since 1990

Data Set	Obs.	Years	Ctry	Mean	Median	Min	Max	SD
SNA unadj.	1,421	15.3	93	35.3	35.5	5.4	90.7	11.8
SNA G1	508	13.4	38	56.5	56.1	26.2	87	10.4
SNA G2	508	13.4	38	45.6	46	21	73.4	8.5
SNA G3	766	10.5	73	62	55.5	21.5	658.4	33.8
ILO unadj.	1,044	14.3	73	39.6	39.9	3.4	93.8	14
ILO adj.	1,044	14.3	73	56.9	56.2	3.4	231.7	25.1
PWT	2,298	24.7	93	52	52.6	9	86.6	13.1
Trapp	1,421	15.3	93	46.8	47	6	90.7	12.5
WIOD unadj.	258	16.1	16	42.3	44.5	22.2	61.8	8.5
WIOD adj.	258	16.1	16	53.2	53.4	31.5	104.5	11.3
UNIDO	1,072	11.2	96	29.9	28.3	1.7	140.9	14

Data Set	Adj. Approach	Data Sources	Authors
SNA unadj.	unadj.	UN SNA	UN 2017
SNA G1	G1	UN SNA	UN 2017
SNA G2	G2	UN SNA	UN 2017
SNA G3	G3	UN SNA, KILM	UN 2017, ILO 2017
ILO unadj.	unadj.	UN SNA, KILM, OECD, China NBS, SNA Brazil	Charpe 2011
ILO adj.	G3	UN SNA, KILM, OECD, China NBS, SNA Brazil	Charpe et al. 2014
PWT	G2 (47%), G1[a] (47%), G3 (3%), unadj. (3%)	UN SNA, WIOD	Feenstra et al. 2015
Trapp	G3[b] full (50%), G3[b] 2/3 (18%), G1 (4%), G2 (21%), unadj. (6%)	UN SNA, FAOStat, WB WDI	Trapp 2015
WIOD unadj.	unadj.	WIOD SEA	Timmer et al. 2015
WIOD adj.	G3	WIOD SEA	Timmer et al. 2015
UNIDO	corp. manuf. Sector	INDSTAT2	UNIDO 2015

[a]Agricultural value added used as proxy for mixed-income .

[b]Agricultural employment share used as proxy for self-employment share.

Source: van Treeck (2017).

Among the 133 countries with labor income share data provided by the Penn World Tables (PWT), we analyze countries for which the trade liberalization indicator is available and whose labor income shares are estimated based on actual observed values. In the PWT, about 66.7% of labor income share data are either extrapolated or interpolated for the years for which observed data are not available. The extrapolation assumes that the labor income shares are constant over time and missing values are replaced by the closest year's labor income share. Interpolation is applied for missing years between two calculated values. It employees linear approximation and replaces the missing labor income share value, inserting a value from trajectories of the connected closest two points. As those nonobserved data are not appropriate for analyzing the impact of trade liberalization on the labor income share, we exclude them and focus on countries and years with labor income shares neither extrapolated nor interpolated. Those eliminations of the data leave 108 countries for our analysis of trade liberalization.

Table A1 presents the summary statistics of the labor income share and the trade liberalization variable. When we see the year of trade liberalization, about 38% of the sample countries open their economy in the late 1980s to early 1990s (from 1985 to 1994). However, we can observe the regional tendency. For example, some countries open their economy in the 1960s, and they are mainly observed in East Asian and European regions. We have five countries that open their economies before 1950 and 19 countries are characterized as being closed as of 2001. PWT 9.0 data cover the period 1950 to 2014, but only France and the United States have the labor income share data, which were calculated based on the observed values from 1950. Other countries have data from 1970 at the earliest. This allows the United States to have the longest sample period and the largest observation, from 1950 to 2014 and 65, respectively. In contrast, Kenya, Togo, and the Russian Federation have only one observation each. Wacziarg and Welch (2008) report on the temporal trade openness for 13 countries. However, due to the data availability of calculated labor income shares, only four countries experienced temporal liberalization in our sample years.[3] The right-hand column of Table A1 shows the nonweighted labor income share for each country and region, though it is not comparable as it is not adjusted for the number of observations for each country, and nor are the sample years. The largest average labor income share is observed in Togo (0.852) followed by Rwanda (0.773) and Barbados (0.746), while the smallest is Iraq (0.138) followed by Nigeria (0.303) and Botswana (0.318). As regards the regional average, South Asia (0.694) has the largest unweighted average, while the smallest is Latin America and the Caribbean (0.519).

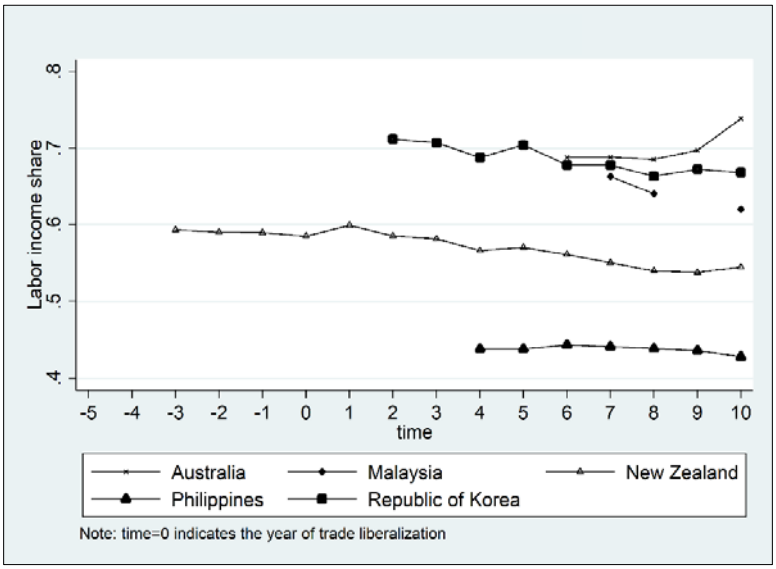
To assess the impact of trade liberalization on the labor income share, we cover a period of five years before and 10 years after trade liberalization. This left 56 countries with us, 5 from East Asia and the Pacific, 18 from Europe and Central Asia, 17 from Latin America and the Caribbean, 5 from MENA and South Asia, and 11 from sub-Saharan Africa. Figures 1 to 10 show time trends of the labor income share for each country over a period of five years of pre- and 10 years of post-liberalization. As indicated below in Figures 1 to 10 and Appendix A1, the year of trade liberalization varies from country to country. Thus, in Figures 1 to 10, the year of trade liberalization for each country is normalized to 0, and the preceding five years and the following 10 years are numbered –5 to –1 and 1 to 10, respectively.

Among East Asia and Pacific countries, New Zealand experiences a moderate decline in the labor income share after the liberalization (Figure 1). The labor income shares of the other countries are observed only after the liberalization, but overall, they kept constant trends.

Among the first group of European and Central Asian countries, France has a moderate declining trend since five years before the liberalization. Although the labor income share data before the liberalization are not available, Georgia experienced a steep decline in the labor income share after it opened up to trade.

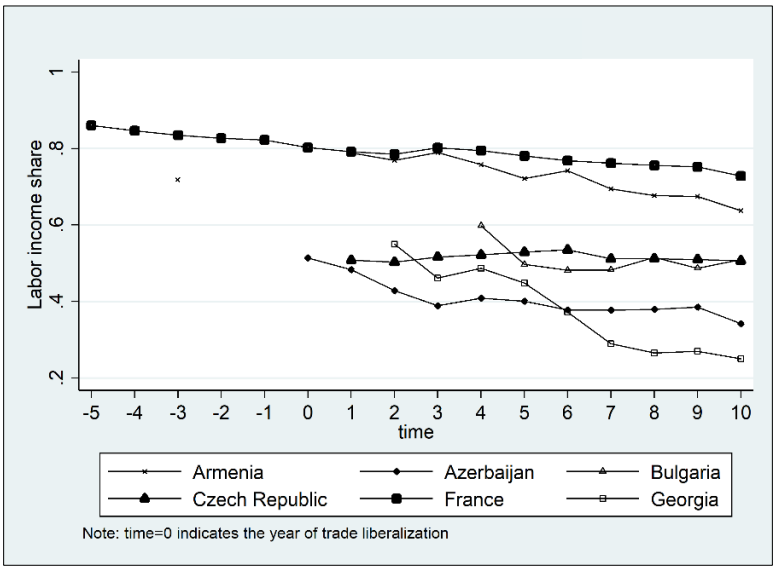
[3] Bolivia, Sri Lanka, Ecuador, and Jamaica.

Figure 1: Trade Liberalization and Labor Income Share in East Asia and Pacific



Note: The period for each country is: 1970–74 (Australia); 1970–71, 1973 (Malaysia); 1983–96 (New Zealand); 1992–98 (Philippines); and 1970–78 (Republic of Korea).

Figure 2: Trade Liberalization and Labor Income Share in Europe and Central Asia (I)

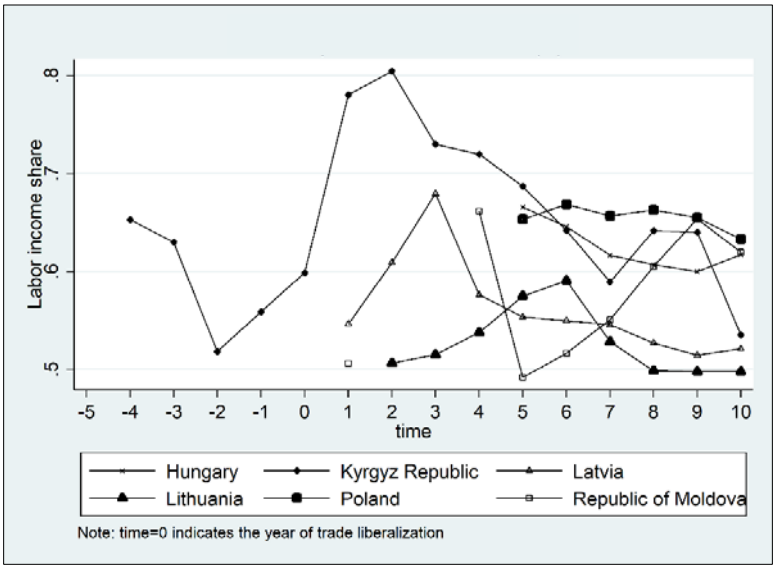


Note: The period for each country is: 1992, 1996–2005 (Armenia); 1995–2005 (Azerbaijan); 1995–2001 (Bulgaria); 1992–2001 (Czech Republic); 1954-–69 (France); and 1998–2006 (Georgia).

Trends of the labor income shares of the second group of European and Central Asian countries are shaky (Figure 3). The Kyrgyz Republic experienced a steep decline from four years to two years before the liberalization, a rapid increase from two years before to two years after the liberalization, and then a sharp decrease afterwards.

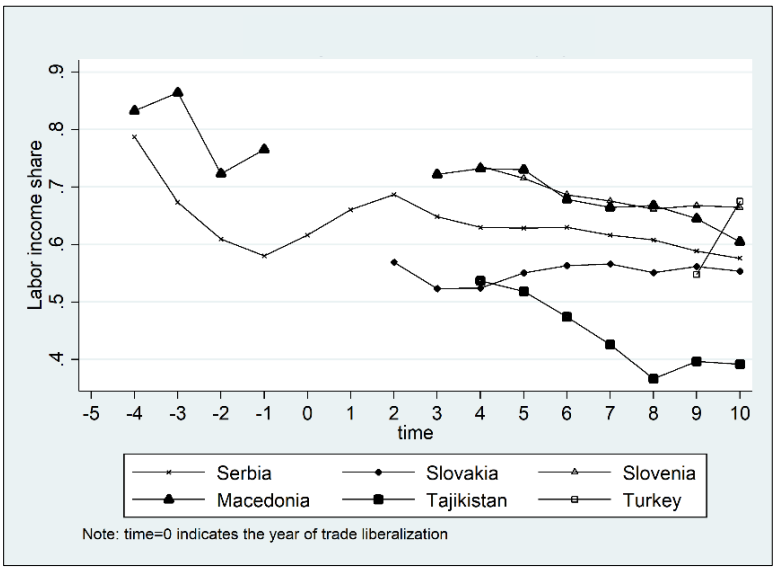
Among the third group of European and Central Asian countries, Serbia witnessed a sharp decline in the labor income share from four to one years before the liberalization, a slight increase right after the liberalization, and then a moderate decline from two years after the liberalization (Figure 4).

Figure 3: Trade Liberalization and Labor Income Share in Europe and Central Asia (II)



Note: The period for each country is: 1995–2000 (Hungary); 1990–2004 (Kyrgyz Republic); 1994–2003 (Latvia); 1995–2003 (Lithuania); 1995–2000 (Poland); and 1995*, 1998–2004 (Republic of Moldova). * denotes a year in which the adjustment method used for calculating labor income share differs from the one applied for the other years.

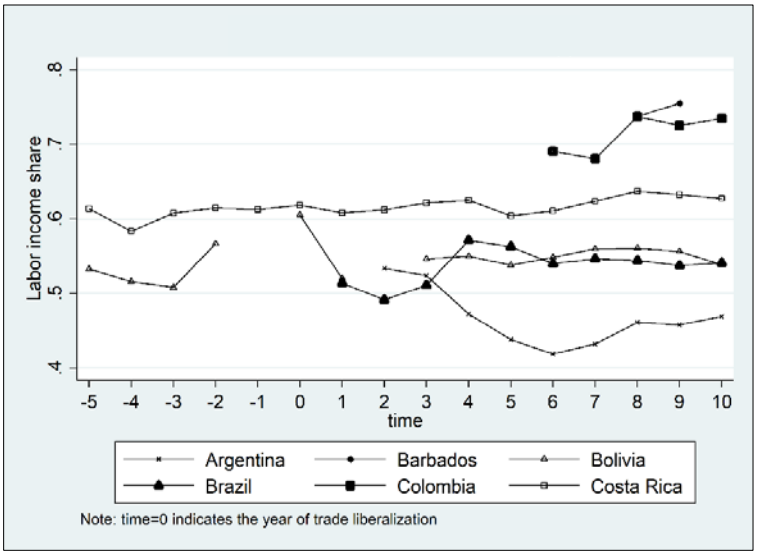
Figure 4: Trade Liberalization and Labor Income Share in Europe and Central Asia (III)



Note: The period for each country is: 1997–2001 (Serbia); 1993–2001 (Slovakia); 1995–2001 (Slovenia); 1990*–93*; 1997–2004 (Macedonia); 2000–06 (Tajikistan); and 1998–99 (Turkey). * denotes years in which the adjustment method in calculating labor income share differs from the one applied for the other years.

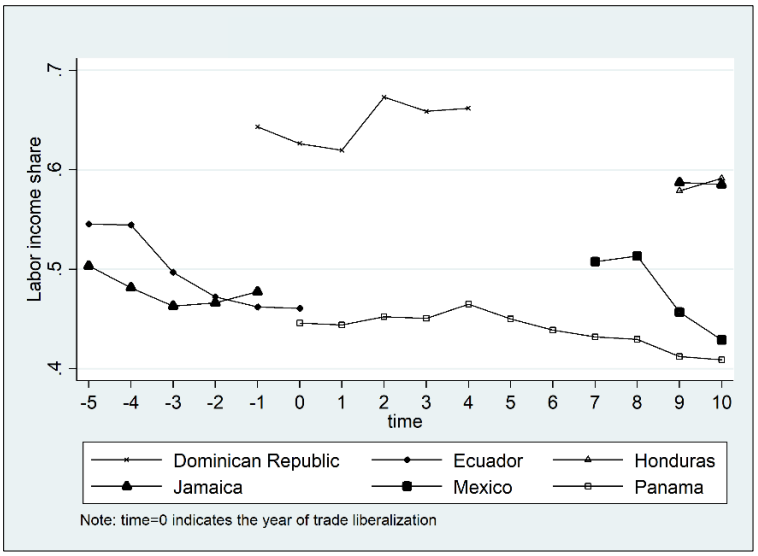
Among the first group of Latin American and Caribbean countries, Costa Rica had a relatively constant trend in the labor income share (Figure 5). Argentina experienced a decline after the liberalization, while Brazil witnessed an increase after the liberalization.

Figure 5: Trade Liberalization and Labor Income Share in Latin America and the Caribbean (I)



Note: The period for each country is: 1993–2001 (Argentina); 1974–75 (Barbados); 1980–83, 1985–86, 1988–95 (Bolivia); 1992–2001 (Brazil); 1992–96 (Colombia); and 1981–96 (Costa Rica).

Figure 6: Trade Liberalization and Labor Income Share in Latin America and the Caribbean (II)



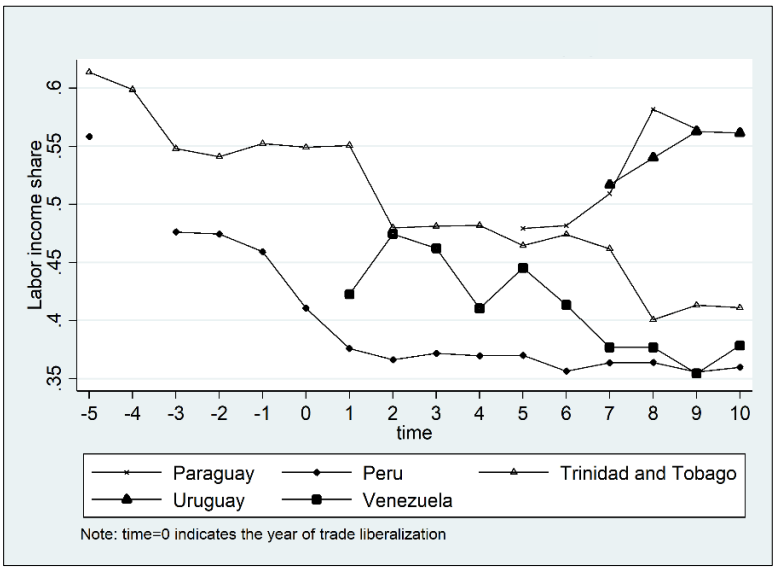
Note: The period for each country is: 1991–96 (Dominican Republic); 1986–91 (Ecuador); 2000–01 (Honduras); 1984–88, 1998–99 (Jamaica); 2003–06 (Mexico); and 1996–2006 (Panama).

Among the second group of Latin American and Caribbean countries, Panama witnessed a slight decline in the labor income share after the liberalization. The labor income share of Ecuador had a declining trend before the liberalization, while its post-liberalization data are not available.

Among the third group of Latin American and Caribbean countries, Trinidad and Tobago and Peru had decreasing trends for four to five years prior to liberalization and continued to decrease after opening up to trade (Figure 7). The labor income share of Venezuela was shaky, but it had a long-term declining trend after the liberalization.

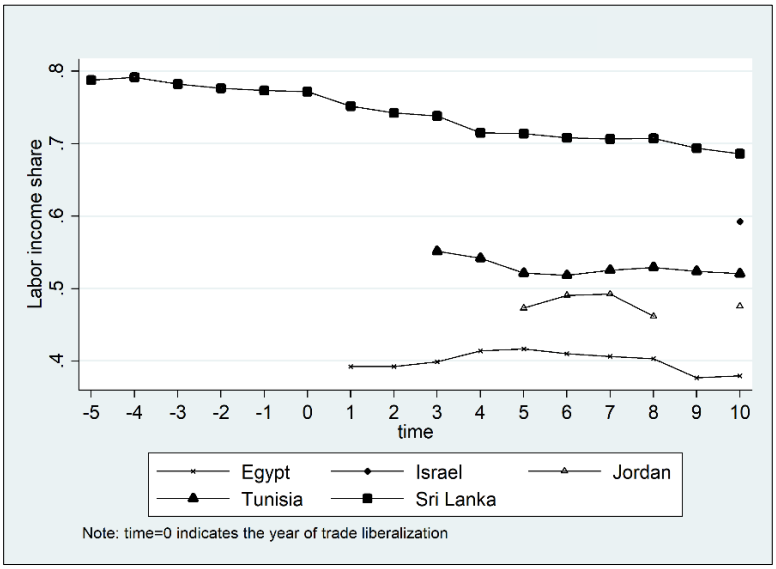
Among MENA and South Asian countries, Sri Lanka experienced a long-term declining trend after the period that predated the liberalization (Figure 8). The labor income share was relatively constant for Egypt after the liberalization.

Figure 7: Trade Liberalization and Labor Income Share in Latin America and the Caribbean (III)



Note: The period for each country is: 1994–98 (Paraguay); 1986, 1988–2001 (Peru); 1987–2002 (Trinidad and Tobago); 1997–2000 (Uruguay); and 1997–2006 (Venezuela).

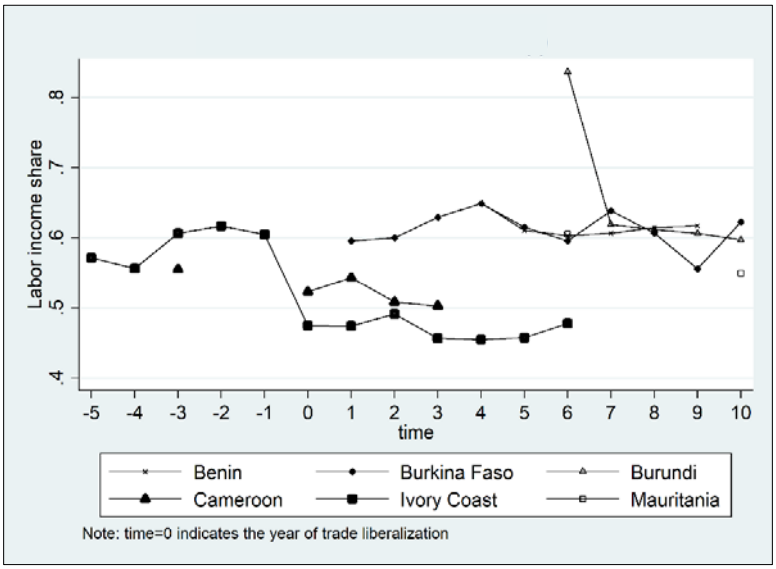
Figure 8: Trade liberalization and labor income share in MENA and South Asia



Note: The period for each country is: 1996–2005 (Egypt); 1995 (Israel); 1970–73, 1975 (Jordan); 1992–99 (Tunisia); and 1986–2001 (Sri Lanka).

Among the first group of sub-Saharan African countries, Ivory Coast witnessed a drop in the labor income share in the year of liberalization (Figure 9). Burundi experienced a sharp decline from six to seven years after the liberalization.

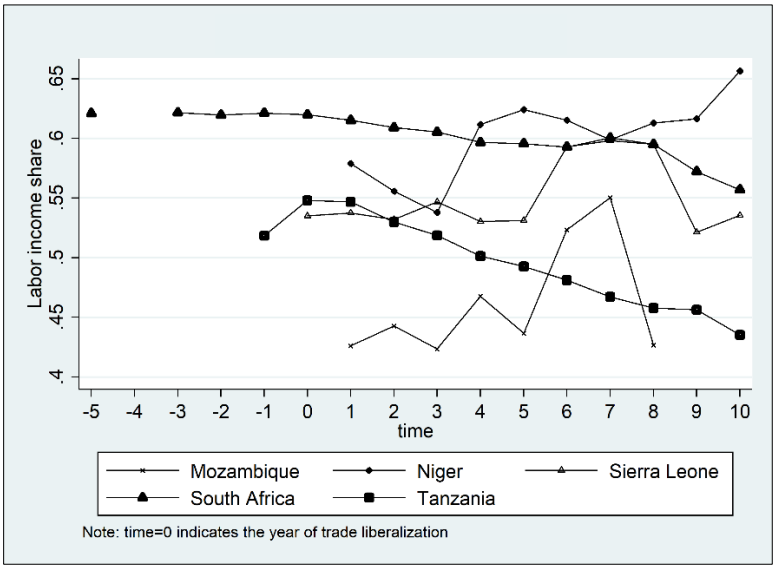
Figure 9: Trade Liberalization and Labor Income Share in Sub-Saharan Africa (I)



Note: The period for each country is: 1994–99 (Benin); 1999–2008 (Burkina Faso); 2005–09 (Burundi); 1990, 1993–96 (Cameroon); 1989–2000 (Ivory Coast); and 2001, 2005 (Mauritania).

Among the second group of sub-Saharan African countries, South Africa followed a decreasing trend, which predated the trade liberalization (Figure 10). Tanzania experienced a decline in the labor income share after the liberalization, while Niger witnessed an increase after three years of trade liberalization.

Figure 10: Trade Liberalization and Labor Income Share in Sub-Saharan Africa (II)



Note: The period for each country is: 1996–2003 (Mozambique); 1995–2004 (Niger); 2001–11 (Sierra Leone); 1986, 1988–2001 (South Africa); and 1994–2005 (Tanzania).

The time series plots of the labor income share for most of the countries suggest a downward trend following the episode of trade liberalization. However, from this bivariate analysis it is difficult to identify whether a fall in labor income share was driven entirely by trade openness, as for some countries the labor income share started declining before they embraced the trade reform measures. Such causal links are difficult to discern unless we look at the sectoral labor income shares and understand the sectoral dynamics of labor income share associated with trade reforms. We take this up in the following section.

3.2 Evidence at the Sectoral Level

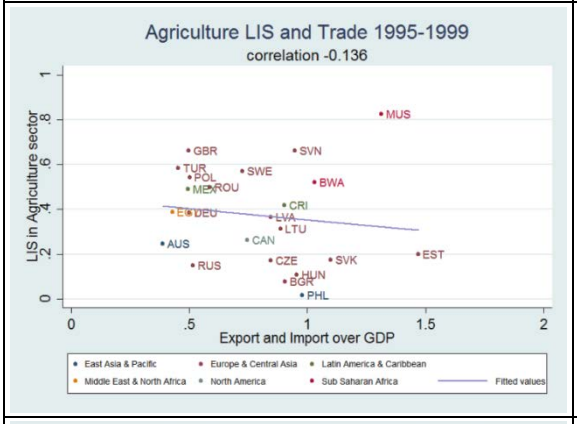
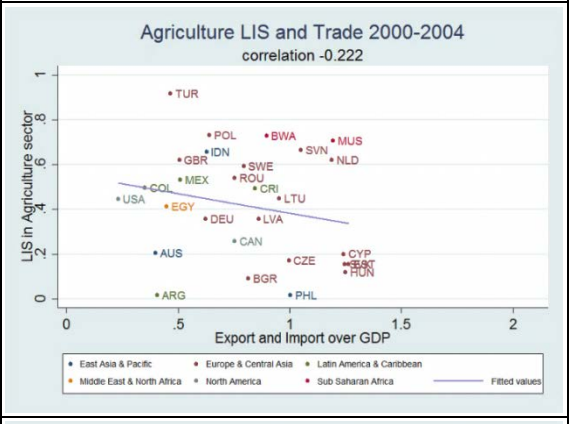
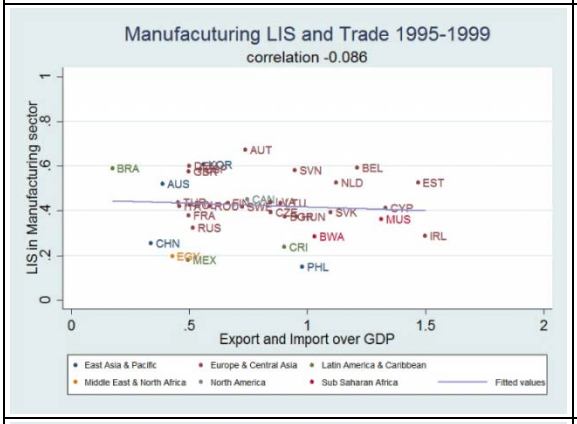
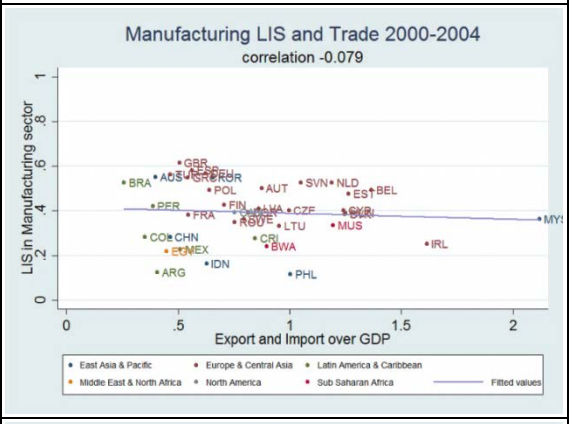
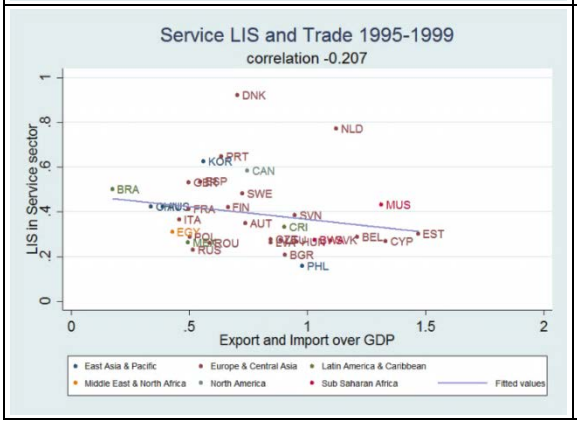
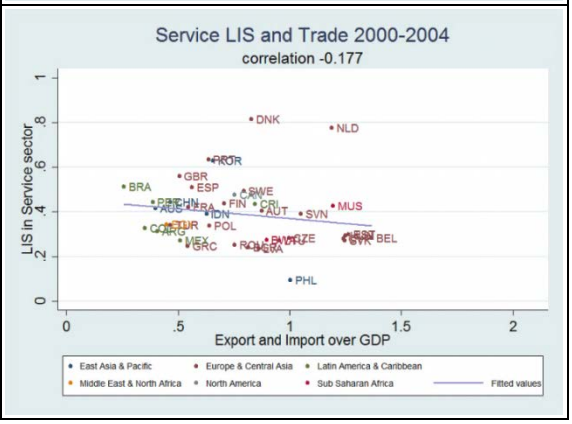
In this section, we discuss some stylized facts about the labor income share at the sectoral level. For this purpose, we rely on the sectoral-level labor income share data computed by Oishi and Paul (2018) for 54 countries across five regions based on the most recent World Bank classification of countries (9 from East Asia and the Pacific, 28 from Europe and Central Asia, 8 from Latin America and the Caribbean, 2 from the Middle East and North Africa, 2 from North America, and 5 from sub-Saharan Africa). In Figure 11, we show cross-country scatter plots between the sectoral labor income share and trade share of GDP. In the left-hand column, the plots show labor income shares for three key sectors (agriculture, manufacturing, and services)[4] and trade share of GDP averaged over the period from 1995 to 1999. In the right-hand column, we plot the same variables, but averages are taken for the period from 2000 to 2004. In each plot countries from different regions are demarcated by different colors.

Overall, the results show a negative correlation between the volume of trade (as a share of GDP) and labor income shares at the key sectoral levels. The negative correlation in the manufacturing sector is somewhat weaker than in other sectors; however, such sectoral patterns of trade and factor income shares do not change over time, except for agriculture, where it almost doubled from –.14 in the period 1995–99 to –.22 in the period 2000–04. Countries like Turkey, Poland, and Botswana show a relatively higher share of labor income in agriculture, whereas Brazil and Austria have the highest labor income share in manufacturing. We do not find any regional bias. The same holds for the services sector, where Denmark and the Netherlands continue to have the highest labor income share.

Moving on, next we showcase the dynamic (changes over time) relationship between sectoral labor income share and trade. The plots in the left-hand column of Figure 12 compare the changes in the average values of labor income share and trade share of GDP between two periods: 1995–97 and 2001–03. And in the right-hand column, the plots compare the same relationship between 2001–03 and 2007–09. The correlation between changes in the sectoral labor income share and trade share of GDP is negative for all the sectors and periods, except in agriculture between 2001–03 and 2007–09 where we find a positive association between changes in the labor income shares in agriculture and changes in the trade share of GDP. Since the plots show a dynamic relationship considering different time periods, it is difficult to directly compare the results with that at the level. However, the negative correlation observed both at the level and dynamics over time provide some robustness from across time and space. The bivariate plots suggest a negative correlation between labor income share at the sectoral level and trade volume, which is in line with many of the studies on this topic.

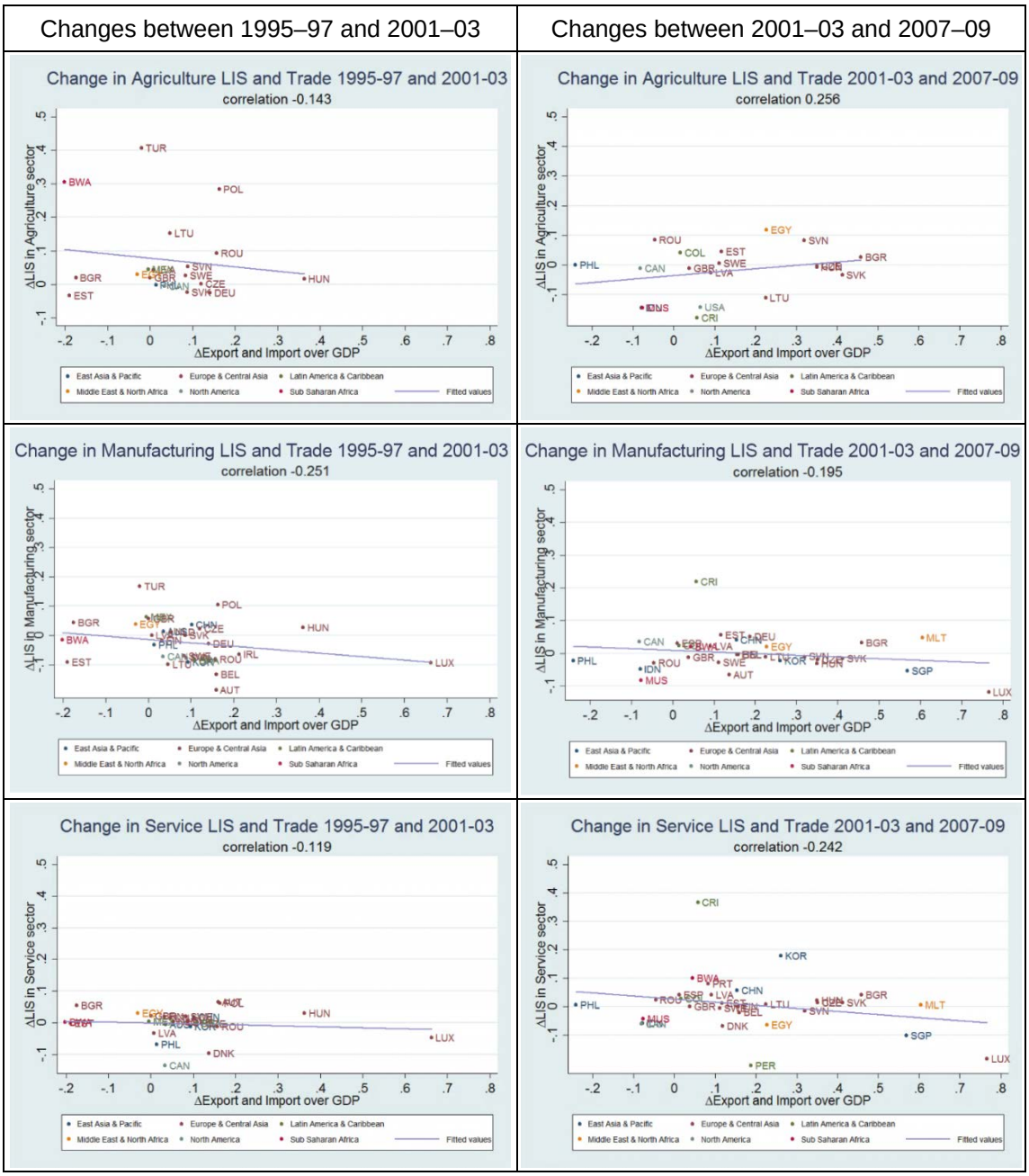
[4] Services include five disaggregated sectors: WRT, TRA, FIRE, GOV, and OTH.

Figure 11: Sectoral Labor Income Share (Broad Categories) and Trade Share of GDP

Average for the period 1995–1999	Average for the period 2000–2004
	
	
	

Source: Authors' own calculations.

Figure 12: Changes in Sectoral Labor Income Share and Trade Share of GDP

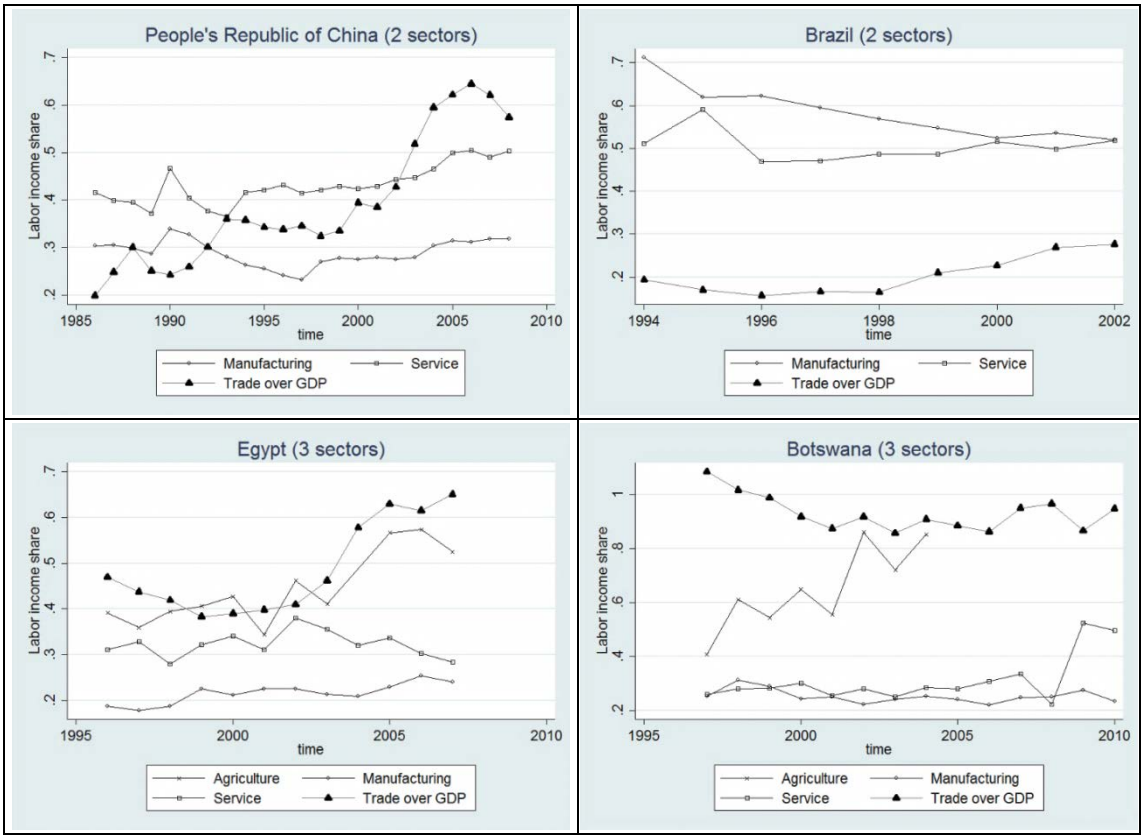


Source: Authors' own calculations.

Finally, we examine the time series plots at the country level. Figure 13 shows labor income share trends for three sectors and the trade GDP ratio for four countries: the PRC (manufacturing and services), Brazil (manufacturing and services), Egypt (agriculture, manufacturing, and services), and Botswana (agriculture, manufacturing, and services). Let us first compare the trade performance of these countries. The PRC outperforms other countries in terms of the growth in trade share of GDP. While the data from the period available for these countries differ, both Brazil and Egypt show stronger trade performance from the early 2000s whereas it did not change much for Botswana and the trade share of GDP oscillated around 1. In the PRC, the labor income shares in manufacturing remained constant around .3, whereas the same in

services steadily grew from the early 2000s and reached about .5 by 2008. On the other hand, in Brazil, the labor income shares trends for both sectors are similar with a slight decline in the labor income share in the manufacturing sector since 1994. For Egypt and Botswana, the labor income share in agriculture is higher than in the other sectors. In Egypt, the trade volume and labor income share in agriculture show a strong positive correlation. Overall, the time series plots from country cases suggest a more diverse picture of the relationship between trade and sectoral labor income shares.

Figure 13: Changes in Sectoral Labor Income Share and Trade Share of GDP



Source: Authors' own calculations.

To conclude, based on the descriptive analysis we find mild support for a negative correlation between labor income share and trade openness at the cross-country level. Evidence at the sectoral level provides a more nuanced picture and suggests a possible association between sectoral labor income share and trade. This prompts us to dig deeper and examine the process of structural transformation at the sectoral level as a causal mechanism between trade reforms and the labor income share.

4. STRUCTURAL TRANSFORMATION AND THE LABOR INCOME SHARE: DESCRIPTIVE EVIDENCE

4.1 Skill-biased Structural Transformation and the Labor Income Share

It is well documented in the literature that there has been a dramatic increase in the supply and relative wages of skilled labor over time (Acemoglu and Autor 2011). While the literature on skill-biased technical change (SBTC) argues for an increase in the demand for skill as a potential driver (Acemoglu and Autor 2011), the availability of cheaper capital equipment could also increase the demand for skilled labor with or without SBTC (Krusell et al. 2000). Extending the literature that argues for an increase in the relative demand for skilled labor, Buera, Kaboski, and Rogerson (2015) argue for a systematic reallocation of value-added shares toward high-skill-intensive sectors, which they term the "skill-biased structural change" (SBSC from here on). They develop a two-sector model of the SBSC process and use it to examine the rise in the skill premium in the US, and a broad panel of advanced economies, over the period 1977 to 2005. Their empirical findings across a broad panel of advanced economies suggest that increases in GDP per capita are associated with a shift in the composition of value added to sectors that are intensive in high-skill labor.

We use the labor income share data compiled by Buera, Kaboski, and Rogerson (2015) from the EU KLEMS database to compare the labor income shares for high-skilled labor (college graduates and above) for the 10 key sectors (Figure 8). Overall, the labor income shares of high-skilled workers show rising trends across the board, which supports the role of SBSC (Buera, Kaboski, and Rogerson 2015) in sectoral labor income share movements. We also find three parallel trends clearly emerging:

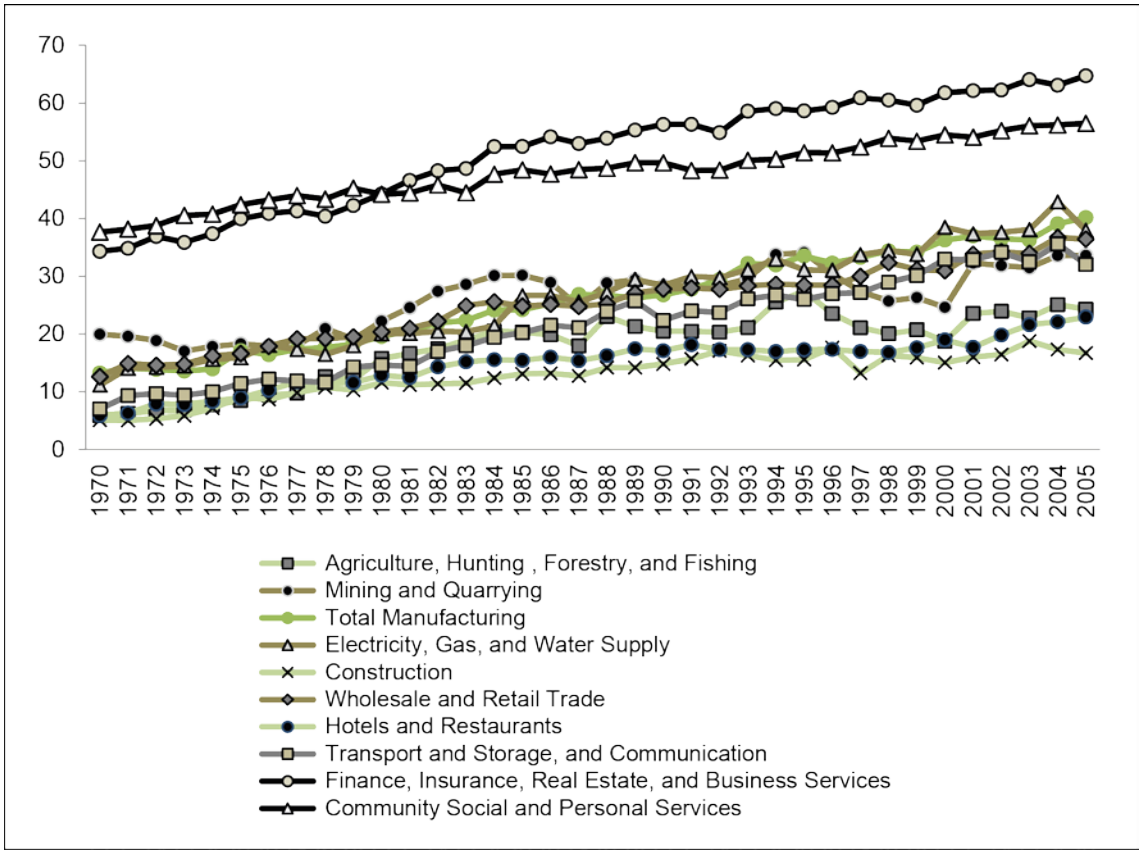
(1) high $L_S{}^{Skilled}$ sectors – finance, insurance, real estate, and other business; community, social, and personal services.

(2) medium $L_S{}^{Skilled}$ sectors – electricity, gas and water, manufacturing, wholesale and retail trade, mining and quarrying, transport, storage and communication.

(3) low $L_S{}^{Skilled}$ sectors – agriculture, hotels and restaurants, construction.

In a recent paper, Buera and Kaboski (2012) argue that this rising return to skill is closely related to the structural transformation from manufacturing to services. They show that it is useful to model the different roles of human capital to various activities to understand some key features of structural transformation, and labor income share trends, as we find in Figure 14. As the economy develops, it produces services that are complex, which also creates additional incentives for market production skill accumulation. As the authors assume an upward sloping supply curve for skilled workers, the skill premium also increases.

Figure 14: Sectoral Labor Income Share Trends for High-skilled Workers, 1970–2005



Note: EU KLEMS data cover the following countries: Australia, Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Spain, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Lithuania, Latvia, Luxembourg, Malta, the Netherlands, Poland, Portugal, the Slovak Republic, Slovenia, Sweden, the United Kingdom, and the United States.

Source: Authors' calculation based on data compiled by Buera, Kaboski, and Rogerson (2015). Original data source is EU KLEMS.

4.2 Structural Transformation and Labor Income Share in Japan, 1970–2010

In this section we provide a snapshot of the sectoral trends in the labor income and employment share in Japan for the period from 1970 to 2010. In this period structural transformation in Japan mainly came through the growth of commerce and private sector services[5] (Fukao and Paul 2017). Between 1970 and 1990, the primary gainers in employment shares were construction, commerce and services, and machinery. However, the rate of productivity growth slowed down compared to the previous period in all sectors including commerce and services. For the first time in Japan's history, labor was moving out of most manufacturing sector industries to private sector services. At the same time, compared to the early 1970s, the aggregate labor income share in Japan decreased by approximately 10 percentage points in the following three decades. This decline was primarily driven by services as the labor income share

[5] Private services include private medical services, private education services, private hygiene services, private research services, information and Internet-based services, work in eating and drinking places, automobile maintenance, etc.

in manufacturing sectors remained almost constant (Fukao and Perugini 2018). This section aims to reconcile some of these facts using a sectoral-level analysis.

4.2.1 Descriptive Evidence using Japan Industrial Productivity (JIP) Data

We use the Japan Industrial Productivity (JIP) and the Regional Japan Industrial Productivity (R-JIP) databases compiled by RIETI (Research Institute of Economy, Trade and Industry) and Hitotsubashi University, Tokyo.[6] The latest round of the JIP database (2015) covers 108 industries for the period 1970–2012. Following Fukao and Perugini (2018), we construct the labor income share by sector (industry) as the ratio of nominal total labor compensation to nominal value added (at current prices). Since nominal total labor compensation includes all types of remuneration, such as employee compensation and mixed income (i.e. for labor supplied by self-employed and family workers), it automatically adjusts for labor compensation of nonworkers (employees). This makes our labor income share measure less susceptible to measurement errors as highlighted by many researchers (Gollin 2002; Guerriero 2012). In addition, we use the Regional-Level Japan Industrial Productivity (R-JIP) database,[7] which consists of 23 sectors (agriculture, mining, food, textiles, pulp, chemicals, petroleum, nonmetallic minerals, primary metals, fabricated metals, machinery, electrical machinery, transport equipment, precision instruments, other manufacturing, construction, utilities (electricity, gas, and water supply), wholesale and retail trade, finance and insurance, real estate, transport and communication, private services, and government services. We merge this data set into the JIP database, mainly to facilitate the creation of the classification of sectors.

We divide 108 industries into six broad categories of sectors. *Agri* consists of agriculture, forestry, and fisheries. *Heavy manufacturing* comprises mining, chemicals, petroleum, fabricated metals, machinery, construction, and electrical machinery. *Light manufacturing* consists of food, textiles, pulp, nonmetallic minerals, primary metals, transport equipment, precision instruments, and other manufacturing. *Utilities* include electricity, gas, and water supply. *Commerce* consists of wholesale and retail trade, finance and insurance, real estate, transport, and communication. We include both private services and government services in *Services*. The left-hand panel of Figure 15 shows labor income share trends for these six broad sectors. The labor income shares remained almost constant in heavy manufacturing and light manufacturing whereas the other sectors showed downward trends in the period from 1970 to 2010. During the same period, we observe the secular trends of structural transformation: employment shares rising in services, falling in agriculture, and remaining unchanged in manufacturing.

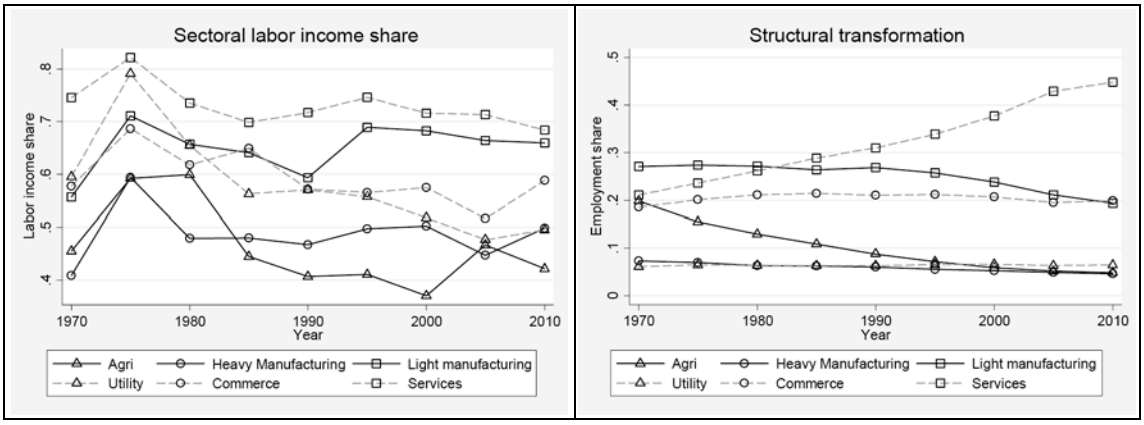
Despite a growth in employment shares, services experienced a decline in labor income share. To gain more insights into this topic, we compare the labor income share trends between two groups of sectors: (a) sectors that experienced rapid expansion and (b) sectors that experienced contraction in terms of employment shares between 1970 and 2010. The right-hand panel of Figure 16 confirms the rising trend in employment shares for three fast-growing sectors: eating and drinking places, private medical services, and other business services. However, the labor income shares decline for both the eating and drinking places and private medical sectors. An increase in the employment share is likely to increase the labor income share unless

[6] See https://www.rieti.go.jp/en/database/JIP2015/#01. For a detailed account of the JIP database, see Fukao et al. (2007). JIP sectors can be easily translated into international industry classifications such as ISIC and KLEMS.

[7] http://www.rieti.go.jp/en/database/r-jip.html (It should be noted that data are missing for Okinawa for the period 1955 to 1970.)

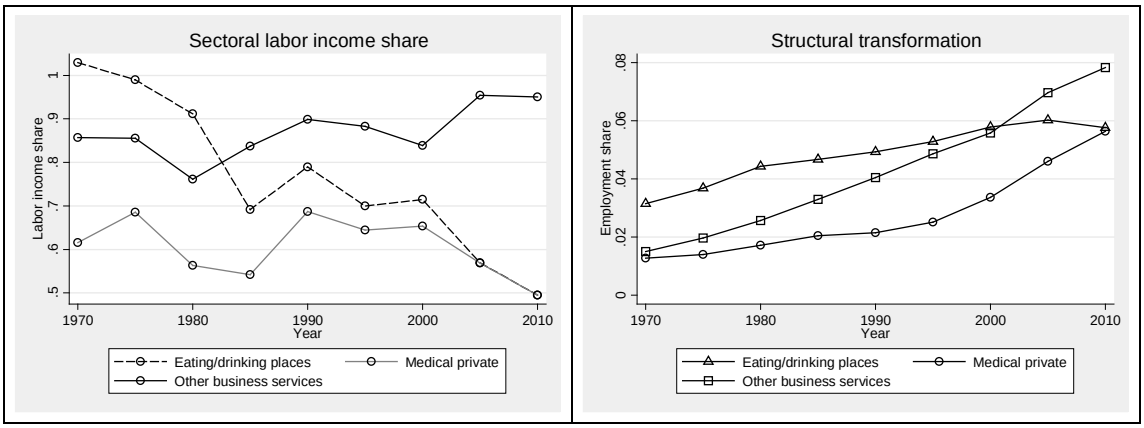
the wages dramatically fall. As a next step, we examine some other factors that could be correlated with a fall in labor income share in these sectors.

Figure 15: Sectoral Labor Income and Employment Share in Japan, 1970–2010



Note: Authors' calculation based on the Japan Industrial Productivity (JIP) database https://www.rieti.go.jp/en/database/JIP2015/#01, and Regional-Level Japan Industrial Productivity (R-JIP) database, http://www.rieti.go.jp/en/database/r-jip.html. The latter data set consists of 23 sectors. We divide them into six broad categories.

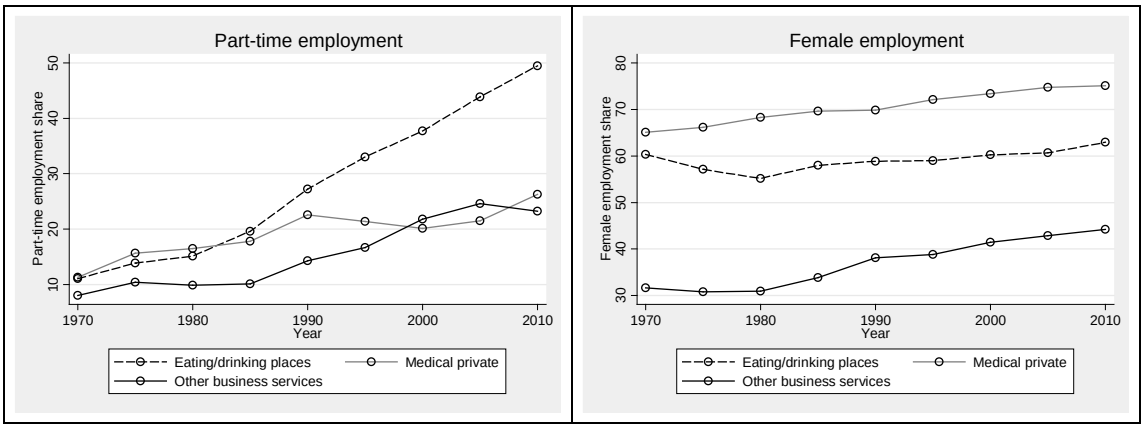
Figure 16: Labor Income and Employment Share in Some Fast-growing Sectors



Note: Authors' calculation based on the Japan Industrial Productivity (JIP) database, https://www.rieti.go.jp/en/database/JIP2015/#01.

In the left-hand panel of Figure 17, we compare the part-time employment shares. The part-time employment share in eating and drinking places rose from about 10% to nearly 50% between 1970 and 2010. The other two sectors also show an increasing trend for part-time workers but to a somewhat lesser extent. At the same time, female employment shares had been very high and became more than 75% in 2010 in private medical services. Taken together, if one can argue that if part-timers get paid less per hour and female employees face gender discrimination in wages, then a fall in labor income share in these sectors despite a growth in employment is conceivable. To conclude, a drop in the labor income share in eating and drinking places could be driven by a significant increase in part-time workers whereas a drop in the labor income share in private medical services could be due to a combination of the growth in part-time workers and an increase in the female labor force participation rate.

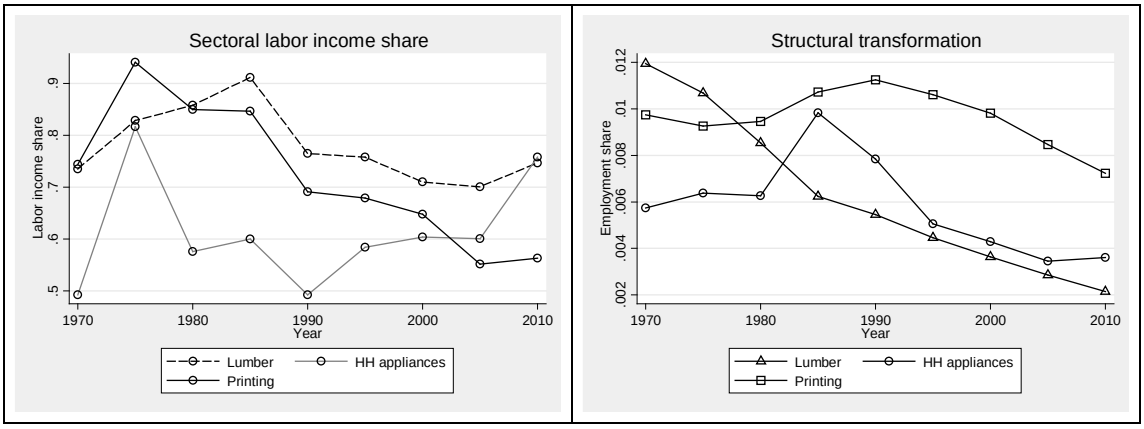
Figure 17: Part-time and Female Employment Shares in Some Fast-growing Sectors



Note: Authors' calculation based on the Japan Industrial Productivity (JIP) database, https://www.rieti.go.jp/en/database/JIP2015/#01.

We finally look at the labor income share trends in some shrinking sectors. As is evident from the right-hand panel of Figure 18, lumber industries, printing businesses, and household appliances industries experienced a significant drop in employment shares over the period from 1970 to 2010. However, the labor income shares in household appliances industries in fact rose after 1990. The other two sectors, lumber and printing, experienced a drop in the labor income share. One can use the same logic to reconcile the puzzling outcomes on employment shares and labor income share in household appliances industries.

Figure 18: Labor Income and Employment Share for Some Shrinking Sectors



Note: Authors' calculation based on the Japan Industrial Productivity (JIP) database, https://www.rieti.go.jp/en/database/JIP2015/#01.

4.2.2 A Shift-share Decomposition Analysis

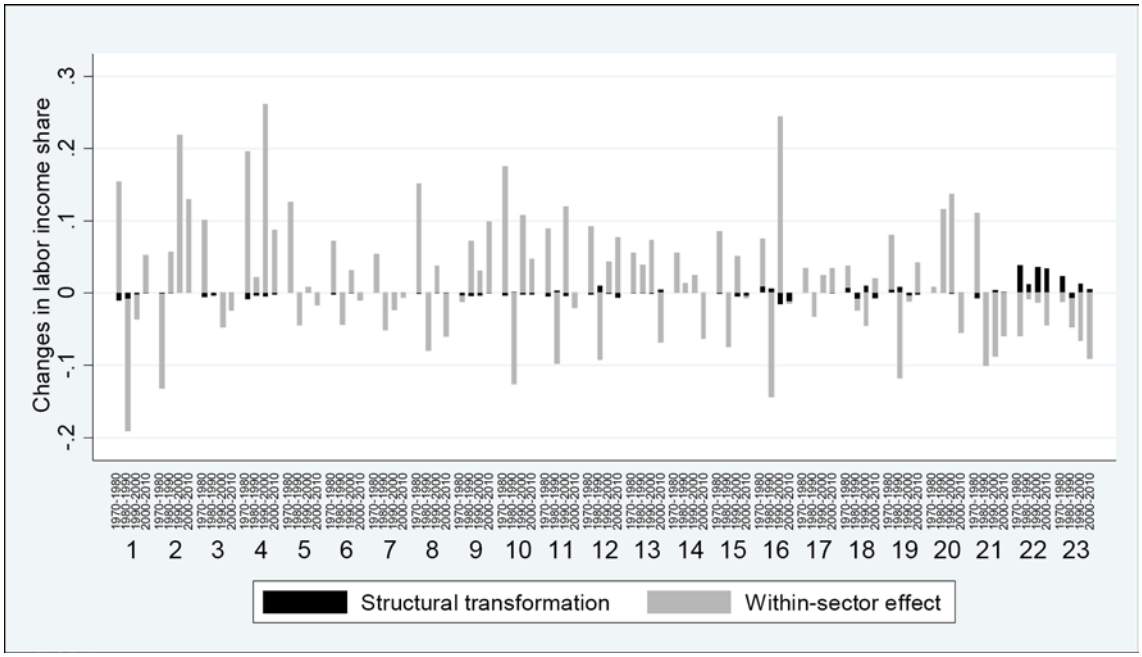
In this section, we provide some results from a shift-share decomposition of labor income share changes between 1970 and 2010. We use a variant of the canonical shift-share decomposition methodology (Fabricant 1942; de Vries, Timmer, and de Vries 2013) and write changes in the aggregate labor income share between t and $t+1$ as

$$\Delta LIS = \sum_i (VA_i^t)(\Delta LIS_i) + \sum_i (\Delta VA_i)(LIS_i^t), \quad (1)$$

where LIS_i is the labor income share in sector *i*, and LIS denotes the aggregate labor income share. Labor is reallocated across sectors between two points in time, t and $t+1$, and VA_i^t denotes the value-added share of sector *i* in period *t*. The first term on the right-hand side of equation (1) measures the contribution of changes in the sectoral labor income share over time whereas the second term measures the contribution of structural transformation (to put it simply, the changes in the weights of the sector). Thus, in the absence of structural transformation, the aggregate labor income share trend would simply be a weighted average of the sectoral labor income share trends.

We describe the decomposition outcomes in Figure 19. A decomposition exercise is performed for four time periods, 1970–1980, 1980–1990, 1990–2000, and 2000–2010, and for 23 main sectors based on the R-JIP database. As is clear from Figure 5, the contribution of structural transformation to changes in the labor income share over time for most of the sectors is negligible. Structural transformation explains a sizable variation in the labor income share only for sectors like private and government services, and to a lesser extent for wholesale and retail trade, and finance and insurance. These services sectors also experienced employment growth in recent years. So we find mild support for the fact that the role of structural transformation in explaining the variation in sectoral labor income share also depends on the level of structural transformation in that sector.

Figure 19: Shift-share Decomposition Outcomes



Authors' calculation based on the Regional-Level Japan Industrial Productivity (R-JIP) database, http://www.rieti.go.jp/en/database/r-jip.html. The latter data set consists of 23 sectors.

Note: 1 = agriculture, 2 = mining, 3 = food, 4 = textiles, 5 = pulp, 6 = chemicals, 7 = petroleum, 8 = nonmetallic minerals, 9 = primary metals, 10 = fabricated metals, 11 = machinery, 12 = electrical machinery, 13 = transport equipment, 14 = precision instruments, 15 = other manufacturing, 16 = construction, 17 = utilities (electricity, gas, and water supply), 18 = wholesale and retail trade, 19 = finance and insurance, 20 = real estate, 21 = transport and communication, 22 = private services, and 23 = government services.

The main goal of this section is to highlight the role of structural transformation in labor income share trends using a case study on Japan. We used JIP data to provide some descriptive evidence and analytical evidence supporting the role of change in the sectoral employment share behind changes in the sectoral labor income share. Overall, the findings suggest a limited role of structural transformation in the movement of labor income share in Japan, and the direction of changes in certain sectors is driven by part-time employment.

5. REGRESSION OUTCOMES ON SECTORAL LABOR INCOME SHARE, TRADE, AND STRUCTURAL TRANSFORMATION

In this section we discuss the regression model and outcomes both at the country and sectoral level.

5.1 Empirical Analysis at the Country Level

To elaborate on the descriptive evidence on the relationship between trade openness and labor income share trends in Section 3, we conduct regression analyses using cross-country panel data. While bivariate descriptive evidence may be contaminated by confounding factors that happened at the same time as trade liberalization, regressions allow us to isolate the effects of trade openness after controlling other potential drivers of the labor income share.

We constructed panel data by combining multiple secondary data sources. Data on the labor income share across countries and years are taken from the Penn World Tables (PWT). As in Section 3, the year of trade liberalization for each country is based on Sachs and Warners (1995) and Wacziarg and Welch (2003, 2008). A dummy variable is constructed that takes 0 for years before trade liberalization and 1 for years after trade liberalization. Other country characteristics that potentially impact the labor income share and are correlated with trade openness are retrieved from the World Development Indicators (WDI) of the World Bank. Such control variables include GDP per capita, population, the share of export and import to GDP, and the share of manufacturing, agriculture, and service value added to GDP. Since available data periods differ across countries, the constructed panel data are unbalanced. Summary statistics of the unbalanced panel data are presented in Table 3.

Table 3: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
labor income share	2,484	0.55	0.12	0.09	0.89
Trade_open	2,103	0.85	0.36	0.00	1.00
GDPPC_constant2010	2,392	17,210.44	19,709.05	209.86	111,968.30
log(GDPPC_constant2010)	2,392	8.92	1.46	5.35	11.63
POP_total	2,449	52,300,000.00	166,000,000.00	18,427.00	1,350,000,000.00
log(POP_total)	2,449	16.14	1.79	9.82	21.02
trade_GDP	2,352	82.92	57.64	8.93	441.60
MANU_VA_GDP	2,136	15.24	6.61	0.00	54.21
AGRI_VA_GDP	2,191	10.38	10.79	0.04	55.95
SERVICE_VA_GDP	2,006	54.74	14.87	–77.42	155.55

Note: Authors' calculation based on the Penn World Tables (PWT) and World Development Indicators (WDI).

To identify the impact of trade liberalization, we first carry out fixed-effect (FE) estimations. We regress the labor income share on the dummy variable indicating trade liberalization status and other control variables as follows:

$$labsh_{i,t} = \alpha + \beta_1 Trade\_open_{i,t} + \boldsymbol{X'_{i,t}\gamma} + \varphi_i + \varepsilon_{i,t}, \quad (1)$$

where $\boldsymbol{X'_{i,t}}$ includes GDP per capita (in log form), total population (in log form), the share of trade (export plus import) to GDP, and the share of manufacturing and agriculture value added to GDP. φ_i are country fixed effects and $\varepsilon_{i,t}$ is an error term.

We next investigate how soon the effects of trade liberalization start to impact the labor income share. Dummy variables for four periods surrounding the liberalization were introduced to further examine the timing of the labor income share response to liberalization. The specification is as follows:

$$labsh_{i,t} = \alpha + \beta_1 D_{1i,t} + \beta_2 D_{2i,t} + \beta_3 D_{3i,t} + \beta_4 D_{4i,t} + \boldsymbol{X'_{i,t}\gamma} + \varphi_i + \varepsilon_{i,t}, \quad (2)$$

where $D_{1i,t} = 1$ if $T - 3 \leq t \leq T - 1$ and zero otherwise; $D_{2i,t} = 1$ if $T \leq t \leq T + 2$; $D_{3i,t} = 1$ if $T + 3 \leq t \leq T + 6$; $D_{4i,t} = 1$ if $t > T + 6$; and T denotes the year of trade liberalization. The coefficients of these four dummy variables are interpreted as the mean difference in the labor income share between these years and the period preceding three years before liberalization (the base period).

Further, we shed light on potential channels through which trade liberalization impacts the labor income share. We examine whether the liberalization reforms did indeed increase the share of trade (export plus import) to GDP.

$$trade\_GDP_{i,t} = \alpha + \beta_1 Trade\_open_{i,t} + \boldsymbol{X'_{i,t}\gamma} + \varphi_i + \varepsilon_{i,t} \quad (3)$$

Lastly, we re-estimate the impact of trade liberalization on the labor income share using fixed-effects-instrumental-variable (FEIV) estimations to counter the possible correlation between the trade openness dummy and the error term in the model (1). We use the share of agriculture and service value added to GDP as instruments, assuming that they are correlated with trade liberalization but uncorrelated with unobservable, time-variant country characteristics. The first-stage and second-stage regressions are as follows:

$$Trade\_open_{i,t} = \alpha + \beta_1 AGRI\_VA\_GDP_{i,t} + \beta_2 SERVICE\_VA\_GDP_{i,t} + \boldsymbol{X'_{i,t}\gamma} + \varepsilon_{i,t} \quad (4)$$

$$labsh_{i,t} = \alpha + \beta_1 \widehat{Trade\_open}_{\iota,t} + \boldsymbol{X'_{i,t}\gamma} + \varphi_i + \varepsilon_{i,t}, \quad (5)$$

where $AGRI\_VA\_GDP_{i,t}$ and $SERVICE\_VA\_GDP_{i,t}$ are the ratio of agricultural and service value added to GDP, respectively. $\widehat{Trade\_open}_{\iota,t}$ is the fitted value from the regression of (4).

FE estimation results on the impact of trade liberalization are somewhat mixed. On average, although statistically insignificant, the labor income share of open regimes is 1.8 percentage points lower than that of closed regimes ((1) of Table 4). After the share of trade to GDP and the shares of sectoral value added to GDP are added as additional controls, however, the impact of trade liberalization becomes small in absolute terms and statistically insignificant ((3) and (4) of Table 3.2).

Table 4: Fixed Effects of the Labor Income Share

	FE	**FE**	**FE**	**FE**
	(1)	**(2)**	**(3)**	**(4)**
Trade_open	–0.018	–0.005	0.001	0.008
	[0.023]	[0.022]	[0.017]	[0.017]
lGDPPC_constant2010	–0.079***	–0.071***	–0.075***	–0.057***
	[0.013]	[0.013]	[0.013]	[0.015]
lPOP_total	–0.059*	–0.071**	–0.061*	–0.051
	[0.033]	[0.032]	[0.034]	[0.033]
trade_GDP		0	0	0
		[0.000]	[0.000]	[0.000]
MANU_VA_GDP			0	0
			[0.001]	[0.001]
AGRI_VA_GDP				0.002**
				[0.001]
_cons	2.242***	2.368***	2.237***	1.880***
	[0.491]	[0.492]	[0.525]	[0.537]
chi2				
r2	0.321	0.315	0.35	0.365
N	2,062	2,010	1,799	1,799
FE vs. RE				
Sargan-Hansen statistic	51.475	49.714	48.564	46.608
P-value	0	0	0	0

* p<0.10, ** p<0.05, *** p<0.01.

Further, the negative effects of trade liberalization seem to have emerged in the period following several years after the liberalization. In the regressions of the labor income share on dummy variables for four periods, the coefficients of dummy variables become larger in absolute terms in the later periods ((1) to (4) of Table 5).

Table 5: Fixed-effects Regressions of the Labor Income Share (with Four Period Dummy Variables)

	FE (1)	FE (2)	FE (3)	FE (4)
D1	–0.031	–0.024	–0.027	–0.034
	[0.023]	[0.029]	[0.030]	[0.029]
D2	–0.042**	–0.024	–0.029	–0.029*
	[0.019]	[0.021]	[0.020]	[0.016]
D3	–0.046**	–0.024	–0.033	–0.031*
	[0.021]	[0.022]	[0.020]	[0.017]
D4	–0.068***	–0.044*	–0.051**	–0.046**
	[0.022]	[0.023]	[0.023]	[0.019]
lGDPPC_constant2010	–0.075***	–0.059***	–0.066***	–0.049***
	[0.014]	[0.014]	[0.013]	[0.014]
lPOP_total	–0.055	–0.065*	–0.048	–0.037
	[0.037]	[0.037]	[0.036]	[0.036]
trade_GDP		–0.000**	–0.000***	–0.000***
		[0.000]	[0.000]	[0.000]
MANU_VA_GDP			0	0
			[0.001]	[0.001]
AGRI_VA_GDP				0.002*
				[0.001]
_cons	2.199***	2.241***	2.016***	1.664***
	[0.549]	[0.559]	[0.550]	[0.570]
chi2				
r2	0.366	0.363	0.382	0.395
N	1,727	1,684	1,499	1,499
FE vs. RE				
Sargan-Hansen statistic	58.525	53.85	59.253	57.663
P-value	0	0	0	0

* p<0.10, ** p<0.05, *** p<0.01.

The effects of liberalization on the share of trade to GDP are counterintuitive. The estimated coefficients of the trade liberalization dummy take relatively large negative values, although they are statistically insignificant (Table 6).

Table 6: Fixed Effects of the Share of Trade to GDP

	FE	FE	FE
	(1)	(2)	(3)
Trade_open	–3.298	–1.457	–1.188
	[3.878]	[3.748]	[3.608]
lGDPPC_constant2010	30.220***	27.191***	27.879***
	[8.114]	[6.598]	[7.281]
lPOP_total	14.733**	11.563*	11.932
	[7.054]	[6.800]	[7.304]
MANU_VA_GDP		–0.323	–0.315
		[0.442]	[0.453]
AGRI_VA_GDP			0.084
			[0.456]
_cons	–428.875***	–342.084***	–355.476***
	[112.658]	[106.632]	[133.105]
chi2			
r2	0.224	0.218	0.218
N	2,010	1,799	1,799
FE vs. RE			
Sargan-Hansen statistic	42.756	34.971	38.423
P-value	0	0	0

* p<0.10, ** p<0.05, *** p<0.01.

Finally, FEIV estimation results indicate that trade liberalization had a large negative impact on the labor income share. The first-stage regressions suggest that the shares of agricultural and service value added to GDP are strong predictors of trade openness ((1) of Table 7). When the trade liberalization dummy is instrumented, the estimated liberalization effects take –11.9 percentage points ((2) of Table 7).

Summarizing this section, trade liberalization seemed to have a negative impact on the labor income share. Moreover, over the course of liberalization, the negative effects of opening up to trade would have emerged in the period following several years after the liberalization. When the trade liberalization variable is instrumented by agricultural and service value added, the negative impact is magnified. However, we could not reach a full understanding of how trade liberalization impacted the labor income share. The liberalization policy did not have a clear impact on the actual share of trade to GDP.

Table 7: Fixed-effects-instrumental-variable Regressions of the Labor Income Share

	First Stage (dep=Trade_open)	Second Stage (dep=labsh)
	FE or RE	FE
	(1)	(2)
AGRI_VA_GDP	–0.014***	
	[0.002]	
SERVICE_VA_GDP	–0.002***	
	[0.001]	
Trade_open		–0.119***
		[0.027]
lGDPPC_constant2010	0.018*	–0.081***
	[0.010]	[0.005]
lPOP_total	–0.01	0.009
	[0.007]	[0.017]
trade_GDP	0	–0.000***
	[0.000]	[0.000]
_cons	1.131***	1.244***
	[0.153]	[0.242]
chi2		327,788.492
r2	0.222	
N	1,697	1,697
FE vs. RE		
Sargan-Hansen statistic		8.994
P-value		0.0027

* p<0.10, ** p<0.05, *** p<0.01.

5.2 Empirical Analysis at the Sectoral Level

To elaborate descriptive evidence on the relationship between trade openness and sectoral labor income share trends in Section 3.2, we conduct regression analyses using cross-country unbalanced panel data. We use sectoral labor income shares (both at the broad and disaggregated levels) as the dependent variables. The summary statistics for these variables are available in Table 8. The sectoral data are available for 10 GGDC disaggregated sectors and following the WDI database we create the broad sectors in the following manner: (1) Agriculture consisting of AGR; (2) Manufacturing sector consisting of MAN; and (3) Services consisting of WRT, TRA, FIRE, GOV, and OTH. The average (unweighted) figures (across all countries) for these broad sectors and 10 disaggregated sectors are shown in Table 3. On average, employees in the agriculture, manufacturing, and services sectors enjoy about 40% of the total income. At a more disaggregated level, GOV shows the highest share of labor income (46%) followed by MAN (41%), AGR, WRT, and TRA, each with an average of 40%. On the other hand, PU (16%) and MIN (20%) are the sectors with the lowest share of labor income. Other country characteristics that potentially impact the labor income share and are correlated with trade openness are taken from the World Development Indicators (WDI) of the World Bank. These control variables include GDP per capita, population, the share of export and import to GDP, and the share of manufacturing, agriculture, and service value added to GDP. Since available data periods differ across

countries, the constructed panel data are unbalanced. Summary statistics of these variables are also reported in Table 8.

We use trade share of GDP as a proxy for trade openness or trade intensity. To examine the effect of structural transformation, we use sectoral valued added shares of GDP. The regression models for both the baseline and alternative specification are discussed below. We also run regressions on the different components of the sectoral labor income share measure to understand the causal channels better. With the help of panel data methods, we can address both cross-country and temporal effects.

Table 8: Summary Statistics (Unweighted)

	Observations	Mean	Standard deviation	Min	Max
Labor Income Share					
Agriculture	330	0.40	0.24	0.01	0.97
Manufacturing	505	0.41	0.14	0.07	0.97
Service	495	0.39	0.16	0.06	0.97
AGR	330	0.40	0.24	0.01	0.97
MIN	493	0.20	0.15	0.00	0.95
MAN	505	0.41	0.14	0.07	0.97
PU	499	0.16	0.11	0.03	0.74
CON	451	0.32	0.22	0.03	1.00
WRT	432	0.40	0.16	0.04	0.97
TRA	468	0.40	0.16	0.09	0.97
FIRE	405	0.28	0.19	0.03	0.99
GOV	320	0.46	0.14	0.16	0.93
OTH	82	0.33	0.18	0.10	0.99
Employment (logarithm)					
AGR	545	12.62	2.19	6.28	17.58
MIN	538	9.85	2.15	1.79	14.14
MAN	549	13.36	1.79	7.74	16.49
PU	538	10.39	1.83	3.50	14.62
CON	549	12.44	1.77	6.25	15.57
WRT	549	13.41	1.86	7.26	16.92
TRA	549	12.34	1.82	5.94	15.71
FIRE	549	12.50	1.89	5.34	15.77
GOV	529	13.46	1.85	6.67	16.68
OTH	482	12.43	1.66	8.52	16.09
GDP per capita in 2010 (logarithm)	541	9.51	1.12	5.45	11.63
Trade to GDP ratio	540	0.93	0.65	0.10	4.42
Service trade to GDP ratio	510	0.23	0.28	0.02	2.12
Agriculture value added to GDP	527	5.42	5.44	0.04	41.17
Manufacturing value added to GDP	520	16.48	6.07	0.00	32.45
Service value added to GDP	495	57.17	7.67	33.37	76.02
Other sector value added to GDP	488	21.16	6.10	8.58	53.87

Source: Authors' own calculations.

To identify the impact of trade liberalization, we carry out fixed-effect (FE) estimations. We prefer the fixed-effects (or within) estimation in this analysis because it allows us to address the issues of endogeneity in a limited manner. We accept the fact that the correlation between the unobserved heterogeneity and the explanatory variables, caused for example by institutional factors at the sectoral level, cannot be directly measured. In addition, with FE estimation we can remove any time-invariant variable, which helps eliminate country-specific idiosyncrasies in the data used to compute the labor income share. We regress the labor income share on the indicators of trade liberalization, structural transformation, and other controls. The baseline model takes the form of equation (7):

$$LIS_{ijt} = \alpha + \varphi_i + \delta_t + \beta_1 Trade\_open_{jt} + \beta_2 StrucTrans_{ijt} + \boldsymbol{X'_{jt}\gamma} + \varepsilon_{i,t}\,, \qquad (7)$$

where φ_i are country fixed effects, δ_t capture time fixed effects, $\boldsymbol{X'_{i,t}}$ includes GDP per capita (in log form) and other controls, $Trade\_open_{jt}$ is measured by the share of trade (export plus import) to GDP, $StrucTrans_{ijt}$ are proxied by sectoral value added shares to GDP, and $\varepsilon_{i,t}$ is an error term.

As a next step, we shed light on potential channels through which trade liberalization and structural transformation impact the labor income share. The labor income share is the ratio between the total income earned by the laborers and the total income generated in the economy. The total income earned by the laborers in a sector can be affected in two ways: (a) changes in the average sectoral wages and (b) changes in the size of sectoral employment. Since wages are not PPP adjusted and as a result are more likely to generate bias in the estimation, we decide to examine the sectoral employment as a possible causal mechanism channel. In other words, our second set of regressions use log employment in each sector to find potential channels through which trade and structural transformation affect the labor income share (equation 8).

$$LogEmp_{ijt} = \alpha + \varphi_i + \delta_t + \beta_1 Trade\_open_{jt} + \beta_2 StrucTrans_{ijt} + \boldsymbol{X'_{jt}\gamma} + \varepsilon_{i,t} \qquad (8)$$

In Table 9 we show the baseline model outcomes for broad sectors: agriculture, manufacturing, and services. FE estimation results suggest that trade share of GDP is negatively correlated to labor income share in all sectors; however, the estimates are statistically significant for manufacturing and services. We control for sectoral value-added shares (agriculture, services and other) with manufacturing as the omitted group. The pace of structural transformation is low in a country with a higher agriculture value-added share of GDP. The labor income share in agriculture and services is negatively correlated with the agriculture value-added share of GDP. This implies that countries at an advanced stage of structural transformation, on average, are more likely to enjoy a higher labor income share in these sectors. This could be due to a higher bargaining power for the workers. However, such effects could be dampened by the negative effect of trade, which could also be associated with substitution of labor by capital as discussed in Section 4.1. Richer countries enjoy a higher labor income share in services, but we find opposite results for agriculture and manufacturing. Services value-added share of GDP is positively correlated with manufacturing labor income share. This could be driven by complementarity between manufacturing and services sectors in some countries.

Table 9: Baseline Models (Broad Sectors) of the Labor Income Share

	Labor Income Share		
	Agriculture	**Manufacturing**	**Service**
	(1)	**(2)**	**(3)**
GDP per capita in 2010 (logarithm)	–0.147***	–0.112***	0.0606**
	(0.0451)	(0.0219)	(0.0257)
Trade to GDP ratio	–0.00783	–0.0602***	–0.0900***
	(0.0449)	(0.0165)	(0.0188)
Agriculture value added to GDP	–0.0226***	0.00253	–0.00907***
	(0.00573)	(0.00302)	(0.00350)
Service value added to GDP	0.00506	0.00464***	–0.00374*
	(0.00399)	(0.00171)	(0.00198)
Other sector value added to GDP	–0.00516	0.00943***	–0.00650***
	(0.00429)	(0.00195)	(0.00228)
Constant	1.734***	1.066***	0.298
	(0.409)	(0.219)	(0.256)
Observations	297	445	437
R-squared	0.137	0.206	0.079
Countries	33	47	48

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

In Figure 10, we extend the baseline model to disaggregated sectors. It shows outcomes for eight sectors: MIN, PU, CON, WRT, TRA, FIRE, GOV, and OTH. The last five sectors are included in services. Labor income share in GOV is higher in richer countries, but it is significantly lower in countries where services value-added share of GDP is higher. This suggests that the opposite channels are at work, and the net effect depends on how large the services sector in a rich country is. At the disaggregated level, the effect of trade is mostly negative but statistically insignificant, except for MIN and WRT. We do not find any consistent trend or relationship between structural transformation and labor income shares at the disaggregated sectoral level.

Table 11 shows the same baseline model outcomes with alternative specification. We use service trade share of GDP instead of trade share of GDP as the proxy for trade openness. Overall, the results conform to the baseline model outcomes with original specification. Service trade share of GDP is negatively correlated with labor income share in TRA, which suggests possibilities of outsourcing of jobs, in turn lowering the labor income share in TRA in the home country. The estimated coefficients of the sectoral value-added shares of GDP are now statistically significant for more sectors at the disaggregated level.

Table 10: Baseline Models (Disaggregated Sectors) of the Labor Income Share

	MIN	PU	CON	WRT
	(2)	(4)	(5)	(6)
GDP per capita in 2010 (logarithm)	–0.0174	–0.0132	0.0145	–0.0310
	(0.0282)	(0.0268)	(0.0257)	(0.0264)
Trade to GDP ratio	–0.0869***	–0.0195	–0.00942	–0.0478**
	(0.0229)	(0.0214)	(0.0186)	(0.0188)
Agriculture value added to GDP	–0.00550	–0.00645*	–0.0110***	–0.0111***
	(0.00387)	(0.00372)	(0.00348)	(0.00358)
Service value added to GDP	–0.00592***	–0.00624***	–0.0113***	–0.00322
	(0.00224)	(0.00215)	(0.00198)	(0.00210)
Other sector value added to GDP	–0.00901***	–0.00238	–0.0107***	–0.000424
	(0.00253)	(0.00244)	(0.00229)	(0.00246)
Constant	1.005***	0.738***	1.111***	0.992***
	(0.287)	(0.278)	(0.256)	(0.262)
Observations	435	442	431	379
R-squared	0.112	0.036	0.091	0.064
Countries	46	47	45	44
	TRA	**FIRE**	**GOV**	**OTH**
	(7)	**(8)**	**(9)**	**(10)**
GDP per capita in 2010 (logarithm)	0.00495	0.0480	0.0969***	0.0292
	(0.0309)	(0.0340)	(0.0214)	(0.146)
Trade to GDP ratio	–0.0308	–0.0159	0.0142	0.0405
	(0.0276)	(0.0304)	(0.0207)	(0.195)
Agriculture value added to GDP	0.00524	–9.08e–05	–0.00597*	0.0771***
	(0.00416)	(0.00466)	(0.00313)	(0.0226)
Service value added to GDP	–0.00352	0.00591**	–0.00505***	0.0338**
	(0.00264)	(0.00281)	(0.00175)	(0.0127)
Other sector value added to GDP	–0.000643	0.00113	–0.0107***	0.0138
	(0.00279)	(0.00325)	(0.00212)	(0.00877)
Constant	0.566*	–0.515	0.0625	–2.580*
	(0.294)	(0.330)	(0.213)	(1.524)
Observations	410	347	272	67
R-squared	0.053	0.075	0.200	0.268
Countries	47	41	33	14

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Alternative Specification: Service Trade as a Share of GDP

	Labor Income Share				
	AGR	**MIN**	**MAN**	**PU**	**CON**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP per capita in 2010 (logarithm)	–0.150***	–0.0482*	–0.119***	–0.0147	0.0222
	(0.0401)	(0.0259)	(0.0191)	(0.0254)	(0.0225)
Service trade to GDP ratio	–0.0322	–0.156***	–0.0371	0.00142	–0.0138
	(0.0652)	(0.0324)	(0.0230)	(0.0304)	(0.0260)
Agriculture value added to GDP	–0.0219***	–0.00134	0.00610**	–0.00663	–0.00906***
	(0.00570)	(0.00401)	(0.00301)	(0.00403)	(0.00347)
Service value added to GDP	0.00565	–0.00290	0.00693***	–0.00652***	–0.0103***
	(0.00395)	(0.00237)	(0.00175)	(0.00239)	(0.00199)
Other sector value added to GDP	–0.00479	–0.00723***	0.0112***	–0.00226	–0.00987***
	(0.00419)	(0.00259)	(0.00189)	(0.00261)	(0.00220)
Constant	1.722***	1.022***	0.891***	0.749***	0.951***
	(0.406)	(0.286)	(0.210)	(0.288)	(0.246)
Observations	298	420	416	417	411
R-squared	0.138	0.136	0.169	0.031	0.085
Countries	34	47	48	48	46
	Labor Income Share				
	WRT	**TRA**	**FIRE**	**GOV**	**OTH**
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
GDP per capita in 2010 (logarithm)	–0.0551**	–0.00527	0.0390	0.101***	0.0598
	(0.0240)	(0.0276)	(0.0311)	(0.0200)	(0.190)
Service trade to GDP ratio	–0.0276	–0.124***	–0.0231	0.0186	0.442
	(0.0269)	(0.0342)	(0.0378)	(0.0227)	(1.116)
Agriculture value added to GDP	–0.00907**	0.00840**	0.000799	–0.00663**	0.0758***
	(0.00368)	(0.00417)	(0.00474)	(0.00312)	(0.0234)
Service value added to GDP	–0.00162	–0.000678	0.00668**	–0.00555***	0.0333**
	(0.00217)	(0.00265)	(0.00284)	(0.00178)	(0.0127)
Other sector value added to GDP	0.00167	0.00110	0.00191	–0.0109***	0.0143
	(0.00244)	(0.00270)	(0.00319)	(0.00211)	(0.00947)
Constant	1.026***	0.448	–0.503	0.0800	–2.888
	(0.260)	(0.293)	(0.334)	(0.214)	(1.910)
Observations	364	399	336	264	59
R-squared	0.046	0.084	0.074	0.195	0.273
Countries	44	47	41	33	14

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Moving on, we next analyze the effects of structural transformation and trade on sectoral employment as a possible channel of the relationship between these factors and the sectoral labor income share. As expected, employment in agriculture is lower in richer countries. Employment in all the service sectors (such as WRT, TRA, FIRE, GOV, and OTH) is positively correlated per capital GDP of a country. Increase in trade intensity is negatively correlated with the size of employment in most of the sectors; the estimated coefficients are statistically significant for MIN, MAN, and CON (Table 12). The results do not alter when we consider the alternative specification as shown in Table 13. Employment is positively correlated with sectoral value-added shares of GDP.

Table 12: Channels of Change in Labor Income Share (Baseline Model Specification)

	Number of Employments (logarithm)				
	AGR	**MIN**	**MAN**	**PU**	**CON**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP per capita in 2010 (logarithm)	–0.557***	0.0874	–0.0200	–0.165*	0.825***
	(0.0530)	(0.125)	(0.0328)	(0.0850)	(0.0538)
Trade to GDP ratio	–0.105**	–0.274***	–0.0663***	–0.107	–0.169***
	(0.0412)	(0.101)	(0.0247)	(0.0686)	(0.0406)
Agriculture value added to GDP	0.00762	0.0581***	–0.0156***	0.0102	0.0249***
	(0.00721)	(0.0170)	(0.00443)	(0.0116)	(0.00727)
Service value added to GDP	–0.00713*	–0.000570	–0.0203***	0.00627	0.00652
	(0.00409)	(0.00967)	(0.00249)	(0.00660)	(0.00410)
Other sector value added to GDP	0.00597	0.0260**	–0.00522*	0.00979	0.0264***
	(0.00465)	(0.0111)	(0.00286)	(0.00757)	(0.00469)
Constant	18.33***	8.493***	15.05***	11.56***	3.687***
	(0.537)	(1.264)	(0.331)	(0.862)	(0.543)
Observations	483	476	487	476	487
R-squared	0.486	0.095	0.227	0.040	0.525
Countries	50	49	50	49	50
	Number of Employments (logarithm)				
	WRT	**TRA**	**FIRE**	**GOV**	**OTH**
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
GDP per capita in 2010 (logarithm)	0.351***	0.355***	1.007***	0.288***	0.452***
	(0.0347)	(0.0409)	(0.0758)	(0.0448)	(0.0538)
Trade to GDP ratio	–0.0192	–0.0428	0.0323	0.124***	0.0600
	(0.0261)	(0.0309)	(0.0571)	(0.0358)	(0.0426)
Agriculture value added to GDP	0.00933**	0.0193***	0.0181*	0.0280***	0.0147*
	(0.00468)	(0.00553)	(0.0102)	(0.00647)	(0.00784)
Service value added to GDP	0.00741***	0.000974	0.0223***	0.0147***	0.00693*
	(0.00264)	(0.00312)	(0.00577)	(0.00343)	(0.00415)
Other sector value added to GDP	0.0154***	0.0122***	0.0205***	0.0124***	0.0127***
	(0.00302)	(0.00357)	(0.00661)	(0.00397)	(0.00475)
Constant	9.359***	8.655***	1.112	9.452***	7.192***
	(0.350)	(0.413)	(0.765)	(0.464)	(0.554)
Observations	487	487	487	467	449
R-squared	0.417	0.231	0.551	0.277	0.333
Countries	50	50	50	48	46

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Channels of Change in Labor Income Share (Alternative Specification)

	Number of Employments (logarithm)				
	AGR	**MIN**	**MAN**	**PU**	**CON**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP per capita in 2010 (logarithm)	–0.604***	–0.0722	–0.0373	–0.221***	0.722***
	(0.0490)	(0.118)	(0.0300)	(0.0810)	(0.0498)
Trade to GDP ratio	–0.000306	–0.000757	–0.00166***	4.43e–06	–0.000526
	(0.000591)	(0.00142)	(0.000361)	(0.000979)	(0.000600)
Agriculture value added to GDP	0.0114	0.0687***	–0.00938**	0.00986	0.0321***
	(0.00760)	(0.0182)	(0.00464)	(0.0125)	(0.00770)
Service value added to GDP	–0.00410	0.00813	–0.0160***	0.00649	0.0117***
	(0.00441)	(0.0106)	(0.00268)	(0.00732)	(0.00445)
Other sector value added to GDP	0.00876*	0.0311***	–0.00206	0.00998	0.0311***
	(0.00480)	(0.0117)	(0.00293)	(0.00807)	(0.00486)
Constant	18.47***	9.207***	14.90***	12.03***	4.186***
	(0.544)	(1.296)	(0.331)	(0.892)	(0.550)
Observations	454	447	458	447	458
R-squared	0.476	0.086	0.237	0.033	0.505
Countries	51	50	51	50	51
	Number of Employments (logarithm)				
	WRT	**TRA**	**FIRE**	**GOV**	**OTH**
	(6)	**(7)**	**(8)**	**(9)**	**(10)**
GDP per capita in 2010 (logarithm)	0.341***	0.294***	0.995***	0.306***	0.452***
	(0.0318)	(0.0361)	(0.0715)	(0.0420)	(0.0507)
Trade to GDP ratio	0.000179	–0.000743*	0.00123	0.000992**	0.000469
	(0.000383)	(0.000436)	(0.000862)	(0.000500)	(0.000600)
Agriculture value added to GDP	0.0143***	0.0246***	0.0175	0.0232***	0.00767
	(0.00491)	(0.00559)	(0.0111)	(0.00684)	(0.00830)
Service value added to GDP	0.0103***	0.00542*	0.0220***	0.0116***	0.00276
	(0.00284)	(0.00323)	(0.00639)	(0.00375)	(0.00451)
Other sector value added to GDP	0.0178***	0.0149***	0.0211***	0.00824**	0.00863*
	(0.00310)	(0.00352)	(0.00698)	(0.00415)	(0.00500)
Constant	9.262***	8.950***	1.334*	9.717***	7.690***
	(0.351)	(0.399)	(0.791)	(0.473)	(0.570)
Observations	458	458	458	438	422
R-squared	0.422	0.208	0.533	0.220	0.301
Countries	51	51	51	49	47

The outcomes from Tables 7 and 8 provide mild support for the employment channel of the link between trade and labor income share. Trade affects firm productivity and employment through different channels. Differences in trade costs and trade imbalances (Smitkova 2018), lower cost of innovation with the availability of new foreign inputs (Goldberg and Pavcnik 2007), resource allocation through more productive firms through export opportunities and competition (Melitz 2003; Melitz and Ottaviano 2008) – such processes of trade adjustment also vary across countries and regions as countries open up and become a part of different trade agreements. All these point to the development of more capital-intensive technologies as the trade intensity increases, which in turn could cause a lower share of labor income if labor and capital are gross substitutes in the production function.

To conclude, the empirical evidence at the sectoral level does not allow us to claim any strong causal relationship between trade and labor income share. We find support for a negative correlation between trade openness and sectoral labor income share; however, the evidence on the relationship between the process of structural transformation and labor income share is at best mixed. Skill-biased structural transformation is likely to be positively correlated with the share of labor income predominantly in the service sectors.

6. CONCLUSION

There is a growing interest in examining the role of trade in the process of structural transformation. In this paper, we go one step further. Using two novel data sets at the country and sectoral level, we examine the relationship between trade, structural transformation, and labor income share. From the bivariate graphical analysis, we find weak evidence supporting a downward trend of the labor income share following the episode of trade liberalization. The cross-country regression estimates, both at the country and the sectoral level, suggest that trade liberalization is negatively correlated with the labor income share, both at the national and the sectoral level. The negative relationship in the manufacturing sector is somewhat weaker than in other sectors, and such sectoral trends in factor income shares do not alter with trade reforms change over time. While the support for a negative correlation between trade openness and sectoral labor income share is somewhat robust, the evidence on the relationship between the process of structural transformation and labor income share is at best mixed. A case study on Japan shows that a decline in some of the key services sectors could be driven by a significant increase in the part-time workers and female labor force participation rate. There is weak evidence that skill-biased structural transformation is likely to be positively correlated with the share of labor income predominantly in the service sectors.

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APPENDIX 1: YEAR OF TRADE LIBERALIZATION AND SAMPLE PERIOD

Country	Temporal Liberalization (if applicable)	Year of Liberalization	Sample Period	Observation	Average LIS[a]
Middle East and North Africa					
Egypt		1995	1996–2012	17	0.381
Iran		After 2001	1994–2001	8	0.360
Iraq		After 2001	1997–2001	5	0.138
Israel		1985	1995–2013	19	0.571
Jordan		1965	1970–2009	39	0.473
Morocco	1956–64	1984	1998–2011	14	0.503
Tunisia		1989	1992–2011	20	0.510
Regional average of Middle East and North Africa					*0.464*
Sub-Saharan Africa					
Benin		1990	1994–1999	6	0.617
Botswana		1979	1992–2000	9	0.318
Burkina Faso		1998	1979–2011	19	0.622
Burundi		1999	1984–2010	11	0.687
Cameroon		1993	1990–1996	5	0.526
Chad		After 2001	1975–2001	8	0.520
Ivory Coast		1994	1989–2000	12	0.520
Gabon		After 2001	1972–2001	8	0.367
Guinea		1986	2003–2010	8	0.384
Kenya	1963–67	1993	2013	1	0.428
Lesotho		After 2001	1997–2001	2	0.685
Mauritania		1995	2001–2006	3	0.536
Mauritius		1968	1995–2010	16	0.470
Mozambique		1995	1996–2003	8	0.462
Niger		1994	1995–2013	19	0.570
Nigeria		After 2001	1981–2001	21	0.303
Rwanda		After 2001	1975–1989	15	0.773
Senegal		After 2001	1991–2001	11	0.388
Sierra Leone		2001	2001–2013	13	0.546
South Africa		1991	1979–2013	30	0.577
Togo		After 2001	1971	1	0.852
Tanzania		1995	1994–2013	20	0.473
Zimbabwe		After 2001	1970–1990	21	0.661
Regional average of sub-Saharan Africa					*0.533*

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Appendix 1 *table continued*

Country	Temporal Liberalization (if applicable)	Year of Liberalization	Sample Period	Observation	Average LIS[a]
East Asia					
Australia		1964	1970–2012	43	0.622
Hong Kong, China		Before 1950	1980–2012	33	0.489
Indonesia		1970	1995–2009	15	0.445
Japan		1964	1980–2012	33	0.644
Malaysia		1963	1970–1983	5	0.607
New Zealand		1986	1983–2013	31	0.559
People's Republic of China		After 2001	1992–2001	10	0.634
Philippines		1988	1992–2012	21	0.405
Republic of Korea		1968	1970–2014	45	0.578
Singapore		1965	1980–2010	31	0.444
Taipei,China		1963	1995–2009	15	0.500
Thailand		Before 1950	1970–2010	41	0.425
Regional average of East Asia					*0.529*
Latin America and the Caribbean					
Argentina		1991	1993–2007	15	0.438
Barbados		1966	1974–1975	2	0.746
Bolivia	1956–79	1985	1970–2013	42	0.527
Brazil		1991	1992–2009	18	0.535
Chile		1976	1996–2009	14	0.446
Colombia		1986	1992–2012	21	0.685
Costa Rica	1952–61	1986	1970–2012	43	0.615
Dominican Republic		1992	1991–1996	6	0.647
Ecuador	1950–82	1991	1970–2010	26	0.561
Guatemala	1950–61	1988	2001–2012	12	0.437
Honduras	1950–61	1991	2000–2012	13	0.598
Jamaica	1962–73	1989	1970–2013	35	0.570
Mexico		1986	1993–2012	20	0.441
Nicaragua	1950–60	1991	2006–2009	4	0.556
Panama		1996	1996–2012	17	0.423
Paraguay		1989	1994–1998	5	0.523
Peru	1948–67	1991	1979–2010	30	0.409
Trinidad and Tobago		1992	1970–2009	40	0.475
Uruguay		1990	1997–2005	9	0.514
Venezuela	1950–59; 1989–93	1996	1997–2012	16	0.404
Regional average of Latin America and the Caribbean					*0.519*

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Appendix 1 *table continued*

Country	Temporal Liberalization (if applicable)	Year of Liberalization	Sample Period	Observation	Average LIS[a]
Europe and Central Asia					
Armenia		1995	1992–2011	17	0.687
Austria		1960	1995–2013	19	0.590
Azerbaijan		1995	1995–2012	18	0.340
Belarus		After 2001	1990–2001	12	0.547
Belgium		1959	1985–2013	29	0.626
Bulgaria		1991	1995–2013	19	0.514
Croatia		After 2001	1997–2001	5	0.690
Cyprus		1960	1995–2013	19	0.507
Czech Republic		1991	1992–2014	23	0.513
Denmark		1959	1995–2014	20	0.640
Estonia		After 2001	1994–2001	8	0.639
Finland		1960	1975–2014	40	0.620
France		1959	1950–2013	64	0.704
Georgia		1996	1998–2013	16	0.399
Germany		1959	1991–2013	23	0.636
Greece		1959	2000–2013	14	0.525
Hungary		1990	1995–2013	19	0.612
Ireland		1966	1999–2013	15	0.484
Italy		1959	1980–2014	35	0.557
Kazakhstan		After 2001	1990–2001	12	0.544
Kyrgyz Republic		1994	1990–2012	23	0.622
Latvia		1993	1994–2013	20	0.571
Lithuania		1993	1995–2013	19	0.515
Luxembourg		1959	1980–2012	20	0.625
Netherlands		1959	1980–2014	35	0.643
Norway		Before 1950	1978–2013	36	0.567
Poland		1990	1995–2013	19	0.610
Portugal		Before 1950	1995–2014	20	0.634
Republic of Moldova		1994	1995–2012	16	0.602
Romania		1992	2004–2012	9	0.518
Russian Federation		After 2001	1997	1	0.702
Serbia		2001	1997–2012	16	0.633
Slovakia		1991	1993–2013	21	0.548
Slovenia		1991	1995–2013	19	0.667
Spain		1959	1995–2013	19	0.629
Sweden		1960	1993–2014	22	0.541
Switzerland		After 2001	1995–2012	18	0.658

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Appendix 1 *table continued*

Country	Temporal Liberalization (if applicable)	Year of Liberalization	Sample Period	Observation	Average LIS[a]
Europe and Central Asia (cont.)					
TFYR of Macedonia		1994	1990–2011	19	0.654
Tajikistan		1996	2000–2010	11	0.417
Turkey	1950–59	1989	1998–2009	12	0.524
Ukraine		After 2001	1989–1995	7	0.533
United Kingdom		Before 1950	1987–2013	27	0.619
Regional average of Europe and Central Asia					*0.589*
South Asia					
India		After 2001	1976–2001	25	0.653
Sri Lanka	1950–56; 1977–83	1991	1983–2012	30	0.728
Regional average of South Asia					*0.694*
North America					
Canada		1952	1970–2013	44	0.652
United States		Before 1950	1950–2014	65	0.629
Regional average of North America					*0.638*

[a] Nonweighted average labor income share of the sample period.

Source: Wacziarg and Welch (2008) and authors' calculation.