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POLICY PAPER
September 2021

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PP-15/21

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Abstract

We explore whether improved export sophistication increases women's participation in wage employment. Using panel data from a large group of developing and emerging economies, and Fixed-effects and Generalized Method of Moments (GMM) estimators, we find that export sophistication has significant and mostly positive effects on women's participation in paid employment in all regions, but these effects are nonlinear, since they become positive only after a threshold level of sophistication is attained. We also find stronger positive impacts of export sophistication on women's share of wage employment in sub-Saharan Africa (SSA) and Latin America relative to other regions. Additionally, and after accounting for the impact of export sophistication, we find that openness to trade has a positive effect on women's share of wage employment through its interplay with high levels of foreign direct investment (FDI). The evidence for an independent positive effect from trade is less robust (it is only robust in the GMM estimations), but there are significant regional differences. Notably, we find a robust negative independent (direct) effect in North Africa and a positive impact in SSA.

Keywords: gender inequality, wage employment, international trade, export sophistication
JEL classification: F16, J16, O1

Acknowledgment:

The author is grateful for support from the R4D program for Research on Global Issues for Development funded by Swiss National Science Foundation and the Swiss Development Cooperation.

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1. Introduction

The gains from trade liberalization have been documented by a large number of scholars, and regional and global development organizations, including regional development banks, the World Bank and UNCTAD. However, in more recent decades studies have noted that increased openness to trade may not automatically lead to growth and development, and that gains from trade liberalization depend on several other factors[1], including human capital, infrastructure, institutions, and the composition of trade. In particular, studies have investigated whether trade liberalization has gendered effects in both developed (Kucera, 2001; Black and Brainerd, 2004; Sauré and Zoabe, 2014) and developing economies (Aguayo-Tellez, 2014; Juhn et al, 2014; Gaddis and Pieters, 2017; Baliamoune-Lutz, 2020; Ben Yahmed and Bombarda, 2020).

Recent theoretical and empirical studies have stressed the importance of the types of products that are exported (Lall et al, 2006; Hausmann et al, 2007), and the destination of a country's exports (Mendoza 2010; Baliamoune-Lutz, 2011 and 2019; Brambilla et al, 2012 and 2015) for stronger development and growth effects from trade. In addition, the impact of increased openness to trade on labor markets and income distribution remains a fundamental question in policy and academic discussions.

A particular aspect of international trade, which has since the mid-2000s attracted much attention and growing interest in the literature, is the sophistication of a country's exports and its effects on growth and development[2]. The literature on export sophistication includes studies that developed an index of export sophistication and then tested its predictive ability in explaining growth and/or development[3] (Lall et al, 2006; Hausmann et al, 2007), as well as a more recent, but growing, body of work that uses these export sophistication indices and others to explore the determinants, or growth effects, of export sophistication (Xu, 2010; Jarreau and Poncet, 2012; Anand et al, 2012; Córcoles et al, 2014; Weldemicael, 2014; Thorbecke and Pai, 2015; Cherif et al, 2018). Overall, these studies point to a positive impact of export sophistication on growth and development. These studies, in general, identify the sophistication of the products a country exports as a mechanism through which gains from greater openness to trade can be generated.

1. See, for example, Rodrik (2001), and Baliamoune-Lutz and Ndikumana (2007).
2. It is important to note that how you export may matter more than what you export (see Lederman and Maloney (2012) for an interesting discussion on these questions). We posit that a minimum level of export sophistication ('what') is involved in a sophisticated production process ('how'). In addition, in many developing countries policymakers are currently placing export upgrading on their list of priorities and, thus, investigating how export sophistication affects women s employment is a useful undertaking.
3. Although the most widely-cited index of export sophistication is that developed by Hausmann et al (2007), an index similar to the income-level based indices developed in Lall et al (2006) and Hausmann et al (2007) was first provided in Michaely (1984).

If export sophistication is essential for gains from trade to be generated and, consequently, for growth and development, then it would be useful for scholars and policymakers to ask at least three important questions:

- What are the main determinants of a developing economy's export sophistication?
- What are the main channels through which the sophistication of exports affects a country's growth and development?
- Does exporting more sophisticated goods contribute to a more inclusive growth? In particular, does export sophistication produce gendered labor-market outcomes through, notably, its effects on male-female wage and employment gaps?

The literature contains extensive work addressing the first question and a smaller body of work devoted to studying the second question. However, research examining the third question, and especially the issue of the impact of export sophistication on gender gaps in labor markets, is lacking. The present study aims to fill this gap in the literature by exploring the impact of export sophistication on women's paid (wage) employment and, since the focus in this study is on the share of women in total wage employment, on gender inequality in paid employment.

This paper makes a novel contribution to the literature by focusing on the effects of export sophistication on women's share of paid employment and by identifying this as an additional channel through which trade (in sophisticated products) can impact growth. If export sophistication can cause trade to have gendered effects on labor-markets, it could have an impact on gender inequality and indirectly influence growth and development, in addition to any direct growth and development effects trade and export sophistication may generate.

We posit that an important factor that might mitigate the impact of trade on female employment is the composition of exports and this factor might have differentiated gender effects. A priori, export sophistication may have a positive or negative effect on women's wages and employment relative to their male counterparts. In theory and practice, sophisticated products tend to be skill and technology-intensive (Lall et al, 2006; Hausmann et al, 2007). However, given the documented evidence of gender differences in access to education and training (and presumed related gender differences in performance on specific skills) but also the remarkable advances in the education of girls in most countries in recent years, depending on the types of skills that are valued by expanding industries, women may or may not gain when the country expands its export of more sophisticated products. This warrants an empirical investigation.

In theory, technical change-induced demand for skills and investment in human capital (education in particular) is expected to rise as countries upgrade production and exports. We should expect (at least in theory) countries with higher levels of education and skilled labor, for both men and women, to produce more sophisticated products (and exports) and also have lower gender inequality in employment. On the other hand, countries with male-female gender inequality in education and access to skills, may still be able to improve product sophistication but with increasing gender inequality (biased against women) in wage and employment. For example, if the country produces both the intermediary inputs (intermediary goods) and the final good, a certain segmentation may take place, with women overrepresented in the simpler, non-sophisticated, tasks and male employment

dominating the more sophisticated tasks. At least in theory, this would suggest a negative relationship between gender inequality and product sophistication: greater product sophistication is associated with lower gender inequality. Thus, in theory export sophistication may have either a positive or a negative effect on gender inequality in labor markets.

We address the question of whether export sophistication has a positive or negative impact on women's wage employment by performing country-level panel-data estimations using data from a large group of emerging and developing economies, and focusing on the effects of export sophistication on women's share of wage employment in the non-agricultural sector. We use fixed-effects and Arellano-Bond Generalized Method of Moments (GMM) estimators, and control for other factors, such as fertility rates, foreign direct investment (FDI), trade, and region effects. The empirical results suggest that export sophistication has a non-linear impact on women's participation in wage employment with the effect operating with a threshold level of sophistication.

Moreover, the positive impact of export sophistication on women's share of wage employment is stronger in sub-Saharan Africa (SSA) and Latin America. On the other hand, openness to trade seems to have a positive effect only through its interplay with high levels of FDI (a threshold effect). The statistical evidence of an independent positive effect from trade is robust only when we use the difference-in-difference GMM (GMM-DIFF) estimator, but we identify clear regional differences. We find that trade has a stronger positive independent effect on women's share of wage employment in SSA and, overall, a negative effect in North Africa. This last result could shed additional light on the so-called MENA gender-equality paradox and is consistent with the findings in Baliamoune-Lutz (2020).

The remainder of the paper is organized as follows. Section 2 provides an overview of related theoretical and empirical literature. Section 3 describes the data and methodology and presents the empirical results. In Section 4, we discuss the main policy implications of the empirical findings. Section 5 concludes.

2. A Brief Review of Related Literature

To the best of our knowledge, this is the first study to explore the effects of export sophistication on women's wage employment. In the following discussion, we briefly review two strands of closely related literature. The first strand focuses on the impact of trade on female-male wage and employment gaps. The second literature strand concerns the impact of trade upgrading on low-skilled and high-skilled labor. The present study addresses issues arising at the intersection of these two lines of research. Since in many countries women and men may have significant differences in certain skills, countries may experience gendered effects of export sophistication, as they increase the sophistication of their products, and thus trade (exports) could influence the female-male wage and employment gaps.

2.1 Trade and Female-Male Wage and Employment Gaps

Over the past three decades, most developing countries have implemented a variety of liberalization policies and programs, especially in the international trade area. Indeed, trade liberalization has been pursued by many developing economies for over a generation now, in the hope that they would expand their exports and achieve the sort of economic progress obtained by the four Asian tigers (Hong

Kong, Singapore, South Korea and Taiwan). However, as noted by Baliamoune-Lutz (2020), trade is expected to have differentiated gender effects because of the pre-existing gender discrimination in labor markets. This is due, at least partly, to the presence of gender occupational segregation and labor market segmentation (Beneria and Lind, 1995).

Globalization "may have caused a global division of labor between developed and developing countries and this should warrant an examination of its effects on specific groups, particularly women in developing countries" (Baliamoune-Lutz, 2007). Trade liberalization-induced global division of labor has been shown to adversely affect women in many cases and to impede gains from trade openness (Ertürk and Darity, 2000). This has been confirmed by the finding, in many studies, of a negative link between increased openness to trade and gender equality (Çağatay and Özler, 1995; Çağatay, 2001; Baliamoune-Lutz, 2007). Interestingly, some studies have found that gender inequality is associated with higher growth in more open economies, suggesting that openness to trade enhances growth, but it does so in the presence of a persistently high (or higher) gender inequality[4].

The standard theory of trade assumes that wage inequalities do not exist when markets are competitive (Busse and Spielmann, 2006; Baliamoune-Lutz, 2020). The theory predicts that increased openness to trade exposes firms to greater competition, thus making discrimination more costly and (controlling for differences in educational attainments) would eventually reduce gender gaps in wages and employment, as posited in Becker (1971). However, more recent theoretical literature and empirical studies show that increased openness to trade can increase, rather than decrease, gender gaps in wages and employment. Indeed, trade has been shown to contribute to the explanation of female-male differences in labor force participation and wages. In general, even in theory the impact of trade is ambiguous while in empirical literature on the effects of increased openness on women's employment and wages relative to men provides mixed evidence.

A theoretical model (Sauré and Zoabe, 2014) challenged the view that international trade-induced competition would make discrimination more costly, forcing firms to reduce discrimination and, consequently, causing a decline in the male-female wage gap and increasing female labor participation. Sauré and Zoabe (2014) incorporated endogenous choice of fertility in a theoretical framework assuming that women have less physical labor endowments relative to men and that the complementarities between capital and labor are higher for women relative to men. Their theoretical model predicts that when trade expands, in a capital-abundant economy, the labor reallocation from the contracting to the expanding sector causes the capital-labor ratio in the female-intensive sector to decline and, due to stronger complementarity between capital and female labor (relative to male labor), the marginal productivity of women would fall more than that of their male counterparts. Consequently, the gender wage gap rises and women's labor force participation falls.

These theoretical predictions were supported by empirical results from estimations using data on U.S. trade with Mexico (Sauré and Zoabe, 2014). As noted in Baliamoune-Lutz (2020), this result does not necessarily mean that the opposite effects would take place in the trading partner's (developing) economy.

4. Although many studies show that gender inequality in education and/or employment has an adverse effect on growth (Lagerlof, 2003; Klasen, 2002; Klasen and Lamana, 2009; World Bank, 2011), some studies have also found a positive relationship between gender inequality and economic growth either directly (Seguino, 2000) or through the interaction of gender inequality with openness to trade (Çağatay and Özler, 1995; Standing, 1999; Baliamoune-Lutz and McGillivray 2009 and 2015).

Trade integration induces exporting firms to upgrade technology (Bustos, 2011). This is especially so when the sophistication of exports is high. Under certain conditions, when female-intensive sectors experience technological upgrading, wages in the sector would rise, which may attract male workers and lower women's share of employment in the sector (Sauré and Zoabe, 2014). On the other hand, studies have argued that the introduction of some technologies (adoption of computers, for example) that raises the importance of non-routine interactive and analytic tasks may benefit women relatively more and thus reduce wage and employment gaps (Black and Spitz-Oener, 2010). Similarly, Goldin (1990), contended that "[t]he labor market's rewards for strength, which made up a large fraction of earnings in the nineteenth century, ought to be minimized by the adoption of machinery, and its rewards for brain power ought to be increased" (p. 59). Thus, according to the author, the remarkable rise in women's relative wage was a due to the rapid accumulation of capital in the nineteenth century.

It is commonly assumed (following classical trade theories) that trade liberalization would cause a capital-scarce developing country to increase exports of its unskilled-labor intensive sectors and that this would lead to higher demand for unskilled labor so that the skilled-unskilled wage gap falls. However, quite the opposite could happen if the country ends up exporting mainly from skill-intensive industries (or capital-intensive such as mining and minerals industries). Baliamoune-Lutz (2007) noted that "[e]ven when trade liberalization leads to higher female employment, it does not unequivocally improve women's conditions or reduce gender inequality as many studies find that even when female labor force increases as a result of trade liberalization, women's welfare may deteriorate (lower wages, poor work conditions, absence of safety nets,…)."

A vast empirical literature[5] has focused on data from developed countries but the evidence is mixed. For example, Black and Brainerd (2004) reported that trade seems to benefit women by reducing gender discrimination by firms. However, evidence from several studies focusing on developed countries points to a negative impact of trade on women; shown either as an increase in the female-male wage gap, a decline in woman's participation in the labor force or high-wage industries, or through both of these mechanisms. For example, Sauré and Zoabe (2014) showed that there was an increase in the gender wage gap and a decline in the female labor force in the United States as a result of trade with Mexico, following NAFTA. Based on data from Japan and Germany (covering the period 1970-1996), Kucera (2001) found that trade expansion exerted an adverse effect on women's manufacturing wages in Japan (increased the male-female wage gap), but had the opposite effect in Germany.

There is a rich body of empirical literature on trade and gender wage and employment discrimination[6] that uses micro-level data mainly from countries currently considered 'emerging economies', but the evidence from this literature remains mixed. Berik et al (2004) examined the impact of competition from international trade on gender wage discrimination in South Korea and Taiwan and found that "in contrast to neoclassical theory, competition from foreign trade in concentrated industries is positively associated with wage discrimination against women." Similarly, Guicheney (2015) examined the gender effects of South Korea's export-led industrialization policy and noted that "labor policies enacted by the government to promote the growth of the private sector negatively impacted the opportunities women had for upward mobility, leaving them in a position of permanent inferiority relative to men" (p. 14).

5. This section draws, in part, on the discussion in Baliamoune-Lutz (2020).
6. To the best of our knowledge, the present paper is the first research to explicitly study the impact of export sophistication on gender inequality. Thus, the existing literature discussed in this section is related mainly to the impacts of trade since there are no studies dealing with the effects of sophistication.

Gaddis and Pieters (2017) explored the effects of trade liberalization on gender differences in labor market outcomes, using difference-in-difference estimation focusing on variation in pre-liberalization industry composition across micro regions in Brazil and concluded that trade liberalization reduced male and female labor-force participation rates and employment rates in the tradable sector, especially among the low-skilled workers. The authors also found that "liberalization reduced the percentage point gender gap in employment and participation rates… in proportionate terms, [they] find no evidence that women's employment and participation increased relative to men's, or that women benefitted from the procompetitive effects of free trade." On the other hand, Benguria and Ederington (2017) examined the effect of trade on wage inequality in Brazil and found a negative impact from growing imports. However, the wage decline affected only male workers, while trade increased women's share of higher-paying occupations and increased the returns to primarily-female occupations.

Evidence obtained in studies focusing on Mexico is also mixed. For example, While Ghiara (1999) failed to find an effect from the adoption of export-led strategies on Mexican woman's wages from 1987-1993, Fleck (2001) found a negative effect using 1997-1998 data. Dominguez-Villalobos and Brown-Grossman (2010) found that trade liberalization has an adverse impact on both women's and men's wages, but women had a higher loss in absolute and relative terms. Juhn et al (2014) found that the tariff reductions associated with NAFTA caused new firms in Mexico to modernize their technologies so they could enter export markets, and to replace male blue-collar workers with female blue-collar workers. On the other hand, Aguayo-Tellez et al (2014) reported that trade liberalization policies increased the relative demand for female workers within industries and skilled groups.

Studies focusing on China also tend to provide mixed results. For example, Wang et al (2019) combined Chinese data (for the period 1990-2005) from firm and various population surveys, and linked prefectural city-level employment of males and females to local industry-wide exposure to both import and export tariff reductions. The authors found that, with lower output tariffs, the increase in employment was relatively higher for women compared to men, while tariff reductions on locally relevant inputs increased male employment by more than female employment. On the other hand, their results showed that export tariff reductions reduced both female and male employment, but with a stronger effect on women. Based on these findings Wang et al (2019) concluded that the gendered effects of trade liberalization could be explained by several channels, including the competition-induced reductions in discrimination, changes in sectoral segregation, differential adjustments of firms by ownership, and changes in household income. Finally, Chen et al (2013) found that foreign participation and export orientation, within the same region and industry, increased female employment and narrowed the wage gap, while there was evidence of gender pay discrimination only among private non-exporting companies. According to the authors, their results underscore "the importance of globalization in encouraging female employment and reducing gender discrimination".

Empirical research using data from India shows that trade liberalization has contributed to widening the female-male wage gap. For example, Chamarbagwala (2006) examined the widening skill wage gap and narrowing gender wage differential during India's economic liberalization period and found that "international trade in manufactures benefited skilled men but hurt skilled women, whereas outsourcing of services generated a demand for both female and male college graduates." Menon and van Der Meulen Rodgers (2009) investigated the effects of increasing competitive forces from trade liberalization on female-male wage and employment gaps and found (based on OLS and fixed-effects estimates) that trade openness was associated with wider wage gaps in concentrated Indian manufacturing industries, which is in contrast to the neoclassical theory which predicts that costly

gender discrimination would fall when industries are exposed to more competition as a result of trade liberalization.

Evidence from studies using cross-sectional data from developing countries is also mixed. Using cross-country data for 1985-1990, Çağatay and Özler (1995) found that, after controlling for the feminization U (the U-shaped relationship between long-term development and women's share of the labor force), structural adjustment policies tend to increase the feminization of the labor force "via worsening income distribution and increased openness". Çağatay (2001) also contended that trade reforms tend to favor medium and large producers because small farmers, particularly women, "often lack access to credit, new technologies, marketing know-how and the like needed to take advantage of new markets." Çağatay and Ertürk (2004) stressed the presence of a positive link between trade and gender inequality in the labor market in semi-industrialized economies, while noting the existence of a negative relationship between other kinds of gender inequalities, and growth and trade, concluding that in some cases, the use of gender inequalities (such as in labor markets) served as an means of international competition and that these gender inequalities were associated with higher growth rates in the case of semi-industrialized economies, and have led governments "to be complacent" about these inequalities, while in other instances, gender inequalities in access to credit, education, and asset ownership, have "dampened growth rates and successful integration in the world economy."

Using data from at least 80 developed and developing countries for the period 1983-1999, Oostendorp (2009) found that trade and FDI reduce gender wage gaps in rich countries and uncovered little evidence that trade and FDI reduced the gender wage gap in poorer countries. Wamboye and Seguino (2015) identified gendered employment effects of trade liberalization in SSA but showed that these effects depend on the structure of the economy and the country's infrastructure. Tejani and Milberg (2016) found that exports did not have a significant relationship with shifts in women's share of employment in manufacturing and concluded that "an anti-female bias exists in labor demand changes that result from output or employment shifts in developing countries when manufacturing becomes more capital intensive, a process likely related to industrial upgrading."

More recently, Li et al (2019) identified the presence of a critical level (optimal value for the level of trade openness) between female labor force participation and international trade in a group of developing Asian countries. Trade enhances (depresses) women's participation in the labor force below (above) this optimal value. This result is consistent with the findings in Baliamoune-Lutz (2020) on the relationship between trade and women's share of paid employment. Li et al (2019), however, examined further the long-term links between export and import dependency and the female labor force and found that only export dependency has the inverted-U link with women's share of the labor force, while import dependency has a negative effect. On the other hand, Baliamoune-Lutz (2020) identified an inverted-U effect of trade openness on the female share of wage employment but also showed that the overall effect depends on the region. The author found that the overall effect (at least up to the optimal level or critical point) of openness to trade on women's share of wage employment is positive in all regions except North Africa, where it is mostly negative.

As argued by Baliamoune-Lutz (2020), if trade composition is biased towards skilled-labor-intensive industries (which tends to be the case when developing countries enter sophisticated export markets), "women in many developing countries may experience reduced access to wage employment, given that they tend to possess lower skills relative to men, and thus would end up in lower-productivity jobs, mostly in the informal sector". This argument is consistent with the numerous studies reporting that

greater integration in world markets can promote growth but at the same time increase (or at least fail to reduce) gender inequality (Boserup, 1970; Seguino, 2000; Baliamoune-Lutz, 2007; Baliamoune-Lutz and McGillivray, 2009 and 2015). Hence export upgrading (sophistication) that alters a country's composition of trade can potentially have a negative effect on women's wages and employment (relative to men), if the new exports are skill-biased and women are underrepresented in the skilled labor force. In the next section we briefly review the literature on the effects of technical change or adoption of new technology (which tends to be required for improving product sophistication) on skilled and unskilled labor.

2.2 Trade (Export) Upgrading and Skilled Versus Unskilled Labor

For many developing countries, trade based on comparative advantage often implies limited scope for vertical integration, which leads such countries to focus on exporting mainly primary commodities or low-skilled labor-intensive products. However, with the rise in tertiary education and the growth and diffusion of information and communication technologies (ICTs), many developing countries are trying to identify ways to improve export competitiveness, especially through greater export sophistication.

Numerous studies have emphasized the importance of product (export) sophistication in fostering a country's economic growth and development (Hausmann and Rodrik, 2003; Hausmann et al, 2007; Minondo, 2010; Jarreau and Poncet, 2012). Indeed, in a relatively recent study of growth determinants, Cherif et al (2018) found that "export sophistication is the only robust determinant of growth among standard growth determinants such as human capital, trade, financial development, and institutions." The authors further noted that other determinants may play an important role to the extent that they help strengthen export sophistication.

An important question related to 'what to export' is, as noted by Reis and Farole (2012), "whether export competitiveness is best achieved through an evolutionary process of upgrading selling lower-quality goods to regional markets and building capabilities before moving into more competitive, sophisticated global markets, or leapfrogging immediately to sophisticated goods or rich-country markets". This evolutionary process of upgrading depends, to a great extent, on the level and quality of skills in the country. In fact, existing measures of product sophistication include indicators of skills (skilled labor).

When an economy upgrades its trading capabilities by expanding the sophistication of its exports an important aspect that is worth examining, and has been widely debated in the literature, is the complementarity between capital, technology and skills. Indeed, since the publication of Zvi Griliches' seminal work in 1969, many studies have examined the proposition that complementarity of physical capital with skilled labor is higher than with unskilled labor.

Goldin and Katz (1998) traced the origins of technology-skill and capital-skill complementarity in the US and showed that both types of complementarity have existed in manufacturing since the early years of the twentieth century and continued to be significant throughout the rest of the century, with industries which have more capital hiring more skilled labor and paying higher wages. Duffy et al (2004) used a panel of macro-level data (spanning a 25-year period) from 73 developing and developed countries and obtained evidence in support of the capital-skill complementarity hypothesis.

Berman et al (2005) found that greater output and capital-skill complementarity seem to be the best explanations of skill upgrading in India in the 1990s. On the other hand, Papageorgiou and Chmelarova (2005) used Hansen's endogenous threshold methodology to test the capital-skill complementarity hypothesis and found strong evidence in support of this hypothesis in the case of non-OECD countries but no evidence in OECD countries. Gonzaga et al (2006) explored the factors explaining the decline in the skilled labor differentials during Brazil's trade liberalization period of 1988-1995, and found that employment shifted from skilled to unskilled labor intensive sector, while the share of skilled labor increased in both sectors.

Yasar and Paul (2008) used a production function in which they distinguished between technical and non-technical labor, machinery, computer capital, structure, the share of women workers, and imported capital. They applied this function to manufacturing plants in Turkey and found that capital and skill were complementary for both machinery and computers, with greater productive contributions, and thus wages, for skilled labor being correlated with more machinery intensity and computer use. However, the authors found that the reverse was true in the case of unskilled labor, which was complementary only with capital structures. Also, Parro (2013) developed a general-equilibrium trade model with capital-skill complementarity and examined the effect of changes in worldwide trade costs and technologies on the skill premium. The author found that the effects of technical change and trade costs are comparable, particularly in developing economies and noted that while skilled and unskilled labor both gain from trade, greater gains from trade were associated with larger increases in the skill premium.

In addition to technology upgrading, product sophistication (especially when products are exported to developed economies' markets) may require organizational changes, and these, in turn, could cause higher demand for skilled labor. For example, Piva et al (2006) examined the skill-biased organizational change hypothesis in Italy's machinery industry and found that organizational change is positively related to skilled workers, but technological change had a negative link with both skilled and unskilled labor.

Finally, there is a vast literature on the relationship between the type of occupation and gender gaps in developed and developing countries. Several studies have documented the presence of a significant link between the gender composition of an occupation (occupational segregation) and wages, finding that occupations with larger shares of women (occupational feminization) tend to pay lower wages (England et al, 2007; Mandel, 2013). Liao and Paweenawat (2020) investigated the effect of occupational feminization on wages in Thailand (a country with high female labor participation) over the period 1985-2007, and concluded that the findings in their study "have suggested a different impact of occupational feminization for men and women on wages, indicating that gender composition and job characteristics are affected by the difference in job preferences, and a growing wage penalty related to occupational feminization".

One of the common explanations of gender differences in occupations relates to differences (both real and perceived) in skills (Blau and Kahn, 2017). Thus, in countries where women are over-represented in low-skill occupations, export upgrading (greater export sophistication) may perpetuate the occupational feminization and widen the male-female earning gap.

3. Empirical Analysis

3.1 Variables, Data and Methodology

In the empirical analysis, we consider export sophistication, measured by EXPY in log form (see Hausmann et al, 2007), as the main variable of interest[7]. But we are also interested in examining the impact of trade (the share of exports and imports in GDP) to find out whether openness to trade and export sophistication have separate (independent) effects on women's wage employment. In addition, we control for several other variables which have been shown to affect female participation in employment, including female schooling (secondary enrollment)[8], fertility, and income. We also include foreign direct investment (FDI) which has been found to affect gender inequality, especially inequality in wages and employment[9], and account for the interplay of FDI with trade and export sophistication. Because of the high correlations between many of the potential factors affecting women's participation in labor markets, we had to reduce the list of potential explanatory variables. Given the heterogeneity of countries, we include region dummy variables for sub-Saharan Africa, North Africa, and Latin America, and interaction between each regional dummy and trade and export sophistication. We include the interplay of some of the variables, as well as the interplay of region dummy variables with trade and export sophistication to explore potential indirect effects (through interaction) from trade and export sophistication.

We use the fixed-effects estimator and also the difference-in-difference GMM (GMM-DIFF) estimator. The second estimator is used because a potential problem of endogeneity of some of the RHS variables may arise in fixed-effects estimates. Greater female participation in wage employment could potentially cause a decline in fertility and a rise in female secondary school enrollments. It could also lead to improved openness to trade and export sophistication. In the GMM-DIFF estimation, export sophistication, trade openness, FDI, income, fertility, and enrollments in secondary education are treated as endogenous.

Table 1 shows descriptive statistics for the main variables. These statistics indicate that the female share of non-agricultural wage employment has a relatively low average (35.4%) and varies from the low level of 7.7% to a high level of 52.3%. Similarly, export sophistication varies significantly across countries, with the sample maximum value reaching 26,903 (in Botswana in 2001).

3.2 Empirical results

Table 2 reports correlation coefficients. The female share of non-agricultural wage employment is positively (negatively, with fertility) but weakly correlated (correlation coefficient is below 0.5) with all other variables. Interestingly, the linear association between export sophistication and trade (also see Figure 1), while positive, is rather weak (0.10). Similarly, EXPY has no significant association with the share of women in wage employment and FDI. However, Figure 2 suggests a U-relationship

7. This indicator is chosen because it has been widely used in the empirical literature. Some studies use UNCTAD's similarity index to measure export sophistication (Islam, 2014; Schott, 2008; Wang et al, 2010; Zhu and Fu 2013; Baliamoune-Lutz, 2019), with the underlying assumption that since developed economies export highly sophisticated products then the higher the similarity of a developing country's exports to those of its developed partners, the higher is its export sophistication.
8. Using tertiary female education (although data are limited) did not change the findings (results are not reported but are available on request).
9. For a useful survey of the literature on this topic, see Braunstein (2006).

between export sophistication and women's share of wage employment. On the other hand, there is a strong linear correlation between EXPY (export sophistication) and income (0.73), secondary school enrollments (0.55), and fertility (-0.76).

Table 3 reports the results from fixed-effects estimation. For the most part, the results in columns 1 through 5 suggest that the evidence on the impact of FDI and trade is either non-existent or non-robust, except for openness to trade in sub-Saharan Africa, where the impact is positive, and North Africa, where the effect is negative. On the other hand, the estimates show a robust U-effect (or at least relationship) of export sophistication on women's share of wage employment. The results suggest that, beyond a threshold level, the impact of export sophistication becomes positive. However, at low-levels of sophistication, women may actually lose as countries begin to upgrade their exports through increased sophistication. We also find that the positive effect from export sophistication is stronger in Latin America than it is in other regions.

The results reported in Table 4 are based on fixed-effects estimations in which we account for the role of income per capita and the interplay of FDI with openness to trade. We find a statistically significant positive effect of this interplay on the share of women in wage employment but only at high levels of FDI. Thus, while openness to trade does not seem to have an independent effect, it does have an indirect impact, through its interplay with FDI. Additionally, the negative effect of trade in North Africa and the positive effect in sub-Saharan Africa are consistent with the results in Table 3, and with the findings in Baliamoune-Lutz (2020). On the other hand, the evidence on a positive impact from income is weak. The effect of export sophistication remains qualitatively the same. Export sophistication has a positive influence on women's share of wage employment only at high levels of sophistication.

The GMM-DIFF estimation results reported in Table 5 also show that export sophistication seems to exert a positive influence on women's share of wage employment only at high levels of sophistication, thus confirming the results derived from fixed-effects estimations. We find that openness to trade has a direct positive effect (except in the case of North Africa where the overall direct effect is negative) and an indirect effect through its interplay with FDI. There is, however, a threshold effect (a U-relationship) since the impact from this interplay is only positive at high levels of FDI. This result is in line with the fixed-effects estimates reported in Table 4.

Export sophistication has additional positive impacts on women's share of wage employment in sub-Saharan Africa and Latin America, with both regions having overall strong positive effects from export sophistication. Interestingly, even after including income, and finding that its effect is positive and statistically significant, the effects of fertility, FDI, openness to trade, and export sophistication, as well as the interplays of openness with FDI and export sophistication with region dummy variable, remain statistically significant (although in the case of North Africa the significance on the effect of openness is now at the 10% level), and maintain the same signs as in the equations excluding income.

4. Summary and Implications of Findings

The results we obtain suggest that export sophistication increases women's share of wage employment in all regions, but only once a reasonably high (higher than the median and the mean in the sample we use) level of sophistication is reached. Additionally, in line with previous research findings (Baliamoune, 2020), we find that trade openness is associated with a reduction in the female share of paid employment in North Africa, while (at least when using the GMM-DIFF estimator) it has a significant positive effect in other regions. We also find that, through its interplay with FDI, trade has an indirect positive effect on women's share of wage employment, but only once a significantly high level (in excess of 10% of GDP) of FDI is reached. This is particularly concerning for African countries (including North Africa) where, according to World Bank data, net inflows of FDI (as a share of GDP) in 2019 exceeded 10% in only three countries: Congo Republic, Mozambique and Seychelles, at 27.4%, 14.3%, and 13.4%, respectively.

In the case of North Africa, not only does export sophistication produce a weaker effect compared to countries in sub-Saharan Africa and Latin America, but also openness to trade exerts a negative influence on women's share of paid employment. Both results seem consistent with the so-called MENA gender-equality paradox. While openness to trade may help explain (at least partly) this paradox, the relatively low level (compared with Asian exporters, for example) of export sophistication in North Africa may provide an explanation for why trade is not enabling more women to access non-agricultural wage employment, and thus reducing the female-male gap in paid employment.

Overall, our findings point to the need for countries with low levels of export sophistication to enhance product and skill upgrading (especially for women). Since export sophistication and skill development can reinforce one another, this is a good investment for the country; the greater the degree of skill upgrading, the higher the product (or export) sophistication will be, and vice versa. Both skill development and product sophistication need good-quality institutions and a stimulating business environment, and a strong willingness on the part of both business and political institutions to ensure more inclusive growth. Factors such as macroeconomic instability (recession, inflation, high unemployment, excessive exchange-rate volatility, etc.), civil conflict, and laws and policies that are biased against women (e.g. inheritance laws, tax laws, asset ownership regulation, and family law), discourage women from investing in skill upgrading and from joining (formal) labor markets.

Product sophistication has been shown to enhance growth and development and can potentially help a developing country close the income gap with more developed economies. However, in the presence of female-male wage and employment gaps, gains from upgrading exports may be lost because of gender-based discrimination. Cavalcanti and Tavares (2016) quantified the cost that barriers to female labor-force participation impose in terms of an economy's output, based on a growth model in which saving, fertility, and labor market participation are endogenous, and calibrating the model to mimic the U.S. economy's behavior in the long-run. The authors found that a 50% rise in the gender wage gap leads to a 35% decline in per-capita income in the steady state. Cavalcanti and Tavares used independent estimates of the female-to-male earnings ratio for a large cross-section of countries and found that for several countries, "a large fraction of the difference between the country's output and the US output can be ascribed to differences in gender discrimination." This suggests that gender-based wage discrimination in developing countries can retard income convergence to developed countries levels of income.

Trade can have differential effects on the demand for human capital in different countries. Galor and Mountford (2008) contended that developed countries invested the gains from trade in education and per-capita income growth, while developing countries directed those gains towards population growth. Based on cross-country regressions, the authors found that "indeed trade has positive effects on fertility and negative effects on education in non-OECD economies, while inducing fertility decline and human capital formation in OECD economies". To the extent that trade sophistication may require a developing economy to undertake more investment in skills and education (human capital), it could mitigate (or even negate) the result obtained in Galor and Mountford (2008) and, thus, trade (especially if it involves exporting highly sophisticated goods and services) may lead to lower fertility and more education in non-OECD countries as well.

It is worth noting that trade liberalization and export sophistication often imply upgrading and/or expansion of productive activity, mostly in the private (not the public) sector, which tends to exhibit more wage and employment discrimination. According to Siphambe and Thokweng-Bakwena (2001), who examined the female-male wage gap in Botswana's formal market, "[t]here is a relatively less discrimination in the public sector, while in the private sector discrimination against women is a major factor explaining the differences in their earnings."

Similarly, Dong and Zhang (2008) used firm-level data to study male-female wage discrimination in China's industry and obtained evidence of a significant negative relationship between wages and the share of female workers in a firm's workforce, with the wage gap being smaller than the productivity gap in state-owned enterprises, while the opposite applied to private firms. Thus, policymakers should tackle the problem of discrimination in the private-sector labor market to ensure that trade and export sophistication benefit both men and women. Although the empirical analysis in this study does not include a direct form of discrimination, we consider the share of women (relative to men) in wage employment as a proxy for discrimination in labor markets.

According to Acemoglu (1998), a higher proportion of skilled workers in the labor force would increase the market size for skill-complementary technologies, and faster upgrading of the skilled-worker productivity and, consequently, a rise in the supply of skills would reduce the skill premium in the short-run, "but then it induces skill-biased technical change and increases the skill premium, possibly even above its initial value." The author used this proposition to argue that the rapid rise in the proportion of college graduates in the United States labor force in the 1970s may explain the fall in the college premium in the 1970s and the significant rise in inequality in the 1980s. If this proposition is valid, then many developing countries should expect, as tertiary education (especially female education) expands, the skilled-unskilled labor wage gaps would fall in the short-to-medium-run, which would likely cause a decline in the cost of producing more sophisticated products and services in the short-to-medium term, but may increase significantly in the long run as the country increases the sophistication of its products and demand for skilled workers intensifies. If women remain over-represented in the low-skill segments of the labor force, gender inequality in labor market would increase. Thus, when policymakers promote export sophistication, especially through use of new technologies, they should take into account the potential effects export upgrading may have on the skilled-unskilled worker wage and employment gaps, and on female-male inequalities in the labor market, both in the short and the long run.

5. Concluding remarks

In this paper, we have aimed to address the important question of how export sophistication influences women's share of paid work (wage employment in the non-agricultural sector). The empirical results indicate that export sophistication enhances women's access to wage employment but only once the country has reached a reasonably high level of sophistication, implying that gains (for female wage labor) from exporting sophisticated products require a threshold level of sophistication. We also find that openness to trade exerts a negative impact on women's share of wage employment in North Africa, while women in this region gain less from export sophistication, relative to women in sub-Saharan Africa and Latin America. On the other hand, in sub-Saharan Africa, women seem to benefit the most from trade expansion, while women in Latin America gain the most from export sophistication. Finally, we find that openness to trade (after controlling for export sophistication) has a direct positive effect (at least when using the GMM-DIFF) for all regions except for North Africa, and an indirect positive effect on women's share of wage employment through its interplay with high levels of FDI, but this positive impact requires a relatively high level of FDI (as a share of GDP).

The empirical results also show that fertility has (as expected) a robust negative impact on women's share of wage employment. This result is consistent with findings reported in the literature. Interestingly, Quy-Toan et al (2016) examined theoretically and empirically the effect of comparative advantage in international trade on fertility and found lower fertility in countries with comparative advantage in industries that primarily employ women. They explained this negative effect of trade on fertility by the fact that "female wages, and therefore the opportunity cost of children, are higher in those countries."

The present paper contributes new insights by identifying export sophistication as a possible factor explaining how some trade-induced movements affect women's share of wage employment. Future research in this area should investigate how specific policies (industrial, labor and trade policies) would influence the impact of export sophistication on gender gaps in wage and employment, especially in regions where female labor-force participation is remarkably low, notably the MENA region.

In theory, international trade-induced competition can cause firms to reduce wage discrimination (Becker, 1971). We would then expect firms to hire more women. However, if firms consider the male and female labor input as imperfect substitutes (Acemoglu et al, 2004)[10], firms might not hire more women and gender discrimination in employment may persist.

An important mechanism through which trade may affect women's participation in the labor force as well as female-male wage gaps is the impact of technical change on firms' demand for skills (Acemoglu, 2003). In countries where women tend to have limited access to education, especially access to science, technology, engineering, and mathematics (STEM) education, greater openness to trade increases women's participation in the labor force (and could reduce female-male wage gaps) if the expanding (export) industries use low-skilled labor (low product sophistication). However, increased trade may reduce female employment if the expanding sector is skilled labor-intensive.

10. Also, see discussion in Baliamoune-Lutz (2020).

On the other hand, in countries where women's access to STEM education, which enables them to have high skills levels, is relatively high, women would benefit from the expansion of industries that rely on high skills, provided gender discrimination in hiring is not prevalent. In this case, the female-male wage gap may decline but it is not certain whether it would decline because of women's wages increasing (as a result of increased demand for skilled labor) or because of a decline in men's wages since the overall supply of skilled labor has increased, or for both reasons. At the macro level, we might be able to observe only changes in the share of women in wage employment, which does not provide information on which wage has changed (male or female) and by how much. Studies using microeconomic data at firm and industry-level should be able to shed light on the causes of changes in wage gaps as a result of trade liberalization or export expansion.

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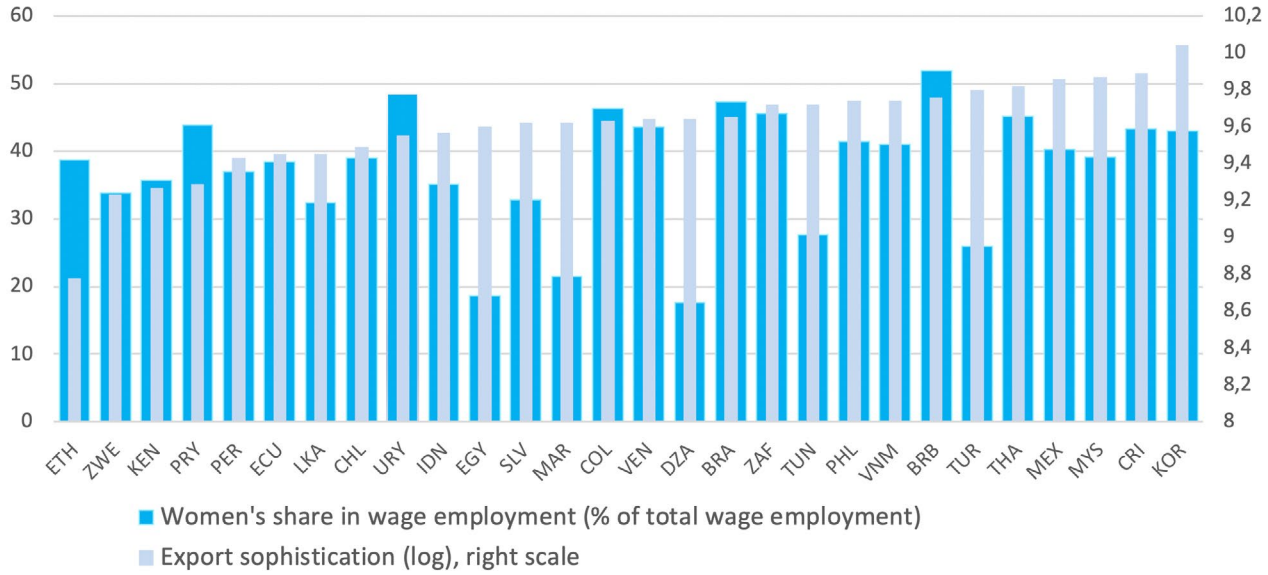
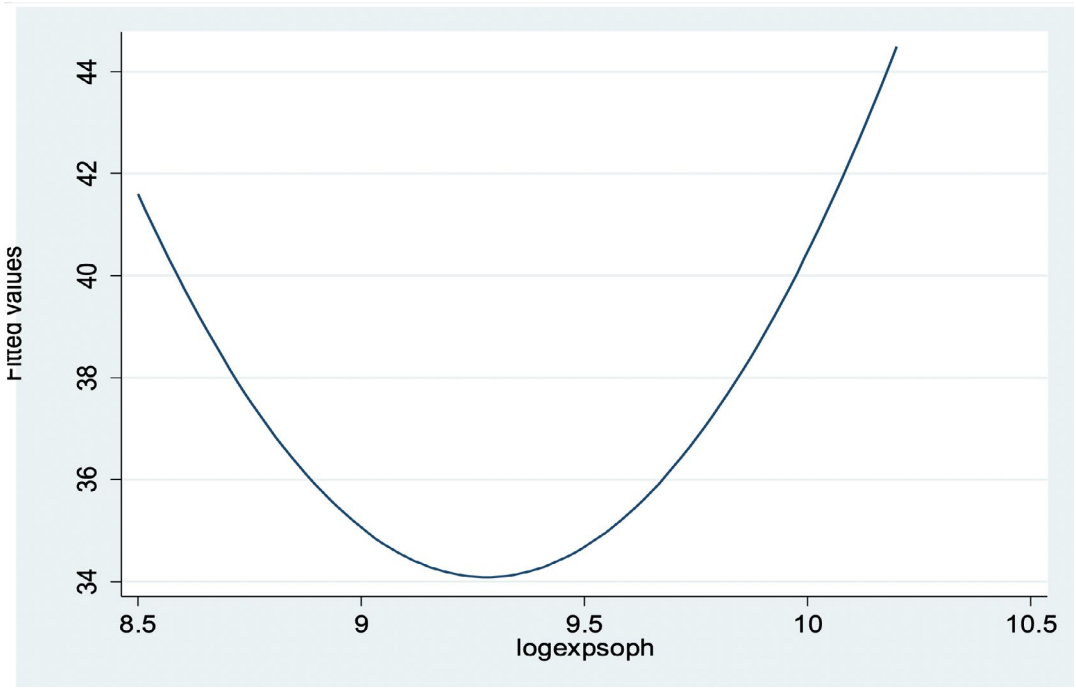
Figure 1 : Export sophistication and female wage employment (2013)



See Appendix A for data source and variable description.

Note: For Colombia (COL), Morocco (MAR), the Philippines (PHL), and Tunisia (TUN), the wage employment share is from 2012, while it is from 2011 for Zimbabwe ((ZWE). See Appendix A for data source and variable description.

Figure 2 : Export sophistication and share of women in wage employment in the non-agricultural sector



Source of data: see Appendix A

Table 1 Summary statistics

Variable	Obs	Median	Mean	Std. Dev.	Min	Max
sharewemp	772	38.3	35.39	10.417	7.7	52.3
EXPY	872	14617.87	14123.08	3337.20	4582.50	26903.18
open	1054	63.86	73.34	35.665	13.753	220.41
fertility	1060	2.80	3.15	1.248	1.076	7.246
Secfem	720	74.69	70.33	25.554	5.906	121.380
fdi	1074	1.86	2.82	3.389	-6.898	43.912
income	1080	7884.05	8373.87	5300.97	515.24	32684.32

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

Table 2 Pairwise correlation*

	sharewemp	EXPY (log)	Secfem	fdi	open	fertility
EXPY (log)	0.0859					
Secfem	0.4837	0.545				
fdi	0.2409	0.063	0.319			
open	0.2547	0.1019	0.216	0.355		
fertility	-0.4847	-0.756	-0.743	-0.196	-0.219	
income (log)	0.3115	0.7269	0.770	0.217	0.2469	-0.8015

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

* All P values are less than 0.01 except the correlations of export sophistication (EXPY) with the share of women in wage employment and with FDI, where the P value is 0.029 and 0.063, respectively.

Table 3 : Export sophistication and women's wage employment: Fixed-effects estimates (Dependent variable: Share of women in wage employment)

	(1)	(2)	(3)	(4)	(5)
lagged dep. var.	0.681***	0.685***	0.681***	0.677***	0.612***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)
Fdi	0.041	0.040	0.041	1.691	0.691*
	(0.028)	(0.028)	(0.028)	(1.68)	(0.028)
Open	0.006	0.006	0.008**	0.008***	0.006
	(0.123)	(0.122)	(0.002)	(0.002)	(0.009)
Soph	-52.633**	-54.833**	-53.586**	-62.065**	-68.824*
	(24.16)	(24.03)	(25.79)	(21.38)	(35.68)
soph_squared	2.67**	2.806**	2.73**	3.19**	3.503*
	(1.25)	(1.22)	(1.33)	(1.10)	(1.81)
NA x open	-0.042*	-0.035	-0.040*	-0.039*	-0.054***
	(0.024)	(0.023)	(0.022)	(0.022)	(0.008)
SSA x open	0.026**	0.030***	0.026**	0.027**	0.027**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.018)
LAC x open	-0.018*		-0.016	-0.016	-0.005
	(0.010)		(0.009)	(0.009)	(0.016)
Fertility	-0.963***	-0.875***	-0.932***	-0.897***	
	(0.305)	(0.269)	(0.378)	(0.288)	
Secfem					0.022**
					(0.009)
LAC x soph	3.002**	2.325**	2.430**	3.05**	1.845**
	(1.32)	(1.06)	(0.95)	(1.210)	(1.399)
SSA x soph	1.011				
	(1.23)				
NA x soph	-0.733				
	(3.21)				
open x soph	-0.0048	-0.0002			
	(0.012)	(0.012)			
FDI xsoph				-0.172	
				(0.173)	
Obs	559	559	559	559	415
R-sq					
Within Between	0.69	0.69	0.69	0.69	0.63
Overall	0.68	0.70	0.70	0.64	0.75
	0.62	0.64	0.64	0.56	0.67

Details on 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 : Controlling for the effect of income and the interplay of FDI with openness: Fixed-effects estimates (Dependent variable: Share of women in wage employment)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lagged dep. Var.	0.575*** (0.08)	0.579*** (0.08)	0.572*** (0.08)	0.576*** (0.08)	0.574*** (0.08)	0.578*** (0.08)	0.578*** (0.08)	0.574*** (0.08)
Fdi	0.127 (0.125)	0.129 (0.125)	0.115 (0.130)	0.128 (0.124)	0.094 (0.123)	0.121 (0.125)	0.129 (0.129)	0.052 (0.111)
Open	0.007 (0.006)	0.010 (0.006)	0.009 (0.006)	0.010 (0.006)	0.032 (0.019)	0.009 (0.007)	0.009* (0.005)	0.031 (0.019)
soph (log)	-79.81** (35.54)	-64.15** (23.95)	-65.43*** (24.05)	-64.17** (23.90)	-62.54** (23.42)	-66.39*** (24.10)	-64.93*** (24.62)	-61.97*** (23.39)
soph_squared	4.051** (1.81)	3.099** (1.21)	4.40** (2.35)	3.09** (1.20)	3.02** (1.18)	3.22** (1.22)	3.13** (1.24)	2.99** (1.18)
NA x open	-0.058*** (0.010)	-0.067*** (0.012)	-0.069*** (0.012)	-0.062*** (0.007)	-0.073*** (0.014)	-0.063*** (0.013)	-0.061*** (0.005)	-0.073*** (0.014)
SSA x open	0.029* (0.015)	0.030** (0.014)	0.031** (0.014)	0.030* (0.014)	0.035** (0.016)	0.033** (0.015)	0.031** (0.014)	0.036** (0.016)
LAC x soph	2.268 (1.57)	4,552* (2.35)	4,403* (2.35)	4,724* (2.59)	4,59* (2.30)	4,59* (2.30)	4,67* (2.58)	4,59* (2.13)
Fertility	-1.078* (0.446)	-0.924** (0.44)	-0.514 (0.47)	-0.919** (0.44)	-0.761* (0.44)	-0.983** (0.45)	-0.915** (0.44)	-0.761* (0.44)
Secfem	0.005 (0.011)	0.004 (0.011)	-0.001 (0.013)	0.004 (0.011)	0.006 (0.012)	0.009 (0.011)	0.004 (0.011)	0.008 (0.011)
open x fdi	-0.0015 (0.001)	-0.0016 (0.001)	-0.0015 (0.001)	-0.0016 (0.001)	-0.0011 (0.001)	-0.0015 (0.001)	-0.0016 (0.001)	-0.0016 (0.001)
open x fdi_squared	0.000036** (0.00001)	0.000038** (0.00001)	0.000037** (0.00001)	0.000038** (0.00001)	0.000034** (0.00001)	0.000037** (0.00001)	0.000039** (0.00001)	
income (log)	0.996* (0.543)	1.139* (0.59)	0.233 (1.08)	1.195* (0.64)	1.186** (0.58)	-5.221 (7.30)	1.194* (0.64)	1.194* (0.64)
SSA x soph		4.160* (2.14)	3.844* (2.10)	3.35* (2.39)	4.014* (2.12)	4.105* (2.12)	4.287* (2.36)	4.287* (2.36)
Time			0.054 (0.046)					
NA x soph				2.582 (4.434)			2.538 (4.429)	
open_squared					-0.00014 (0.0001)			-0.00014 (0.00011)
Income (log)_squared						0.337 (0.375)		
LAC x open							0.002 (0.012)	
fdi_squared								0.004** (0.002)
Obs	415	415	415	415	415	415	415	415

R-sq: Within	0.64	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Between	0.70	0.54	0.55	0.45	0.55	0.55	0.48	0.55
Overall	0.62	0.48	0.48	0.38	0.48	0.48	0.41	0.48

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: Export sophistication and women's wage employment: A-B GMM estimates (Dependent variable: Share of women in wage employment)

	(1)	(2)	(3)	(4)	(5)
lagged dep var	0.379*** (0.079)	0.448*** (0.102)	0.461*** (0.021)	0.494*** (0.047)	0.416*** (0.055)
fdi	0.443*** (0.13)	0.563*** (0.137)	0.315*** (0.058)	0.369*** (0.06)	0.424*** (0.11)
open	0.0299*** (0.01)	0.0367*** (0.009)	0.026*** (0.004)	0.022*** (0.008)	0.024** (0.009)
fertility	-2.492 (1.557)	-1.762* (0.908)	-2.911*** (0.950)	-1.942* (1.059)	-2.424** (1.059)
secfem	0.022 (0.027)	0.033 (0.026)	0.0167* (0.009)	0.014 (0.015)	0.021 (0.024)
open x fdi	-0.005*** (0.001)	-0.006*** (0.001)	-0.0036*** (0.0004)	-0.004*** (0.001)	-0.004*** (0.001)
Open x fdi_squared	0.00006*** (0.00001)	0.00006*** (0.00001)	0.00005*** (0.0000)	0.00007*** (0.00001)	0.00006*** (0.00001)
soph (log)	-9.749*** (1.94)	-9.431*** (1.80)	-100.68*** (33.38)	-67.44*** (23.46)	-7.87*** (1.62)
soph_squared			4.93*** (1.72)	3.150*** (1.20)	
income (log)	-0.314 (1.31)	-0.712 (1.181)		1.504** (0.65)	2.01** (0.93)
time	0.0562 (0.08)	0.059 (0.07)			
NA x open	-0.100* (0.05)	-0.097* (0.05)	-0.078* (0.046)		-0.094* (0.05)
SSA x open					0.032** (0.013)
NA x soph	13.425 (11.81)			-2.89 (2.64)	
LAC x soph	10.37*** (2.07)	10.54*** (2.12)	6.709*** (0.919)	7.60*** (0.87)	8.31*** (1.87)

SSA x soph	7.135*** (1.25)	6..631** (2.19)	5.848** (2.36)	6..625*** (1.07)	11..83*** (3.84)

obs	330	330	330	330	330
A-B test (z)	-1.335	-1.337	-0.885	-0.927	-0.976
Sargan test (chi2)	25.34	24.74	27.67	26.08	23.89

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

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

a All RHS variables except 'time' are treated as endogenous.

We test for second-order autocorrelation and overidentifying restrictions (Sargan test) to assess the validity of the instruments and all reported estimates pass both tests. The results from the Arellano-Bond test indicate that there is no statistical evidence of second-order autocorrelation.

Appendix A

Description of the main variables and data sources*

- **sharewemp:** Share of women in wage employment in the nonagricultural sector is the share of female workers in wage employment in the nonagricultural sector (industry and services), expressed as a percentage of total employment in the nonagricultural sector. Source: International Labor Organization Labor Statistics online database and World Bank's World Development Indicators online database.

- **open:** 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.

- **Soph:** Export sophistication represented by the log of EXPY (The country's expected GDP per capita) which is calculated by summing all the PRODY values for the products exported by the country, each weighted by the product's share in total exports. PRODY is an outcome-based measure of sophistication: if a product is mostly produced by rich countries, then it is revealed to be a "rich," or sophisticated, product. PRODY is calculated as a weighted average of per capita GDP of countries producing that product, with weights derived from revealed comparative advantage. Source: World Integrated Trade Solutions online database.

- **fdi:** Net foreign direct investment. It represents the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is presented as a share (%) of gross domestic product. 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.

- **secfem:** 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.

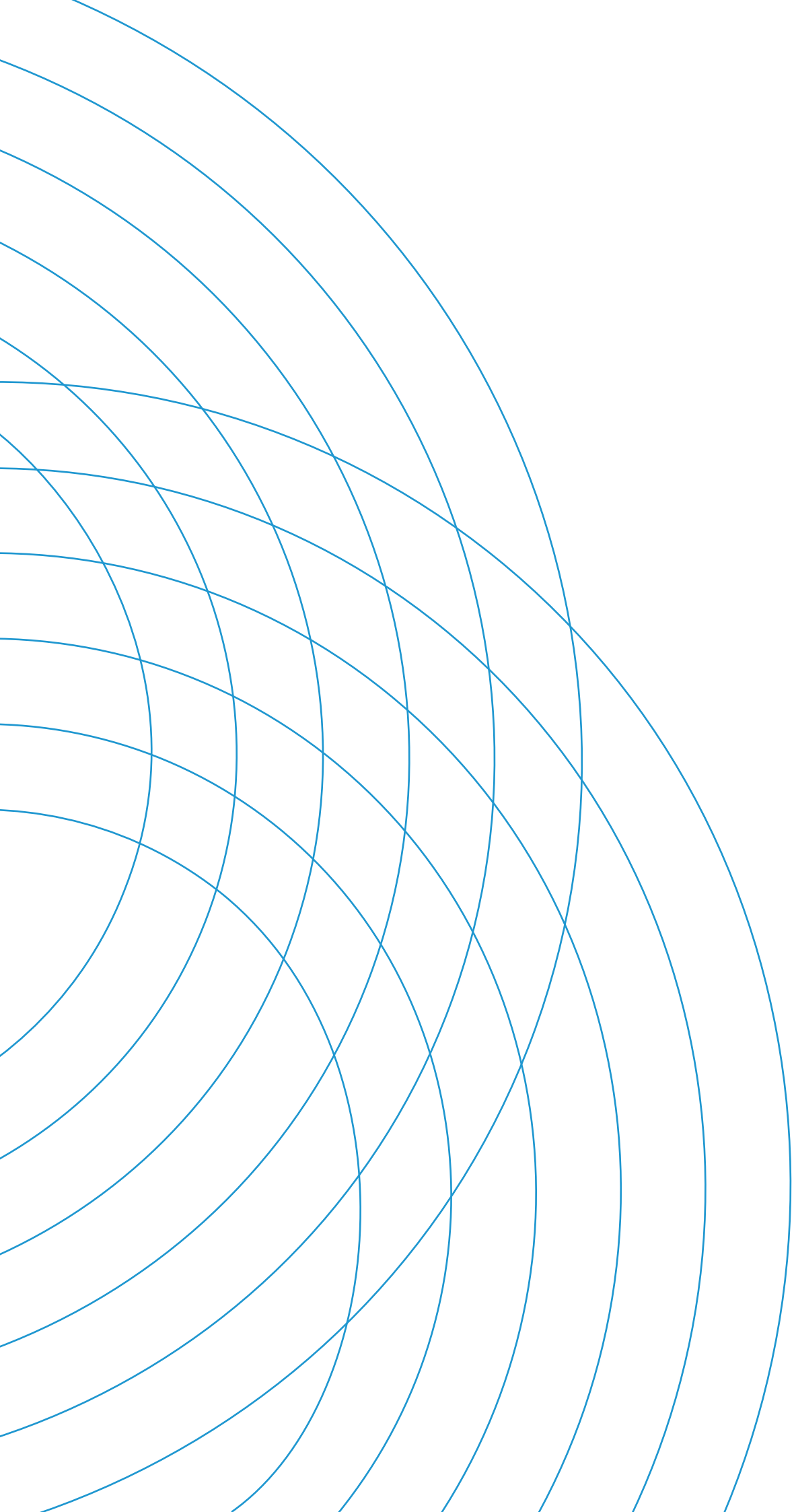
- **Income:** GDP per capita (in log) based on purchasing power parity (PPP). Source: World Bank World Development Indicators online database.

- **SSA:** Dummy variable for sub-Saharan Africa.

- **LAC:** Dummy variable for Latin America.

- **NA:** North Africa

* Note: Data used in the empirical analysis are the same as the ones used in Baliamoune (2020), except for data related to export sophistication.



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