Policy Paper

February 2022

Trade and Youth Labor Market Outcomes: Empirical Evidence and Policy Implications

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PP - 02/22

We examine the effects of trade on youth labor force participation and unemployment rates by performing fixed-effects and Arellano-Bond GMM estimations on data from 89 developing and emerging economies from 1990 to 2018. The empirical results suggest that trade openness has U-shaped effects on youth labor force participation rates, with negative impacts at low-to-moderate levels of trade and positive but minor effects at relatively high levels of trade. Except for Latin America, the results also indicate that openness to trade reduces female youth unemployment rates after a country has reached a significantly high level of trade (greater than 200%) as a share of its GDP. The results associated with the male youth are less robust. Interestingly, in Latin America, trade openness unambiguously reduces youth unemployment rates, with , more substantial impacts on female unemployment. We discuss the main policy implications of these findings.

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Keywords: trade openness, labor market outcomes, youth unemployment, youth labor force participation
JEL classification: E24, F16, J11

Acknowledgment
The author gratefully acknowledges support from the R4D Program for Research on Global Issues for Development funded by the Swiss National Science Foundation and the Swiss Development Cooperation.

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I. INTRODUCTION

In the last few decades, trends in world population have produced significant impacts on the demographic structures within and between countries and between world regions. While the share of the older population in developed countries has increased substantially relative to the share of children and youth, many developing countries are experiencing a 'youth bulge' due to a significant decline in infant mortality rates and a much lower decline in fertility rates.

Figure 1 shows that sub-Saharan Africa (SSA) has the highest proportion of youth population (age 15-24), which is nearly double the proportion in Europe (19.9% versus 10.3%). North Africa, Latin America, and Asia also have higher proportions compared to North America and Europe. In the next two decades, and as today's children become youth, this trend will become even more pronounced in SSA and North African countries. In 2020, the proportion of children in the total population in these two regions exceeded 42% and 32%, respectively. These demographic trends are expected to intensify pressures on policymakers to create pathways to decent work, mobilize more funding for education, vocational training, and social services, and improve the provision of other public goods for youth.

While the youth bulge in Africa and South Asia, in particular, offers a range of opportunities, including the potential to be the main suppliers of the world's workforce for producing goods and services and to increase the size of the manufacturing sector due to lower labor costs compared with countries in other regions where wages have risen (Filmer and Fox, 2014), creating pathways to decent work has been a challenge for many countries in these regions. Figure 2 shows that youth unemployment rates exceed 50% in South Africa, and are nearly at, or above, 30% in Algeria, Jordan, Libya, and Tunisia, and 23% in India, whereas. In contrast, the world average is about 15.2%. We also note significant disparities among countries within the same region. For example, some SSA countries have low levels of youth unemployment (e.g., Rwanda, Uganda, Burundi, and Tanzania).

The situation is even more troubling when considering female youth unemployment rates (Figures 3 and 4). As shown in Figure 4, female youth unemployment rates in Iraq, Saudi Arabia, and South Africa are at, or above, 60%. These rates exceed 40% in Algeria, Egypt, Jordan, Syria, Botswana, Sudan, and Gabon. On the other hand, female youth unemployment rates are below 10% in several countries, including Israel, Qatar, Mexico, Guatemala, Bolivia, Peru, and many SSA countries. We note similar disparities in female labor force participation. Some MENA countries register very low participation rates (among the lowest rates in the world), while many SSA countries show high female youth labor force participation rates.

Youth unemployment is one of the main socio-economic challenges facing many developing countries in the 21st century, especially in SSA, Asia, and the MENA region. Many of these countries have not been able to transform the youth bulge experienced since the 1990s into a demographic dividend. The result was remarkably high youth unemployment rates and increasing dissatisfaction and distrust of government policies. The persistent lack of satisfactory employment opportunities and earnings implies that "the youth bulge will become a demographic bomb, because a large mass of frustrated youth is likely to become a potential source of social and political instability" (Justin Lin, 2012). Both theoretically and empirically, it has been shown that binding labor-market constraints -which tend to be predominant in countries where adequate employment opportunities are lacking- influence the effects of the youth cohort's relative size on insurrections (Apolte and Gerling, 2018).

Notwithstanding the impacts of the COVID-19 pandemic, many countries have not been able to meet an important target of Sustainable Development Goal 8 (SDG8), which is target 8.6:

"By 2020, substantially reduce the proportion of youth not in employment, education or training".

Many scholars and policymakers consider trade an essential contributor to job creation. Some political leaders are opposed to trade liberalization because they believe international trade (imports) 'causes' aggregate unemployment. On the other hand, a significant number of studies have shown that trade can destroy jobs and cause higher unemployment. A large body of literature focused on U.S. labor market outcomes of international trade by using industry-level, sector-level, or state-level data (Sachs *et al.*, 1994; Addison *et al.*, 1995; Bernard *et al.*, 2006; Artuç *et al.*, 2010; Autor *et al.*, 2013 and 2014; Ebenstein *et al.*, 2014; Acemoglu *et al.*, 2016; Caliendo *et al.*, 2019; Helm, 2020). Other studies examined these impacts using cross-country data from other developed economies (Felbermayr *et al.*, 2011; Gozgor, 2014; Nordmeier *et al.*, 2016; Mohler *et al.*, 2018; Celi, 2021). There is also a relatively small but growing literature on the labor market outcomes of international trade in developing countries (Kambourov, 2009; Hasan *et al.*, 2012; Dix-Carneiro, 2014; Coşar *et al.*, 2016). In general, the literature provides mixed evidence on the impacts of trade on unemployment.

Research on the effects of trade openness on youth labor market outcomes, especially in developing countries, is more limited. To the best of our knowledge, the literature includes only three closely related studies (focusing primarily on the impacts of trade on youth employment or unemployment): Anyanwu (2014), Awad (2019), and Kpognon *et al*. (2020). These are published empirical studies investigating the effects of trade openness on youth unemployment (or employment). All three studies used panel data from African countries only.

In this paper, we investigate the effects of trade on youth labor force participation and unemployment rates using fixed-effects and Arellano-Bond GMM estimators and data from a large group of developing and emerging economies throughout 1990 to 2018. We obtain the following main results. First, we find that trade openness has U-shaped effects on youth labor force participation rates, with negative impacts at low-to-moderate levels of trade openness and positive, although minor, effects at relatively high levels of trade openness. Second, except for Latin America, we show that openness to trade reduces female youth unemployment rates but only after a country has reached a significantly high level of trade (greater than 200% of its GDP). Third, trade openness unambiguously reduces youth unemployment rates in Latin America but with , more substantial impacts on female unemployment.

Our study complements the literature on the effects of international trade on unemployment, and aims to fill the gap in research on trade and youth labor market outcomes by using data from a larger sample (compared to previous studies), including African countries, as well as developing and emerging economies from Latin America and Asia. We also make a novel contribution to the empirical literature by examining the impacts of trade openness on youth labor force participation, examining trade effects on youth unemployment, and differentiating between impacts on females and impacts on male youth unemployment and labor force participation.

The remainder of the paper is structured as follows. The next section provides an overview of related literature. Section 3 describes the variables and methodology used in the empirical analysis, while Section 4 presents the estimation results. In Section 5, we discuss the main policy implications of the findings. Section 6 concludes.

II. LITERATURE REVIEW

2.1. Theoretical literature

Studies have noted that standard trade theory did not consider the impacts of trade on labor markets as this theory assumes full employment and (as in the Heckscher–Ohlin framework) costless intersectoral shift in production and labor mobility (Dutt *et al.*, 2009; Carrère *et al.*, 2020; Celi, 2021). However, in recent decades, economists have begun to consider the labor market impacts of international trade and develop models that help explain how international trade can influence unemployment, which is a fact of life and can sometimes reach persistently high levels.[1] These models are, in general, based on microeconomic decision-making, linking and extending models of trade with differentiated products, factor proportions, or productivity differences (Belenkiy and Riker, 2015).

As Belenkiy and Riker (2015) noted, search models are the more common theoretical models in this literature. These models consider the effects of international trade on aggregate unemployment through their impacts on the job search. Using a theoretical model of search unemployment (from the perspective of OECD countries), Moore and Ranjan (2005) showed that while skill-biased technological change and globalization both contributed to increases in wage inequality, they may have had different effects on unemployment. More specifically, the authors show that while skill-biased technological change leads to a reduction (but with some caveats) in the unemployment rate of unskilled workers, globalization increases this unemployment rate. They argued that one way to interpret this result is that "globalization increases the unemployment rate in the import-competing sector and reduces the rate of unemployment in the export sector." On the other hand, Mitra and Ranjan (2010) found that when there is imperfect labor mobility "unemployment in the offshoring sector can rise, with an unambiguous unemployment reduction in the non-offshoring sector", suggesting that the impact on aggregate unemployment is ambiguous. Similarly, Stepanok (2018) presented a North-South model of international trade featuring search-frictional unemployment in the North and showed that trade liberalization raises welfare but has an ambiguous impact on unemployment.

To study the interaction of labor market rigidities with international trade, Helpman and Itskhoki (2010) developed a two-country, two-sector model of international trade, with one sector producing differentiated products while the other sector produces homogenous products, and both sectors are characterized by search and matching frictions in the labor market. Their model showed that openness to trade increases (reduces) a country's unemployment rate if its relative labor market frictions in the differentiated sector are low (high). The authors also noted that "[c]ross-country differences in rates of unemployment exhibit rich patterns…lower labor market frictions do not ensure lower unemployment, and unemployment and welfare can both rise in response to falling labor market frictions and falling trade costs." Carrère *et al.* (2020) constructed a multicountry, multisector trade model characterized by labor market frictions risk-averse workers, unemployment benefits, and equilibrium unemployment. They showed that "[t]rade opening leads to a reduction in unemployment when it simultaneously raises welfare and reallocates labor toward sectors with lower-than-average labor market frictions." Based on their model, the authors quantified the potential real wage, unemployment, and welfare effects of repealing NAFTA and raising bilateral tariffs between Mexico and the United States to 20%. They found that this would increase unemployment by 2.4% in the United States and 48% in Mexico.

1. Belenkiy and Riker (2015) provide a review of theoretical and empirical literature.

On the other hand, Kim and Vogel (2021) developed a model with economies characterized by many labor groups and sectors. They examined the effects of trade shocks on several labor market adjustment margins. The authors demonstrated that "labor groups earning a greater share of wage income in sectors with relative price declines experience a relative increase in unemployment and nonparticipation and decrease in wages and welfare." Finally, Mesa (2012) analyzed the impacts of openness to trade on the labor market and the impacts of an increase in the minimum wage and a favorable productivity shock in the export sector. The author used a general equilibrium model for a small open, less developed, country with three sectors-an an informal and nontradable sector with flexible wages, along an export and an import sector. He found that if institutional and market frictions are considered, trade liberalization could explain some unemployment levels, but "the unemployment effects might be offset if the trade liberalization improves both the efficient allocation of resources in the economy and productivity in the export sector." Mesa also found that raising the minimum wage could reduce the positive effects on employment from the expanding export sector. Thus, the evidence in the theoretical literature seems ambiguous. As Belenkiy and Riker (2015) pointed out, "theoretical models demonstrate that there is a complex and often ambiguous relationship between trade and unemployment: whether trade increases or reduces unemployment rates depends in a complicated way on the industry composition of a country's output and, on differences in labor market frictions across industries and countries."

2.2. Empirical studies

A large body of empirical literature used micro-level data and focused on the manufacturing sector in OECD countries, and a few developing countries. For example, Autor *et al*. (2013) found that United States' labor markets exposed to increasing Chinese import competition experienced a substantial decline in employment, especially in manufacturing and among non-college workers. Using panel data from OECD countries and cross-sectional data from a larger group, including developed and developing countries, Felbermayr *et al*. (2011) found that higher trade openness was associated with lower structural unemployment rates. Their benchmark specification suggested that "a 10-percentage point increase in total trade openness reduces aggregate unemployment by about three-quarters of one percentage point."

Similarly, Gozgor (2014) found that greater openness to trade (and other globalization indicators) was significantly and negatively associated with unemployment rates in the G7 countries. Mohler *et al*. (2018) focused on the case of Switzerland, which experienced the highest relative rise in low-skill worker unemployment rate among OECD countries in 1991-2014. The authors used 1991-2008 panel data on about 33,000 Swiss manufacturing sector employees. They did not find strong evidence of a positive association between import competition and low-skilled workers' likelihood of becoming unemployed. Nordmeier *et al*. (2016) used a structural vector-auto-regressive (VAR) approach to explore the short- and long-run effects of trade on unemployment in Germany and found that trade influences unemployment mainly through a reduction in the job-separation rate, while it takes time (time lag) for the job-finding rate to increase. On the other hand, Yanikkaya (2013) investigated the effects of trade liberalization on the growth rate of sectoral labor in developed and developing countries and found a negative influence of trade volumes on industrial employment. The author noted that "trade openness is not in itself a solution to the unemployment problems of developing countries and yet it has not been the prime factor to blame for the lower employment levels in developed countries."

The empirical literature using data from developing countries is small but growing. Examining data on individual workers in Brazil, Menezes-Filho and Muendler (2011) found that trade liberalization in the 1990s led to an increase in transitions to services and unemployment and out of the labor force. The authors reported that "exporters separate from significantly more and hire fewer workers

than the average employer." In contrast, using state and industry-level unemployment and trade protection data from India, Hasan *et al*. (2012) found no evidence that trade liberalization increased unemployment. On the contrary, the authors found that "urban unemployment declines with trade liberalization in states with flexible labor markets and larger employment shares in net exporter industries…workers in industries experiencing greater reductions in trade protection were less likely to become unemployed, especially in net export industries in industries." These results seem to be consistent with Dhamija (2019) findings of a negative association between trade openness and unemployment in India. However, this relationship was significant only in rural parts of India's states, while it was insignificant for urban parts of the states. Dhamija (2019) concluded that these results imply that "in developing countries trade openness leads to increase in the employment of labor; but more so of unskilled workers and leads to a movement away from the agriculture." On the other hand, Selwaness and Zaki (2019) found that trade in a panel of MENA countries positively affected employment. Still, this effect is reduced as a result of labor market rigidities.

Some studies used counterfactual experiments to investigate the effects of trade liberalization on labor market outcomes. For example, Dix-Carneiro (2014) estimated a structural dynamic equilibrium model for Brazil's labor market and used it for counterfactual trade liberalization experiments. The author found a substantial market response following trade liberalization, while the transition could take several years. In addition, the author found that "trade-induced welfare effects depend on initial sector of employment and on worker demographics such as age and education." On the other hand, Coşar *et al*. (2016) used establishment-level data from Colombia and estimated an open economy dynamic model linking trade to wages and job flows. Using counterfactual experiments, the authors found that Colombia's integration in the global economy "increased its national income at the expense of higher unemployment, greater wage inequality, and increased firm-level volatility."

Empirical research has also examined the effects of trade openness on the labor force (Menezes-Filho and Muendler, 2011; Cooray *et al*., 2017; Madanizadeh and Pilvar, 2019), and especially the effects of trade on female labor force participation (Meyer, 2006; Sauré and Zoabe, 2014; Gaddis and Pieters, 2017; Li *et al*., 2020). Madanizadeh and Pilvar (2019) explored the effect of trade openness on labor force participation in a panel of 90 developed and developing economies for 1990-2012 and found that lower trade barriers are associated with greater labor force participation in both developed and developing countries. More specifically, the authors found that an increase of 10 percentage points in tariff rates lowered the labor participation rate by 4-to-6 percentage points, with this negative association being more severe in the long run. In contrast, Menezes-Filho and Muendler (2011) found that trade liberalization in Brazil in the 1990s had a negative impact on the labor force.

The empirical evidence on the impacts of international trade on female labor force participation and employment in developed and developing countries seems mixed. Kucera (2001), Sauré and Zoabe (2014), and Tejani and Milberg (2016) reported negative impacts. However, using data for 1990-2016 from nine Asian countries and a panel threshold regression technique, Li *et al*. (2020) found that increases in trade openness were associated first with increases in female labor force participation rates and then decreased in those rates beyond a threshold point. Similarly, Baliamoune-Lutz (2020) finds an inverted-U relationship between trade and women's share of wage employment in most countries. On the other hand, Aguayo-Tellez *et al*. (2014), Juhn *et al*. (2014), and Gaddis and Pieters (2012) found positive impacts of trade on women's employment and labor force participation.

2.3. Trade openness and youth employment

The effects of international trade on employment and unemployment can also depend on demographic factors, such as age and gender. While there is an essential body of empirical literature on the gendered effects of trade openness on labor market outcomes, research on the impacts of trade on youth labor market outcomes, especially in developing countries, is minimal. Yet, many theoretical and empirical studies focusing on the impacts of trade on labor market outcomes use models that consider skills and labor mobility as important factors influencing trade-induced effects. Since youth, especially in developing countries, may have different skills and can have costless (or low-cost) mobility compared with older age groups, we should expect the effects of trade openness on young workers to be different from the effects on older workers.

As noted earlier, the literature includes only three empirical studies that focused primarily on the effects of trade openness on youth employment (or unemployment) in developing countries: Anyanwu (2014), Awad (2019), and Kpognon *et al*. (2020). All three studies used panel data from African countries only. Anyanwu (2014) explored the effects of intra-regional trade in Africa on youth unemployment using panel data f from 1980 to 2010. He found that "higher levels of intra-African trade reduce the aggregate female and male youth unemployment in Africa". Similarly, Awad (2019) investigated the effects of globalization on youth unemployment by applying a system GMM estimation to data from 50 African countries, covering the period 1994 to 2013. He found that greater openness to global markets reduced youth unemployment rates, and labor market rigidity (using a composite index consisting of six sub-indicators of labor market regulation) also appeared to reduce youth unemployment.

On the other hand, Kpognon *et al*. (2020) used data over 2002-2015 from 41 SSA countries and examined how labor market rigidities influenced the effects of trade on youth unemployment. Based on pooled ordinary least squares (OLS) regression and instrumental variable two-stage least-squares (IV-2SLS) estimations, the authors concluded that both openness to international trade and labor market rigidity had a positive and statistically significant impact on youth employment. However, their results showed that the interplay of labor market rigidity with openness to trade negatively impacted youth employment, suggesting that trade openness exerts a negative influence on youth employment in more rigid labor markets in SSA. Furthermore, Kpognon *et al*. (2020) examined the impacts of trade and labor market rigidity on female youth employment in SSA. The estimated effects of trade openness, labor market rigidity, and the interplay of these two variables were the opposite of the effects found in the case of total employment. More specifically, the authors found that trade openness and labor market rigidity negatively impacted young women's employment. In contrast, the interaction of trade openness with labor market rigidity had a positive influence. Kpognon *et al*. noted that this last result means that since women, including young women in SSA, often face discrimination in the labor market, and employers tend to encourage and benefit from this situation, "[s]tricter labor market regulations in favor of women and young women would be more favorable to them."

It is essential to examine whether trade increases (or decreases) both labor force participation and employment or increase both labor force participation and unemployment. To the best of our knowledge, there are no studies that no studies have investigated the impacts of trade openness on female and male youth labor force participation in developing countries using country-level panel data. This is because greater trade openness may attract youth to the labor market. Still, other factors, such as lack of skills, employer hesitancy to hire younger workers, and labor market rigidities, could prevent them from joining the ranks of the employed and instead, they become unemployed. Thus, we aim to fill the research gap on trade and the youth labor market outcomes and make a novel contribution to the empirical literature by examining the impacts of trade openness on youth labor force participation.

III. METHODOLOGY AND DATA

3.1. Econometric specification

We examine the relationship between youth labor force participation and unemployment rates (as dependent variables) and trade openness, after controlling for other factors, starting with the following specification:

$$y_{i,t} = \alpha y_{i,t-1} + X_{i,t}\beta + \mu_i + \varepsilon_{i,t} \qquad (1)$$

where $y_{i,t}$ is youth labor force participation rate (or, alternatively, youth unemployment rate) in country i at time t and X is a row vector of the factors that influence the dependent variable, including trade openness and other control variables. μ_i is the individual (country) fixed effect, and $\varepsilon_{i,t}$ is a time-varying error term.

Unemployment and labor force participation may cause trade openness and other right-hand-side (RHS) variables we use in the estimation. Thus, we also use the Arellano–Bond generalized method of moments (A-B GMM) estimator to take this potential endogeneity problem into account. Applying the A-B GMM estimator to the specification in equation (1) yields

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta X_{i,t}\beta + \Delta \varepsilon_{i,t} \qquad (2)$$

Some of the RHS variables (as explained in Section 4) are treated as endogenous. We also account for the interaction between region dummy variables and trade openness in both specifications.

Variable selection

We examine the impacts of trade on two youth labor market outcome indicators: youth labor force participation rate and youth unemployment rate. In addition, we explore these effects for total, female, and male youth labor market outcomes. The data on these youth labor market outcome indicators are published by the International Labor Organization (ILO). Youth labor force participation (ylfp) is the labor force participation rate for ages 15-24, which represents the proportion of the population ages 15-24 that is economically active, while the youth unemployment rate (yunemp) represents the share of the labor force ages 15-24 without work but available for and seeking employment.

Our main RHS variable of primary interest is openness to international trade, which we measure by the sum of exports and imports as a share of a country's GDP. Instead of separating the two variables, we include both exports and imports because international trade can lead to job creation in expanding (often export) industries and job destruction in import-competing industries. We are interested in the net effect of increased trade flows on youth labor force participation and unemployment rates. We also include other control variables: fertility rates, internet use, real gross domestic product (GDP) per capita, secondary education enrollments, a time trend, and interactions of trade openness with region dummy variables for SSA, MENA, and Latin America (see Appendix A for more details). These control variables have generally been used in studies investigating the determinants of unemployment and labor force participation.

Fertility

Many studies have documented a negative impact of fertility on female labor force participation and employment (Chun and Oh, 2002; Lee and Chung, 2008; Bloom *et al.*, 2009; De Jong, 2017; Aaranson *et al.*, 2021). For example, using data from South Korea, both Chun and Oh (2002) and Lee and Chung (2008) found that fertility was negatively associated with female labor force participation rates. Chun and Oh (2002) found that having children reduced by 27.5% married women's labor force participation rates. Similarly, using data from SSA and instrumental-variable estimation, De Jong *et al*. (2017) concluded that having more children reduced women's labor force participation, especially in non-farm jobs. Interestingly, in a recent study, Aaronson *et al*. (2021) examined the effects of fertility on mothers' labor supply over the last two centuries and showed that this effect depended on the level of development. The authors used data for 1787-2015 from 441 censuses and surveys from 103 countries and 51.4 million mothers, and found that there was no effect of fertility on labor supply at low levels of development, while the impact was negative and substantial at higher levels of development.

Baliamoune-Lutz (2021a) obtained results showing a robust negative effect of fertility on the share of women in wage employment. Baliamoune-Lutz (2021b) found a robust negative association between fertility rates and female labor force participation rates. Similarly, Kpognon *et al*. (2020) found that fertility negatively impacted young women's employment. On the other hand, evidence from the MENA region indicates that female labor force participation remains low despite the significant decline in fertility rates, suggesting that the impact of fertility in the region is negligible (Majbouri, 2020).

Since female youth is defined as 'young women ages 15 to 24', fertility may positively or negatively impact female youth labor outcomes. If a country's average fertility rate increases above age 24 (say, between 24 and 30) and has a well-documented negative impact on female employment, we should expect employment opportunities for young women (24 and younger) to increase as older women (25 and older) may drop out of the labor force or decide not to participate in labor markets due to having more children. On the other hand, some countries tend to have relatively high adolescent fertility rates, which may adversely affect young women's ability to participate in the labor force. There are large cross-regional (and within region) disparities in adolescent and total fertility rates. For example, adolescent fertility rates in 2018 were 101.2, 62.1, 39.8, and 24.5 births per 1,000 women ages 15-29 in SSA, Latin America, MENA, and South Asia, respectively. Average (total) fertility rates in 2018 were 4.7, 2, 2.8, and 2.4 births per woman in the same regions, respectively. The relationship between income and fertility is generally high, as low-income countries show significantly higher adolescent and total fertility rates. In 2018, the average adolescent fertility rate (births per 1,000 women ages 15-19) in low-income countries was 95 versus 42.8 in lower-middle-income and 27.7 in upper-middle-income countries. The average total fertility rate was 4.7 in low-income countries and 2.7 and 1.8 in lower-middle and upper-middle-income countries, respectively.

Additionally, most empirical studies examining the impact of fertility on labor market outcomes are concerned with women's labor market outcomes. With few exceptions, empirical studies tend to exclude fertility when focusing on men's labor market outcomes. Yet, high fertility rates could also influence male employment and labor force participation rates; this is because changes in fertility rates can change the optimal time allocation within the household, thereby affecting the male and female labor supply (Becker, 1985; Kim and Aassve, 2006).

The empirical evidence on the effects of fertility on men and women is mainly based on data from developed economies and is mixed. For example, Angrist and Evans (1998), Millimet (2000), and Lundberg and Rose (2002) reported different findings using data from the United States. Millimet

(2000) found that fertility reduced female and male labor supply and had no impact on wages. In contrast, Angrist and Evans (1998) showed that fertility had a negative effect on female labor supply but had no significant impact on male labor supply, while Lundberg and Rose (2002) showed that the presence of children had a positive effect on male labor supply. On the other hand, using data from Indonesia, Kim and Aassve (2006) examined how an exogenous increase in fertility influenced male and female labor market participation and found that higher fertility caused women to reduce their working hours in Indonesia's rural and urban areas. In contrast, increased fertility caused men to increase their working hours only in rural areas.

Given the mixed evidence reported in previous studies and the limited research using fertility as a control variable when focusing on male and female labor market outcomes in developing countries, more empirical evidence would complement the literature. Thus, we include fertility rates on the RHS when considering the effects of trade and other variables on total, female, and male youth unemployment and labor force participation. This is an additional difference with the three studies (discussed above) that examined the relationship between trade and youth labor market outcomes. Kpognon *et al*. (2020) used fertility rates only when focusing on women's employment and not when the dependent variable was total youth employment. Neither Awad (2019) nor Anyanwu (2014) controlled for the effects of fertility, even though the latter study examined the effects of intra-regional trade on total, male, and female youth unemployment separately.

Income

Empirical studies have examined the effects of output fluctuations on unemployment, mostly based on Okun's law,[2] which predicts a significant negative association between changes in a country's output (GDP) and changes in its unemployment rates (Lee, 2000; Singlair, 2009; Elshamy, 2013; Islas-Camargo and Cortez, 2018; Ball *et al.*, 2019; Lee *et al.*, 2020; Cajner *et al.*, 2021, Obst, 2021; An *et al.*, 2021).

Some studies have found the association of unemployment with output fluctuations in developing countries to be different from the documented association in developed countries (Bartolucci *et al.*, 2018; Ball *et al.*, 2019; Lee *et al.*, 2020; An, 2021). For example, Ball *et al*. (2019) found the Okun coefficient to be about half as significant in developing as in developed economies. The authors noted that "there is considerable heterogeneity across countries, with Okun's Law fitting quite well for a number of developing countries." Similarly, Lee *et al*. (2020) documented significant variations across world regions and income levels. They found a lower Okun's coefficient in developing countries than in developed countries. An *et al*. (2021) found that "unemployment is more than twice as sensitive to aggregate demand in advanced as in emerging market and developing economies". On the other hand, using US data for 1947-1999, Silvapulle *et al*. (2004) obtained empirical evidence indicating that "[t]he response of unemployment to output is found to be stronger when there is a negative rather than a positive output gap." . This finding seems consistent with the fact that often youth unemployment is much higher (compared to other age groups) during a recession and a significant level of youth unemployment persists even when the economy has recovered. Plausibly, dismissing younger workers would generally be less costly during an economic downturn, while hiring them when the economy is recovering would be less attractive (compared with more experienced age groups) to employers.

To investigate Okun's law in OECD countries, Zanin (2014) examined estimates for male and female age cohorts using data for 1998–2012 and obtained results showing higher Okun coefficients for the youngest cohorts. The author concluded that the young population, and particularly the young male population, tend to be most exposed to the business cycle in both developed and emerging

2. In his original estimation, Arthur Okun used quarterly US data for 1947-1960 and found that an increase in output of one percentage point reduced unemployment by approx. 0.3 percentage points (Okun, 1962),

OECD countries." Similarly, An *et al*. (2021) found that, compared with adults' unemployment, youth unemployment was twice as sensitive to aggregate demand.

Empirical research has also documented significant effects of output (real GDP) fluctuations on labor force participation. For example, Cajner *et al*. (2021) found that the US labor force participation rate was highly cyclical. It had a significantly longer-lived response to cyclical fluctuations than the unemployment rate. On the other hand, Perez-Arce and Prados (2021) surveyed the literature and reported that "research on the extent to which the Great Recession caused the decline [in the US labor force participation rate] establishes that most of the drop cannot be attributed to cyclical factors". Using micro-level data on labor force participation of urban married women in eight developing countries (Bolivia, Brazil, India, Indonesia, Jordan, South Africa, Tanzania, and Vietnam), Klasen *et al*. (2021) found that "the economic, social, and institutional constraints that shape women's labor force participation remain largely country-specific". However, the authors reported that "rising education levels and declining fertility consistently increased participation rates, while rising household incomes contributed negatively in relatively poorer countries, suggesting that a substantial share of women work out of economic necessity."

Many studies have identified a U-shaped relationship between female labor force participation and the level of economic development (Pampel and Tanaka, 1986; Goldin, 1995; Çağatay, and Özler, 1995; Tam, 2011), which has been widely dubbed as the 'feminization U' hypothesis: female labor force participation initially falls with increasing development, then increases with further economic growth and significant structural changes. However, Gaddis and Klasen (2014) showed that the empirical support for the feminization U hypothesis is weak and "depends on the data sources used, especially GDP estimates." Similarly, Roncolato (2016) used data from South Africa's 2007 Community Survey to investigate whether a feminization U exists and found no evidence of a U-shaped relationship between the share of households with electricity (an indicator of development and structural change) and women's probability of being in the labor force.

Among studies that focused primarily on the impact of trade openness on youth labor market outcomes, Kpognon *et al*. (2020) found a robust negative effect of real GDP per capita on young women's employment rates but not on total youth employment rates, while Awad (2019) did not find any impact of real GDP or output volatility on youth unemployment. On the other hand, Anyanwu (2014) found a robust negative effect of lagged real GDP growth rates on total, female, and male youth unemployment. The effect was more significant in magnitude for female youth unemployment.

Secondary education

Numerous studies have examined links between education and labor market outcomes, especially when examining female labor force participation, employment, and wages (Franz, 1985; Psacharopoulos and Tzannatos, 1987 and 1989; Kerckhoff *et al.*, 2001; Lincove; 2008; Anyanwu, 2014; Klasen and Pieters, 2015; Kpognon *et al.*, 2020). For example, using 1964-81 data from the Federal Republic of Germany, Franz (1985) found that "education was a major determinant of a woman's wage rate and that labor force participation increased with education." Psacharopoulos and Tzannatos (1987) found that education positively impacted the incidence of female labor force participation and women's lifetime length of participation in the labor market. The authors reported that "an extra year of schooling results in two more years of participation." Psacharopoulos and Tzannatos (1989) included a table summarizing findings from 20 studies (published in the 1970s) which examined the relationship between Schooling and female labor force participation, mostly in developing countries. The summarized results showed that 15 out of the 20 studies found a positive relationship, two studies found a positive relationship and no effect, and two studies reported a negative relationship and no effect. In contrast, the results in one study showed an

unclear relationship. Nevertheless, it is worth noting that labor markets and education have changed significantly since the 1970s. As the size of the educated working-age population expands, the link between education and labor force participation may have changed considerably.

IV estimates in Anyanwu (2014) showed that higher secondary education reduced youth unemployment in African countries, while fixed-effects estimates suggested that education reduced total and female youth unemployment but did not influence male youth unemployment. In contrast, Kpognon *et al*. (2020) found that higher secondary education caused lower employment for both women youth and all (total) youth.[3] On the other hand, a study of the causes of stagnation of female labor force participation in India between 1987 and 2011 found that rising incomes and education contributed to a withdrawal of women from the labor force (Klasen and Pieters, 2015).

Internet use

The internet can reduce frictional unemployment by serving as a labor market matchmaker (Kuhn, 2014; Bhuller *et al.*, 2020). Empirical studies have found that broadband expansion and internet use had a significant impact on employment and labor force participation (Kuhn and Skuterud, 2004; Atasoy, 2013; Dettling, 2017; Hjort and Poulsen, 2019; Bhuller *et al.*, 2020; Viollaz and Winkler, 2020; Bahia *et al.*, 2021). For example, Kuhn and Skuterud (2004) used US Current Population Survey Computer and Internet Use Supplements data from December 1998 to August 2000 to investigate which types of unemployed workers used online search to look for a job and whether Internet searchers found a job more quickly. The authors found that those looking for work online "have observed characteristics typically associated with shorter unemployment spells and spend less time unemployed." However, their results showed that, once the observable characteristics were held constant, this unemployment differential is eliminated and, in some cases, reversed. Atasoy, 2013 used US data for 1999-2007 and found important impacts of broadband expansion on the employment rate using a county and time fixed effects model, indicating that "moving from no availability [of broadband] to full availability increases the percentage of the population employed by 1.8 percentage points." The author also noted that the employment impact was larger in rural and more isolated areas. Also, based on data from the US, Dettling (2017) found that home highspeed Internet use caused a 4.1 percentage-point increase in labor force participation for married women, while it had no impact on men's or single women's labor force participation. On the other hand, Bhuller *et al*. (2020) examined the effects of broadband expansions in Norway. They found that, due to these expansions, online vacancy-posting and average duration of vacancies fell, which, in turn, increased the rate of job finding and starting wages, enhanced employment stability, and lowered the steady-state unemployment rate by as much as one-fifth.

Studies using data from developing countries also found a significant association between internet use and employment. Hjort and Poulsen (2019) explored the effects of fast Internet on employment in 12 African countries using a difference-in-difference technique. They found robust estimates indicating significant positive impact on employment rates. Viollaz and Winkler (2020) found that internet adoption raised women's participation in the labor force in Jordan but did not significantly impact men's labor force participation. Bahia *et al*. (2020) exploited a dataset integrating three waves of a nationally representative longitudinal household survey on living standards in Nigeria with information on the deployment of mobile broadband (3G and 4G) coverage between 2010 and 2016. Their study showed that mobile broadband coverage had significant and positive effects on household consumption and a negative impact on the proportion of households below the poverty line. The authors found that these effects were primarily due to increases in employment and labor force participation, especially among women. Similar findings were reported in Bahia *et al*. (2021) for Tanzania. The authors found that working-age residents of areas covered by mobile internet

3. Kpognon *et al*. (2020) also found that tertiary education had a negative impact on youth employment.

experienced a rise in non-farm self-employment, wage employment, and labor force participation. Interestingly, the authors found "[Y]ounger and more skilled men benefit the most through higher labor force participation and wage employment, while high-skilled women benefit from transitions from self-employed farm work into non-farm employment." Finally, Baliamoune-Lutz (2021b) used panel data for 1990-2018 from a large group of developing and emerging economies and obtained results suggesting that the interaction between greater trade openness and internet use had a positive impact on women's participation in the labor force.

It is worth noting that none of the three closely related studies on the effects of trade on youth labor market outcomes controlled for the effects of internet use or any other ICT indicator. Yet, young men and women tend to use the internet more intensively than older individuals in many developing countries. This is expected since secondary and tertiary education has been on the rise in most developing countries which had very low levels of educational attainments two-to-three decades ago, implying that the size of educated population (secondary education or higher levels) among the youth in many countries is significantly higher than the size of educated population among older generations. A 2017 survey[4] covering six SSA countries (Ghana, Kenya, Nigeria, Senegal, South Africa, and Tanzania) by the PEW Research Center highlighted "long-standing digital divides along demographic lines: Higher-income, more-educated and younger people are consistently more likely to use the internet, own a smartphone and engage in social networking."

IV. ESTIMATION RESULTS

4.1. Effects of trade openness on youth labor force participation

We investigate the effects of trade on youth labor force participation rates using the fixed-effects (FE) estimator after controlling for the roles of fertility, secondary education, income, internet use and time, and potential hysteresis in labor market outcomes (Blanchard and Summers, 1986; Logeay and Tober, 2006; Mednik *et al.*, 2012; Rodriguez-Gil1, 2018; Yagan, 2019; von Wachter, 2020). by including the lagged value of the dependent variable. We also explore whether these factors have gender-differentiated effects by estimating the effects on total, female, and male youth labor force participation rates.

The first three columns in Table 3 show the estimated impacts of openness to trade (the variable 'trade') and other control factors on total, female, and male labor force participation rates. We note that trade negatively influences (or at least associated with) youth labor force participation for all three categories of labor force participation rates. However, while this negative effect is statistically significant in the case of total and female labor force participation (at the 5-percent and 1-percent levels, respectively), it is nonsignificant in the case of young men's labor force participation. We also observe that the estimated effects of income (although it is nonsignificant) and education are negative.

The next three columns in Table 3 show, in addition to the effects of these factors, the estimated impacts of the squares of trade, income, and secondary education. We include the squared forms of these variables to investigate the presence of non-linear relationships with the dependent variable. We also account for region effects by including dummy variables for MENA, SSA, and Latin America and interacting them with trade. The results suggest a non-linear (U-shape) association between trade openness and all three categories of youth labor force participation. However, the magnitude of the impacts for young women is significantly higher than for men. Since the threshold level above which trade begins to exert a positive influence is relatively high and the magnitude of the

4. https://www.pewresearch.org/global/2018/10/09/internet-connectivity-seen-as-having-positive-impact-on-life-in-sub-saharan-africa/

effect is rather small, for many countries trade openness seems to have a negative influence on labor force participation, and this negative impact is stronger (in size) for young women. In Latin America, however, the overall effect is positive and statistically significant.

Next, we drop income (due to its linear correlation with trade and possibly high nonlinear correlation with other variables) and report the results in the first three columns of Table 4. We note that the coefficients on the variable 'trade' and 'trade squared' are statistically significant (at the 5-percent or 1-percent levels) and are consistent with a U-shape relationship between openness to trade and labor force participation rates. Again, we find that the effects of trade openness are negative for most countries since the turning point for the positive effects of trade is quite high, and the impact is stronger for female relative to male youth. Removing the variable 'fertility' and then removing both income and fertility did not change the main results: trade openness negatively influences youth labor force participation in most countries. A notable exception is Latin America, where trade seems to exert a positive influence. Still, the statistical evidence is more robust in the case of young women's labor force participation rates relative to their male counterparts.

Turning attention to the other control variables, we note that income and fertility do not appear to influence (or be associated with) youth labor force participation, and the effect of internet use is positive but not consistently statistically significant. At the same time, there is statistical evidence supporting a negative association between secondary school enrollments and female labor force participation rates. On the other hand, the lagged dependent variable and time have a robust and significant (positive and negative, respectively) association with all three categories of youth labor force participation (Tables 3 and 4). This impact is stronger for young men relative to young women. The labor force participation of young men and women appears to have a significant persistent component: A substantial portion (at least 33% in the case of women and 46% in the case of men) of changes in the previous year's rate of labor force participation is transmitted to this year's rate. Finally, the interplays of region dummy variables with trade openness seem to exert a robust and significant (at the 5-percent level or better) positive effect on youth labor force participation only in the case of Latin America, and mainly in the case of young women's labor force participation.

Due to the potential endogeneity of trade, fertility, and income, we need to be careful in interpreting these results as they may indicate correlation but not necessarily causality. Although we included the lagged dependent variable in the main primary estimations (Tables 3 and 4), the FE estimation technique is a static panel-data estimation model. To address the problem of potential endogeneity and to incorporate dynamic elements, we also use the dynamic panel generalized method of moments (A-B GMM) estimator (Arellano and Bond, 1991) and report the results in Table 5.

The A-B GMM estimates confirm the findings we obtained from the FE estimations and provide further support for the negative impact of trade at low-to-moderate levels of trade openness and positive but small effects at relatively high levels of trade openness. For example, let us consider the case of the MENA region where the U-shaped effect and the interplay of MENA with trade are statistically significant (at the 5-percent level) in the case of young women (column 5 in Table 5). The turning point (threshold beyond which trade starts to exert a positive effect) occurs at a trade openness value of approximately 121%. The A-B GMM estimates also indicate that the effect of trade is primarily on the female youth labor force participation. In contrast, its impact on male labor force participation is generally statistically nonsignificant.

Interestingly, the A-B GMM estimates (Table 5) show that higher fertility rates reduce total and male youth labor force participation rate in all three specifications, but this effect on female youth labor force participation is much weaker. Previous studies reported mixed evidence on the effects of fertility on men (Angrist and Evans, 1998; Millimet, 2000; Lundberg and Rose, 2002), while Kim and Aassve (2006) found that higher fertility caused women to reduce their working hours in both rural and urban areas, whereas increased fertility caused men to increase their working hours only

in rural areas. On the other hand, secondary education has a U-shaped effect on both male and female youth labor force participation. The threshold for the positive effect of secondary education is high, ranging from 89.5 to 98% secondary education rate. Previous studies have documented a positive effect of education, especially on female labor force participation (Psacharopoulos and Tzannatos, 1987; Lincove, 2008). On the other hand, Klasen and Pieters (2015) reported that that rising incomes and education contributed to a withdrawal of women from the labor force in India. Our results show that secondary education increases youth labor force participation in countries where secondary school enrollments are almost universal. The A-B GMM results also show that internet use and income per capita have no significant effects on youth labor force participation.

4.2. Effects of trade openness on youth unemployment

We estimate the effects of trade openness on total, female, and male unemployment rates using a similar methodology to the one we used for labor force participation rates. The FE estimates reported in Table 6 suggest that the impact of trade openness is generally nonsignificant. In fact, we obtain statistical significance (at the 10-percent level) only for the relationship between trade and female youth unemployment rates and only when we control for region effects. For further robustness checks, we removed the effect of income, both fertility and income, and secondary enrollments (Table 7), but the results are generally similar to those reported in Table 6.

The estimates suggest that, except for Latin America, greater openness to trade seems to be associated with a lower female youth unemployment rate only beyond a significantly high threshold level of trade which is, as a share of GDP, generally greater than 200%. On the other hand, the estimates indicate that trade openness in Latin America has a strong negative association with youth unemployment, with a more substantial effect on female youth unemployment.

We find that the coefficient on the lagged dependent variable is statistically significant (at the 1-percent level) and has a high value (exceeding 0.8) in all specifications. This result appears to be consistent with possible hysterics in youth unemployment in many countries (as noted earlier). We also find a non-linear (inverted-U) relationship between income and youth unemployment. The results indicated that the turning point (threshold beyond which increases in income are associated with lower unemployment rates) for female and male youth are different. Based on the results in Tables 6 and 7, the turning point is reached at a value of income between $2,094 and $2,435 for female youth and between $2,115 and $2,755. Nonetheless, these values apply to countries considered as lower-middle-income economies. This implies that low-income countries may not experience a decline in unemployment as income rises. On the other hand, in lower-middle-income countries with average income (PPP values), say, more significant than $2,500, higher income is associated with lower female youth unemployment rates but not necessarily with lower male youth unemployment rates.

Additionally, we address the potential endogeneity of trade openness, income, and fertility rates, as well as the interplay of openness to trade with other variables, by estimating the model using the A-B GMM estimator and reporting the results in Table 8. The A-B GMM estimates provide similar evidence to the one derived using the FE estimator. These results indicate that, except for Latin America, openness to trade reduces female youth unemployment rates after a country has reached a level of trade as a share of its GDP of approximately 218% (column 2 under heading 1 in Table 8). The results associated with male youth are less robust. On the other hand, we obtain unambiguous empirical evidence indicating that trade openness reduces youth unemployment rates in Latin America, with stronger impacts (in magnitude) on female unemployment rates.

Interestingly, the A-B GMM estimates also support an inverted-U impact of income on unemployment rates. We find the turning point at a value of income of about $2,137 in the case of female youth unemployment rates and a value of $2,528 in the case of male youth unemployment rates. These

values are consistent with the ones obtained in FE estimations, suggesting that countries within the low-income group and some within the lower-middle-income group may experience 'jobless growth': higher per-capita income with no significant decrease in youth unemployment rates.

V. SIGNIFICANCE OF THE FINDINGS AND POLICY IMPLICATIONS

The statistical evidence we obtain in this paper suggests that the effects of trade openness on youth labor force participation are not linear and seem to be mostly negative in countries with low-to-moderate openness to international trade. At the same time, there are unambiguous positive effects of trade on youth labor force participation rates in Latin America. We also show that greater openness to trade does not reduce youth unemployment in most countries in our sample since the threshold for an unemployment-reducing impact is at markedly high rates of trade openness. On the other hand, we find that trade openness unambiguously reduces female youth (and to a lesser extent male youth) unemployment rates in Latin America. At least for the effects of trade openness on female youth unemployment rates and our findings related to Latin America, our results seem consistent (notwithstanding the nonlinearity) with the results in Kpognon *et al*. (2020). Kpognon *et al*. found that trade openness had a positive effect on youth employment, while the interaction of labor market rigidity with openness to trade had a negative impact. The inverted-U effect we uncover could possibly be due to the impact of labor market rigidities, which policymakers may ease at higher levels of trade. We also uncover interesting effects of income per capita on youth unemployment rates. These findings have important policy implications, especially for countries where youth labor force participation is low, youth unemployment rates are persistently high, and the proportion of youth (in total youth population) not in education, employment, or training (NEET) is high or increasing.

First, the nonexistence of a positive trade-induced impact on youth labor force participation rates (notwithstanding the caveat mentioned in the next section) is unsettling. Given that many people in developing and emerging economies do not oppose greater trade openness and younger people are less opposed to it than older people,[5] if the fact that trade does not benefit youth by raising their participation in the labor force and/or significantly reducing youth unemployment rates persists (and our statistical evidence indicates this fact tends to persist), it may lead to a backlash against further trade liberalization. This may cause the youth bulge to become more like a "demographic bomb" (Lin, 2012).

Second, young workers, in general, are assumed to have more mobility than older workers due to smaller family size (often single or married with no children), less time and effort invested on the job they are separating from (e.g., pension plans, seniority-based benefits, work experience, and networks/memberships), lower resistance to change, and often (at least in many low- and lower-middle-income countries) having more educational attainments than older workers. These characteristics facilitate adaptability and movement to other (newer) occupations, especially those created as part of a country's export promotion policies, which tend to be clustered in export-processing zones. However, youth in many countries in our sample have not been enabled to transform this into significant labor market occupational and geographical mobility. Therefore, an important question arises: Is the lack of a significant positive effect of greater trade openness on youth employment due to negligible (or in some cases negative) net effects of trade openness or do other factors prevent the trade-induced reallocation of workers across sectors and geographical locations by causing imperfect youth labor mobility (Ranjan, 2010; Topalova (2010) Dix-Carneiro, 2014; Coşar

5. https://www.pewresearch.org/global/2014/09/16/faith-and-skepticism-about-trade-foreign-investment/

et al., 2016)? The answer to this question should provide important guidance to policymakers as it would help identify key entry points to enable youth to gain from greater openness to trade. Suppose imperfect or low labor mobility is the main cause of the lack of favorable impacts (in terms of employment) from trade. In that case, we should investigate the type and causes of this worker's immobility. Different policy approaches would apply depending on whether it is geographical or occupational immobility of youth labor. If it is the former, perhaps housing subsidies and provision of youth-friendly public transportation (e.g., high-speed trains and technology-equipped trams and busses) could provide strong incentives to young workers. On the other hand, if the main source is occupational labor immobility, policy initiatives may need to primarily focus on skill upgrading through apprenticeship and training and other targeted investments in human capital. Policymakers should also consider the possible impacts of labor market rigidities on youth labor mobility and trade-induced effects (Kambourov, 2009; Awad, 2019; Kpognon *et al.*, 2020).

Third, the finding that trade unambiguously reduces youth (especially female youth) unemployment in Latin America is interesting. Some studies have found that labor market rigidities adversely affect employment gains from greater trade openness. Yet, labor markets in Latin America tend to be characterized by a rigid regulatory environment. For example, "[d]ismissal of even one worker often requires third-party approval, permanent contracts are often mandatory for permanent tasks, and redundancy costs are higher than in advanced economies or other emerging market and developing economies" (David *et al.*, 2021). However, our findings for Latin America appear to be in line with the results Kpognon *et al.*, (2020) who found that the interplay of trade openness with labor market rigidity had a positive influence on female youth employment rates and interpreted the result to imply that since women often face discrimination in the labor market, and employers tend to benefit from this situation, more stringent labor market regulation in favor of women would benefit them.

Finally, our finding of an inverted-U effect of income on unemployment rates and no effect on youth labor force participation, along with a robust positive (and large in magnitude) coefficient on the lagged value of youth unemployment rates are consistent with strong hysteresis in youth unemployment rates[6] and imply a policy challenge: how to reduce youth unemployment rates if they are not responsive to output fluctuations. This can become a greater policy challenge during and after an economic crisis (Choudhry *et al.*, 2012), such as the COVID-19 pandemic-induced deep recession that many countries have experienced, affecting youth employment more acutely (von Wachter, 2020). The policy implications can become even more challenging as inflation rates in many countries increase, due largely to global supply chain disruptions during the pandemic. Policymakers may face possible long-run non-superneutrality of monetary policy due to hysteresis in labor markets (Logeay and Tober, 2006).

6. Although we did not test (using time series analysis) the hypothesis of hysteresis in unemployment rates, our findings seem to support it.

VI. CONCLUSION

We used 1990-2018 data from 89 developing and emerging economies and investigated the effects of trade on two indicators of labor market outcomes, youth labor force participation and unemployment rates. We examined the effects of trade and other control variables, as well as interactions between trade and region dummy variables, on total, female, and male labor force participation and unemployment rates. We used four main control variables: per-capita income, fertility rates, secondary education, and the percentage of internet users in the population. We presented the results from two estimation techniques, fixed-effects, and A-B GMM estimators.

Our main conclusions are (i) trade openness has U-shaped effects on youth labor force participation rates, with negative impacts at low-to-moderate levels of trade openness and positive, although small, effects at relatively high levels of trade openness, (ii) except for Latin America, openness to trade reduces female youth unemployment rates but only after a country has reached a significantly high level of trade (greater than 200%) as a share of its GDP, and (iii) trade openness unambiguously reduces youth unemployment rates in Latin America, but with more substantial impacts on female unemployment. These results are generally consistent with the mixed evidence reported in the empirical literature. We also showed that the effect of income on unemployment rates is non-linear (inverted-U shape). This significant result suggests that many countries within the low-income and lower-middle-income groups may experience 'jobless growth': higher per-capita income without significantly considerable reduction in youth unemployment rates. We discussed the main policy implications of our findings.

The main caveat of our study is our inability to incorporate data on informal employment. Developing countries tend to have a large informal sector, and studies have documented significant relationships between trade and informal employment (Stallings and Peres, 2000; Goldberg and Pavncik, 2003; Dix-Carneiro and Kovak, 2019), which may have implications for the ILO unemployment data that are widely used (Benanav, 2019). Thus, research using industry- and worker-level data and information on informal activities and industry exposure to trade openness would advance our understanding of how openness to trade affects youth labor market outcomes. Notwithstanding this caveat, studies using country-level (aggregate) data can provide useful insight into the net effect of trade openness on aggregate youth unemployment and labor force participation rates.

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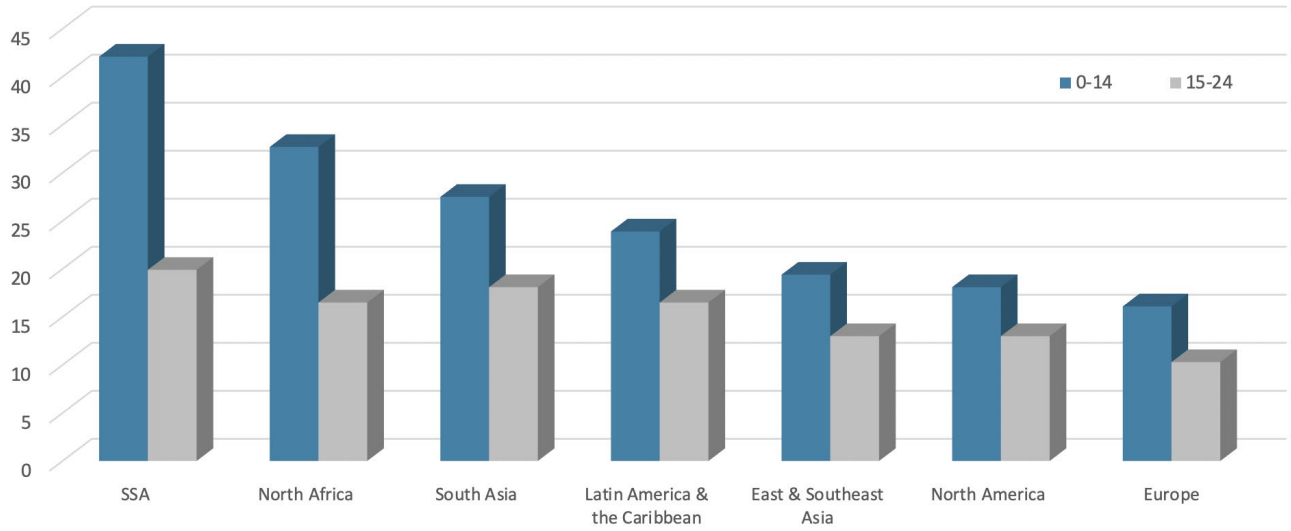
Figure 1

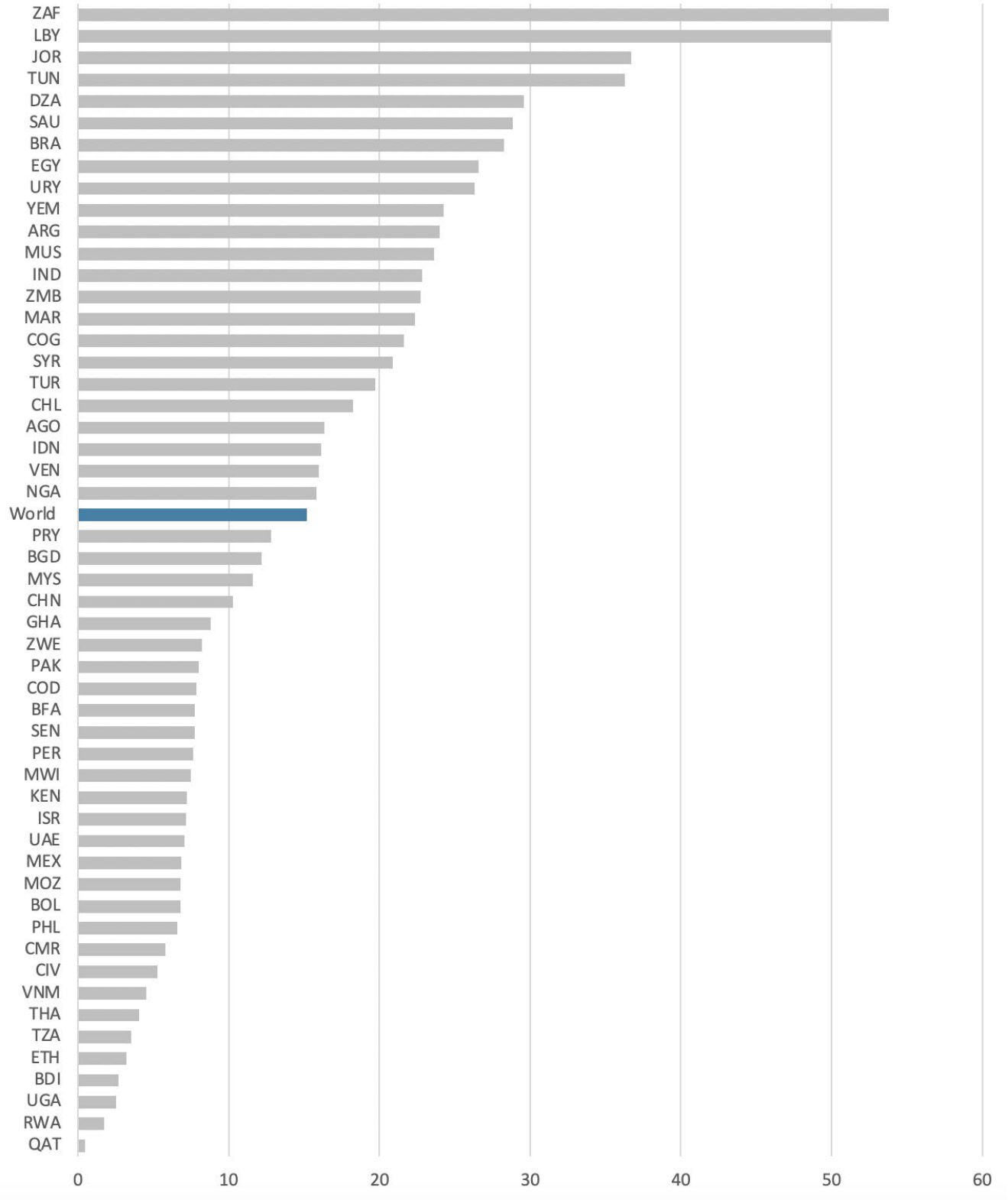
Population, age 0-24 (2020)



Source of data: World Population Prospects database online (https://population.un.org/wpp/database online), accessed on 11/27/2021.

Figure 2

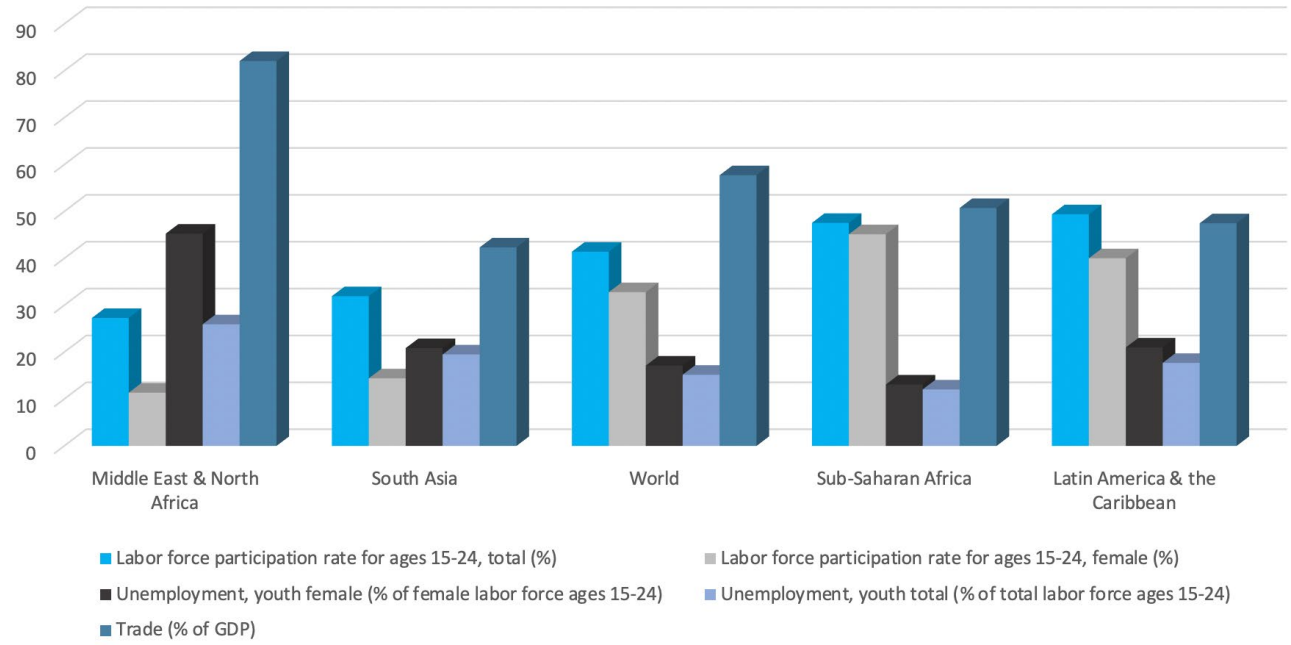
Youth unemployment rates, 2018 (selected countries)



Source of data: World Development Indicators database online (World Bank), accessed on 11/29/2021

Figure 3

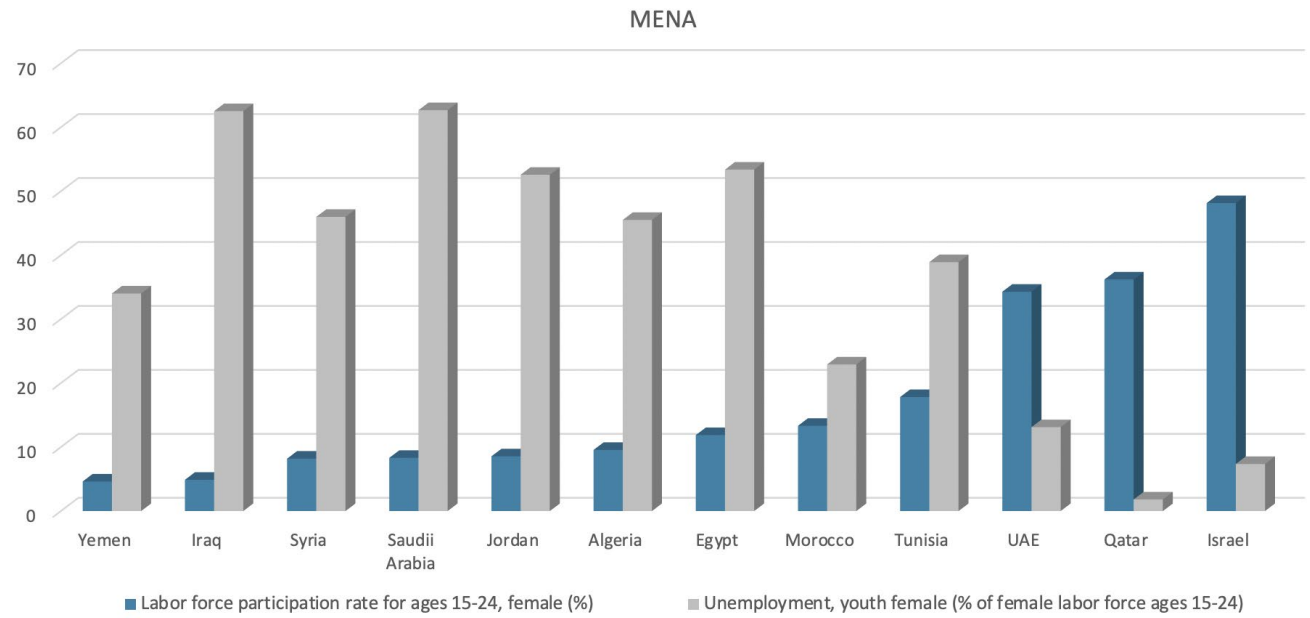
Trade, youth labor force participation, and unemployment (2018)

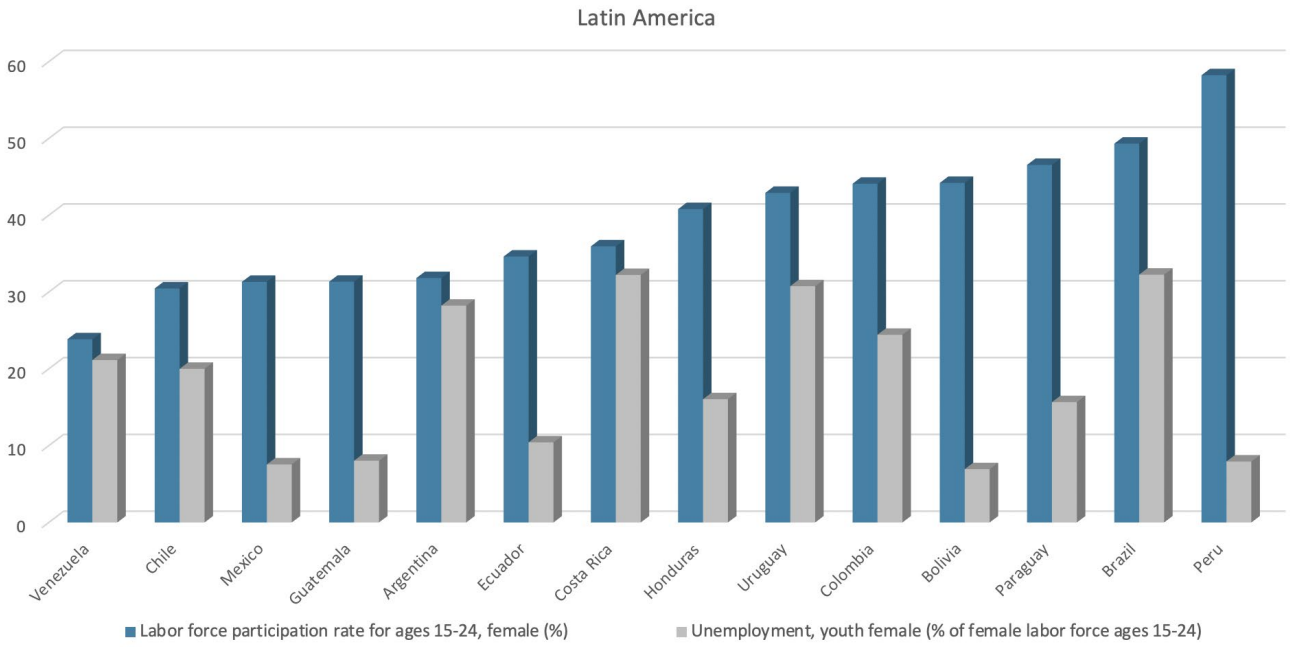


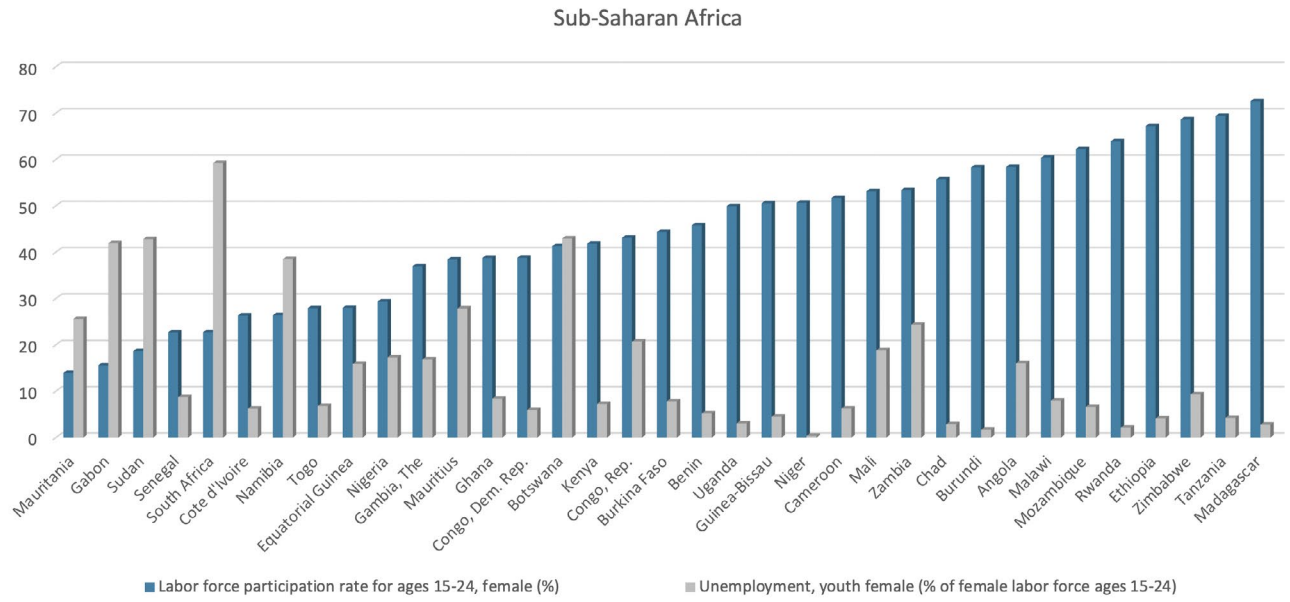
Source of data: World Development Indicators database online (World Bank), accessed on 11/29/2021.

Figure 4

Female youth labor force participation and unemployment (2018)







Source of data: World Development Indicators database online (World Bank), accessed on 11/29/2021

Table 1

Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total youth labor force (ylaborf_total)	2726	49.48	14.42	15.85	91.47
Female youth labor force (ylaborf_female)	2726	41.79	17.99	4.63	89.25
Male youth labor force (ylaborf_male)	2726	56.67	14.55	20.85	93.73
Total youth unemployment (yunemp_total)	2632	14.02	11.71	0.37	60.83
Female youth unemployment (yunemp_female)	2632	16.16	14.26	0.16	67.33
Male youth unemployment (yunemp_male)	2632	12.97	10.59	0.21	55.89
Trade openness (trade)	2515	75.60	54.62	0.17	442.6
Income	2605	10594	15883	436.72	111454
Fertility	2726	4.02	1.67	0.9	8.6
Secondary education	1789	57.07	29.22	5.22	132.81
Internet users, % of total population (internet)	2653	12.73	20.77	0	99.65

Details on the source of data and variable description are in Appendix A.

Table 2

Pairwise correlations for the main variables*

	ylaborf_ total	ylaborf_ female	ylaborf_ male	yunemp_ total	yunemp_ female	yunemp_ male	trade
trade	-0.17	-0.10	-0.23	0.044	0.05	0.04	
income	-0.22	-0.31	-0.15	0.02	0.07	0.002	0.51
fertility	0.21	0.28	0.10	-0.23	-0.27	-0.19	-0.32
secondary education	-0.43	-0.44	-0.32	0.28	0.34	0.25	0.24
internet	-0.26	-0.25	0.24	0.06	-0.12	0.02	0.34

Details on the source of data and variable description are in Appendix A.

* All P values are less than 0.01 except the correlations of yunemp_total, yunemp_female and yunemp_male with trade where the p values are less than 0.05 (significant at the 5-percent level), and for correlations of yunemp_ total and yunemp_male with income, and for yunemp_male with internet, where the p values are greater than 0.1 (no statistical significance).

Table 3

Trade and labor force participation: Fixed-effects estimates
Dependent variable: Labor force participation (ylaborf), % of total

	(1)			(2)		
	Total	Female	Male	Total	Female	Male
ylaborf_lag	0.424*** (0.080)	0.349*** (0.073)	0.468*** (0.072)	0.412*** (0.072)	0.331*** (0.063)	0.462*** (0.068)
Time	-0.199** (0.079)	-0.174** (0.079)	-0.209** (0.086)	-0.187*** (0.070)	-0.158** (0.073)	-0.203** (0.074)
Fertility	-0.202 (0.609)	-0.255 (0.681)	0.119 (0.714)	-0.376 (0.608)	-0.649 (0.671)	0.129 (0.754)
Income	-2.847 (1.945)	-3.485 (1.945)	-1.887 (1.870)	-0.428 (9.203)	-13.289 (11.455)	8.840 (9.553)
Trade	-0.018** (0.008)	-0.027*** (0.009)	-0.011 (0.009)	-0.075*** (0.024)	-0.097** (0.037)	-0.059*** (0.022)
internet	0.046*** (0.016)	0.050*** (0.017)	0.033 (0.021)	0.033* (0.017)	0.018 (0.019)	0.036* (0.021)
secondary education	-0.045** (0.021)	-0.043 (0.030)	-0.054** (0.024)	-0.113 (0.069)	-0.141* (0.076)	-0.083 (0.074)
income_squared				-0.107 (0.508)	0.651 (0.632)	-0.623 (0.559)
trade_squared				0.0001*** (0.00003)	0.00012** (0.00005)	0.00009*** (0.00003)
secondary education_squared				0.0004 (0.0004)	0.00066 (0.0005)	0.0002 (0.0005)
MENA x trade				0.036** (0.017)	0.039 (0.026)	0.035* (0.020)
SSA x trade				0.030 (0.023)	0.043 (0.033)	0.020 (0.024)
LAC x trade				0.103** (0.044)	0.142** (0.054)	0.072 (0.046)
R-sq						
Within	0.67	0.57	0.69	0.68	0.60	0.69
Between	0.79	0.76	0.81	0.73	0.67	0.75
Overall	0.78	0.77	0.78	0.74	0.67	0.77

Number of observations: 1526 (number of countries: 87)

Details on the source of data and variable description are in Appendix A. Standard errors (in parentheses) are clustered at the country level.

* indicates significance at 0.10 ** indicates significance at 0.05 and *** indicates significance at 0.01.

Table 4

Trade and labor force participation: Fixed-effects estimates – Robustness checks
Dependent variable: Labor force participation (ylaborf), % of total

	(1)			(2)			(3)		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
ylaborf_lag	0.421***	0.338***	0.469***	0.414***	0.333***	0.461***	0.425***	0.340***	0.469***
	(0.068)	(0.061)	(0.067)	(0.072)	(0.064)	(0.069)	(0.069)	(0.062)	(0.068)
time	-0.228***	-0.189**	-0.243***	-0.163**	-0.118*	-0.212***	-0.201***	-0.152**	-0.243***
	(0.076)	(0.075)	(0.085)	(0.063)	(0.070)	(0.067)	(0.063)	(0.069)	(0.065)
fertility	-0.457	-0.632	0.0001						
	(0.674)	(0.728)	(0.787)						
income				0.250	-12.068	8.617			
				(9.319)	(11.678)	(9.965)			
trade	-0.086***	-0.110***	-0.066***	-0.074***	-0.094***	-0.059**	-0.085***	-0.108***	-0.066***
	(0.028)	(0.038)	(0.024)	(0.025)	(0.038)	(0.022)	(0.028)	(0.039)	(0.024)
internet	0.029*	0.021	0.028	0.031*	0.015	0.367*	0.026	0.017	0.028*
	(0.017)	(0.019)	(0.019)	(0.017)	(0.020)	(0.020)	(0.016)	(0.019)	(0.017)
secondary education	-0.012*	-0.181**	-0.067	-0.108	-0.133*	-0.085	-0.112*	-0.171**	-0.067
	(0.063)	(0.069)	(0.071)	(0.065)	(0.073)	(0.072)	(0.059)	(0.067)	(0.068)
income_ squared				-0.152	-0.570	-0.608			
				(0.518)	(0.645)	(0.591)			
trade_ squared	0.00012***	0.00014***	0.00010**	0.00010***	0.00011**	0.0001***	0.00011***	0.00014**	0.0001**
	(0.00004)	(0.00005)	(0.00004)	(0.00004)	(0.00005)	(0.00003)	(0.00004)	(0.00005)	(0.00003)
secondary education_ squared	0.0005	0.0009*	0.00006	0.0004	0.0006	0.0002	0.00044	0.00085*	0.00006
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.00038)	(0.00045)	(0.004)
MENA x trade	0.043**	0.044*	0.041*	0.036**	0.038	0.035*	0.043**	0.044	0.042*
	(0.020)	(0.026)	(0.023)	(0.017)	(0.026)	(0.020)	(0.020)	(0.026)	(0.022)
SSA x trade	0.049*	0.059*	0.038	0.029	0.041	0.020	0.048*	0.057*	0.038
	(0.025)	(0.032)	(0.025)	(0.024)	(0.033)	(0.025)	(0.026)	(0.032)	(0.025)
LAC x trade	0.113***	0.152***	0.080*	0.103**	0.142**	0.072	0.113***	0.152***	0.080*
	(0.042)	(0.051)	(0.042)	(0.044)	(0.054)	(0.046)	(0.041)	(0.051)	(0.041)
No. of observations	1565	1565	1565	1526	1526	1526	1565	1565	1565
R-sq									
Within	0.68	059	070	0.68	0.60	0.69	0.68	0.59	0.69
Between	0.76	0.62	0.86	0.70	0.65	0.77	0.74	0.61	0.86
Overall	0.75	0.62	0.82	0.73	0.65	0.78	0.74	0.62	0.82

Details on the source of data and variable description are in Appendix A. Standard errors (in parentheses) are clustered at the country level.

* indicates significance at 0.10 ** indicates significance at 0.05, and *** indicates significance at 0.01.

Table 5

Trade and labor force participation: A-B GMM estimates
Dependent variable: Labor force participation (ylaborf), % of total

	(1)			(2)			(3)		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
ylaborf_lag	0.857***	0.831***	0.858***	0.855***	0.851***	0.863***	0.855**	0.845***	0.858***
	(0.023)	(0.023)	(0.043)	(0.023)	(0.023)	(0.021)	(0.022)	(0.021)	(0.023)
time	-0.037	-0.027	-0.072**	-0.032	-0.005	-0.066***	-0.038**	-0.022**	-0.062***
	(0.031)	(0.034)	(0.031)	(0.025)	(0.032)	(0.025)	(0.015)	(0.016)	(0.016)
fertility	-0.477**	-0.375*	-0.634**	-0.344*	-0.227	-0.579***	-0.404**	-0.285	-0.634***
	(0.225)	(0.220)	(0.252)	(0.184)	(0.261)	(0.180)	(0.192)	(0.226)	(0.216)
internet	0.006	0.004	0.005						
	(0.006)	(0.007)	(0.008)						
Trade	-0.009	-0.011*	-0.008	-0.021***	-0.021***	-0.015	-0.018**	-0.023***	-0.015
	(0.006)	(0.006)	(0.006)	(0.008)	(0.006)	(0.011)	(0.008)	(0.008)	(0.012)
trade_squared	0.00002*	0.00002*	0.00002**	0.000035***	0.000033***	0.000029*	0.00003***	0.00004***	0.00003*
	(0.00001)	(0.00001)	(0.000009)	(0.000009)	(0.00001)	(0.000016)	(0.00001)	(0.00001)	(0.000017)
income	-2.555	-2.473	-2.502	0.032	-2.109	-1.895			
	(3.746)	(4.431)	(3.906)	(3.455)	(3.177)	(3.267)			
income_ squared	0.102	0.102	0.129	-0.004	-0.083	-0.119			
	(0.213)	(0.264)	(0.223)	(0.196)	(0.188)	(0.187)			
secondary education	-0.066***	-0.068**	-0.063**	-0.063***	-0.071***	-0.064***	-0.072***	-0.078***	-0.071***
	(0.022)	(0.028)	(0.027)	(0.020)	(0.025)	(0.024)	(0.021)	(0.021)	(0.021)
secondary education_ squared	0.00035**	0.00038**	0.00032*	0.00032***	0.00039**	0.00033**	0.00038***	0.00042***	0.00038**
	(0.0001)	(0.0001)	(0.00016)	(0.00012)	(0.00015)	(0.00015)	(0.00012)	(0.00012)	(0.00014)
MENA x trade				0.012*	0.013**	0.007	0.010	0.013*	0.006
				(0.007)	(0.006)	(0.009)	(0.007)	(0.007)	(0.009)
SSA x trade				-0.010	-0.009	-0.003	0.002	0.007	0.0005
				(0.007)	(0.007)	(0.001)	(0.006)	(0.007)	(0.010)
LAC x trade				0.023	0.021	0.009	0.009	0.016	0.008
				(0.018)	(0.016)	(0.017)	(0.016)	(0.015)	(0.016)
No. of observations	1241	1241	1241	1284	1284	1284	1321	1321	1321
A-B test: z [p>z]	-0.478	-0.486	-0.244	-0.485	-0.522	-0.225	-0.467	-0.542	-0.204
	[0.63]	[0.63]	[0.81]	[0.63]	[0.60]	[0.82]	[0.64]	[0.59]	[0.84]

Details on the source of data and variable description are in Appendix A. Robust Standard errors (in parentheses) are clustered at the country level.

The reported estimates pass the Sargan test for overidentifying restrictions (results may be obtained from the author upon request).

* indicates significance at 0.10 ** indicates significance at 0.05, and *** indicates significance at 0.01.

Table 6

Trade and youth unemployment: Fixed-effects estimates
Dependent variable: Youth unemployment rate (yunemp)

	(1)			(2)			(3)		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
yunemp_lag	0.881***	0.847***	0.874***	0.877***	0.839***	0.870***	0.873***	0.834***	0.866***
	(0.024)	(0.029)	(0.031)	(0.024)	(0.028)	(0.031)	(0.024)	(0.029)	(0.030)
time	-0.026	-0.031	-0.027	-0.021	-0.015	-0.026	-0.017	0.0012	-0.027
	(0.018)	(0.024)	(0.018)	(0.017)	(0.022)	(0.017)	(0.018)	(0.023)	(0.019)
fertility	-0.028	-0.243	-0.029	0.091	-0.105	0.097	0.058	-0.127	0.159
	(0.167)	(0.202)	(0.164)	(0.181)	(0.214)	(0.180)	(0.187)	(0.218)	(0.184)
Income (log)	-0.280	-0.734	-0.295	8.465***	12.804***	7.240***	7.960***	12.449***	6.689**
	(0.295)	(0.498)	(0.30)	(2.775)	(3.534)	(2.782)	(2.644)	(3.353)	(2.718)
trade	-0.0022	0.0024	-0.004	-0.0028	0.0026	-0.0035	0.0099	0.021*	0.008
	(0.003)	(0.004)	(0.0037)	(0.006)	(0.007)	(0.006)	(0.008)	(0.011)	(0.008)
internet	0.0031	0.012	0.001	0.010	0.019**	0.009	0.010	0.017*	0.010
	(0.005)	(0.007)	(0.005)	(0.007)	(0.008)	(0.007)	(0.008)	(0.009)	(0.008)
secondary education	0.012	0.016	0.013	0.003	-0.020	0.012	-0.0014	-0.030	0.009
	(0.009)	(0.010)	(0.009)	(0.002)	(0.021)	(0.014)	(0.016)	(0.021)	(0.016)
income (log)_ squared				-0.530***	-0.821***	-0.457***	-0.508***	-0.814***	-0.431**
				(0.169)	(0.221)	(0.167)	(0.161)	(0.211)	(0.163)
trade_squared				0.00001	-0.00001	-0.00003	-0.000017	-0.000031*	-0.00002
				(0.0001)	(0.0001)	(0.00012)	(0.000015)	(0.000016)	(0.00002)
secondary education_ squared				0.000086	0.00027*	0.00003	0.00011	0.00032**	0.00004
				(0.0001)	(0.0001)	(0.0001)	(0.00012)	(0.00015)	(0.0001)
MENA x trade							-0.015	0.004	- 0.020
							(0.012)	(0.013)	(0.014)
SSA x trade							-0.002	-0.012	-0.001
							(0.009)	(0.011)	(0.008)
LAC x trade							-0.039**	-0.050**	-0.038**
							(0.015)	(0.019)	(0.015)
R-sq									
Within	0.75	0.70	0.74	0.75	0.71	0.74	0.75	0.71	0.75
Between	0.99	0.99	0.99	0.98	0.97	0.98	0.98	0.97	0.97
Overall	0.98	0.97	0.98	0.97	0.96	0.97	0.97	0.96	0.96

Number of observations: 1423

Details on the source of data and variable description are in Appendix A. Standard errors (in parentheses) are clustered at the country level.

* indicates significance at 0.10 ** indicates significance at 0.05, and *** indicates significance at 0.01.

Table 7

Trade and youth unemployment: : Fixed-effects estimates – Robustness checks
Dependent variable: Youth unemployment rate (yunemp)

	(1)			(2)			(3)		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
yunemp_lag	0.878***	0.846***	0.871***	0.879***	0.849***	0.871***	0.870***	0.865***	0.874***
	(0.023)	(0.029)	(0.029)	(0.022)	(0.030)	(0.028)	(0.018)	(0.023)	(0.020)
time	-0.033*	-0.031	-0.040**	-0.029	-0.014	-0.037*			
	(0.019)	(0.027)	(0.018)	(0.020)	(0.023)	(0.020)			
fertility	-0.058	-0.303	-0.048						
	(0.189)	(0.232)	(0.182)						
trade	-0.007	0.015*	-0.048	0.007	0.016*	0.005	0.003	0.008	0.002
	(0.007)	(0.008)	(0.183)	(0.008)	(0.008)	(0.007)	(0.004)	(0.005)	(0.004)
internet	0.004	0.007	0.004	0.004	0.006	0.004	0.006	0.012*	0.005
	(0.007)	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.004)	(0.007)	(0.004)
secondary education	0.014	-0.006	0.022	0.015	-0.001	0.023			
	(0.018)	(0.021)	(0.018)	(0.016)	(0.019)	(0.016)			
trade_squared	-0.000017	-0.00003**	-0.000018	-0.00002	-0.00003**	-0.00001	-0.00001	-0.00002**	-0.00008
	(0.000013)	(0.00001)	(0.000014)	(0.000014)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00008)
secondary education_ squared	-0.00002	-0.0001	-0.0001	-0.00003	-0.00008	-0.00002			
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)			
MENA x trade	-0.011	-0.011	-0.017	-0.011	0.010	-0.016	-0.016*	0.004	-0.023**
	(0.012)	(0.012)	(0.013)	(0.012)	(0.011)	(0.013)	(0.009)	(0.009)	(0.010)
SSA x trade	0.002	0.002	0.004	0.002	-0.003	0.004	0.0009	-0.0003	0.0011
	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.007)	(0.004)	(0.004)	(0.003)
LAC x trade	-0.041***	-0.041***	-0.038**	-0.040***	-0.048***	-0.038***	-0.030**	-0.033**	-0.029***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)	(0.014)	(0.012)	(0.014)	(0.011)
Income (log)							4.302***	4.880**	3.905**
							(1.470)	(2.393)	(1.499)
income (log) _squared							-0.275***	-0.313**	-0.255***
							(0.092)	(0.155)	(0.093)
No. of obs.	1460	1460	1460	1460	1460	1460	2206	2206	2206
R-sq									
Within	0.75	0.71	0.75	0.75	0.71	0.74	0.77	0.77	0.77
Between	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.97
Overall	0.97	0.96	0.97	0.97	0.97	0.97	0.97	0.97	0.96

Details on the source of data and variable description are in Appendix A. Standard errors (in parentheses) are clustered at the country level.

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Table 8

Trade and labor force participation: A-B GMM estimates
Dependent variable: Youth unemployment rate (yunemp)

	(1)			(2)			(3)		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
yunemp_lag	0.841*** (0.021)	0.816*** (0.021)	0.855*** (0.022)	0.807*** (0.028)	0.742*** (0.016)	0.811*** (0.016)	0.804*** (0.030)	0.737*** (0.035)	0.805*** (0.036)
time	-0.025 (0.015)	-0.043* (0.025)	-0.023 (0.014)	-0.081** (0.035)	-0.060 (0.038)	-0.088** (0.034)	-0.036 (0.034)	0.013 (0.039)	-0.050 (0.035)
fertility	-0.249 (0.200)	-0.653** (0.331)	-0.145 (0.193)	-0.278 (0.343)	-0.631 (0.488)	-0.179 (0.335)			
internet	0.004 (0.004)	-0.043* (0.013)	0.003 (0.004)	0.005 (0.010)	0.0002 (0.010)	0.005 (0.010)	0.019 (0.012)	0.014 (0.013)	0.018 (0.012)
trade	0.007 (0.004)	0.014** (0.005)	0.004 (0.004)	0.018 (0.012)	0.030* (0.016)	0.016 (0.011)	0.019 (0.016)	0.031 (0.021)	0.017 (0.016)
trade_ squared	-0.00002** (0.000007)	-0.000032*** (0.00001)	-0.000014* (0.000008)	-0.000041** (0.00001)	-0.000057** (0.00002)	-0.000043** (0.000018)	-0.000035 (0.000025)	-0.000054* (0.000031)	-0.000038 (0.000025)
MENA x trade	-0.014 (0.009)	0.008 (0.009)	-0.021* (0.010)	-0.006 (0.010)	0.017 (0.016)	-0.011 (0.012)	-0.012 (0.012)	0.009 (0.018)	-0.018 (0.013)
SSA x trade	0.003 (0.004)	0.0003 (0.005)	0.004 (0.004)	-0.013 (0.009)	-0.022 (0.013)	-0.008 (0.009)	-0.017 (0.013)	-0.028 (0.018)	-0.013 (0.012)
LAC x trade	-0.038*** (0.012)	-0.045*** (0.013)	-0.038*** (0.011)	-0.047** (0.021)	-0.057** (0.025)	-0.046** (0.020)	-0.045* (0.024)	-0.056* (0.029)	-0.044* (0.023)
secondary education				0.008 (0.025)	-0.061 (0.032)	0.021 (0.026)	-0.014 (0.021)	-0.042 (0.026)	-0.005 (0.023)
secondary education_ squared				0.0013 (0.0016)	0.0003 (0.0002)	0.00008 (0.0001)	0.00029** (0.00014)	0.00043* (0.00018)	0.00025* (0.00014)
income (log)							13.329*** (4.884)	14.706*** (5.647)	12.944*** (4.542)
income(log)_ squared							-0.855*** (0.293)	-0.959*** (0.345)	-0.826*** (0.270)
No. of observations	2145	2145	2145	1228	1228	1228	1197	1197	1197
A-B test: z [p>z]	-0.071 [0.28]	0.861 [0.39]	-1.672 [0.10]	0.177[0.86]	0.578 [0.56]	-0.818 [0.41]	0.557 [0.58]	0.959 [0.33]	-0.633 [0.53]

Details on the source of data and variable description are in Appendix A. Robust Standard errors (in parentheses) are clustered at the country level.

The reported estimates pass the Sargan test for overidentifying restrictions (results may be obtained from the author upon request).

* indicates significance at 0.10 ** indicates significance at 0.05, and *** indicates significance at 0.01.

Appendix A

Data Description and Source

ylaborf : Youth labor force participation rate; total/female/male (% of total/female/male total labor force) represents total/female/male labor force participation rate for ages 15-24, total/female/male (% of total/female/male population ages 15-64). Source: International Labor Organization (ILO) database.

yunemp: Unemployment, youth total/female/male female (% of total/female/male labor force ages 15-24)
Source: International Labor Organization (ILO) database.

trade: Openness to international trade (in log) measured as the sum of exports and imports of goods and services, measured as a share (%) of gross domestic product (net of exports to developed countries). Source: World Bank World Development Indicators online database.

Income: GDP per capita (in log) based on purchasing power parity (PPP). Source: World Bank World
Development Indicators online database.

fertility: Total fertility rate (births per woman) represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. Source: World Bank World Development Indicators online database.

Secondary education: Female school enrollment, secondary (% gross). This is the ratio
of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of secondary education level. Source: World Bank World Development Indicators online
database.

Internet: Individuals using the Internet (% of the population) are individuals who have used the Internet
(from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc. Source: International Telecommunication Union (ITU) World Telecommunication/ICT Indicators Database.

LAC: Dummy variable taking the value of 1 if the country is in Latin America & the Caribbean and 0 otherwise.

MENA: Dummy variable taking the value of 1 if the country is in the Middle East and North Africa and 0 otherwise.

SSA: Dummy variable taking the value of 1 if the country is in sub-Saharan Africa and 0 otherwise.

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Mina Baliamoune is Senior Fellow at Policy Center for the New South and Richard de Raismes Kip Professor of Economics and University of North Florida Distinguished Professor. She is additionally an Affiliate Professor at the Faculty of Governance, Economic and Social Sciences of the Mohammed VI University. She is Research Fellow at NTU-SBF Centre for African Studies (CAS) in Singapore, the Economic Research Forum in Cairo and the Global Labor Organization, and has served as Senior Fellow at the African Center for Economic Transformation, Vice-President and President of the African Finance and Economics Association (AFEA), Associate Editor of the Journal of African Development and Information Technology for Development, and on the Editorial Board of Feminist Economics and the Board of Directors of the Eastern Economic Association. Her research focuses on growth & development economics and policy, international macroeconomics, social cohesion and the gender effects of globalization. She has taught and lectured at numerous universities and research institutions around the world.

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