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Trade liberalization, employment, and gender in Ethiopia

Giorgia Giovannetti,[1,2] Marco Sanfilippo,[3,4] and Arianna Vivoli[1,*]

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Abstract: This paper analyses the impact of trade liberalization on local labour markets in Ethiopia, with a focus on the gender dimension of employment. By exploiting rich micro-level data on Ethiopian workers, we evaluate the effect of the Ethiopian trade reforms on the changes and composition of employment, adopting as unit of analysis Ethiopian districts. We find that districts more exposed to trade liberalization experienced reductions in their employment levels, especially in female employment. We also show that reductions in (agricultural) input tariffs triggers a process of sectoral reallocation from agriculture to services and that this process is particularly pronounced for women. This in turns contributes to increase sectoral segregation.

Key words: tariffs, employment, structural transformation, gender, Ethiopia

JEL classification: C23, F14, F16, J16

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[1] University of Florence, Firenze, Italy; [2] European University Institute, Firenze, Italy; [3] University of Turin, Torino, Italy; [4] University of Antwerp, Antwerpen, Belgium; * corresponding author: Arianna Vivoli, arianna.vivoli@unitn.it

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

1 Introduction

In the 1980s, several developing countries started to implement trade reforms to stimulate their economies and possibly improve their living standards. Ethiopia was no exception to this general trend. Following the Structural Adjustment Programme from the World Bank and the International Monetary Fund (Easterly 2003), from 1992–93 onwards Ethiopia implemented trade reforms in order to reduce barriers to trade and to open up to foreign competition as a strategy of long-term growth (Jones et al. 2011). However, evidence on the effects of trade liberalization in Ethiopia is scant and mostly focused on (manufacturing) firms (Bigsten et al. 2016; Fiorini et al. 2019).

In this paper, we use micro-level data to investigate the effects of trade liberalization on local labour markets in Ethiopia. More specifically, we exploit variation in output and input tariffs across local labour markets over time to check whether and how increased international competition affects employment. In addition, with Ethiopia being largely characterized by high levels of agricultural employment, we ask specifically whether trade liberalization has affected the process of structural transformation in the country.

Since tariffs vary across goods, and households have different sources of income and spending habits, trade policies are likely to have a heterogeneous impact on workers in different sectors, with different skills, and across women and men. Throughout the paper we adopt a gender perspective. Whereas tariff reductions took place predominantly in female-dominated sectors, in the period covered by our study, the gender employment gap dropped from 20 percentage points in 1994 to 12 percentage points in 2013. The structural transformation of the Ethiopian economy from the agricultural sector to the services sector seems to concern especially female workers, but with only low-skilled services growing following a reduction in input tariffs. Understanding whether trade liberalization has fostered gender-specific changes in the labour market is an important issue in view of the large gender gaps that remain in the Ethiopian labour market (Essers et al. 2021; WB and WTO 2020).

Theoretically, changes in tariffs result in two simultaneous effects: on the one hand, trade liberalization increases competitive pressures in the output market; on the other hand, it also increases the competitiveness of firms by reducing their input costs.

According to the literature, a reduction in output tariffs due to trade liberalization may stimulate labour demand through two opposite channels (Winters and Di Ubaldo 2020).[1] It can generate disruptive effects on employment levels since domestic markets may be penetrated by cheaper imported products. The negative price shock can, in turn, hamper domestic production, thereby inducing firms to fire workers if their production drops or if they exit the market [this was found, for instance, by Revenga (1997) for Mexico and by Dix-Carneiro and Kovak (2017) for Brazil]. On the other hand, the pro-competitive effect of a drop in output tariffs may induce firms to invest to remain competitive; if these investments bring factor substitution towards labour, international trade can also increase labour demand (e.g., for Mauritius: Milner and Wright 1998).

For input tariffs, theory predicts different effects. Lower input tariffs are supposed to increase firms' productivity through several channels, including via a learning effect, through the acquisition

[1] For an extensive review on the subject, see Goldberg and Pavcnik (2007b), Hoekman and Winters (2005), and Cirera et al. (2014).

of foreign technology embodied in imported inputs (in some cases, leading to the so-called skill-biased technological change), through an increase in the quality, and the variety of inputs. The effect of lower input tariffs in low-income countries has been empirically investigated, among others, by Amiti and Konings (2007) and Goldberg et al. (2010) for Indonesia and India, respectively. Both studies find that cheaper inputs (because of lower input tariffs) increase firms' productivity. Goldberg et al. (2010) also find an increase in new products, output, and research and development for Indian firms. This increase in productivity might expand production and, therefore, increase employment. At the same time, if productivity growth exceeds output growth (for instance, because of the lack of skilled workers or infrastructure and because in some sectors technological inputs free up workforce that is not absorbed by other sectors), employment might also decrease (Meschi and Vivarelli 2009).

Trade liberalization may have relevant heterogenous consequences across genders; women tend to hold a disproportionate share of low-skilled jobs and often are engaged in less productive activities, especially in agriculture (WB and WTO 2020). Hence, trade policy, which is in principle gender neutral, can affect women more. The literature has proposed several channels through which trade liberalization may affect female labour force participation. The first is by reducing discrimination. As initially proposed by Becker (1957), only employers with market power can engage in discriminatory practices, whereas employers operating in a perfectly competitive market cannot, because discrimination is costly. Becker's theory, confirmed by many empirical tests (e.g., for industries in the United States: Black and Brainerd 2004; for Colombia: Ederington et al. 2009), implies that women should benefit more from an increase in competition (i.e. from a lowering in output tariffs), thereby lowering the gender employment gap. In a similar vein, Schultz (2007) highlights that trade liberalization triggers an increase of human capital and gender equality. Another channel through which output tariffs might affect women has to do with social norms. Indeed, if cultural norms, preferences or even stigmas play a role in the definition of which sectors are more 'appropriate' for men and women, when foreign competition induces structural transformation, there might be gender-specific shifts in the reallocation across sectors, changing the sectoral segregation of the economy (Goldin 1995; Gaddis and Pieters 2017; Wang et al. 2020). Further, given that technologies can affect the composition of employment, a shift towards more capital or technological-intensive activities can favour employment of women because women are less likely to be involved in physically demanding activities than men. If women's labour productivity is more closely tied to the capital intensity of production, the adoption of more sophisticated technologies in response to input or output tariff reductions can favour gender employment and their wages [as shown for instance by Juhn et al. (2014) for Mexico]. Finally, provided that a certain level of sectoral segregation of male and female workers is common, the outcomes of trade liberalization in terms of structural transformation will not be neutral to existing structures (Pieters 2018). For instance, in Indonesia input tariff reductions in the 1990s led to higher employment rates, which happened to be concentrated among women, since female-intensive industries relied to a greater extent on inputs for which import tariffs declined most (Kis-Katos et al. 2018).

Ultimately, the impact of trade policies, as well as their consequences on gender and structural transformation, is an empirical question, possibly different in different countries, and between different groups of workers and sectors. We address this question using micro-level data for Ethiopia over a 20-year period. In our study, we combine the 1994 population census with the three waves of the Ethiopian National Labour Force (NLF) Survey, covering the years 1999, 2005, and 2013 (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014). Individual-level information is re-aggregated in a panel dataset of 388 districts (*woreda*, the third administrative division of Ethiopia). Our identification strategy links changes in tariffs with changes in the

composition of the local workforce on the basis of a district's exposure to trade (as in Autor et al. 2016; Kovak 2013; Topalova 2007).

Our results show that districts more exposed to trade liberalization experienced a reduction in employment—a result that is robust to several specifications—and that female workers were more affected than male workers. Moreover, we find evidence of a contribution of trade liberalization (especially in the form of lower input tariffs) to the structural transformation of the Ethiopian economy from agriculture to services, even though the shift to services cannot make up for the employment losses in the agricultural sector; this transition seems to be mostly driven by a higher mobility of the female component of the workforce. In this context, if stringent social norms or preferences are in place, liberalization and sectoral reallocation can have important implications for women, increasing sectoral segregation. We test this channel and find that input tariffs increase sectoral segregation. Finally, we extend our analysis to other dimensions related to employment, by looking at the effect of trade liberalization on unemployment, education, and movements within the services sector; we find that reductions in input tariffs decrease women's educational attainment (but not for men) and push them to move into low value-added industries, such as community services and private household activities.

Our work fits into a large body of literature that has investigated the effects of trade liberalization on employment and gender. Although initially this literature has mostly focused on the firm level (e.g., Edwards 2004) or on the worker level (e.g., for Mexico: Feliciano 2001; for Colombia: Attanasio et al. 2004), more recent work has looked into labour markets with a regional perspective. To some extent, our findings are consistent with the results from various other contexts in which trade liberalization has been found to reduce employment (e.g., for India: Topalova 2007; for Brazil: Kovak 2013; Dix-Carneiro and Kovak 2017; for the United States: Autor et al. 2016; for South Africa: Lepelle and Edwards 2020).

Our findings on the gender-specific effects of trade liberalization contributes to the existing evidence, which so far does not provide univocal results. Wang et al. (2020) and Kyander (2020) find positive effects of import competition on female work for China and India, respectively, especially in the manufacturing sector and for women with limited or no schooling. Trade liberalization (proxied by a decrease in output tariffs) in Mexico[2] increases formalization in the manufacturing sector between genders, but men benefit the most, while in the services sector, women experience an increase in informality (Ben Yahmed and Bombarda 2020). More in line with (some of) our results, female workers in Indonesia have responded more strongly to the positive labour demand shock of input tariff liberalization than male workers (Kis-Katos et al. 2018). Similarly, in Brazil lower output tariffs reduce the gender employment gap and increase male unemployment, also shifting general employment towards trade and services (Gaddis and Pieters 2017). A similar shift in our analysis is due to input rather than output tariffs.

Our results are also consistent with international trade literature showing that openness to trade can shape the process of structural transformation (Fajgelbaum and Redding 2014). In this respect, Erten et al. (2019) suggest the existence of a causal relationship between trade openness and structural transformation away from agriculture across Chinese counties following WTO accession. For South Africa, Lepelle and Edwards (2020) find that tariff liberalization is associated

[2] A recent report (WB and WTO 2020) points out that the impact of trade policy on the probability of working formally for women (in Mexico after the North American Free Trade Agreement) are not uniform (positive for large firms and negative for small firms), but also that the African Continental Free Trade Area is likely to boost female employment, particularly for skilled women, with the gender or skill wage gap worsening in only a few countries.

with a decline in the manufacturing–services ratio, even though their result is driven by a decline in the manufacturing sector rather than by a rise in services, especially in more exposed regions. Among other things, they also find that the decline in manufacturing employment was more pronounced for Black women, reflecting their relevant presence in those sectors more exposed to tariff cuts (e.g., clothing and textiles) and that also this group was unable to relocate into the services sector.

The remainder of the paper is structured as follows. Section 2 provides a quick overview on the trade liberalization process of Ethiopia over the period 1993–2013. Section 3 describes the data and methodology. Section 4 contains our main results. The underlying mechanism and extensions are analysed in Section 5 and Section 6 concludes.

2 Ethiopian trade liberalization

By the beginning of the 1990s, like many other developing countries, Ethiopia abandoned the import-substituting policy that the country had pursued both in a private-led way (from the early 1950s to 1974, during the Imperial regime) and in a public-led way (from 1974 to 1991, under the Dergue regime) (Gebreeyesus 2016). In 1991 the new government, led by the Ethiopian People's Revolutionary Democratic Front, decided to turn to a more market-oriented economic policy and to implement various reforms under the Structural Adjustment Programme sponsored by the World Bank and the International Monetary Fund. As far as trade policy was concerned, the main objectives were the reduction of both tariff and non-tariff barriers and the devaluation of the *birr*, the national currency. The Ethiopian government implemented six waves of tariff reforms between 1993 and 2003; before 1993 the tariff rates ranged from 0 to 240 per cent, in 1995 the range was reduced to 0–80 per cent, and in 2002 to 0–35 per cent; meanwhile, the number of tariff bands fell from 23 to 6, including the 0 tariff band (Bigsten et al. 2016).

In this paper, we use tariffs data from the World Integrated Trade Solution (WITS) database (see World Bank 2021). More precisely, we extract the Ethiopian import tariff rates[3] at the three-digit level (following the ISIC Rev. 3 classification; see United Nations 1990) for each of the years in our dataset and use them to construct our trade exposure measures for both input and output tariffs. Following Topalova (2007, 2010), Ethiopian industry-specific import tariffs are weighted using the district-level composition of employment at the baseline year.[4]

For output tariffs, we calculate the number of employed workers in each sector *s* at the baseline $(Empl_{s,k,1994})$ by district *k* and divide these figures for the total employment by district $(Empl_{k,1994})$.[5] We then merge these weights with time-varying sector-specific tariff data

[3] We use the trade-weighted average of the World Trade Organization's 'Most Favoured Nation' *ad valorem* tariff rate at the industry level.

[4] To be more in line with Topalova (2007), we should have used pre-liberalization information on employment in districts; that is, in the Ethiopian case, information before 1993. Unfortunately, our most remote information comes from the 1994 census, which is 1 year after the starting of the liberalization period. We acknowledge this limit of our data.

[5] Given that tariff data from the WITS database are expressed using the ISIC Rev. 3 at the three-digit level, we harmonized the sectoral information from the 1994 census and the 1999, 2005, and 2013 NLF to this international classification.

($Tariff_{s,t}$). Lastly, we sum by district. In this way, we end up having a district-level trade exposure measure, as shown in the formula below:

$$Output\ Tariff_{k,t} = \sum_{s=1}^{S} \frac{Empl_{s,k,1994}}{Empl_{k,1994}} \times Tariff_{s,t}$$

where *t*=1994, 1999, 2005, and 2013. This measure indicates how much a district has been exposed to output tariff reduction, given the district's employment composition across sectors in the initial year. For the way it is constructed, a reduction in output tariffs should capture the effect of a reduction of prices in the output market and, therefore, an increase in foreign competition. As far as the non-tradeable sector[6] is concerned, we follow Autor et al. (2016), Kis-Katos and Sparrow (2011), and Topalova (2007) and we treat it as an additional sector, setting tariffs to zero, thereby including also its workforce in the weighting of tariffs.[7]

To account for input tariffs, we create an analogous district-level trade exposure measure:

$$Input\ Tariff_{k,t} = \sum_{s=1}^{S} \left(\frac{Empl_{s,k,1994}}{Empl_{k,1994}} \times \sum_{i=1}^{I} \left(\frac{M_{i,s,2005}}{M_{s,2005}} \times Tariff_{s,t} \right) \right),$$

which is equivalent to the output tariff exposure measure, with the only difference that here tariffs are first weighted with the input shares $M_{i,s}$ that each sector *s* acquires from each sector *I*, and then the product is weighted for the district's employment share. We extract information on input shares from the 2005–06 Ethiopia Input Output (I/O) Table and Regionalized Social Accounting Matrix (SAM), constructed by the Ethiopian Development Research Institute and the International Food Policy Research Institute (IFPRI) (see Tebekew et al. 2009).[8] To construct the input tariff measure we proceed in the following way: as the Ethiopian SAM table we used is only commodity-by-activity (with 58 commodities and 47 activities[9]), and only the activity account is classified according to the ISIC Rev. 3.1 classification, we first had to harmonize the commodity account according to the ISIC classification and assign each commodity to an activity category; once done, it is possible to assign the tariff level of the same ISIC class to each category (coded according to the ISIC classification). Next, we calculated the industry-specific input tariffs for each year of our panel by multiplying each I/O coefficient (from the 'intermediate input demand' section of the I/O table) for its tariff and, finally, we weighted them for the district industry-specific employment weights, as for the output tariffs.

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[6] We classify as non-tradeable sectors all those industries for which the WITS database does not provide information on tariffs. This includes all industries included from division E to division Q in the ISIC Rev. 3 classification.

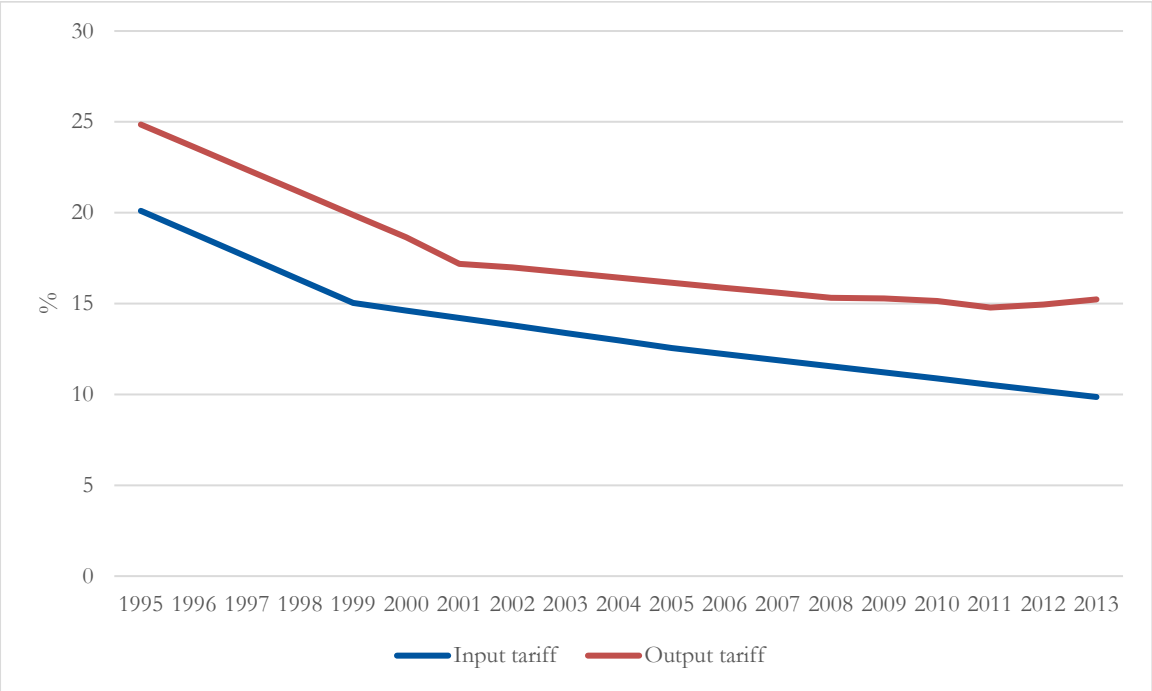
[7] We also perform the baseline analysis for output tariffs excluding the non-tradeable sector from the weights. Estimates are still significant and point to the same direction, but figures get smaller. Conversely, for the input tariff analysis we follow Kis-Katos and Sparrow (2015) and Kis-Katos et al. (2018) and we include both tradeables and non-tradaebles in the output sectors (*s*), but only tradaebles in the input suppling sectors (*i*).

[8] We acknowledge that the optimal solution would have been to use data from a pre-sample input–output (I/O) table; unfortunately, the IFPRI I/O table is the first available constructed with real Ethiopian data. Moreover, we are quite confident that I/O coefficients remain quite stable over time.

[9] Usually the number of activities in a social accounting matrix (SAM) tends to be smaller, but the IFPRI SAM has a relatively high level of disaggregation for production activities and commodities in the Ethiopian economy, especially for what concerns the agricultural sub-sectors.

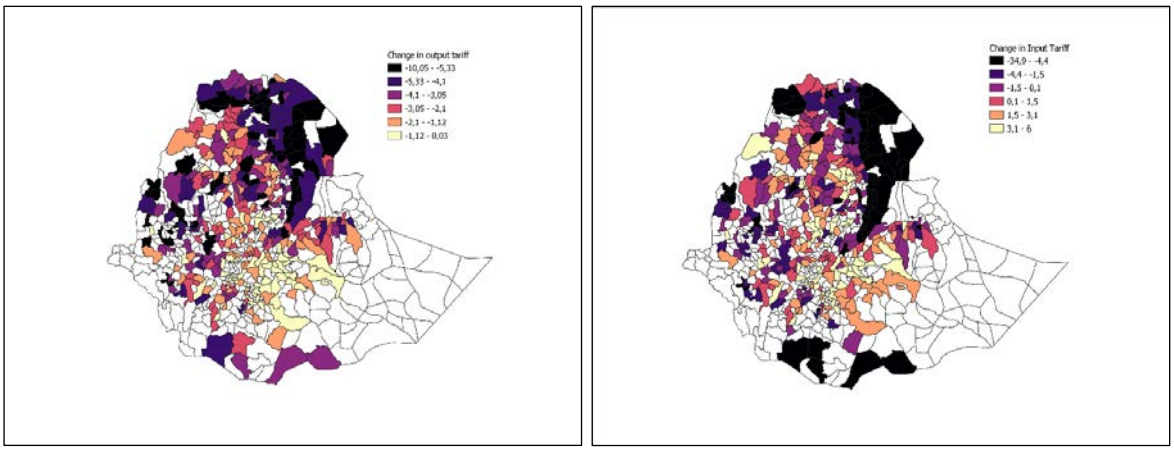
Figure 1 shows changes of average (input and output) tariff rates in Ethiopia over the period covered in this study.[10] Figure 2 shows how output and input tariff exposure measure varies substantially across districts over the period considered.

Figure 1: Trends in tariffs



Source: authors' elaboration on WITS data (World Bank 2021).

Figure 2: Changes in output and input tariffs (%) by Ethiopian districts



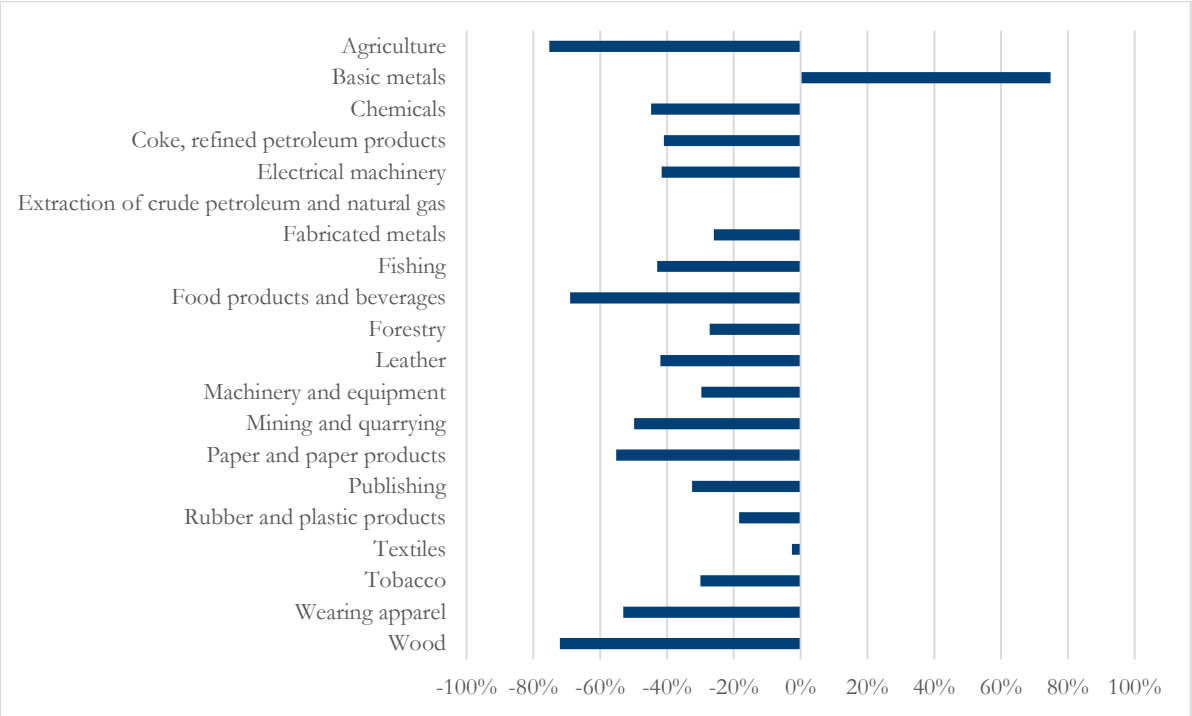
Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Figure 3 reports the percentage change in tariff reduction for the main economic sectors, defined according to the two-digit code of the ISIC Rev. 3 classification. It shows that the larger reductions took place in those sectors that absorb most of the Ethiopian workforce, namely agriculture (–75

[10] Unfortunately, WITS reports tariffs for Ethiopia only since 1995 and not for all years (data on tariffs are missing for 1996–2000, 2003–05, 2007, and 2013). Therefore, we use the 1995 tariff rate as a proxy for the 1994 tariff rate and we linearly interpolate tariff data where missing.

per cent), food production (−68 per cent), and wood (−72 per cent), whereas the only sector more protected was the basic metal sector (+74 per cent).

Figure 3: Changes (%) in tariffs by sector (1993–2013)



Source: authors' elaboration on WITS data (World Bank 2021).

3 Data and empirical analysis

3.1 Worker-level data

We harmonize and merge the 1994 population census with three existing waves of the Ethiopian NLF Survey, for 1999, 2005, and 2013. The 1994 census provides information on the socio-demographic characteristics of the respondents. It provides information also on their employment status, including the sectoral distribution of workers.[11] The NLF, administered by the Central Statistics Agency (CSA),[12] provides information about labour under-utilization, unemployment, and the working conditions of persons in employment. We restrict the sample to the working age population (i.e. those aged 15–64 years[13]) and harmonize the sectoral affiliation of workers using the ISIC Rev. 3 classification.

[11] Information on the employment status of individuals, and their sectoral distribution, is not included in the most recent census (2007).

[12] The NLF surveys are nationally representative. They cover all urban and rural areas of the country, except the non-sedentary areas in the Somali region. The sampling frame to select enumerator areas is provided by the population census (the 1994 census for the 1999 and 2005 NLF and the 2007 census for the 2013 NLF). All the relevant information on the sampling procedures, coverage, and full descriptive statistics are available from the survey reports published by the Ethiopian Central Statistical Agency (see CSA 2014).

[13] We also check the robustness of our results by running the baseline regressions with the whole sample (i.e. including workers not only between 15 and 64 years but of all ages) and the results remain stable.

After harmonizing the 1994 census with the three waves of NLF, we collapse the individual-level dataset to the district level (*woreda*) using sampling weights. The result is a panel of Ethiopian districts over 4 years. For consistency, we decided to confine the analysis only to *woreda* whose name appear at least twice in the four waves of the panel. This results in an unbalanced panel including 388 districts representing the 88.71 per cent of estimated population and 89.31 per cent of the total workforce.

Table 1 provides an overview on the socio-demographic characteristics of our working sample. Figure 4 provides change in the distribution of male and female workers across sectors between 1994 and 2013. Employment levels are generally high while the employment gender gap has decreased from almost 20 percentage points in 1994 to 12 percentage points in 2013.[14] Education steadily increases but the educational attainments remain quite low, especially for women (on average, in 2013 women have 1.98 years of education whereas men have 3.31 years).

Table 1: Socio-demographic characteristics of the working sample

	1994	1999	2005	2013
Male (%)	49.13	47.40	47.18	48.86
Age (years)	31.38	31.83	31.67	31.75
Urban (%)	9.59	12.86	13.75	5.52
Employed (%)	78.50	64.06	84.07	82.25
Unemployed (%)	1.12	1.54	1.34	1.09
Years of school	0.95	1.21	1.70	2.62
Illiterate (%)	78.19	69.73	63.49	49.40
Agriculture (%)	88.89	72.96	76.31	74.40
Manufacturing (%)	1.78	6.19	7.36	6.25
Services (%)	6.68	17.96	14.89	18.49

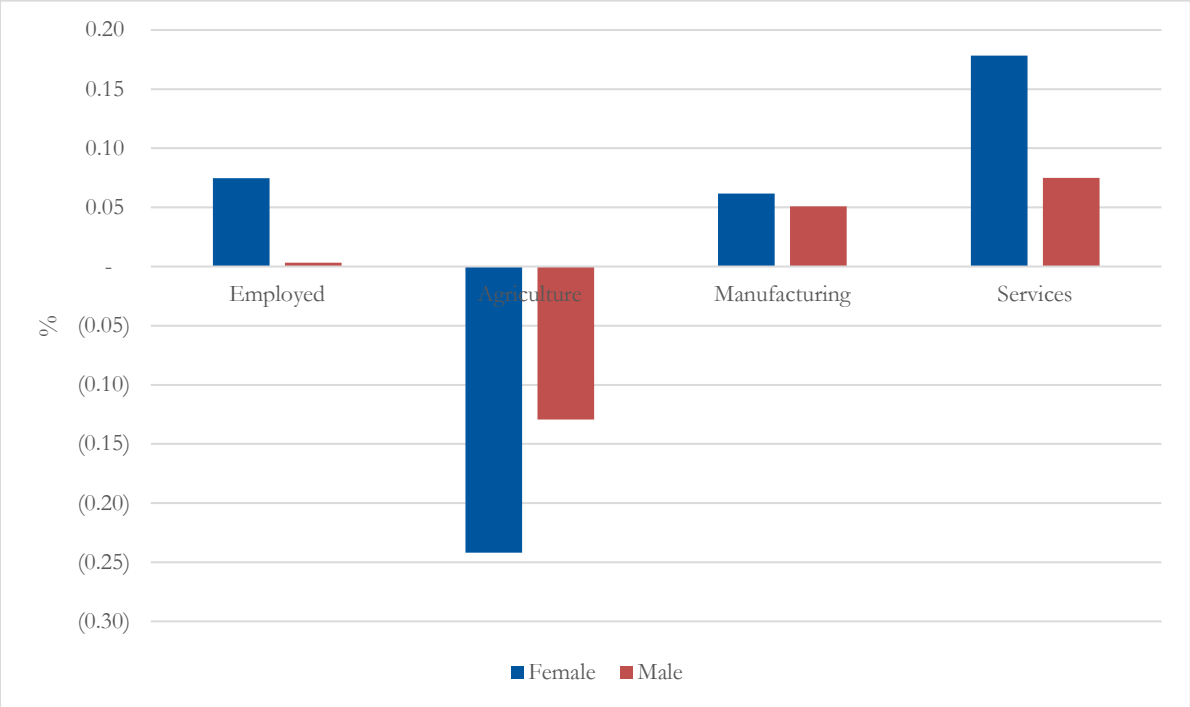
Source: authors' elaboration on the census and NLF data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014).

Needless to say, the predominant source of employment is agriculture, especially among men. While manufacturing was not yet able to take off in the Ethiopian economy,[15] structural transformation is going towards the services sector, which in 2013 employed almost 21 per cent of the total workforce. In proportion, female employment reduced more than that of men in the agricultural sector and increased more in the services sector.

[14] The employment rate of men (women) is calculated by dividing the number of men (women) aged 15–64 years in employment by the total male (female) population of the same age group.

[15] The weaknesses of the manufacturing sector in Ethiopia has been widely recognized by many studies (Diao et al. 2021). To give an idea, Sutton and Kellow (2010), who conducted an in-depth analysis of the Ethiopian secondary sector, documented that 78 per cent of exports come from a few labour-intensive primary sector industries: coffee, oilseeds, khat (chat), while the remaining 22 per cent come from only four industries: cut flowers, leather, meat and meat products, and clothing and textiles.

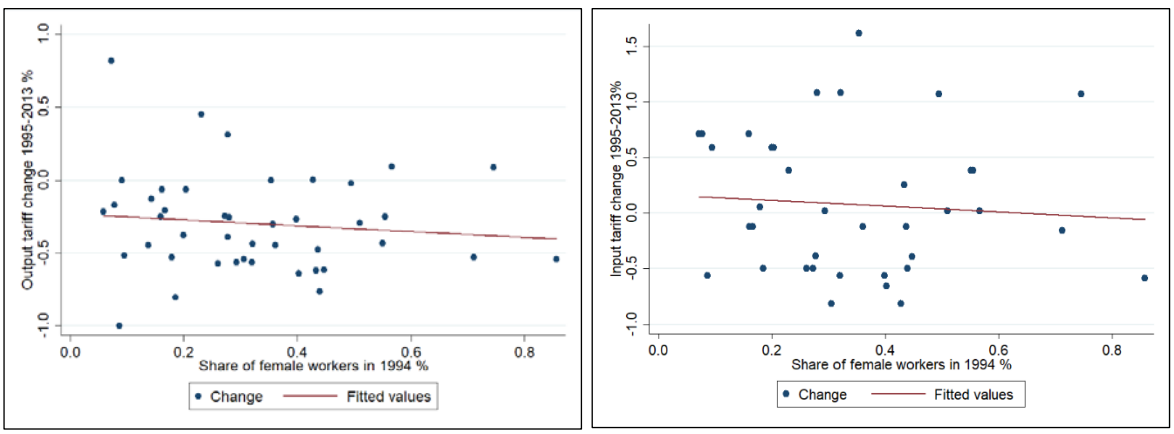
Figure 4: Change in distribution of workers across sectors in 1994 and 2013



Source: authors' elaboration on the census and NLF data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014).

In addition to the two aforementioned gender-related stylized facts, that is, a decreasing employment gender gap and a (though not yet well pronounced) shift from the male-dominated agricultural sector to the female-dominated services sector, there is a third fact that motivates our focus on gender. Figure 5 plots changes in tariffs against the initial share of female employment in each industry. Sectors that in 1994 were more female-intensive witnessed larger tariff cuts, especially output tariff cuts, suggesting that we might find differential impacts of tariffs reduction across gender.

Figure 5: Tariff declines (1994–2013) and initial female employment shares (1994)



Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

3.2 Empirical strategy

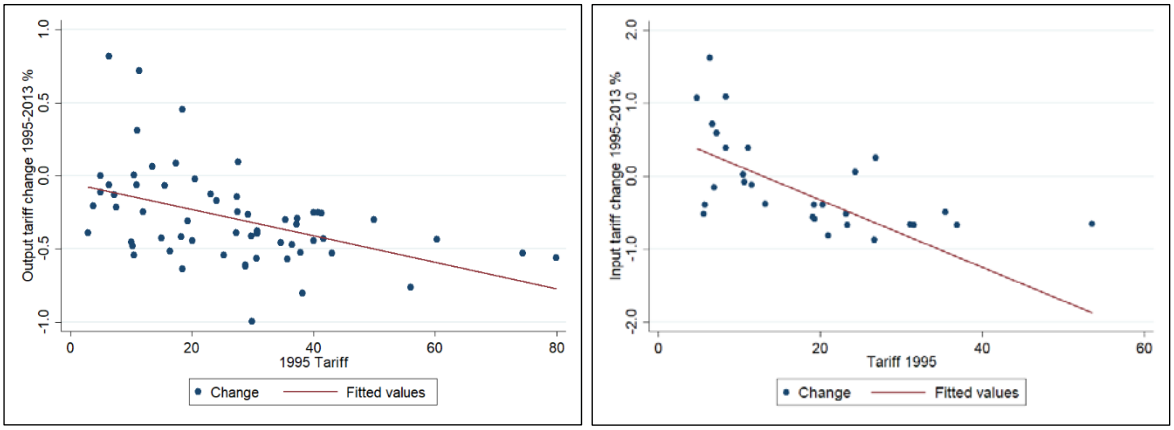
We aim at estimating the impact of trade liberalization on employment levels by adopting a local labour market perspective and by considering the Ethiopian trade liberalization as a sort of natural experiment. This is possible considering the relatively short-time frame (1993–2003) in which Ethiopian tariffs were reduced and, as we will argue later, the likely exogenous nature of this policy. The identification strategy follows existing work on the effect of trade liberalization on local labour markets (Autor et al. 2016; Kovak 2013). By exploiting the cross-sectional variation in the employment structure of districts at the onset of the trade liberalization programme, we aim at comparing the heterogenous response in terms of district employment levels and other socio-economic outcomes between districts more exposed to tariff reduction compared with those more protected.

For the causal identification to be valid, the treatment (i.e., the exposure to trade liberalization) should be exogenous to the outcomes analysed. There is a widespread concern in the trade literature regarding the endogeneity of tariffs; indeed, it is reasonable to question whether labour market conditions, such as a fall in the employment rate for instance, might influence political decisions about raising tariffs (or taking other protectionist measures) in some sectors, thereby introducing a bias in our estimates. The issue has been widely explored in both the theoretical and empirical literature (Grossman and Helpman 1994) and scholars have recognized the potential interference of industrial lobbies and interest groups in the delineation of trade policies.

We acknowledge that, for their intrinsic characteristics, trade policies will always show some degree of endogeneity. However, this is not necessarily a concern in our study. Indeed, Jones et al. (2011) analyse tariff reforms of four countries in Eastern Africa, including Ethiopia, between the early 1990s and early 2000s; they conclude that there was limited evidence of political distortions in the tariff reduction process in these countries, mainly because the technocratic reforms were implemented according to World Bank guidelines, leaving little room for lobbyist pressures.[16] As in Jones et al. (2011), in Appendix Table A1 we report some descriptive statistics for output and input tariffs throughout the period under study, to better understand the process behind the Ethiopian tariffs reform. As expected, tariffs decreased on average by almost 10 percentage points, but also their dispersion decreased, as signalled by a decreasing standard deviation. Moreover, we can also see how both the kurtosis and the skewness approach zero over time, implying respectively that the distribution gained more symmetry around the mean and lost weight in its tails; that is, there were fewer extreme cases. Consistent with this trend, in Figure 6 we can see how in Ethiopia the higher the tariffs around the baseline, the higher the reductions in targeted sectors. Next, as in Topalova (2007), we regress tariffs against industrial characteristics to test whether trade policy has been used to protect particular sectors. We did this by aggregating our data at the three-digit sectoral level; results are reported in Table 2. Specifically, we regress the change in tariffs (output tariffs Columns 1–3, input tariffs Columns 4–6) on sectoral employment at the baseline (a large sectoral workforce might translate into a large electoral basis if protected) and on the share of illiterate workers (as a proxy for unskilled workers, likely to be the most vulnerable to trade liberalization). The only significant relationship appears to be the one with initial levels of tariffs, suggesting that tariff reductions were faster for those sectors that were more protected at the baseline. This should imply, cautiously, that tariff rate reductions are part of a generalized trend towards liberalization.

[16] This was also the case for many other developing countries in the 1990s as well, such as Colombia's tariff reduction for WTO accession (Goldberg and Pavcnik 2007a, b) or Brazil's liberalization for the Mercosur (Dix-Carneiro and Kovak 2017).

Figure 6: Changes in output and input tariffs (%) compared with the baseline



Source: authors' elaboration on WITS data and IFPRI SAM (World Bank 2021; Tebekew et al. 2009).

Table 2: Tariff declines and baseline industrial characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Output tariffs	Δ Output tariffs	Δ Output tariffs	Δ Input tariffs	Δ Input tariffs	Δ Input tariffs
Employment	–7.970			–5.889		
	(6.538)			(4.245)		
Share of illiterate workers		–0.151			0.198	
		(0.872)			(0.174)	
Baseline tariffs			–0.192***			–0.144***
			(0.018)			(0.017)
Observations	133	124	195	336	309	330
R-squared	0.011	0.000	0.366	0.006	0.004	0.186

Note: *p<0.1, **p<0.05, ***p<0.01. Standard errors are in parentheses. Employment rate is calculated by dividing the number of people aged 15–64 years in employment by the total population of the same age group in the same sector. The sectoral share of illiterate workers is calculated over the number of employed people aged 15–64 years. Baseline tariffs are sectoral input and output tariffs in the baseline year.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Our main explanatory variables are the district-level time-varying measures of exposure to output and input tariff reduction, which were defined in Section 2. The cross-sectional variation in initial conditions is crucial to have heterogenous responses across districts to nation-wide tariffs reduction.

Our baseline panel specification is therefore the following:

$$y_{k,t} = \alpha + \beta_1 Output\ Tariff_{k,t} + \beta_2 Input\ Tariff_{k,t} + \gamma X_{k,t} + \delta_t + \pi_k + \varepsilon_{k,t}$$

where $y_{k,t}$ represent one of our outcomes, namely general and disaggregated levels of employment for district k and at time t, but also unemployment rate and educational attainment. Our main coefficients of interest are β_1 and β_2, which show the average effect of tariffs reduction on $y_{k,t}$. If $\beta$is greater (lower) than zero, this means that a reduction in tariffs is associated with a reduction (increase) in employment (or more in general our variable of interest) $y_{k,t}$.

To tackle the potential omitted variable bias, we add a vector of time-varying controls at the district level, $X_{k,t}$. Controls include the share of urban population within each district, to capture the effect

of urbanization movements, the share of illiterate people, to capture human capital accumulation, and the average age of the population. We also add year fixed effects (δ_t), to control for common shocks affecting all districts and, especially, district-level fixed effects (π_k), to control for potential time-invariant district-specific unobserved factors.[17] Standard errors are clustered at the district level, to account for potential autocorrelation within districts over time. Although changes in the two tariff variables are correlated, this should not affect our estimates. Their partial correlation, once all covariates are controlled for, amounts to around 0.15. To be sure that our identification assumption is robust, we test our results through alternative specifications, in first difference and using the volume of imports as the main explanatory variable, whose results are reported in Section 4.2.

4 Results

4.1 Main results

Table 3 shows the main results of our baseline specification. In Column 1 we regress the district levels of employment against the district exposure to a reduction in output tariffs, plus the above-mentioned set of covariates, district and year fixed effects; what we observe is a detrimental impact of the reduction in output tariffs on the general level of employment in the Ethiopian districts. In Column 2, we isolate the effects of an exposure to a reduction in input tariffs, which turns out to be negligible. Note, however, that if we control for both effects simultaneously, as in Column 3, we can see that the negative effect of a reduction in output tariffs remains (and slightly increases in magnitude), whereas the coefficient of the input tariffs becomes negative and significant, suggesting that in the specification of Column 2 there could be some omitted variable bias. Overall, for the average district, a 1-point reduction in output tariffs is associated with a 2.1 percentage point decrease in employment, but at the same time is also associated with a 0.2 percentage point increase in employment, due to an equivalent reduction on input prices. However, if we consider that, on average, the drop in output tariffs (1.097) is about three times larger than the one of input tariffs (0.389), there will be a net reduction of employment due to trade liberalization. Therefore, the first takeaway message is that in Ethiopia trade liberalization, proxied by a reduction in output tariffs, has not resulted in pro-competitive effects but rather it seems to have had disruptive effects on employment; at the same time, the possibility of using cheaper inputs had (even though smaller) positive effects on district employment.

The robustness of this first finding is tested in two ways: first, switching specification to a first-difference approach [used in a similar context, for instance, by Kis-Katos et al. (2018) and Lepelle and Edwards (2020)]; second, changing the definition of the explanatory variable, from (output) tariffs to the volume of imports. We run the same analysis of the baseline, but employing a first-difference specification, where changes in employment rates are related to changes in tariff measures, and report the results in Column 1 of Appendix Table A2. As in the baseline, we include the same set of control variables. The direction and significance of our estimates do not change, despite the fact that the sample is smaller. In Column 2 of Appendix Table A2 we use import

[17] To control for district-specific unobserved factors, we could use a fixed-effect or random-effect specification. However, the random-effect model requires that the omitted variables are uncorrelated with the other covariates, which seem unrealistic in our case. In any case, to check the validity of our specification, we perform the post-estimation Hausman test.

values instead of (output) tariffs.[18] The coefficient is negative, and therefore the result is consistent with the previous, showing that an increase in imports leads to a decrease in general employment.

Table 3: Baseline results

Variables	OLS	OLS	OLS
	Employed	Employed	Employed
Output tariffs	0.022***	—	0.027***
	(0.003)		(0.004)
Input tariffs	—	0.001	–0.003***
		(0.001)	(0.001)
Urban	–0.115***	–0.126***	–0.115***
	(0.035)	(0.036)	(0.035)
Age	0.003	0.003	0.004
	(0.003)	(0.003)	(0.003)
Illiterate	0.134***	0.148***	0.118***
	(0.041)	(0.042)	(0.042)
Constant	0.457***	0.560***	0.488***
	(0.093)	(0.095)	(0.092)
Mean of dependent variable	0.78	0.78	0.78
Observations	1,285	1,285	1,285
R-squared	0.429	0.405	0.433
Number of districts	388	388	388
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Note: OLS, ordinary least square; SE, standard error. *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Note that the employment rate is calculated by dividing the number of people aged 15–64 years in employment by the total population of the same age group.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

4.2 Differences across gender

Next, we check whether there are differences in terms of employment levels to liberalization across the gender of workers. Results are reported in Table 4. The magnitude of the output tariff coefficient is almost three times larger for women (Column 2) than for men (Column 1); a fact in line with Figure 5, where we showed that more female-intensive sectors experienced a faster reduction in output tariffs. Input tariffs, instead, seem to have a significant and positive effect only on female employment. To test whether input and output tariffs are statistically significant across gender, we perform a Wald test and find that there is a significant differential impact of tariff reductions between female and male workers. A 1-point reduction in output tariffs is associated with a 1 percentage point reduction in male employment but also with a 3 percentage point

[18] For this test, following Autor et al. (2016), we assess the impact of trade liberalization using changes in the volume of imports instead of changes in tariffs. Therefore, we construct a measure similar to tariff measure, but using real imports (in US$), as illustrated below:

$$Import\ index_{k,t} = \sum_{s=1}^{S} \frac{Empl_{s,k,1994}}{Empl_{k,1994}} \times \ln\left(Imports\right)_{s,t}$$

where Ethiopian industry-specific imports from all over the world (in logs) are weighted using employment shares for each district.

reduction in female employment. At the same time, the same reduction in input tariffs has no effect on male employment but increases female employment by a 0.5 percentage point. Overall, it seems that trade liberalization, besides having a negative impact on the general employment level, also widens the gender employment gap, penalizing women more than men; the negative effect of output tariffs seems to be not totally compensated by the positive effect that input tariff liberalization has on women. Also in this case, results are robust to the specification in first differences (Columns 1 and 2 in Appendix Table A3).

Table 4: Differences across gender

Variables	OLS	OLS
	Employed male	Employed female
Output tariffs	0.012***	0.042***
	(0.003)	(0.005)
Input tariffs	0.001	–0.007***
	(0.001)	(0.002)
Constant	0.625***	0.325**
	(0.083)	(0.136)
Mean of dependent variable	0.87	0.69
Observations	1,285	1,285
R-squared	0.380	0.366
Controls	Yes	Yes
Number of districts	388	388
District fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Cluster SE	Yes	Yes

Note: OLS, ordinary least square; SE, standard error. *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Note that the employment rate of men (women) is calculated by dividing the number of men (women) aged 15–64 years in employment by the total male (female) population of the same age group. Controls include the share of urban population within each district, the share of illiterate, and the average age of the population.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

5 Mechanisms and extensions

Our results point to a drop in the levels of employment following episodes of trade liberalization. We also show that this drop is apparently more consistent for women than for men, even though there is also a small but significant push of female employment because of the reduction in input tariffs. In this section, we try to unpack some of these findings by showing potential patterns of reallocation of workers across sectors and types of employment. We do this by running our analysis first on total employment and then across genders. Finally, and again with a gender perspective in mind, we check to what extent reallocation due to trade liberalization has come along with more or less segregation across economic activities by women and we explore some extensions to our baseline results, looking at unemployment, education, and reallocation within services.

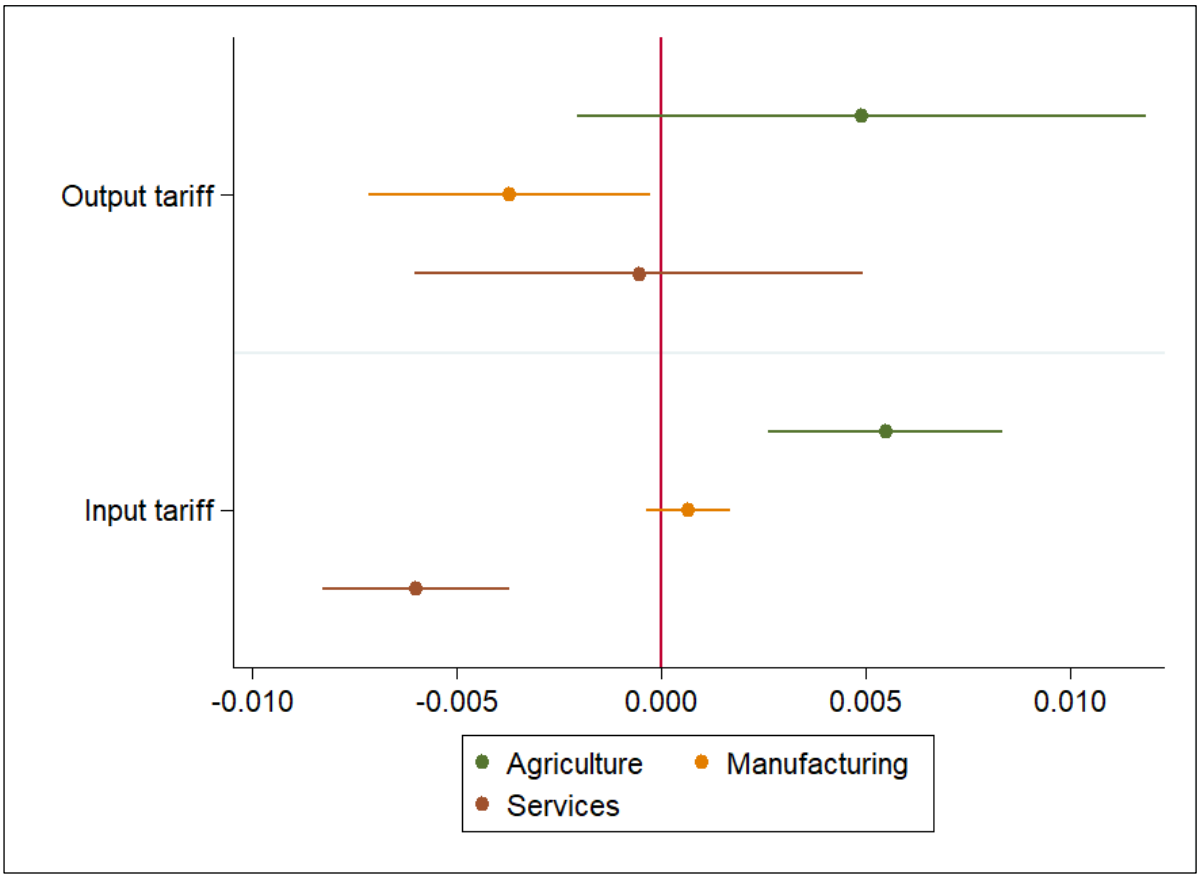
5.1 Reallocation across economic activities

We ask whether labour reallocation dynamics across sectors a consequence of trade liberalization is. We differentiate between the three macro-sectors: agriculture, manufacturing, and services and

explore the relationship between the reduction in the output and input tariffs and employment shares in the three sectors.[19]

Figure 7 plots the coefficients of interest and the full set of results is reported in Appendix Table A4. There is a significant job disruption effect of tariffs in the agricultural sector. This dynamic is mainly driven by the input tariff reduction, whereas the coefficient for output tariffs is not significantly different from zero (green bars, 1 and 4). In the manufacturing sector instead, a reduction in output tariffs is associated with an increase in the general employment level, whereas input tariffs do not seem to play any role in the overall story. The negative coefficients (3 and 6) suggest instead that tariff liberalization induced significant worker reallocation towards the tertiary sector [a result in line, for instance, with what happened during the Brazilian trade reforms in the 1990s, as shown by Menezes-Filho and Muendler (2011) and Gaddis and Pieters (2017)]. Again, this is mainly driven by lower input tariffs. However, looking at the means of the dependent variables, the employment gains in the tertiary sector cannot make up for the overall losses in the primary sector, which is in line with the generalized trade-induced job losses found in the previous sections.

Figure 7: Reallocation across sectors



Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

[19] Note that here the shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district. In this way, by keeping the denominator fixed and equal to the total employment level, we can see the reallocation of the employed across sectors due to tariff liberalization.

We perform the same analysis disaggregated by gender and the results are reported in Appendix Table A5. As we can see, the dynamics from the primary to the tertiary sector seems to be more pronounced for female employment than for male employment. Next, we try to disentangle the effect of the reduction in tariffs by creating two different indices, one covering only tariffs of the agricultural sector and the other confined to the manufacturing sector. We then replicate the same analysis. Results almost identically replicate those obtained when using tariffs of agricultural sector (Appendix Table A6). This is not surprising given the importance of the primary sector in terms of employment in most areas of the country. On the other hand, we observe limited implications due to the drop in manufacturing tariffs (Appendix Table A7), whose effects are mostly found on within-sector changes in employment. Specifically, an increase in competition (proxied by a reduction in output tariffs) contributes to a reduction of (female) employment in the manufacturing sector, whereas a decrease in input tariffs (cheaper inputs) raises it.

Therefore, an additional takeaway message from our study is that trade liberalization in Ethiopia has contributed to some forms of structural transformation, following a pattern of structural transformation without industrialization that seems nowadays typical of laggard economies in the continent (Rodrik 2016). We show that for Ethiopia this phenomenon has involved mostly women. However, similar to Lepelle and Edwards (2020), the decline in employment in the liberalized sector (agriculture in our case, manufacturing in theirs) has not been compensated by an even increase in services.

5.2 Sectoral segregation

The fact that female workers leave the primary sector following trade liberalization can be correlated with what has been found by other studies (discussed in Section 1, in particular Gaddis and Pieters 2017). Indeed, women might be more vulnerable to an increase in imports, given that they are more likely to be engaged in less-productive substance farming (O'Sullivan et al. 2014). Moreover, the country has an estimated 29.5 per cent gender gap in agricultural productivity because female managers use fewer inputs than their male counterparts (WB and WTO 2020). In recent years, the country has experienced a higher adoption of modern inputs in agriculture (together with an increase in urbanization, in the road infrastructure, and in the communication infrastructure; see Minten et al. 2014), which might have contributed to push the least productive workers, among which women are the majority, out of the primary sector. Unfortunately, as we do not have information on productivity nor on the nature of the specific inputs used in each and every productive activity, we cannot test this mechanism.

As we find that output tariffs deteriorate women's employment, changes in discrimination are unlikely to be driving our results. Another channel through which trade liberalization might affect female and male workers differently is sectoral segregation. If particularly stringent social norms are in place, it may be that the structural transformation induced by trade liberalization would take place with differences between gender, resulting in an increase in sectoral segregation between men and women. Naturally, as argued by Wang et al. (2020), the opposite (i.e. a de-segregation) might happen too. Indeed, it is also plausible that an increasing exposure to international markets can shift social norms and lower the preference for a segregated labour market. To quantitatively assess the role played by sectoral segregation, we construct the index of dissimilarity, first proposed by Duncan and Duncan (1955) and then adopted in some related works (Borrowman and Klasen 2020; Kis-Katos et al. 2018; Wang et al. 2020):

$$ID_{k,t} = \frac{1}{2}\sum_{s=1}^{S}\left|\left(\frac{M_{skt}}{M_{kt}} - \frac{F_{skt}}{F_{kt}}\right)\right|$$

where $\frac{M_{skt}}{M_{kt}}$ and $\frac{F_{skt}}{F_{kt}}$, respectively, measure the share of sector *s* for total male employment and female employment at time *t* in district *k*. For the way it is constructed, an increase (reduction) in the index value, that goes from 0 to 1, means that sectors become more (less) segregated by gender. As shown in Table 5, a reduction in input tariffs is correlated with an increase in sectoral segregation, meaning that the average distance in terms of sectoral presence between male and female workers has *increased* following trade liberalization, a fact that is probably linked to the gendered sectoral reallocation observed in the previous section. Our results contrast with those of Kis-Katos et al. (2018) for Indonesia and Wang et al. (2020) for China, who find that lower input tariffs went hand-in-hand with a reduction in sectoral segregation. However, they also find that, overall, trade liberalization contributed to the feminization of the economy, increasing female participation in the labour market, a result that does not seem to apply to the Ethiopian context (possibly because of the low relevance of the manufacturing sector in Ethiopia compared with China and Indonesia). Therefore, what our results seem to suggest is that the sectoral reallocation that has taken place following trade liberalization pushed women out of the agricultural sector towards the services sector. However, structural transformation has increased sectoral segregation, increasing the gap in terms of female and male presence in each sector.

Table 5: Sectoral segregation

Variables	(1)
	Segregation index
Output tariffs	–0.004
	(0.005)
Input tariffs	–0.003*
	(0.002)
Constant	0.345**
	(0.169)
Observations	1,285
Number of districts	388
R-squared	0.498
Year fixed effects	Yes
Controls	Yes
District fixed effects	Yes
Cluster SE	Yes

Note: SE, standard error. *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Controls include the share of urban population within each district, the share of illiterate, and the average age of the population.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

5.3 Extensions: unemployment, years of education, and services decomposition

We conclude our analysis by looking at some dimensions potentially related to employment. On the ground of our main finding showing that trade liberalization brought a net reduction in employment, we investigate some of the potential strategies undertaken by individuals in response to such an occurrence.

First, we look at unemployment levels.[20] Although reported unemployment in Ethiopia is extremely low throughout the period covered by our study (around 2 per cent for all four waves), we can see how an increase in market competition due to lower output tariffs is associated with a small but significant increase in the general unemployment level (Appendix Table A8, Column 1), a result that turns out to be mainly driven by male unemployment.

Second, we look at the average years of education within districts over time. We find that a reduction of output tariffs has no effect on a district's average education level, whereas more exposed districts experienced a reduction in women's educational uptakes as a consequence of a reduction in input prices (Appendix Table A9).[21] This result, read together with our finding that input tariff reduction led to a small but significant increase of female employment, might tell us a peculiar story: a reduction in input prices, through the adoption of cheaper labour-saving inputs, might have freed up (female) workers from the agricultural sector in more exposed districts and reallocated them to the services sector. However, this has not provided incentives for women to invest more in education. A potential explanation for that might be that the relocation to the services sector has predominantly taken place towards low-skilled and low-paying sectors.[22]

To test this hypothesis, we analyse which of the service sectors grew the most following trade liberalization.[23] In line with what we expected, the major shifts following a decrease in input tariffs were for female workers, and towards those sectors that can be reasonably assumed to be low-skilled (Appendix Tables A10 and A11). This includes, for instance, 'Community services' (division O), and 'Private household activities' (division P).[24] Reductions in input tariffs are associated also with an increase in male employment within those sectors, even though of a smaller size. At the same time, we see no significant effects of trade liberalization for men or women in high-skilled market services (e.g. 'Finance and real estate', divisions J–K). Finally, we find some evidence of an increase in the employment in 'Public administration services' (division L) for both men and women following a reduction in output tariffs.

[20] We define as unemployed people aged 15–64 years who are not in employment but carry out activities to seek employment.

[21] Also, Edmonds et al. (2010) find that in rural India schooling improvements were attenuated in districts with employment concentrated in industries losing tariff protection, and that was particularly true for girls, even though they point to the poverty–schooling costs relationship as a potential mechanism. We of course do not exclude it, but we have insufficient data to test it.

[22] This role played by trade-induced structural change (or, as in our case, by sectoral reallocation), in determining returns to education that, in turn, determine educational attainment, has been investigated for instance also by Foster and Rosenzweig (1996).

[23] We categorize services following the ISIC 3.1 classification that divides sectors into divisions. The divisions we use are: E–F (Electricity and construction), G (Wholesale and retail), H (Hotels and restaurants), I (Transports), J–K (Finance and real estate), L (Public admin.), M–N (Health and education), O (Community services), and P (Private household activities).

[24] The subsectors included in divisions O and P are: Sewage and refuse disposal, Activities of membership organizations, Recreational, cultural and sporting activities, and Other service activities in division O, and Activities of private households as employers of domestic staff, Undifferentiated goods-producing activities of private households for own use, and Undifferentiated service-producing activities of private households for own use in division P.

6 Conclusions

This paper shows that districts in Ethiopia that were more exposed to import tariff reductions experienced a stronger reduction in employment levels compared with districts less exposed to international competition. This result is robust to several specifications. The direction of the results is consistent with existing literature (e.g., Dix-Carneiro and Kovak 2017; Topalova 2007). From a gender perspective, we find that tariff reforms have a more detrimental effect on female employment than on male employment. We show also that trade liberalization seems to affect the distribution of employment out of the agricultural sector and towards services, again with more marked effects for female workers. Women are in fact those that exit faster from the primary sector and enter into the services sector following a reduction in input tariffs, although this process was not accompanied by a reduction of sectoral segregation affecting women's employment. Moreover, we see that lower input tariffs, although facilitating the migration to the services sector, discourage women from increasing their educational attainment and push them to move into low value-added sectors such as private household activities.

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Appendix

Table A1: Descriptive statistics for output tariffs

Year	Mean	SD	Kurtosis	Skewness
1995	24.85	17.02	4.04	0.92
1999	19.88	12.44	2.8	0.53
2005	16.14	10.06	2.11	0.34
2013	15.23	9.623	2.3	0.44

Note: SD, standard deviation.

Source: authors' elaboration on WITS data and IFPRI SAM (World Bank 2021; Tebekew et al. 2009).

Table A2: FD and imports—robustness checks

Variables	FD	OLS
	Δ Employed	w/ Imports
Imports	—	–0.025**
		(0.010)
Δ Output	0.043***	—
	(0.007)	
Δ Input index	–0.004**	—
	(0.002)	
Δ Urban	–0.151***	–0.109***
	(0.040)	(0.037)
Δ Illiterate	0.055	0.164***
	(0.049)	(0.042)
Δ Age	0.005	0.003
	(0.004)	(0.003)
Constant	–0.071***	0.662***
	(0.024)	(0.100)
Observations	750	1,285
Number of districts	291	388
Year fixed effects	Yes	Yes
District fixed effects	No	Yes
Cluster SE	Yes	Yes

Note: FD, first difference; OLS, ordinary least square; SE, standard error; *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A3: First difference across gender

Variables	FD	FD
	Δ Employed male	Δ Employed female
Output tariffs	0.033***	0.053***
	(0.006)	(0.010)
Input tariffs	–0.001	–0.006**
	(0.001)	(0.003)
Urban	–0.092**	–0.201***
	(0.040)	(0.061)
Age	0.123***	–0.004
	(0.043)	(0.070)
Illiterate	0.002	0.010*
	(0.003)	(0.006)
Constant	–0.045**	–0.097***
	(0.020)	(0.035)
Observations	750	750
Number of districts	291	291
District fixed effects	No	No
Year fixed effects	Yes	Yes
Cluster SE	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. The employment rate of men (women) is calculated by dividing the number of men (women) aged 15–64 years in employment by the total male (female) population of the same age group.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A4: Reallocation across sectors—complete table

Variables	Agriculture	Manufacturing	Services
Output tariffs	0.005	–0.004**	–0.001
	(0.004)	(0.002)	(0.003)
Input tariffs	0.005***	0.001	–0.006***
	(0.001)	(0.001)	(0.001)
Urban	–0.494***	0.057***	0.441***
	(0.040)	(0.022)	(0.034)
Age	0.001	–0.000	–0.001
	(0.003)	(0.002)	(0.003)
Illiterate	0.340***	–0.093***	–0.229***
	(0.052)	(0.022)	(0.043)
Constant	0.486***	0.092	0.403***
	(0.115)	(0.056)	(0.092)
Mean of dependent variable	0.79	0.05	0.14
Observations	1,285	1,285	1,285
R-squared	0.514	0.202	0.499
Number of districts	388	388	388
Year fixed effects	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A5: Sectoral reallocation across gender (controls not shown)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Agriculture, male	Agriculture, female	Manufacturing, male	Manufacturing, female	Services, male	Services, female
Output tariffs	0.003	0.009*	–0.001	–0.007***	–0.001	–0.001
	(0.003)	(0.005)	(0.002)	(0.003)	(0.002)	(0.004)
Input tariffs	0.003**	0.007***	–0.000	0.002***	–0.003***	–0.009***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	0.534***	0.383**	0.135**	0.053	0.302***	0.546***
	(0.103)	(0.172)	(0.053)	(0.090)	(0.070)	(0.144)
Mean of dependent variable	0.84	0.71	0.04	0.06	0.10	0.20
Observations	1,285	1,285	1,285	1,285	1,285	1,285
R-squared	0.521	0.405	0.227	0.123	0.536	0.386
Number of districts	388	388	388	388	388	388
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. The employment rate of men (women) is calculated by dividing the number of men (women) aged 15–64 years employed in agriculture, manufacturing, and services by the total male (female) employed population of the same age group. Controls include the share of urban population within each district, the share of illiterate, and the average age of the population.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A6: Reallocation across sectors—agricultural tariffs

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Agriculture, male	Agriculture, female	Manufacturing, male	Manufacturing, female	Services, male	Services, female
Output tariff agriculture	0.003	0.006*	–0.001	–0.005***	–0.001	–0.001
	(0.002)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Input tariff agriculture	0.003**	0.007***	0.000	0.002***	–0.002***	–0.009***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Urban	–0.492***	–0.486***	0.070***	0.045	0.422***	0.452***
	(0.043)	(0.051)	(0.023)	(0.033)	(0.033)	(0.050)
Age	0.001	0.004	–0.001	–0.000	–0.000	–0.004
	(0.003)	(0.005)	(0.002)	(0.003)	(0.002)	(0.004)
Illiterate	0.399***	0.238***	–0.119***	–0.048	–0.261***	–0.171**
	(0.048)	(0.080)	(0.022)	(0.032)	(0.035)	(0.074)
Constant	0.543***	0.399**	0.138**	0.063	0.292***	0.518***
	(0.103)	(0.170)	(0.053)	(0.090)	(0.069)	(0.143)
Mean of dependent variable	0.85	0.72	0.04	0.06	0.10	0.20
Observations	1,285	1,285	1,285	1,285	1,285	1,285
R-squared	0.520	0.405	0.228	0.123	0.535	0.385
Number of districts	388	388	388	388	388	388
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A7: Reallocation across sectors—manufacturing tariffs

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Agriculture, male	Agriculture, female	Manufacturing, male	Manufacturing, female	Services, male	Services, female
Output tariff manufacturing.	0.036	0.023	−0.008	0.021**	−0.027	−0.043
	(0.033)	(0.038)	(0.015)	(0.010)	(0.019)	(0.032)
Input tariff manufacturing	−0.069	0.009	0.039	−0.058**	0.027	0.041
	(0.069)	(0.097)	(0.036)	(0.026)	(0.037)	(0.078)
Urban	−0.503***	−0.478***	0.079***	0.050	0.422***	0.441***
	(0.044)	(0.056)	(0.023)	(0.034)	(0.033)	(0.054)
Illiterate	0.403***	0.294***	−0.122***	−0.052	−0.265***	−0.221***
	(0.048)	(0.078)	(0.022)	(0.032)	(0.034)	(0.071)
Constant	0.660***	0.689***	0.097***	0.063**	0.229***	0.228***
	(0.039)	(0.066)	(0.018)	(0.027)	(0.028)	(0.060)
Mean of dependent variable	0.85	0.72	0.04	0.06	0.10	0.20
Observations	1,240	1,240	1,240	1,240	1,240	1,240
R-squared	0.511	0.390	0.247	0.123	0.516	0.354
Number of districts	370	370	370	370	370	370
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A8: Unemployment levels

	OLS	OLS	OLS
Variables	Unemployed	Unemployed male	Unemployed female
Output tariffs	–0.001***	–0.002***	–0.001
	(0.000)	(0.001)	(0.001)
Input tariffs	–0.000	–0.000	0.000
	(0.000)	(0.000)	(0.000)
Urban	0.047***	0.041***	0.054***
	(0.009)	(0.009)	(0.012)
Illiterate	–0.023***	–0.014**	–0.033***
	(0.006)	(0.006)	(0.008)
Age	–0.000	–0.000	–0.000
	(0.000)	(0.000)	(0.000)
Constant	0.036**	0.037**	0.041**
	(0.015)	(0.017)	(0.018)
Mean of dependent variable	0.01	0.01	0.01
Observations	1,285	1,285	1,285
R-squared	0.260	0.181	0.256
Number of districts	388	388	388
District fixed effects	Yes	Yes	Yes
Year fixed effects [4]	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A9: Effects on years of education

	OLS	OLS	OLS
Variables	Years of school	Years of school, male	Years of school, female
Output tariffs	0.019	0.021	0.018
	(0.011)	(0.014)	(0.015)
Input tariffs	0.003	−0.003	0.007**
	(0.003)	(0.003)	(0.004)
Urban	1.139***	1.306***	1.001***
	(0.160)	(0.204)	(0.164)
Age	−0.012	−0.019	0.006
	(0.011)	(0.013)	(0.014)
Illiterate	−6.018***	−7.085***	−5.020***
	(0.190)	(0.225)	(0.236)
Constant	5.734***	7.306***	3.933***
	(0.350)	(0.482)	(0.406)
Mean of dependent variable	1.68	2.26	1.14
Observations	1,285	1,285	1,285
R-squared	0.914	0.894	0.846
Number of districts	388	388	388
Year fixed effects	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Shares of workers in agriculture, manufacturing, and services are expressed as the number of employed persons in each sector over the total number of employed people in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A10: Reallocation across services—female workers

Variables	E–F Electricity and construction	G Wholesale and retail	H Hotels and restaurants	I Transports	J–K Finance and real estate	L Public administration	M–N Health and education	O Community services	P Private household activities
Output tariffs	–0.000	0.003	–0.001	0.000*	0.000	–0.002***	–0.002	0.002	0.002
	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.003)
Input tariffs	0.000	0.001	–0.001	0.000	–0.000	0.000	0.000	–0.004***	–0.008***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
Urban	0.000	0.132***	0.130***	0.007***	0.009	0.044***	0.022	0.104***	0.096***
	(0.000)	(0.025)	(0.029)	(0.002)	(0.008)	(0.013)	(0.013)	(0.025)	(0.029)
Age	–0.000	–0.004*	–0.002	0.000	0.000	0.001	0.001	0.000	–0.002
	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.003)
Illiterate	0.000	–0.102***	–0.059	–0.004	–0.018***	–0.028**	–0.035***	–0.009	0.078*
	(0.000)	(0.033)	(0.037)	(0.004)	(0.007)	(0.011)	(0.011)	(0.027)	(0.043)
Constant	–0.000	0.180**	0.170***	0.002	0.011	–0.005	–0.011	0.100	0.194*
	(0.000)	(0.070)	(0.060)	(0.004)	(0.007)	(0.025)	(0.036)	(0.076)	(0.104)
Mean of dependent variable	0.000	0.07	0.052	0.000	0.002	0.007	0.012	0.030	0.047
Observations	1,285	1,285	1,285	1,285	1,285	1,285	1,285	1,285	1,285
R-squared	0.012	0.202	0.245	0.092	0.137	0.091	0.049	0.167	0.366
Number of districts	388	388	388	388	388	388	388	388	388
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Sectors have been divided following the ISIC 3.1 classification's division in sections. Shares of female workers in the service sectors are expressed as the number of employed persons in each sector over the total number of employed women in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).

Table A11: Reallocation across services—male workers

Variables	E–F Electricity and construction	G Wholesale and retail	H Hotels and restaurants	I Transports	J–K Finance and real estate	L Public administration	M–N Health and education	O Community services	P Private household activities
Output tariffs	0.000	0.001	0.000	0.000	0.000	−0.002**	−0.002	0.001	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Input tariffs	−0.000	−0.000	−0.000	−0.000*	−0.000**	−0.000*	−0.000*	−0.001**	−0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban	−0.001	0.150***	0.023***	0.025***	0.019**	0.112***	0.039***	0.052***	0.005
	(0.001)	(0.026)	(0.004)	(0.007)	(0.008)	(0.016)	(0.013)	(0.011)	(0.005)
Age	−0.000	−0.001	−0.000	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Illiterate	−0.001	−0.081***	−0.014***	−0.023***	−0.034***	−0.022**	−0.053***	−0.036***	−0.007
	(0.001)	(0.018)	(0.004)	(0.005)	(0.008)	(0.010)	(0.012)	(0.010)	(0.006)
Constant	0.003	0.092***	0.019**	0.025***	0.021*	0.026	0.061**	0.058**	0.038
	(0.002)	(0.034)	(0.008)	(0.008)	(0.011)	(0.026)	(0.031)	(0.029)	(0.025)
Mean of dependent variable	0.000	0.036	0.004	0.006	0.004	0.016	0.019	0.015	0.005
Observations	1,285	1,285	1,285	1,285	1,285	1,285	1,285	1,285	1,285
R-squared	0.025	0.304	0.191	0.106	0.276	0.349	0.095	0.232	0.147
Number of districts	388	388	388	388	388	388	388	388	388
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1, **p<0.05, ***p<0.01. SE (in parentheses) are clustered at the district level. Sectors have been divided following the ISIC 3.1 classification's division in sections. Shares of male workers in the service sectors are expressed as the number of employed persons in each sector over the total number of employed men in working age (15–64 years) in each district.

Source: authors' elaboration on the census, NLF, and WITS data (Minnesota Population Center 2015; CSA 1994, 2004, 2006, 2014; World Bank 2021).