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GVCs and Labor Market Outcomes: Evidence from MENA

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Abstract

This paper studies the role of global value chains (GVC) participation in fostering labor market outcomes in Egypt, Jordan, and Tunisia. While theory suggests an upward GVC effect on labor market conditions, we empirically investigate this assumption in Middle East and North Africa (MENA) countries endorsed with low GVC participation, weak labor markets, and high labor divides (skilled vs. unskilled and male vs. female). By merging World Bank Enterprise Surveys (WBES) and Integrated Labor Market Panel Surveys (ILMPs) data, we contribute to the literature as follows. First, we differentiate between GVC participation margins (extensive vs. intensive) and capture the effect of each on different labor market outcomes. Second, we explore the moderating role of job skill requirement in the GVCs and wages nexus. Third, we capture the GVC effect on skilled blue-collar and female employment and study the sectoral effect on the latter. Our results show a positive effect of GVCs on real wages, industry wage premium, skilled production workers, and female employment. In addition, the skill requirement strengthens the positive GVC effect on real wages. Results remain robust when we use alternative methodologies to control for endogeneity.

Keywords: Global value chains, labor market, MENA
JEL Classifications: F16, J21, N35

ملخص

تدرس هذه الورقة دور مشاركة سلاسل القيمة العالمية (GVC) في تعزيز نتائج سوق العمل في مصر، والأردن وتونس. بينما تقترح النظرية تأثير سلاسل القيمة العالمية التصاعدي على ظروف سوق العمل، فإننا نحقق تجريبيًا في هذا الافتراض في دول الشرق الأوسط وشمال إفريقيا (MENA) المعتمدة بمشاركة منخفضة في سلاسل القيمة العالمية، وأسواق عمل ضعيفة، وانقسامات عمالية عالية (ماهرة مقابل غير ماهرة وذكور مقابل إناث). من خلال دمج بيانات استقصاءات مؤسسات البنك الدولي (WBES) والمسوح التتبعية المتكاملة لسوق العمل (ILMPs)، فإننا نساهم في الأدبيات على النحو التالي. أولاً، نميز بين هوامش المشاركة في سلاسل القيمة العالمية (واسعة مقابل مكثفة) ونلتقط تأثير كل منها على نتائج سوق العمل المختلفة. ثانيًا، نستكشف الدور المعتدل لمتطلبات المهارة الوظيفية في سلاسل القيمة العالمية والعلاقة بين الأجور. ثالثًا، نستوعب تأثير سلاسل القيمة العالمية على العمالة الماهرة من ذوي الياقات الزرقاء والإناث وندرس التأثير القطاعي على الأخيرة. تظهر نتائجنا تأثيرًا إيجابيًا لسلاسل القيمة العالمية على الأجور الحقيقية، والأجور العالية في الصناعة، وعمال الإنتاج المهرة، وعمالة الإناث. بالإضافة إلى ذلك، فإن شرط المهارة يعزز التأثير الإيجابي لسلاسل القيمة العالمية على الأجور الحقيقية. تظل النتائج قوية عندما نستخدم منهجيات بديلة للتحكم في عامل النمو الداخلي.

1. Introduction

The quest for productive and high-quality jobs for all is clearly emphasized as the eighth goal of the United Nations Sustainable Development Goals (SDGs) agenda aimed to be achieved by the year 2030. While "decent work for all" is an unfinished business of the millennium development goals, SDGs pertain several indicators covering both the quantity and quality of employment. Although SDG 8 is inclusive to labor markets, it intertwines with other SDGs like ending poverty (SDG 1) by maintaining above than minimum real wage rates, and gender equality (SDG 5) by providing more opportunities for females. Since the 19th century, traditional trade theories highlight interlinkages between international integration and particular labor market outcomes as real wages, productivity, and unemployment.

Because of prevalent development challenges, studies on developing countries are critical to realizing the aimed sustainable goals across regions. In the realm of globalization, broad theoretical and empirical literature continues to study the effect of international trade on labor market indicators across countries, sectors, and firms. Unlike traditional trade patterns of final goods exchange, most trading activities nowadays occur in intermediate goods. This trend -referred to as global value chains (GVCs)- is fast growing due to the decrease in communication and transportation costs. To the end of minimizing production costs, firms engage in product fragmentation where intermediate goods cross borders and regions. Given theoretical frameworks endorsing prosperous development opportunities, this Discussion Paper empirically investigates the effect of GVCs on labor market outcomes in the understudied Middle East and North Africa (MENA) region.

Focusing on the MENA region applies to its particularly weak labor market outcomes. According to a recent World Bank report, youth[3] unemployment is highest in the MENA region (Islam et al., 2022). As an indicator for real wages, MENA lower-middle-income countries have an annual growth rate per capita of 2.6% compared to 6.8% non-MENA counterparts spanning the years 2000 to 2019 (Islam et al., 2022). Besides the underlying country level conditions limiting skill upgrading - like slowed economic growth and weak institutions-, at the firm level, narrow finance access prohibits human capital investments necessary to boost skill levels.[4] Given the fast technological progress, it is important to ensure that the workforce in the MENA region has the required skills to succeed in global jobs. To seize future opportunities, the "New Vision for Arab Employment" aims at closing the gaps in terms of skill and gender divides in the region. Furthermore, one prevalent characteristic across MENA countries is the high informality. In Egypt, 75% of recent labor market entrants are estimated to be in the informal[5] sector (World Economic Forum, 2017).

[3] Nearly half of population in MENA.
[4] Small firms in the MENA region are 40% less likely to receive public support than counterparts in other regions (Islam et al., 2022).
[5] Informality refers to jobs in agriculture, self-employed, or working in an un-registered firm.

Yet, because of stringent formal job conditions, informality is a convenient channel for female employment which is particularly low in the MENA region. As an indicator for gender equality, female employment shows weak performance and youth unemployment rate is severe for young females. By the year 2015, only 27% of women take part in the labor force in MENA compared to 72% of men. In addition, female unemployment rate exceeds that of males by over 20%. In Egypt, Jordan, and Tunisia, educated young women have fewer chances of employment than uneducated young women on average (ILO, 2017). Among other reasons, the intensely low female participation is because of stringent societal roles hindering female participation in the political and economic activities (Acar & Dogruel, 2012). Despite the Arab uprise in 2011, women's political and economic eminence are regressing (Esfandiari & Heideman, 2015) causing a MENA paradox (World Bank, 2013).

In parallel to weak labor market conditions (stagnant wages, low skills, and limited female employment) in the MENA region, GVCs participation is slow. While most of world trade occur in intermediate goods (Nissita et al., 2013), nowadays, only a small fraction of firms located in the MENA region are integrated in GVCs (Ayadi et al., 2024). Despite the studied nexus between international interlinkages and employment (Bernard & Jensen, 1997; Bernard et al., 2007), the effect of GVCs on labor market outcomes is insufficiently studied in MENA countries. In light of the weak labor conditions in the MENA region, this Discussion Paper investigates the effect of GVCs on real wages, skills, and female employment in Egypt, Jordan, and Tunisia.

While the choice of outcomes is bound to underlying predominant weak labor conditions in MENA countries including sticky wages, low skills, and high gender bias, the choice of countries is determined by the available data on individual labor conditions. To have a comprehensive dataset on labor and trade determinants, we match the Integrated Labor Market Panel Surveys (ILMPs) for Egypt, Jordan, and Tunisia fourth wave dataset with the World Bank Enterprise Surveys (WBES) at the year, sector, and governorate levels. We construct GVC measures based on firms' characteristics[6]. In particular, shallow GVC entails two-way trade, comprehensive GVC entails two-way trade, international certification and foreign owned shares, and intensive GVC measures the depth of trade intensity.

By employing different datasets and methodologies, this study contributes to the literature on GVCs and labor market outcomes in three ways. First, it differentiate between extensive and intensive GVC measures. Second, it employs labor market indicators of job quality (real wages, industry premium, and skill requirement) as well as quantity (number of employment). Third, it tackles the gender dimension by focusing on different female employment measures (blue-collar and white-collar) whilst exploring the sectoral heterogeneity. Our study focuses on the

[6] At the country level, measures differentiate between forward and backward GVCs. Given that intermediate goods cross borders more than once, forward GVC measures the domestic content in country's imports and backward GVC measures the foreign content in country's exports. In this paper, our firm level-based measures rely on characteristics of overall GVC participation.

understudied MENA region with prevalent weak labor market outcomes and slow GVC participation.

This paper is composed of five sections proceeding as follows: Section 2 reviews the literature. Section 3 presents stylized facts on GVCs and labor market characteristics in Egypt, Jordan, and Tunisia. Section 4 presents the empirical strategy and data. Section 5 presents the results and Section 5 concludes and provides policy recommendations.

2. A Review of Literature

International trade contributes to improving labor conditions through direct and indirect channels. First, the direct channel involves a standardization effect (Gereffi & Fernandez-Stark, 2011) that enhances developing countries' middling labor conditions compared to developed counterparts. Second, the indirect channel involves a growth effect that fosters various development goals (Azeez et al., 2014), including labor market outcomes in developing countries. This section reviews theoretical and empirical literature on international trade and specific labor market outcomes under study. Because our study is focused on trade in intermediate goods, we review New Trade theories on intra-industry and heterogenous firms' trade frameworks. In addition, we highlight the accompanying empirical studies on the MENA region.

2.1 GVCs and real wages

Starting with real wages as a chief labor market outcome affecting living standards, both conventional interindustry trade of Heckscher and Ohlin (H-O), and "new" intra-industry trade of Krugman (1984) theories agree on a globalization driven upward effect on at both the individual and industry levels (Stewart, 1992). At the individual level, theories agree that the procompetitive effect of trade decreases prices and hence real wages increase. Likewise, at the industry level, the selection effect due to market exit of the least efficient producers -which are unable to face international competition- upscales industry performance (Melitz, 2003).

Both conventional and new trade theories explain the drivers and effects of international trade but in different patterns. The main conventional trade theory (H-O comparative advantage-based) explains the inter-industry trade pattern between countries with different factor endowments. In particular, it emphasizes the role of specialization in increasing factor prices in which the country is initially endowed with. Hence, developing countries endowed with unskilled labor for example, specialize in unskilled labor-intensive goods and trade integration dynamics increases the relative factor price (Masse, 2001). Consequently, trade between developing and developed countries eventually leads to increasing wages of unskilled labor in developing countries and those of skilled labor in developed countries on the condition of different endowments across countries (Chipman,

1969). By explaining the inter-industry trade framework between developing and developed countries, conventional trade theories conclude higher relative wages in both trading partners.

Yet, conventional trade theories' framework is pitfall in explaining intra-industry trade across countries with similar factor endowments. Intra-industry trade refers to trade in differentiated goods either horizontally in case of final consumption goods, or vertically in case of intermediate production goods i.e., GVCs. In this regard, new trade theory is useful in explaining the drivers and advantages of GVCs participation. Based on the Ricardian model, Feenstra (1995) incorporates the effect of GVCs in terms of wages in a theoretical framework by dividing resources to skilled versus unskilled labor. Given vertical specialization, the model compares import and domestic prices within -rather than across- industries. Likewise, given a continuum of intermediate inputs ordered from low to high skill intensity, equilibrium occurs at the minimum cost of production for each country. The model concludes that GVC participation leads to higher wages for skilled labor. According to the extended model, GVCs redistribute resources leading to higher overall efficiency and productivity in both trading countries. Feenstra and Hanson (1996) reexamine the intra-industry trade effect on relative labor demand in models with tradeable intermediate goods, showing a direct upward GVC effect on real wages and higher skill demand.

From another dimension, Grossman and Rossi-Hansberg (2008) "Trade in Tasks" model shows that "unbundling" increasingly involves tasks that are difficult to measure[7]. Because of unmeasurable intangibles, Autor et al. (2003) focus on the skill content of technological change and propose a global production process theory focusing on tradeable tasks. Hence, they explain the effect of offshoring on relative factor prices in the source country and conclude productivity gains. Despite the measuring challenge of product fragmentation, a wide stream of literature highlights means of measuring GVCs by breaking down regionally separable technology (Jones, 2000; Deardorff, 2001; Egger & Falkinger, 2003; Kohler, 2004).

Although GVCs are intensive in manufacturing and capital-intensive goods, thanks to the reduction in communication, transportation, and trade costs, both goods and services nowadays cross borders (Heuser & Mattoo, 2017). Within each sector, firms choose the geographic destination that minimizes the cost of the offshore activity. The extent of offshoring in each activity is determined by a continuous variable in an equilibrium model in which the nature of activity dictates the skill level. Theoretical results show that GVCs are advantageous to labor and industry wages either because of altering terms of trade (Szymczak, 2023), or because of the flow of technological advances across firms (Peng & Zhang, 2020) upscaling wages and skills. Accordingly, as the range of offshore activities widens, the positive effect on wages and skills increases.

[7] Intangible capital constitutes one third of GVC.

To summarize the GVC prospected effect on real wages, the mechanism through which GVC participation fosters real wages is threefold. First, because GVCs are skill biased, the demand effect stimulates skilled labor wages across GVC participants (Feenstra & Hanson, 1996; Grossman & Rossi-Hansberg, 2008). Second, employees training in GVC participating firms escalates labor productivity (Lall, 2000; Humphrey & Schmitz, 2002) across different skill levels. Third, the spillover effect transmitting embodied foreign knowledge enhances productivity across GVC participants (Taglioni & Winkler, 2016; Eissa & Zaki, 2023) fostering industry premiums in participating sectors. Undoubtedly, GVC driven labor gains are strengthened by directly contributing to domestic human capital and industries' development (Gereffi et al., 2011; Bamber et al., 2017).

Focusing on MENA countries with slow GVC participation, a handful of empirical studies show a positive effect of international trade on labor wages. Using ILMPs for Egypt, Jordan, and Tunisia, Abushady et al. (2021) find a positive trade liberalization effect on wage premium. In addition, focusing on Egypt, firm level data show a positive effect of export expansion on employment (Berg et al., 2022) with an unclear effect on wages (Roberston et al., 2021). Although the growth effect of international trade is more evident in the long than short run (Zaki, 2016), international trade fosters wage premium in Egypt (Zaki, 2013). In addition, consistent with theory, exporting firms in Egypt pay higher wages than non-exporting counterparts (Saad, 2020). However, it is important to distinguish between exporting firms and GVC participating firms per se. Withstanding the challenge in GVC measurement at the firm level, Dovis and Zaki (2020) provide four definitions to measure GVCs based on firms' characteristics. The least strict or shallow definition entails simultaneous importing and exporting (two-way trade), whereas the strictest or deep definition entails simultaneous two-way trade, international certification, and foreign owned shares. Grounding on two-way trade definition of GVCs, Urata and Baek (2020) evidence a strong association between labor productivity and GVCs.

2.2 GVCs, female employment, and sectoral heterogeneity

From the same theoretical stance evidencing a positive association between GVCs and wages, moving to gender equality, neoclassical school of thought elucidates that international competition spurred by GVC participation leads to narrowing costly wage gaps (Becker, 1957) and consequently restrains gender bias. Although neoclassical models show that economic growth induces employment opportunities for females (Kucuck, 2013), the direct mechanism of international trade driven female employment is unclear, and solely explained through the sectoral dimension (Arun et al., 2004).

Despite signaling mechanisms of decreasing gender bias, the GVCs effect on female employment is blurred. On the one hand, to the end of maximizing profits, GVC participating firms -usually larger in size- may choose to sustain costly discriminating wage gaps (Melitz, 2003) and hence

employ more females. On the other hand, due to the skill bias nature of GVCs, the relative demand for skilled "males" can mitigate the higher employment of unskilled "females" (Coniglio & Hoxhaj, 2018). Yet, the latter is merely the case for technology and capital-intensive male dominant sectors. Given a higher tendency to specialize in labor intensive and "female friendly" sectors, GVCs foster female employment concluding a sectoral based effect (Barrientos, 2014).

According to the "capability approach", females are expected to participate less in technology intensive sectors (Sen, 2005). Yet, in MENA countries, Information and Communication Technology (ICT) expansion decreased the gender divide over the period 1995 and 2003 (Shirazi, 2008). From another angle, as a determinant of GVC participation, strong governance provides efficient resource allocation and hence decreases gender bias (Branisa et al., 2010). Beside cultural dominance and autocratic nature of MENA countries, oil dependence contributes to the high gender bias due to focusing on male dominant extracting activities (Ross, 2008) and hence discouraging females labor market participation.

From an empirical viewpoint, Zaki (2013) evidences a higher negative effect of trade barriers on females and blue-collar (production) workers than males and white-collar (non-production) workers in Egypt. In parallel, Hendy and Zaki (2012) show that along with trade liberalization, the expansion of the apparel and services sectors in Egypt reduces gender inequality in terms of skilled and unskilled female employment in urban areas. Using the World Bank Enterprise Surveys dataset, empirical results show that GVC participation is "women friendly" due to the evidenced empowering role in terms of female employment and female ownership in developing countries including the MENA region (Kalliny & Zaki, 2024). Furthermore, focusing on MENA countries, studies show a positive association between female labor force participation and different trade margins (Karam & Zaki, 2021). Yet, in the case of India, none of the GVC measures affect the gender wage inequality (Deb, 2022) showing that the positive effect of trade on female employment can be region specific.

In studying the nexus between GVCs and female employment in the MENA region, it is important to analyze the sectoral dimension. On the one hand, GVCs can induce higher female employment but can simultaneously trap MENA countries in low-value added and unskilled-labor intensive activities (Yang et al., 2020). In this case, unskilled workers will be singled out in the positive GVC effect, and the skill level will continue to be sticky. In addition, because females are more represented in unskilled labor activities (Martin, 2023), the quality of jobs created to females through the GVC channel may remain low (Tallontire et al., 2005). Due to prevailing stereotyped gender roles in the MENA region, skill-intensive and construction sectors are well recognized to be male dominated[8] (Bridges et al., 2020). Although GVCs play a significant role in upgrading skill level in developing countries (Tian et al., 2022), on empirical grounds, labor market rigidities in the MENA region limit job creation (Bernard and Jensen, 1997; Bernard et al., 2007) generating

[8] The barriers to women participation in skilled tradable activities are clear in the literature, but insufficient studies explore the means to overcoming these barriers.

a counterforce to skilled labor employment leaving the GVC effect on skill upgrading unrecognized.

Despite the studied nexus between international interlinkages and employment, the effect of GVCs on labor market outcomes is insufficiently studied particularly in MENA countries. Because of the consequential interweaving of employment across borders, the relationship between GVCs and labor markets is complicated (Jihang & Milberg, 2013) to the extent that growing empirical literature do not coincide on a straightforward positive effect across countries. To our knowledge, the GVC effect on real wages from the lens of skill, gender, and sectoral heterogeneity in the MENA region is still scant.

This paper contributes to the literature on GVCs and labor market outcomes in three ways. First, it differentiates between extensive and intensive GVC measures and connects each to different labor market outcomes namely real wages, wage premium, skilled, and female employment. Second, it uses diverse datasets and employs a set of methodologies to reach a robust GVC effect on real wages. Third, it studies the direct and moderating sectoral effects on female employment in MENA countries recognized by significant gender bias.

3. Stylized Facts on Real Wages, Skilled and Female Employment in Egypt, Jordan, and Tunisia

To examine the nexus between GVCs and labor market outcomes, we employ and merge two datasets: Integrated Labor Market Panel surveys (ILMPs) fourth wave on Egypt, Jordan, and Tunisia and the World Bank Enterprise Surveys[9] (WBES). The ILMPs harmonizes data from five rounds of Egypt labor market panel surveys, two rounds of Jordan labor market panel surveys, and one round from Tunisia labor market panel surveys. Because we merge the ILMPs with the WBES[10], we restrict the data to three matched years for Egypt (2006, 2012, and 2018), one matched year for Jordan (2016), and the available one year for Tunisia (2014). The matching between datasets is at the geographical area, year, and sector levels.

In this section, we present data trends on labor market characteristics (indicated by real wages, informality, skilled, and female employment) and GVCs participation. Particularly in terms of gender inequality (Kucuk, 2013), the MENA region is identified by its weak outcomes. In the year 2010 for example, youth and total unemployment in MENA was the highest in the world reaching 25% and 10% respectively (World Economic Forum, 2012). Based on ILMPs dataset, point data shows that Jordan (year 2016) is heterogeneously higher in terms of real wages on average than Tunisia (year 2014) and Egypt. In order to analyze whether higher wages in Jordan is a time trend or only exclusive to the year point data, Figure 1 shows Gross Domestic Product per capita in real terms spanning the years 2008 – 2021 for Egypt, Jordan and Tunisia. As presented, although real

[9] The WBES is a comprehensive firm level pooled surveys data on emerging regions.
[10] This merging is necessary because the ILMPs do not include trade variables.

GDP per capita is significantly higher in Jordan in the years 2008 – 2012, the former has a declining trend and converges to Egypt and Tunisia by the year 2021. Noteworthy, the majority of workers in Jordan earn minimum wage, and only a minority earn living wages (Kraft & Hannafi, 2022). Although the economic liberalization programs that started in Tunisia in 1986, Jordan in 1989, and Egypt in 1991 are bound to stimulating labor earnings in the short and medium terms, yet, in terms of real earnings and inequality, outcomes unexpectedly diverged between and within MENA countries (Said, 2012). Across MENA countries, the increased shares of education are not combined with increased real earnings and employment.

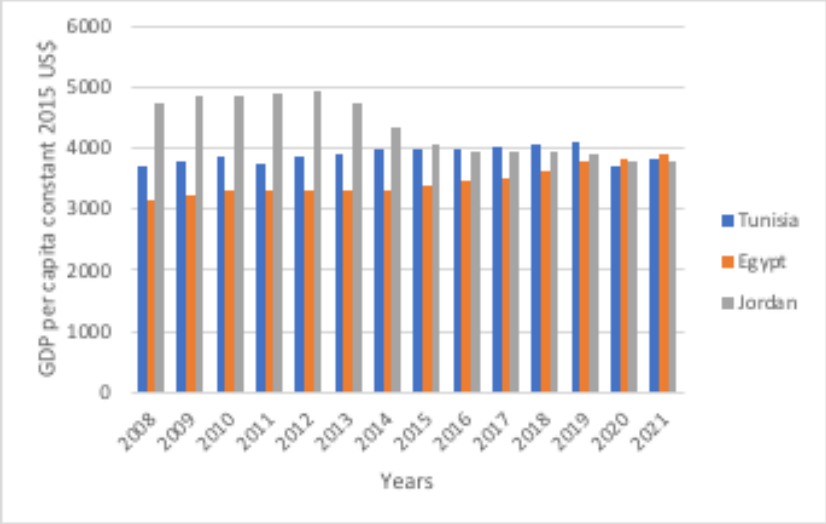
The availability of labor force surveys for Egypt starting the year 1988 facilitates the analysis and shows a declining trend in real wages after liberalization programs (Said, 2012). In this respect, Figure 2 shows a decline in real monthly wages in Egypt by 16% in the year 1998 compared to the year 1988. Yet, real monthly wages recovered by the year 2006 and increased by almost 25% compared to the year 1998. Despite the global financial crisis in the year 2009, the upward trend in real wages in Egypt continued in the year 2012. Yet, as presented, affected by the Arab uprise and its consequential imbalances, real monthly wages witness a slight decline in the year 2018 compared to the year 2012.

In parallel, Figure 3 shows that the share of informal[11] employment in Egypt is consistently rising reaching after the year 1998 reaching 62% in the year 2018 (Assaad & Kraft., 2023). Increased share of informality in Egypt is attributed to deteriorated investment climate and lower finance access to private sector (Zaki, 2023) constraining formal job creation. In addition, high concentration of Egypt's activities in construction and petroleum related activities (Zaki, 2023) limits quality skilled job creation and locks the economy in low value-added activities. Despite the initial decline in unemployment rates in Egypt following trade liberalization, it steadily increased after the financial crisis in 2009 with a steeper slope after the 2011 Arab uprise (Berg et al., 2022).

Focusing on gender equality, female labor force participation deteriorates in the MENA region reaching 7.6% in the year 2020.[12] Despite the literature linking the paradox of higher female education and yet lower labor force participation to cultural and societal roles (Fish, 2002), empirical studies find that neither cultural conditions nor oil dependence are core reasons behind gender inequality in the MENA region (Kucuk, 2013).

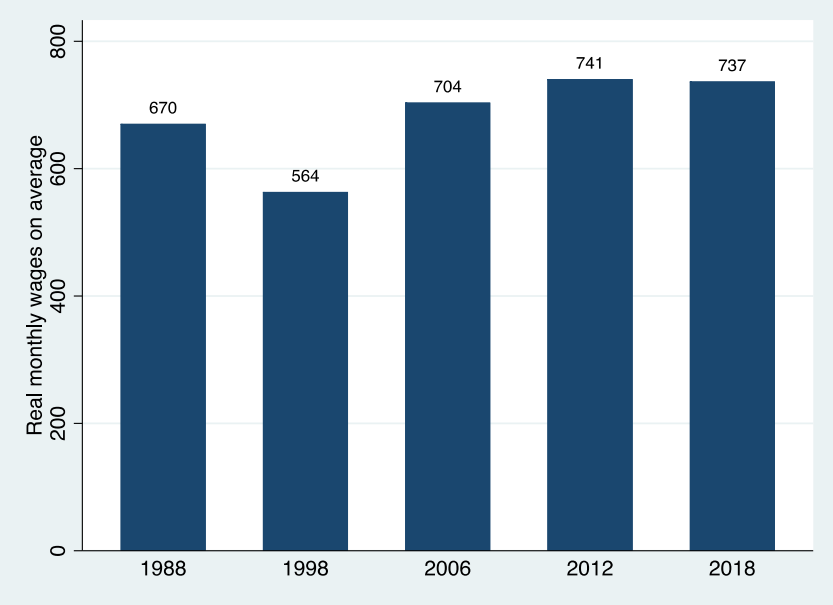
[11] Informal measure in Labor Market Panel Surveys is defined as self-employed, unpaid family workers, or workers without social security coverage.
[12] Own elaboration using the World Development Indicators World Bank dataset.

Figure 1. GDP per capita in constant 2015 $US (2008-2021)



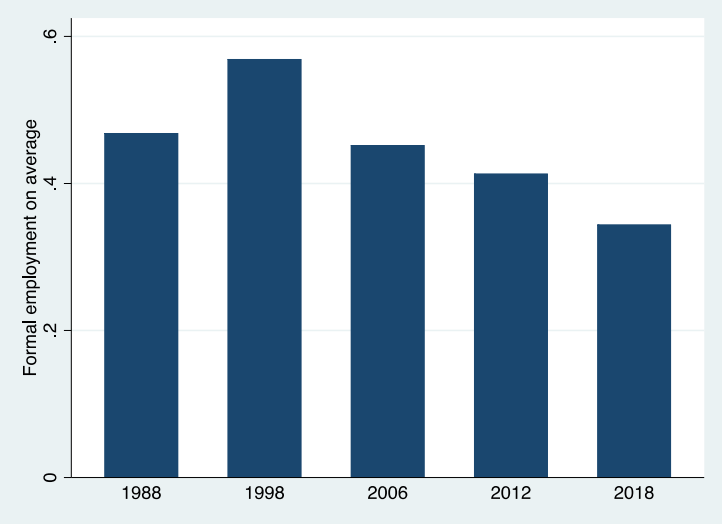
Source: Own elaboration based on World Development Indicators (WDI) World Bank dataset

Figure 2. Real monthly wages in PPP in Egypt



Source: Own construction based on ILMPs dataset
Notes: Due to our employed datasets, our study is restricted on the countries and years available in the merged dataset: three years for Egypt (2006, 2012, and 2018), one year for Jordan (2016), and one year for Tunisia (2014).

Figure 3. Formal employment in Egypt on average



Source: Own construction based on ILMPs dataset
Notes: This measure is based on the survey question if the individual's primary job is a waged employment

Table 1 summarizes labor market characteristics in terms of informality[13], skill requirement[14], and female participation[15], by country on average. As presented, labor markets across the three countries are characterized by high informality, low skill[16], and male dominance. As presented, Egypt has the highest share of informality (53%) that further increased post the Covid-19 pandemic (Assaad & Kraft., 2023). Informal employment in its broad definitions include self-employment, un-paid family workers, and workers without social security coverage. The increased flexibility for firms' hiring and firing in the new labor law of 2003 in Egypt is a major bottleneck for firms' registration of jobs (Wahba and Assad, 2016). Indeed, law flexibility is not the only reason of high informal employment. Informality has been increasing in Egypt since the 1990 to the extent that it has become "the main form of employment" (Assad and Kraft, 2015). Despite some advantages of informality -like more flexible conditions to females- informal jobs tend to have lower quality, less stability, and are excluded from the benefits of social and medical insurance.

Despite the heterogeneity in informality and skill requirement across countries, female presence in jobs is rather homogenous. As presented, 60% of jobs in Egypt do not include females compared with a homogeneously high 54% in Jordan and 59% in Tunisia. Here, female inclusion is measured by a survey question if the job includes females highlighting the fact that above 50% of jobs in the countries under study do not include females. The data shows that despite the prevalence on jobs

[13] Self-employed, unpaid family workers, or workers without social security coverage.
[14] Skill requirement is based on a survey question if the individual's job requires a skill.
[15] Subjective survey question asking if the workplace includes female.
[16] Unskilled labor-intensive sectors include food, furniture, textiles, garments, construction, and other services, excluding information technology and communication.

not requiring a skill, females are still unrepresented despite the globally convention that females dominated unskilled jobs.

Table 1. Labor market characteristics by country on average in percentage

Labor markets	Job characteristics	Jordan	Tunisia	Egypt
Formality	Informal	34.37	50.52	53
	Formal	65.63	49.48	47
	Total	100	100	100
Skills	Skill required	28	26	43
	No skill required	72	74	57
	Total	100	100	100
Gender	No females	54	59	60
	Females	46	41	40
	Total	100	100	100

Source: Own construction based on Integrated LMPs v4.0

Table 2. GVC participants versus non-GVC participants on average across countries

	Jordan			Tunisia			Egypt		
Shallow GVC	**Comprehensive GVC**								
Two-way trade	**Two-way trade + foreign owned shares + international certification**								
	No	Yes	Total	No	Yes	Total	No	Yes	Total
No	785	0	785	720	0	720	6624	0	6624
Yes	248	27	275	280	39	319	751	123	874
Total	1033	27	1060	1000	39	1039	7375	123	7498

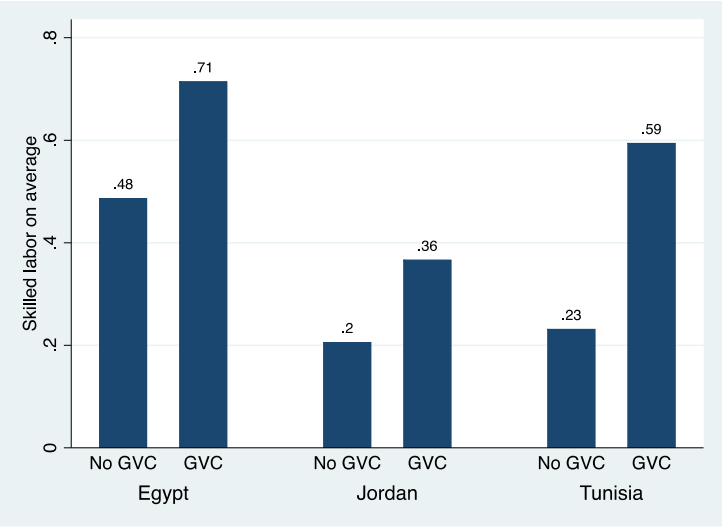
Source: Own construction based on the World Bank Enterprise Surveys comprehensive dataset

Using firms' characteristics, Table 2 presents two extensive GVC participation measures. Extensive measures differentiate between GVC and non-GVC participants and does not infer the depth of integration. The shallow GVC refers to firms' simultaneous exporting and importing and the comprehensive GVC refers to firms' simultaneous exporting and importing, foreign owned shares, and having an international quality certification. As presented, 23%, 27%, and 10% of firms are engaged in shallow GVC and 2%, 3%, and 1% of firms are engaged in comprehensive GVC in Jordan, Tunisia, and Egypt respectively. The overly inhibited GVC participation in Egypt is attributed to weak business environment and excessive costs and time to trade (OECD, 2021) decreasing the likelihood of firms' participation in GVCs in emerging economies (Dovis and Zaki 2020).

Structural drivers of GVC participation are market size, level of development, industrial structure (manufacturing), institutional quality, and low tariff and non-tariff trade barriers (Kowalski et al., 2015). Accordingly, despite the global fast-growing trend, it is sensible that MENA countries still lag behind GVC participation due to the inapt structural characteristics. Indeed, realizing the benefits of GVC participation augments the need for industrial, institutional, and trade policy reforms. In regard to the industrial structure, WBES dataset shows that Tunisia has the highest

share of manufacturing whereas both Jordan and Egypt show a declining share of manufacturing with respect to services[17].

Figure 5. Skilled production workers across shallow GVC, on average



Source: Own construction based on WBES comprehensive dataset.
Notes: GVC refers to two-way trade extensive measure. Skilled labor is the number of skilled production workers.

To combine GVC trends with labor market outcomes, Figure 5 presents the share of firms' skilled production workers over GVC (non-GVC against shallow GVC firms). As presented, GVC participants have a consistently higher share of skilled production workers in total production workers. The obvious positive association aligns with the "skill biased technological change" attributing foreign interlinkages to higher skilled labor demand despite countries' comparative advantage. In contrast to trade theory predictions, employment gains due to GVC participation in developing counties are biased towards skilled workers (Hollweg, 2019).

As for the sectoral dimension, skilled production labor is intensive in manufacture[18] (machinery and other manufacture), yet the share of employment in manufacturing deteriorates in Egypt and Jordan[19]. Because GVCs participation requires digital platforms, skilled workers demand is enhanced in both services and manufacturing integrated in GVCs. Unlike non-tradable traditional services, transportation, logistics and communication, business processes, and other modern services, cross borders easier, and hence are more prone to GVC integration to benefit from reduced costs. Regarding skill and gender sectoral association, the data shows that skilled labor is

[17] Own elaboration using the comprehensive World Bank Enterprise Surveys (WBES) dataset.
[18] See Appendix A.
[19] WBES comprehensive dataset own elaboration, spanning the years 2013-2019.

not consistently negatively associated with female intensity. Textiles for example, has the highest female intensity[20] and the skilled labor shares are relatively high.

Against this background, GVCs effect on labor market outcomes can be sector driven. Put differently, GVC participation can have an upward effect on both skilled and female employment. Across 64 developing and emerging economies, GVC participation positive effect on female wage premium is higher for production than non-production workers (Rocha and Winkler, 2019). Here, sectors with female dominance and relatively high skilled production workers -like textiles- witness a GVC driven higher wage premium and hence a higher demand for both females and skilled labor.

In light of the undersized GVC participation and weak labor market conditions, econometric modelling is necessary in capturing the impact of the former on labor market outcomes in MENA countries. By aggregating and merging WBES with ILMPs fourth wave dataset[21], different empirical strategies are used to guarantee a robust GVC effect on individual real wages, industry wage premia, female, and skilled employment in Egypt, Jordan, and Tunisia.

4. Methodology and data

Our empirical strategy estimates the effect of GVC participation on labor market outcomes including real wages, industry wage premium, skills, and female employment in MENA countries (Egypt, Jordan, and Tunisia)[22] recognized with predominant weak labor market outcomes (sticky wages, low skills, and high gender bias). Our analysis quantifies the benefits of GVCs in terms of labor market outcomes.

We rely on the ILMPs dataset including labor characteristics and rely on the WBES comprehensive dataset on firms characteristics to measure GVCs participation and merge the two datasets at the governorate, sector, and year levels. Following Dovis and Zaki (2020) definitions, we employ two extensive GVC measures. First, the shallow two-way trade definition entailing firms' simultaneous exporting and importing. Second, the comprehensive definition incorporating foreign owned shares and international certification to two-way trade[23]. As for the intensive measure, it reflects the depth of GVC integration by calculating the share of exports in total sales and the share of foreign inputs in total inputs (Aboushady & Zaki, 2023; Urata & Baek 2020).

To capture a robust GVC effect on labor market outcomes, we follow a fourfold empirical strategy. First, we employ a one-step human capital model by including GVC participation as an

[20] Out of total female employment, the shares of female employment in textiles and wholesale and retail are 10.5% and 31% respectively (WBES dataset).
[21] GVC measures are averaged by industry, country, year, and geographical regions and the covariates are matched with ILMPs fourth wave dataset for Egypt, Jordan, and Tunisia.
[22] Our choice of countries and years are bound to data ILMPs data availability.
[23] For brevity, we use the shallowest and the most comprehensive GVC measure provided by Dovis and Zaki (2020).

explanatory variable along with the determinants of real wages. Second, we employ a correction procedure to control for self-selection of low-waged workers in non-GVC firms. Third, we employ a two-stage wage premium analysis to study the effect at the industry level. Fourth, we employ an ordinary least squares methodology to study the GVC effect on female and skilled labor employment. All our models are estimated using the available years and countries in the merged dataset (2006, 2012, and 2018 for Egypt - 2016 for Jordan and 2014 for Tunisia).

4.1 One step human capital model

The "human capital model" by Mincer (1974) quantities the determinants of real wages based on individuals' characteristics. The classic determinates include education, experience, gender, geographical location, and parents' background. Following Zaki (2014) including trade measures as explanatory variables while controlling for the classic determinants, we include GVC constructed measures as follows[24]:

$$\log(w)_{igjst} = \beta_0 + \beta_1 X_{igjst} + \beta_2 GVC_{gjst} + \gamma_t + \gamma_j + \varepsilon_{igjst} \quad (1)$$

where $\log(w)_{igjst}$ is the real monthly wage rate in logarithm for individual *i* in governorate *g*, country *j*, sector *s*, and year *t*. X_{igjst} is a vector of individual characteristics including education level (measured by number of years of education), experience (measured by age), gender (dummy variable equals to 1 if the person is female and equals to 0 if the person is male), parents background (measured by parents' education), region belonging (urban or rural), and belonging to a trade union. All individual level variables rely on the ILMPs. GVC_{gjst} is the GVC participation defined by shallow, comprehensive, and intensive GVC measures. We rely on the WBES to construct the GVC variables. We then match and merge the two datasets by region, sector, and year. γ_t and γ_j are vectors of year and country fixed effects respectively to control for unobservable heterogeneity[25] and ε_{igjst} is the discrepancy term.

From the review of the theoretical and empirical literature, education, experience, urban, trade union belonging, and being male to positively associated with real wages. As for the variable of interest, we expect a positive and significant GVC effect on real wages. On the one hand, individuals employed in GVC firms to be working in larger, capital-intensive, and more innovative enterprises than counterparts in non-GVC firms (Urata & Baek, 2020). On the other, as illustrated in Section 2, the theory endorses hypotheses on enhanced competition, productivity, industry efficiency, knowledge spillovers, and skill upgrading due to GVC participation. Since the comprehensive GVC entails higher foreign interlinkage than the shallow GVC, we expect the former to have a higher magnitude than the latter.

[24] Standard errors are clustered by industry and country and weights are employed in regressions.
[25] We include sector fixed effects for robustness check.

The one step human capital methodology is yet insufficient in guaranteeing a GVC driven positive effect on real wages. We need to control for the probability of self-selection of low wage individuals in non-GVC firms that are not employed in GVC firms due to incompetence and hence work in non-GVC firms that are inefficient and unable to compete in foreign markets. In this case, an evidenced positive effect can be merely reflecting that phenomenon that incompetent individual characteristics leads to low wages and working for a non-GVC enterprise. Hence, to guarantee a robust effect, further empirical strategies controlling for self-selection are needed.

4.2 Heckman two-step correction analysis

Despite controlling for unobserved heterogeneity by including country, year, and sector fixed effects in our first ordinary least squares model, the causal effect is yet skeptical, due to GVC endogeneity. As abovementioned, the GVC effect on wages can be biased by self-selection of low waged employees in non-GVC enterprises. Again, employment in a firm engaged in GVCs (larger, more productive, and pay higher wages) is not at random. Individuals who are privileged with stable, high paying jobs of parents can be self-selected in more productive GVC firms. In this case, our estimated positive effect of GVCs on real wages can be due to a determinant of employment in high wage job and participate in GVCs. To correct for self-selection of low wage individuals in local forms due to family backgrounds, we follow Berg et al. (2022) and employ Heckman's (1979) selection procedure. In this strategy, we estimate the bias criterion as a first step. In the first step, we estimate the probability of employment using a probit model as follows:

$$P(employment)_{igjst} = \beta_0 + \beta_1 X_{igjst} + \gamma_g + \gamma_t + \varepsilon_{igjst} \qquad (2)$$

where, employment is a binary variable equals to 1 if the individual is employed and equals to 0 otherwise. X_{igjst} is a set of individual characteristics illustrated as explanatory variables in Equation 1. $\gamma_g \; and \; \gamma_t$are region and year dummies to control for unobservable heterogeneities, ε_{igjst} is the discrepancy term.

From Equation 2, we obtain inverse Mills ratio[26] where family background is the exclusion criterion (Weiss, 1995) measured by parents' job irregularity. In the second step, we include inverse Mills ratio as an additional control variable to equation 1 to control for GVC endogeneity. Here, we control for the negative bias of incompetent individuals in non-GVC firms.

After evidencing a robust effect of GVCs on real wages, we employ an alternative methodology to estimate the GVCs effect on industry wage premium. This step is important in analyzing the GVC effect at the industry level.

[26] Inverse Mills ratio is the probability density divided by cumulative density distribution. Parent job irregularity is the exclusion restriction. It's relevance on employment is captured by estimating the likelihood of being employed using a weighted probit regression.

4.3 Two-step industry wage premium analysis

To explore the relationship between GVCs and industry wage premium, we employ a two-step wage premium analysis procedure. According to theoretical models, due to scale and selection effects, GVC participation boosts productivity at both the individual and industry levels. Following the literature (Gaston & Trefler, 1994; Salem & Zaki, 2019; Falcone & Galeano, 2017), in the first step, industry wage premia are retrieved from the wage equation for each country and year separately as follows:

$$\log(w)_{igs} = \beta_0 + \beta_1 X_{igs} + \varphi I_s + \gamma_g + \varepsilon_{igs} \quad (3)$$

where $\log(w)_{igs}$ is the real monthly wages in logarithm for individual *i* in governorate *g*, sector *s*. X_{igs} is a vector of individual characteristics including education level, age, age squared, gender, parents' level of education, living in a rural area, and belonging to a trade union. I_s is a vector of sector dummies[27]. γ_g is a vector of regional dummies to control for unobservable heterogeneity, ε_{igs} is the discrepancy term.

Retrieved industry coefficients in Equation 3 are pooled for countries and years (φ_{sjt}) and normalized to express each coefficient as deviation from the employment-weighted average industry wage premia as follows:

$$W_s = \sum_j(\varphi_s * l_s) \quad (4)$$
$$IP_s = \varphi_s - W_s \quad (5)$$

where, l_s is the share of waged employment in sector s, $IP_s$is the normalized industry wage premium. Hence, normalized industry wage premium[28] is defined as the proportional difference in wages for a given worker in a given industry relative to an average worker in all industries with homogeneous observable characteristics (Falcone & Galeano, 2017). In the second step, normalized industry wage premium is regressed on GVC measures as follows:

$$\log(IP_{sjt}) = \beta_0 + \beta_1 GVC_{sjt} + \gamma_s + \gamma_j + \varepsilon_{sjt} \quad (6)$$

where, $\gamma_s and\, \gamma_j$ are sector and country fixed effects respectively to control for unobserved heterogeneities.

After analyzing the GVC effect at the individual and industry returns, we delve into the role of skill requirement in moderating the GVC effect on real wages, the GVC effect on skilled labor, and female employment. Tackling the gender dimension is important to MENA countries with

[27] Including 17 manufacturing and services sectors.
[28] This normalization is necessary in order to dilute omitted industry coefficients' bias.

substantial gender bias. Finally, we analyze the role of sectors in moderating the GVC effect on female employment.

4.4 GVCs, skilled, and female employment

To explore the moderating effect of skill level in the activity, we re-estimate Equation 1 while interacting the skill requirement[29] with GVC measures as follows:

$$\log(w)_{igjst} = \beta_0 + \beta_1 X_{igjst} + \beta_2 GVC_{gjst} + \beta_3 Skillreq_{igjst} + \beta_4 (GVC_{gjst} * Skillreq_{igjst}) + \gamma_t + \gamma_j + \varepsilon_{igjst} \quad (7)$$

Here, our interest is in the sign and significance of the interaction between GVCs and skill requirement. Given a positive GVC effect on real wages, a positive (negative) and significant interaction means that skill requirement strengthens (weakens) the GVC upward effect on real wages. We also explore the interaction effect in the second stage Heckman correction procedure.

Relying on the WBES firm level dataset on Egypt, Jordan, and Tunisia, we estimate the GVC effect on skilled and female employment using ordinary least squares methodology as follows:

$$Skilled_{ijt} = \delta_0 + \delta_1 GVC_{ijt} + \delta_2 X_{ijt} + \gamma_j + \gamma_t + \varepsilon_{ijt} \quad (8)$$

$$Female_{ijt} = \rho_0 + \rho_1 GVC_{ijt} + \rho_2 X_{ijt} + \gamma_j + \gamma_t + \varepsilon_{ijt} \quad (9)$$

where, Skilled is the number of skilled production workers in a given firm. As evidenced in empirical literature, domestic value added in manufacture exports in India, is positively associated with the presence of skilled labor (Aggarwal et al., 2021). Female employment is measured by three variables: the share of female overall employment, the share of female production workers, and the share of female non-production workers in a given firm. Again, GVC is measured by extensive shallow (GVC 1), comprehensive (GVC 4), and intensive measures. X is a vector of firm level control variables including firm age, firm size, share of government ownership, and formal registration[30]. $\gamma_j and\ \gamma_t$ are country and year fixed effects to control for unobserved heterogeneity. *ijt* denote firm, country, and year consecutively.

Our merged dataset includes 9,773 individual observation for 17 industries in 26 regions in Egypt (years 2006, 2012 and 2018), Jordan (year 2016), and Tunisia (year 2014). All data is individual

[29] Skill requirement is a binary variable in the ILMPs equal 1 if the job requires a skill and equals 0 otherwise. It is a subjective measure based on individuals' survey answers.
[30] Formal registration is based on the survey question: "Was the firm formally registered in the year of operation?"

and industry specific and rely on ILMPs fourth wave and WBES comprehensive datasets[31]. Table 3 presents variables' definition and sources.

Table 3. Definitions and sources of variables

Variable	Source	Definitions
Shallow extensive GVC (GVC 1)	WBES	Extensive GVC participation if the firm simultaneously import and export (two-way trade)
Comprehensive extensive GVC (GVC 4)	WBES	Extensive GVC participation if the firm is engaged in two-way trade, has foreign owned shares, and has international quality certification.
Intensive GVC	WBES	Intensive two-way trade: share of exports in total sales and share of foreign inputs in total inputs.
Female workers	WBES	Proportion of permanent full-time workers that are female
Female nonproduction workers	WBES	Proportion of permanent full-time nonproduction workers that are females
Female production workers	WBES	Proportion of permeant full time production workers that are females
Skilled production workers	WBES	Number of permanent skilled production workers
Firm age	WBES	Firm age in years
Firm size	WBES	Firm size by number of workers (small < 20, medium 20-99, large 100 or above)
Government ownership	WBES	Proportion of government/ state ownership in a firm in%
Formality	WBES	Firms with formal registration when started operation
Sector	WBES and ILMPs	World bank definition of 17 manufacturing sectors and services
Year	WBES and ILMPS	Year of survey
Country	WBES and ILMPS	Jordan, Egypt, and Tunisia
Region	WBES and ILMPS	26 matched geographical regions in Egypt, Jordan, and Tunisia
Real monthly wages in logarithm	ILMPs	Individuals' real monthly wages in PPP in logarithm
Education	ILMPs	Number of years of schooling
Individual's age	ILMPs	The age of the individual proxies experience
Gender	ILMPs	0 if male and 1 if female
Father education	ILMPs	1 if above secondary education
Mother education	ILMPs	1 if above secondary education
Father job irregularity	ILMPs	0 if regular job for father and 1 if irregular job of father
Trade union	ILMPs	0 if not belonging to a trade union and 1 if belonging to a trade union
Urban	ILMPs	0 if belonging to a rural area and 1 if belonging to an urban area
Job requiring a skill	ILMPs	0 if individual's job does not require a skill and 1 if job requires a skill

5. Empirical results

Our empirical analysis explore the GVCs effect on labor market outcomes in Egypt, Jordan, and Tunisia in a multifold step. First, using the Integrated Labor Market Panel Surveys (ILMPS) data, returns to labor (measured by real monthly wages and industry wage premium) are regressed on constructed and merged GVC measures while controlling for selection bias. Second, the direct and moderating effect of skill level are explored by interacting skill and GVCs variables and by employing ordinary least squares regressing skilled production workers on GVC measures. Third, relying on the WBES dataset, available female employment variables are regressed on GVCs to

[31] See Appendix B for the descriptive statistics.

explore the role of GVCs in decreasing bias against female employment in MENA countries. Finally, we explore the sectoral direct and moderating effect on female overall employment[32].

5.1 GVCs and wages

Starting with the effect of GVCs on individual real wages, Table 5 presents the results of the one step human capital model and the Heckman correction procedure[33] for Egypt, Jordan, and Tunisia. As presented in Columns (1), (2), and (3), the one-step human capital model regression results show an upward effect of both shallow, comprehensive, and intensive GVCs on real monthly wages. Extensive GVC measure differentiates between GVC and non-GVC firms. However, intensive GVCs measure the depth of GVC participation. While shallow and comprehensive GVCs are extensive measures, they have different definitions. Shallow GVC entails two-way trade only and comprehensive GVC is a stricter definition implying foreign ownership and international certification of the two-way trade firm.

Starting with the classic human capital model determinants of real wages, results align with the literature (Mincer, 1974; Zaki, 2013). As expected, females earn lower wages on average than males. Despite the worldwide phenomenon of lower female income, the MENA region has a particular higher bias against females due to cultural and traditional reasons affecting both the supply and demand of female employment. Likewise, belonging to rural area corresponds to lower real wage on average than belonging to urban areas. Aligned with Ananian and Dellaferrera (2024), rural areas' residents earn on average 24% less than urban areas' counterparts. As presented, experience, years of education, and parents' education corresponds to higher real wages due to the accompanying higher knowledge and skills fostering the demand for labor.

Moving to our variable of interest, both extensive GVCs coefficients reflect the average difference in wages between non GVC and GVC participants. As presented, while both shallow and comprehensive measures exert a positive effect on real wages, the latter is substantially higher in magnitude. In line with empirical literature, foreign equity is a key driver behind wages' increase (Bircan, 2019). As foreign ownership increases, firms tend to restrict labor turnover and "preserve firm-specific human capital" (Bircan, 2019). In Turkey for example, a 10% increase in foreign equity, corresponds to a 3.1% increase in average wages (Bircan, 2019). In our analysis on Egypt, Jordan, and Tunisia, results show that employees in two-way trading firms with foreign ownership and international certification earn 35% higher real wages on average than non-GVC counterparts. As for intensive GVCs, the positive association shows that the depth of GVC matters for real wages. In particular, higher foreign inputs share and/or higher share of exports in sales lead to higher real wages. In this respect, we infer that increasing the intensity of trade shares in two-way trading firms, corresponds to higher real wages in the countries under study[34]. Our results align

[32] In all regressions, we employ three constructed GVC participation measures: shallow GVC, comprehensive GVC, and intensive GVC respectively referred to as GVC 1, GVC 4, and intensive in all tables.
[33] All regressions are weighted, and standard errors are clustered by country and industry.
[34] For the results of each country separately, refer to Appendix C.

with Kamal (2024) showing that exporting and importing firms pay higher wages than non-exporters and non-importers in Egypt. The positive association is explained through the economies of scale and higher productivity rather than the labor force composition (Kamal, 2024).

To control for self-selection of individual characteristics-based low wages in non GVC participating firms, Columns (4), (5), and (6) present the results of the Heckman's correction procedure after controlling for bias due to parents' backgrounds. Following the bias exclusion criteria[35] and including the inverse Mills ratio, the second stage results show that only comprehensive and intensive GVCs preserve an upward effect on real wages. As presented, on average, comprehensive GVCs correspond to 31.6% higher real wages than non-GVC participants. Again, intensive GVCs emphasizing the effect of GVC integration depth shows a positive and significant effect on real wages. As further robustness check, Table 6 presents the OLS results while controlling for sector heterogeneity showing aligned results with Heckman correction procedure.

Table 5. GVC effect on wages: One step human capital model OLS and Heckman selection procedure

Dependent variable	**Log (real monthly wages)**					
	OLS			**Heckman correction**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	GVC 1	**GVC 4**	**Intensive**	**GVC 1**	**GVC 4**	**Intensive**
GVC	.066**	.356***	.782***	.044	.316**	.756***
	(.027)	(.053)	(.238)	(.032)	(.074)	(.112)
Years of schooling	.009***	.009***	.009***	.009***	.009***	.009***
	(.002)	(.002)	(.002)	(.001)	(.001)	(.001)
Experience	.022***	.021***	.022***	.018***	.018***	.018***
	(.002)	(.002)	(.002)	(.003)	(.003)	(.003)
$(Experience)^2$	-.0002***	-.0002***	-.0002***	-.0002***	-.0002***	-.0002***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Female	-.158***	-.159***	-.158***	-.174***	-.173***	-.176***
	(.028)	(.029)	(.027)	(.018)	(.016)	(.014)
Father education	.098***	.098***	.097***	.104***	.104***	.103***
	(.014)	(.014)	(.014)	(.009)	(.007)	(.009)
Mother education	.093***	.101***	.089***	.094***	.101***	.088***
	(.025)	(.025)	(.024)	(.013)	(.014)	(.013)
Trade union	.159***	.161***	.16***	.183***	.186***	.183***
	(.017)	(.016)	(.016)	(.015)	(.013)	(.012)
Rural	-.136**	-.132**	-.133**	-.202	-.196	-.196
	(.061)	(.063)	(.06)	(.11)	(.11)	(.109)
Inverse mills				-.242***	-.234***	-.239***
				(.084)	(.084)	(.084)
Constant	2.545***	2.542***	2.528***	2.525***	2.442***	2.459***
	(.075)	(.066)	(.071)	(.23)	(.174)	(.216)
No. of Obs.	9,773	9,737	9,773	5,949	5,925	5,949
R^2	.193	.196	.195	.206	.208	.208
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Clustered standard errors by region and sector are in parentheses*** p<.01, ** p<.05, * p<.1*

[35] Appendix D presents probit first stage regression results.

Table 6. Robustness check

Dependent variable	Log (real monthly wages)		
	OLS		
	(1)	(2)	(3)
	GVC 1	GVC 4	Intensive
GVC	.029	.486***	.81***
	(.037)	(.119)	(.24)
Years of schooling	.009***	.009***	.009***
	(.002)	(.002)	(.002)
Experience	.022***	.021***	.021***
	(.002)	(.003)	(.002)
(Experience) ^{2}	-.0002***	-.0002***	-.0002***
	(.001)	(.001)	(.001)
Female	-.157***	-.156***	-.157***
	(.028)	(.029)	(.027)
Father education	.1***	.099***	.098***
	(.014)	(.015)	(.014)
Mother education	.098***	.103***	.093***
	(.027)	(.026)	(.025)
Trade union	.157***	.158***	.156***
	(.016)	(.016)	(.016)
Rural	-.136**	-.133**	-.134**
	(.061)	(.064)	(.061)
Inverse mills	2.546***	2.532***	2.511***
	(.072)	(.066)	(.068)
Constant	9773	9737	9773
R^2	.194	.197	.197
Region FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes

*Notes: Clustered standard errors by region and sector are in parentheses*** p<.01, ** p<.05, * p<.1*

So far, our results show a robust positive effect of comprehensive and intensive GVC participation on individual real wages. In our empirical analysis, we explore the GVC effect at the industry level as well. To do so, we employ industry wage premium two stage analysis (Gaston & Trefler, 1994; Salem & Zaki, 2019; Falcone & Galeano, 2017). Table 7 shows the results of the effect of GVCs on normalized industry wage premium[36]. As presented, when controlling for country and sector heterogeneity, comprehensive and intensive GVCs exert a positive and significant on industry wage premium. On average, comprehensive GVC participation corresponds to 8.8% higher industry wage premium than non GVC participants. In particular, aligning with the mentioned results of robustness check on the GVC effect on individual wages, shallow GVC participation shows an insignificant effect on industry wage premium. Likewise, at the industry level, the depth of participation measured by intensive GVC is weakly significant.

Our industry level results show that foreign ownership and international certification are necessary covariates in witnessing GVC driven up scaled wage premia. Despite empirical evidence on the positive association between exporting firms and labor demand in MENA countries (Alabed et al., 2022), our analysis reveals a merely positive effect when restricting the GVC definition to include

[36] For the first stage regression results estimating the industry wage premium, refer to Appendix E1.

foreign ownership and international certification. At both the individual and industry levels, comprehensive GVC participation leads to higher productivity.

Table 7. GVC effect on normalized wage premium

Dependent variable	Log of normalized industry wage premium		
	(1)	(2)	(3)
	GVC 1	GVC 4	Intensive
GVC	.697	8.846***	6.41*
	(.799)	(2.792)	(3.316)
Constant	2.476***	.919	2.121**
	(.861)	(.865)	(.836)
No. of Observations	58	58	58
R^2	.342	.506	.356
Sector FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes

Notes: Robust standard errors are in parentheses

The evidenced upward GVC effect on individual and industry wages is consistent with neoclassical and new trade theoretical and empirical frameworks. Due to a multifold mechanism, GVC participation increases productivity at both the individual and industry levels. First, due to the market scale effect, GVC integrated firms are more productive and efficient (Aghion et al., 2004). Our results show that both comprehensive and intensive GVC foster better allocation of resources reflected in increased wages and wage premium. Second, GVC participation has a selection effect forcing least efficient firms to exit the market and hence overall industry efficiency increases. (Melitz, 2003). Firms exiting the market due to vulnerability are less efficient paying lower than average wages. Hence, due to their exit, industry wages increase. Third, GVCs induces foreign knowledge spillovers to developing countries like Egypt, Jordan, and Tunisia (Eissa & Zaki, 2023) leading to increased productivity. This learning effect is particularly important for MENA countries lagging behind the technological world frontier.

We then extend the analysis to explore one relevant labor market dimension to the MENA region. First, the low skill level in the region has labor market mismatches limiting the opportunities of job seekers. Despite the increase in school enrollment levels, graduates lack the knowledge and skills necessary for a smooth entry to the labor market (ILO, 2017). Through the transferability of skills across participants, GVCs potentially boosts skill levels in engaged firms.

5.2 GVCs and skill level

Through similar mechanisms to boosting productivity, GVC participation plays a role in skill upgrading across upstream and downstream activities. From a sectoral lens, the most integrated sectors in GVCs across the MENA countries under study are apparel (textiles and garments) and chemicals[37]. In terms of skill intensities measured by the number of skilled production workers employed, chemicals are intensive in skilled production workers[38]. Although firms' position along

[37] WBES elaboration.
[38] 53% of total employment.

the value chain is uncertain, the sector of activity and job skill requirement across jobs signal if the GVC participating firm is positioned in high value towards the chain end like finished goods, or low value-added mid-way position activities like assembly. In contrast to low value-added activities intensive in skilled labor, high value added one require skilled labor.

To diagnose the skill requirement moderating effect on real wages, Table 8 presents the results of GVC interaction with the skill requirement variable. Using the ILMPs dataset, the skill requirement is a dummy variable equals zero if the job does not require a skill and equals to 1 otherwise. As presented, both OLS and Heckman correction methodologies show a consistent positive direct effect of skill requirement on real wages. Likewise, Columns (1) and (3) show a strengthening skill requirement effect on the positive GVCs effect on real wages[39]. Using OLS, the strengthening effect is consistent with the shallow and intensive GVC definitions showing that simultaneous two-way trade is sufficient for realizing the strengthening role of skill requirement on real wages. In addition, results signal that high value added GVC positions realize a higher GVC effect on real wages than low value-added ones.

Besides the moderating role of skill requirement, it is important to explore the effect of GVC participation on the number of skilled labor employment to evidence the extent of GVC relevance to boosting skill levels in countries suffering from sticky low skills and labor market mismatch. By employing the WBES dataset, Table 9 presents the OLS regression results of the GVC effect on the number of skilled permanent production workers in Egypt, Jordan, and Tunisia. As presented, on the extensive margin, both shallow and comprehensive GVC participation extensive measures, exhibit a positive effect on the number of skilled production workers. Despite a positive effect of intensive GVC, the magnitude is rather smaller than extensive measures.

From the skill level dimension, we conclude that extensive GVC matters more than the depth of integration. Shifting from non-GVC to GVC participant is a sufficient condition for a firm to realize higher employment of skilled production workers. Firms have a higher number of skilled employment than non-GVC counterparts. Aligning with the literature, GVC is concentrated in capital-intensive sectors generating higher demand for skilled labor (World Bank, 2020). Because of limited supply of skilled labor in the MENA region, the inelasticity upscale wages for skilled more than unskilled labor (Hale & Zu, 2016). Our empirical results on the GVC and skills nexus emphasize the relevance of moving up more value-added activities requiring skills to the GVC effect on real wages. In addition, GVC participation increases the demand for skilled production workers and hence plays a role in boosting skill level in MENA countries endowed with unskilled labor. Results align with the skill biased technological change trade theory (Feenstra & Hanson, 1996). Indeed, GVCs spur the demand for skilled labor to the end of moving to a higher value-

[39] Appendix F shows consistent results for Egypt.

added chain activity. From another angle, GVCs lead to higher levels of innovation (Eissa & Zaki, 2023) inducing higher skill level.

As for the control variables, larger and newer firms have a higher share of skilled production workers. For larger firms, skilled labor demand is higher due to the higher intensity of physical capital requiring skilled labor due to the complementarity between the two (Idson & Oi, 1999). As for firm age, newer firms tend to be more innovative and hence require higher skill level than non-innovative counterparts. This result aligns with Aboushady and Zaki (2020) evidencing a positive association between innovation performance and skilled production labor demand in MENA countries. As for the informality, our results show an insignificant effect on skilled production workers. Across the three countries under study, Egypt has highest informality and yet the highest labor market skill requirement[40]. As presented, informality has an insignificant effect on skilled production workers employment. Particularly in Egypt, empirical studies on MENA countries show that the productivity differential between formal and informal firms is insignificant (Hendy & Zaki, 2013).

Table 8. GVC interaction with skill requirement

Dependent variable	**Log (real monthly wages)**					
	OLS			**Heckman correction**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	GVC 1	**GVC 4**	**Intensive**	**GVC 1**	**GVC 4**	**Intensive**
GVC	.027	.339***	.615**	.035	.355***	.795**
	(.036)	(.081)	(.285)	(.053)	(.021)	(.21)
Skill	.012	.026***	.021**	.044***	.048***	.046***
	(.01)	(.009)	(.01)	(.001)	(.002)	(.005)
Skill*GVC	.072**	.011	.534**	-.001	-.085	.135
	(.029)	(.095)	(.221)	(.038)	(.077)	(.24)
Years of schooling	.009***	.009***	.009***	.009***	.009***	.009***
	(.002)	(.002)	(.002)	(.001)	(.001)	(.001)
Experience	.022***	.021***	.021***	.019**	.018**	.018**
	(.002)	(.003)	(.002)	(.006)	(.006)	(.006)
$(Experience)^2$	-.0002***	-.0002***	-.0002***	-.0002*	-.0002	-.0002*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Female	-.157***	-.157***	-.157***	-.174***	-.174***	-.177***
	(.028)	(.029)	(.027)	(.018)	(.016)	(.013)
Father education	.093***	.093***	.092***	.097***	.097***	.095***
	(.014)	(.014)	(.014)	(.014)	(.012)	(.014)
Mother education	.097***	.104***	.091***	.102***	.108***	.095***
	(.024)	(.023)	(.022)	(.015)	(.015)	(.013)
Trade union	.156***	.158***	.156***	.175***	.178***	.174***
	(.016)	(.016)	(.016)	(.013)	(.012)	(.009)
Rural	-.13**	-.127**	-.13**	-.186	-.182	-.176
	(.06)	(.062)	(.057)	(.109)	(.107)	(.109)
Inverse Mills				-.239***	-.227***	-.23***
				(.025)	(.007)	(.015)
Constant	2.553***	2.537***	2.529***	2.476***	2.393***	2.375***
	(.077)	(.067)	(.07)	(.23)	(.18)	(.212)
No. of Observations	9,768	9,732	9,768	5,948	5,924	5,948
R^2	.196	.198	.198	.211	.213	.214
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Clustered standard errors by country and sector are in parentheses*** p<.01, ** p<.05, * p<.1. Skill is a dummy variable equals 0 if no skill is required in job and equals 1 if skill is required in job.*

[40] ILMPs data elaboration.

Table 9. GVCs and skilled employment

Dependent variable	Log (number of permanent skilled production workers)		
	GVC 1	**GVC 4**	**Intensive**
GVC	.219***	.262**	.004***
	(.06)	(.133)	(.001)
Age	-.008***	-.007***	-.007***
	(.001)	(.001)	(.001)
Government	-.321*	-.333**	-.299*
	(.167)	(.168)	(.169)
Medium	.531***	.561***	.53***
	(.049)	(.048)	(.048)
Large	.598***	.665***	.594***
	(.059)	(.054)	(.056)
Formally registered	.011	.013	.021
	(.07)	(.07)	(.07)
Constant	.881***	.939***	.842***
	(.126)	(.125)	(.126)
Observations	5,737	5,744	5,723
R^2	.174	.17	.176
Country FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

In summary, employing a threefold empirical strategy evidence a robust upward GVC effect on labor wages in Egypt, Jordan, and Tunisia. In addition, firms' GVC position signaled from skill requirement strengthens the GVC upward effect on real wages. Despite unskilled labor abundance in the countries under study, skill requirement fosters the gains of GVCs participation in terms of labor conditions. Worth mentioning, while both OLS and Heckman correction methodologies show a consistent positive effect of skill requirement on wages, the latter's strengthening GVC effect on wages is merely revealed in OLS regression analysis.

Beside the skill level upgrading, gender divide is another core challenge in MENA countries recognized by highest gender bias measures. The rest of our empirical analysis is devoted to addressing the GVC participation effect on different female employment measures as well as the moderating role of sectors.

5.3 GVCs and female employment

In our analysis, we rely on the WBES comprehensive dataset for Egypt, Jordan, and Tunisia to explore the GVCs effect on the shares of production (blue-collar) and non-production (white collar) female workers in total employment. Although the particularly sticky female employment MENA countries is rationalized by the stringent social norms and traditions (Chamlou et al., 2011), yet, on top of cultural factors limiting labor market participation, females in MENA countries face structural barriers in employment (Idowu, 2019).

Table 10 presents the results of the GVCs effect on the shares of full time non-production (white collar) and production (blue collar) female workers. Starting with the control variables affecting female employment, larger firms have higher shares of female production and non-production workers. In contrast, formal registration and government ownership positively affects female

white-collar but not female blue-collar workers. The increased white-collar demand in formal firms reflects higher access to finance than informal private firms. Yet, it is important to note that formal registration measure reflects the status of firm at the beginning of operation and not the actual status. Likewise, compared to the private sector, the government sector is a larger employer of women (Kalliny & Zaki, 2022). Our results show that this tendency is more evident for white rather than blue collar female employment. In contrast, newer firms have higher shares of blue-collar female workers, but the effect is muted for full time white-collar female workers.

Withstanding the heterogeneity in control variables effects on different female employment, GVCs have a consistent positive effect on both production and non-production female workers. Our results align with empirical literature showing a positive effect of trade determinants on female employment in Egypt (Kamal, 2024). In parallel, we evidence a positive association between GVC and female employment in Egypt, Jordan, and Tunisia. Because of the standardization effect and lower costs incentive, GVC integration reduces the gender bias in MENA countries. In addition, shallow GVC matters more than comprehensive GVC including foreign ownership and certification. When it comes to gender bias, foreign ownership is not as relevant as in real wages. On average, a two-way trading firm has 30% higher female non-production workers, and 22% higher female production workers share than a non GVC firm. Furthermore, the depth of participation measured by intensive GVC exert a slight positive effect on different types of female employment.

The mechanism through with GVC participation stimulates female employment in Egypt, Jordan, and Tunisia is twofold. First, to the end of standardization of conditions with foreign counterparts, GVC participants apply policies soothing the bias against female employment. These policies include paid maternity leaves, childcare services, and flexible working hours (Moghadam, 2002). The standardization effect targets the de jure factors behind discrimination in employment. Second, GVC participation and opening to foreign markets enhance diversification in resources. Indeed, employment of females augments the diversity of skills explaining the GVC driven demand for production and non-production female workers (Griffith & Van Reenen, 2004).

To further analyze the mechanism behind the role of GVCs in reducing gender bias in MENA countries, we need to consider the sectoral dimension. Reasonably, if GVCs activities in the region are concentrated in apparel for example, then fostering GVCs absorbs the resources intensive in this sector (females). In contrast, if more machinery, construction, and electronics are produced, then fostering GVCs absorbs more males than females and hence widens the gender gap. Since GVC participation in MENA countries are intensive in textiles and garments[41], and since the share of female employment in apparel sector is the highest (41.4%)[42], then it is not surprising to observe the role of GVCs in reducing gender gaps.

[41] WBES elaboration.
[42] Appendix A presents female and skilled labor intensities across sectors .

To empirically scrutinize the sectoral dimension, Table 11 presents the results of the effect of GVCs on overall female employment as well as the moderating effect of sectors. Concerning the control variables, newer, larger, and formally registered firms are significant determinants of the share of overall female employment. Again, shallow GVC matters more in both significance and magnitude to overall female employment.

In regard to sectors', followed by services, apparel manufacturing has the highest direct effect on female overall full-time employment. In addition, in reference to machinery manufacturing, food, electronics, chemicals, and other manufacturing exert a direct positive effect on the share of female full-time overall employment. Despite the direct effect, none of the sectors positively interact with GVCs in fostering the positive effect on female employment. One of the reasons behind the silent interaction is the small number of observations for GVC participants in the countries under study.

Against our analysis, we imply the important role of GVCs in reducing gender bias in employment in the MENA region with well-recognized gender inequality paradox. The mechanism of the GVC role comes down to the standardization of conditions, diversification of resources, and the fact that across the countries under studies, apparel sector is the most intensive in GVCs participation and has the highest share of female employment. Our results witness a direct positive effect of services as well as other manufacturing sectors on female employment. Although significant, the intensive GVC measure is not showing a high magnitude when it comes to gender bias in employment. Indeed, shallow GVC is the premier driving measure in fostering female employment. To the end of reducing gender bias, it is important to transport firms from non GVC to two-way trade participants in the MENA countries. In addition, enhancing apparel manufacturing and services will have a direct positive effect on reducing gender bias in employment.

To conclude our empirical analysis, our results show that GVC participation positively fosters labor market outcomes measured by real wages, industry wage premium, skilled, and female employment. First, the GVC extensive comprehensive GVC and intensive GVC show a robust positive effect on both real wages and industry wage premium. Second, skill requirement in the job strengthens the positive GVC effect on real wages. Third, inclusive to production and non-production female workers, particularly shallow two-way trade definition, GVCs reduce gender bias in the MENA region destined with a particularly high gender bias. Due to higher demand for employment diversity and better access to finance, larger, government owned and formally registered firms are better performing in terms of non-production female employment than smaller, privately owned, and informal counterparts. Considering the sectoral analysis, aligned with global trends, our results on MENA countries show that services apparel sectors have the highest magnitude in fostering female employment. Yet, the strengthening role of sectors in the GVC driven gender equality is unclear. Based on empirical findings, we draw a principal conclusion that encouraging GVC participation accelerate the convalesces of labor market conditions in MENA countries in terms of real wages, wage premium, skilled, and female employment.

Table 10. GVCs and female employment

Dependent variable	Female full-time non-production workers			Female full-time production workers		
	(1)	(2)	(3)	(4)	(5)	(6)
	GVC 1	GVC 4	Intensive	GVC 1	GVC 4	Intensive
GVC	.301***	.211*	.004***	.219***	.262**	.004***
	(.058)	(.118)	(.001)	(.06)	(.133)	(.001)
Firm age	-.002	-.002	-.002	-.008***	-.007***	-.007***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Government ownership	.386*	.365*	.392*	-.321*	-.333**	-.299*
	(.206)	(.209)	(.207)	(.167)	(.168)	(.169)
Medium	.878***	.918***	.902***	.531***	.561***	.53***
	(.05)	(.05)	(.05)	(.049)	(.048)	(.048)
Large	1.273***	1.385***	1.327***	.598***	.665***	.594***
	(.059)	(.053)	(.056)	(.059)	(.054)	(.056)
Formally registered	.186***	.187***	.191***	.011	.013	.021
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
_cons	.484***	.57***	.492***	.881***	.939***	.842***
	(.119)	(.121)	(.121)	(.126)	(.125)	(.126)
Observations	5,653	5,656	5,638	5,737	5,744	5,723
R-squared	.178	.177	.199	.174	.17	.176
Country FE	Yes	Yes	Yes	.219***	.262**	.004***
Sector FE	Yes	Yes	Yes	(.06)	(.133)	(.001)
Year FE	Yes	Yes	Yes	-.008***	-.007***	-.007***

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

Table 11. Sectoral analysis

	Female full-time workers			Female full-time workers		
	GVC 1	GVC 4	Intensive	GVC 1	GVC 4	Intensive
GVC	.401***	.295***	.004***	.494***	.635**	.004*
	(.049)	(.104)	(.001)	(.106)	(.267)	(.002)
Firm age	-.003***	-.002**	-.006***	-.005***	-.004***	-.006***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Government ownership	.176	.103	.09	.05	-.014	-.013
	(.142)	(.135)	(.159)	(.158)	(.151)	(.165)
Medium	.636***	.652***	.745***	.654***	.664***	.745***
	(.037)	(.036)	(.046)	(.039)	(.038)	(.045)
Large	.643***	.731***	.814***	.71***	.759***	.829***
	(.045)	(.041)	(.05)	(.047)	(.043)	(.05)
Formally registered	.19***	.201***	.113*	.14**	.15**	.103
	(.059)	(.059)	(.066)	(.059)	(.06)	(.065)
Apparel				1.513***	1.501***	1.455***
				(.065)	(.056)	(.061)
Food				.938***	.936***	.904***
				(.06)	(.057)	(.06)
Electronics				.524***	.525***	.423***
				(.124)	(.108)	(.119)
Chemicals				.998***	.858***	.885***
				(.09)	(.076)	(.083)
Wood				.117*	.104	.087
				(.069)	(.069)	(.07)
Non-metallic/Plastic				.301***	.292***	.295***
				(.061)	(.057)	(.06)
Other manuf.				.866***	.745***	.755***
				(.127)	(.118)	(.124)
Services				1.185***	1.145***	.553***
				(.048)	(.046)	(.086)
GVC*Apparel				-.272**	-.721**	-.003

Table 11. Sectoral analysis (continued)

	Female full-time workers			Female full-time workers		
	GVC 1	**GVC 4**	**Intensive**	**GVC 1**	**GVC 4**	**Intensive**
				(.133)	(.327)	(.002)
GVC*Food				.002	-.611*	.003
				(.152)	(.369)	(.003)
GVC*Electronics				-.238	-.868	.003
				(.239)	(.74)	(.004)
GVC*Chemicals				-.696***	-.607	-.007**
				(.168)	(.369)	(.003)
GVC*Wood				-.194		-.004
				(.237)		(.004)
GVC*Non-metallic/Plastic				-.122	.12	0
				(.156)	(.371)	(.003)
GVC*Other manuf.				-.541*	-.324	-.004
				(.314)	(.717)	(.005)
GVC*Services				-1***	-1.249**	-.004
				(.191)	(.604)	(.003)
Constant	1.069***	1.111***	1.069***	-.292**	-.206*	.082
	(.096)	(.094)	(.096)	(.114)	(.111)	(.152)
Observations	8880	9274	8880	7716	8055	5528
R^2	.174	.17	.174	.255	.249	.312
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

6. Conclusion

Studying channels to boost labor market outcomes is particularly relevant to the MENA region with prevalent weak labor markets. Besides low skill levels creating mismatches in job markets, the MENA region is the highest in terms of gender inequality indicators. The particularly high gender inequality in the MENA region has de facto and de jure dimensions. Among other factors, de facto reasons repelling females from labor markets include stringent societal gender roles in the region's culture and traditions and concentration of activities in male dominant sectors like construction and extraction. From another side, de jure reasons like lack of enforceable polices fostering gender equality and soothing female employment barriers in employment conditions restricts female production and non-production employment.

In light of the global fast-growing trade in intermediate goods trend, this Discussion Paper empirically investigates the role of GVC participation in fostering labor market outcomes in the MENA region. We employ the integrated labor market dataset for Egypt, Jordan, and Tunisia to contribute to the nexus between GVC participation on three labor market pillars being them wages, skilled employment, and female employment. Relying on the WBES, we construct three GVC measures: shallow, comprehensive, and intensive GVC. While both shallow and comprehensive are extensive GVC measures differentiating between participants and non-participants, intensive GVC measures the depth of two-way trade by calculating the share of exports in total sales and the share of foreign inputs in total inputs. To scrutinize the GVC effect on wages, we match and merge the WBES with the ILMPs at the geographical area, sector, and year levels.

By employing a threefold methodology, we evidence a robust positive GVC effect on labor market outcomes. First, when controlling for selection bias and using sector fixed effect, both comprehensive and deep GVC measures preserve the positive effect on individual real wages and industry wage premium. Second, jobs requiring a skill strengthen the positive GVC effect on real wages. Third, at the firm level, all GVC exerts a positive effect on skilled production workers. This effect matters for the extensive rather than the intensive GVC measures. Fourth, from the gender equality dimension, shallow extensive GVC fosters the shares of blue-collar and white-collar female employment. Finally, from a sectoral lens, apparel and services sectors have the highest positive effect on overall female employment. Yet, sectors do not show a moderating effect to GVC driven female employment.

The evidence of a positive GVC effect on labor market outcomes matches theoretical frameworks of New trade theory. First, at the individual level, the procompetitive effect of GVC integration increases real wages. Second, since each firm produces more output to satisfy higher demand after integration, productivity increases are reflected in higher wages and wage premiums. Third, because not all firms can face higher competition after integration, the least efficient producers exit the market leading to higher industry wage premium. Fourth, due the skill biased nature of GVCs, skill requirement strengthens the effect on wages and GVCs have a direct positive effect on skilled production workers employment. Fifth, through standardization of conditions across chain participants as well as increased demand for resource diversification, we witness a positive effect of GVCs on different female employment measures. Finally, females are most intensive in textiles and garments (Frederick et al., 2022), and GVCs are intensive in these sectors in the MENA region. Hence, the positive GVCs effect on female employment is reasonable.

By focusing on different job market indicators affected by increased GVC participation, we tackle two chief SDGs aimed to be reached by the year 2030. While SDG 8 targets higher quality and quantity of jobs, SDG 5 focuses on gender equality that can be indicated by higher female employment. Our results are particularly important to the MENA region having the highest youth unemployment and gender bias due to prevalent cultural, institutional, and autocratic conditions. Although the aftermath of the Arab Spring does not show better performance in labor markets including gender bias, GVCs integration is a new opportunity to achieving global goals of decent work and gender equality in the MENA region.

From a policy standpoint, the positive GVC effect on labor market is realized through a threefold recommendation. First, due to the evidenced strengthening effect of skill requirement, investing in human capital is key to avoiding job market mismatches between youth and global job market requirements. Obviously, increasing the years of education is insufficient to boost the sticky skill level in the region. To complement education, providing training to production and non-production workers is necessary. Second, fiscal policy plays a key role in supporting female friendly sectors like apparel. Likewise, increasing public support to small and medium firms is necessary to increasing the ability to offering employees' training to the end of increasing skill levels. Third,

enforcement of laws targeting gender equality is key to decreasing the barriers to female employment and allows for realizing the GVC positive effect. Finally, from a trade policy perspective, facilitating GVCs integration within and across regions directly boosts labor market outcomes in the MENA region.

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Appendix

Appendix A. Shares of female and skilled employment across sectors

Industry	Gender			Production workers		
	Males	Females	Total	Unskilled	Skilled	Total
Basic metals	171	15	186	73	112	185
	91.94	8.06	100.00	39.46	60.54	100.00
Chemical products	367	53	420	197	223	420
	87.38	12.62	100.00	46.90	53.10	100.00
Fabricated metals	529	6	535	117	407	524
	98.88	1.12	100.00	22.33	77.67	100.00
Food	1125	103	1228	785	440	1225
	91.61	8.39	100.00	64.08	35.92	100.00
Furniture and wood products	1290	156	1446	286	901	1187
	89.21	10.79	100.00	24.09	75.91	100.00
Textile and garments	761	538	1299	436	750	1186
	58.58	41.42	100.00	36.76	63.24	100.00
Printing and publishing	359	138	497	154	342	496
	72.23	27.77	100.00	31.05	68.95	100.00
Non-metallic mineral products	349	16	365	167	198	365
	95.62	4.38	100.00	45.75	54.25	100.00
Petroleum products, plastics and rubber	349	44	393	198	193	391
	88.80	11.20	100.00	50.64	49.36	100.00
Machinery and equipment	1044	77	1121	203	812	1015
	93.13	6.87	100.00	20.00	80.00	100.00
Other manufacturing	470	184	654	83	417	500
	71.87	28.13	100.00	16.60	83.40	100.00
Construction	6633	85	6718	3123	3334	6457
	98.73	1.27	100.00	48.37	51.63	100.00
Information technology and communication	532	119	651	280	319	599
	81.72	18.28	100.00	46.74	53.26	100.00
Accommodation and food services	1692	111	1803	1182	469	1651
	93.84	6.16	100.00	71.59	28.41	100.00
Wholesale and retail	8560	1717	10277	7127	2287	9414
	83.29	16.71	100.00	75.71	24.29	100.00
Transportation and storage	4534	107	4641	2273	2063	4336
	97.69	2.31	100.00	52.42	47.58	100.00
Other services	1704	177	1881	819	927	1746
	90.59	9.41	100.00	46.91	53.09	100.00
Total	30469	3646	34115	17503	14194	31697
	89.31	10.69	100.00	55.22	44.78	100.00

Appendix B. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Shallow extensive GVC (GVC 1)	9,622	.155	.362	0	1
Comprehensive extensive GVC (GVC 4)	10,100	.019	.136	0	1
Intensive GVC	6,339	11.33	27.356	0	100
Female workers	9,529	17.18	23.777	1	101
Female nonproduction workers	5,809	17.84	25.959	1	101
Female production workers	5,906	15.42	27.066	1	101
Female workers in log	9,529	1.69	1.651	0	4.615
Female nonproduction in log	5,809	1.49	1.773	0	4.615
Female production workers in log	5,906	1.17	1.709	0	4.615
Skilled production workers	5,887	66.69	181.43	0	3000
Firm age	10,048	21.22	15.851	1	139
Firm size	10,167	1.74	.775	1	3
Government ownership	10,108	.54	5.838	0	99
Formal registration	10,066	.923	.267	0	1
Sectors	8,262	8.3	5.21	1	17
Real monthly wages in logarithm	35,866	2.778	.345	-.26	5.987
Number of years of education	163,389	7.42	5.325	0	61
Individual's age	197,345	26.92	20.171	0	115
Gender (1 if female)	197,205	.502	.5	0	1
Father education	163,193	.074	.261	0	1
Mother education	163,097	.042	.201	0	1
Father job irregularity	84,273	.283	.45	0	1
Trade union	48,086	.184	.387	0	1
Urban	197,437	1.518	.5	1	2
Year of survey	197,445	2013.576	4.301	2006	2018
Job requiring a skill	53,528	.373	.484	0	1

Appendix C. Weighted Least Squares baseline for each country

	Egypt			Jordan			Tunisia		
Dependent variable	**Log (real monthly wages)**			**Log (real monthly wages)**			**Log (real monthly wages)**		
	GVC 1	**GVC 4**	**Intensive**	**GVC 1**	**GVC 4**	**Intensive**	**GVC 1**	**GVC 4**	**Intensive**
GVC	.066**	.376***	.843**	.124***	.247***	.549***	-.026	.78**	1.761***
	(.029)	(.061)	(.308)	(.026)	(.028)	(.087)	(.255)	(.264)	(.499)
Years of schooling	.01***	.01***	.01***	.014	.014	.014	.006	.01	.012
	(.002)	(.002)	(.002)	(.008)	(.008)	(.008)	(.014)	(.013)	(.013)
Experience	.006***	.006***	.006***	.004*	.004*	.004*	.006**	.005**	.005**
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.001)
Female	-.169***	-.171***	-.17***	-.016	-.014	-.013	.179	.2	.195
	(.032)	(.033)	(.031)	(.067)	(.067)	(.067)	(.27)	(.274)	(.271)
Father education	.099***	.099***	.098***	.074**	.073*	.068*			
	(.015)	(.015)	(.015)	(.027)	(.03)	(.03)			
Mother education	.098***	.107***	.093***	.025	.025	.03			
	(.028)	(.027)	(.027)	(.071)	(.07)	(.07)			
Trade union	.159***	.161***	.16***	.099***	.102***	.098***	-.232	-.269	-.286
	(.018)	(.018)	(.017)	(.018)	(.021)	(.017)	(.151)	(.152)	(.161)
Rural	-.203***	-.201***	-.198***	-.024	-.019	-.021	-.042	-.024	-.042
	(.058)	(.06)	(.056)	(.12)	(.122)	(.121)	(.051)	(.065)	(.055)
Constant	2.68***	2.687***	2.686***	2.674***	2.702***	2.689***	2.693***	2.345***	2.443***
	(.062)	(.064)	(.059)	(.142)	(.156)	(.164)	(.229)	(.297)	(.269)
No. of Observations	8863	8827	8863	820	820	820	90	90	90
R^2	.18	.184	.182	.06	.058	.061	.115	.171	.182
Year FE	Yes	Yes	Yes	No	No	No	No	No	No
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Clustered standard errors by region and sector are in parentheses*** p<.01, ** p<.05, * p<.1*

Appendix D1. Heckman Selection Stage 1 probit regression results

Dependent variable	**Employment**	
	(1)	**(2)**
Years of schooling	.009**	.01**
	(.005)	(.005)
Experience	.044***	.046***
	(.008)	(.008)
Female	-.033	-.005
	(.055)	(.054)
Father irregular job	-.131***	-.157***
	(.05)	(.05)
Father education	.065	.058
	(.106)	(.104)
Mother education	.018	.008
	(.179)	(.178)
Trade union	.472***	.451***
	(.082)	(.078)
Rural	-.067	-.052
	(.124)	(.122)
Constant	.825***	1.094***
	(.29)	(.281)
No. of Observations	28619	28619
Pseudo R^2	.074	.055
Year FE	Yes	No
Country FE	No	Yes
Region FE	Yes	Yes

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

Appendix D2. Heckman Selection Stage 2 results on Egypt

Dependent variable	Log (real monthly wages)		
	Simple	**Complex**	**Intensive**
GVC	.051	.387***	.812**
	(.035)	(.063)	(.309)
Inverse Mills	-.222**	-.195*	-.214*
	(.1)	(.095)	(.101)
Years of schooling	.009***	.009***	.009***
	(.002)	(.002)	(.002)
Experience	.02***	.019***	.02***
	(.003)	(.004)	(.003)
$(\text{Experience})^2$	-.0002***	-.0002***	-.0002***
	(.001)	(.001)	(.001)
Female	-.173***	-.174***	-.175***
	(.029)	(.03)	(.027)
Father education	.103***	.104***	.103***
	(.015)	(.016)	(.015)
Mother education	.099***	.11***	.093***
	(.024)	(.023)	(.022)
Trade union	.177***	.178***	.176***
	(.022)	(.022)	(.022)
Rural	-.272***	-.265***	-.266***
	(.073)	(.079)	(.071)
Constant	2.582***	2.578***	2.583***
	(.123)	(.124)	(.119)
No. of Observations	5891	5867	5891
R^2	.211	.215	.213
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes

*Notes: Clustered standard errors by region and sector are in parentheses*** p<.01, ** p<.05, * p<.1*

Appendix E1 Industry Wage premium stage 1 WLS

Dependent variable:	Log (real monthly wages)				
	Egypt 2006	**Egypt 2012**	**Egypt 2018**	**Jordan 2016**	**Tunisia 2014**
Years of schooling	.006***	.009***	.007***	.025***	.006
	(.001)	(.001)	(.001)	(.003)	(.004)
Experience	.027***	.019***	.025***	.018***	.027***
	(.002)	(.003)	(.003)	(.005)	(.007)
$(Experience)^2$	-.0002***	-.0002***	-.0002***	-.0002***	-.0002***
	(.001)	(.001)	(.001)	(.001)	(.001)
Female	-.176***	-.113***	-.173***	-.096***	-.089*
	(.017)	(.019)	(.028)	(.026)	(.049)
Father education	.172***	.122***	.049*	.024	-.135**
	(.027)	(.025)	(.027)	(.031)	(.067)
Mother education	.017	.099**	.083**	.016	
	(.055)	(.05)	(.038)	(.044)	
Trade union	.104***	.127***	.164***	.159***	.107
	(.013)	(.018)	(.026)	(.03)	(.073)
Rural	-.08***	-.193	-.152***	-.084**	-.033
	(.015)	(.131)	(.021)	(.034)	(.032)
Chemicals	.009	-.057		-.192*	-.012
	(.05)	(.05)		(.115)	(.067)
Fabricated metals	.008	-.041	-.15**	-.232**	-.124**
	(.065)	(.043)	(.062)	(.115)	(.06)
Furniture and wood	.068**	-.013	-.293***	-.219*	.014
	(.034)	(.042)	(.094)	(.114)	(.058)
Textiles and garments	0	-.106***	-.115**	-.305***	-.005
	(.03)	(.039)	(.049)	(.116)	(.078)
Printing and publishing	-.004	-.069	-.094*	-.142	.031
	(.029)	(.064)	(.057)	(.114)	(.051)
Non-metallic minerals	.133***	-.056		-.087	-.008
	(.047)	(.046)		(.131)	(.048)
Plastics and rubber	.071	.067	.022	-.125	
	(.049)	(.044)	(.053)	(.117)	
Machinery & eq.	.027	.001		-.156	-.01
	(.03)	(.047)		(.118)	(.059)
Other manufacturing	.032	-.136**	-.109	-.217	
	(.056)	(.061)	(.096)	(.171)	
Construction	.078***	-.074**	-.114***	-.28**	-.067*
	(.027)	(.037)	(.044)	(.116)	(.039)
IT and communication	.01	.001	.062	-.126	.119
	(.036)	(.049)	(.071)	(.116)	(.077)
Accommodation	.058*	-.078**	-.093**	-.193*	-.038
	(.031)	(.04)	(.046)	(.114)	(.046)
Wholesale and retail	-.006	-.11***	-.152***	-.238**	-.116**
	(.027)	(.037)	(.045)	(.113)	(.046)
Transportation & storage	.104***	-.079**	-.107**	-.192*	-.058
	(.027)	(.037)	(.045)	(.111)	(.062)
Other services	-.178***	-.181***	-.196***	-.333***	-.111**
	(.031)	(.04)	(.047)	(.117)	(.055)
Food		-.098**	-.121**	-.213*	-.094**
		(.043)	(.047)	(.114)	(.046)
Constant	2.244***	2.554***	2.478***	2.645***	2.348***
	(.054)	(.147)	(.071)	(.155)	(.153)
No. of Observations	3,731	5,218	5,112	3,382	637
R^2	.319	.181	.146	.151	.127
Region FE	Yes	Yes	Yes	Yes	Yes

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

Appendix E2. Wage premium Egypt

Dependent variable:	Log (wage premium)					
	GVC 1	GVC 4	Intensive	GVC 1	GVC 4	Intensive
GVC	-.762	9.397**	5.138	.681	33.853***	8.904
	(.98)	(3.539)	(3.758)	(1.041)	(3.536)	(10.418)
Constant	2.057***	1.309***	1.711***	.83	-.804*	.844
	(.307)	(.393)	(.274)	(1.356)	(.404)	(1.341)
No. of Observations	36	36	36	36	36	36
R^2	.01	.115	.008	.199	.87	.21
Industry FE	No	No	No	Yes	Yes	Yes

*Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1*

Appendix F. WLS Skill requirement interaction with GVC in Egypt

Dependent variable	**Log (real monthly wages)**					
	OLS			**Heckman**		
	Simple	**Complex**	**Intensive**	**Simple**	**Complex**	**Intensive**
GVC	.028	.371***	.71*	.045	.407***	.786*
	(.04)	(.087)	(.371)	(.048)	(.116)	(.375)
Skill	.012	.027**	.023**	.039**	.041***	.039***
	(.011)	(.009)	(.01)	(.014)	(.01)	(.011)
Skill*GVC	.068*	-.041	.413	.002	-.076	.272
	(.032)	(.092)	(.274)	(.043)	(.151)	(.281)
Years of schooling	.009***	.009***	.009***	.009***	.009***	.009***
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Experience	.021***	.021***	.021***	.019***	.019***	.019***
	(.003)	(.003)	(.002)	(.004)	(.004)	(.004)
$(Experience)^2$	-.0002***	-.0002***	-.0002***	-.0002*	-.0002	-.0002*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Female	-.165***	-.165***	-.165***	-.172***	-.173***	-.176***
	(.03)	(.032)	(.029)	(.028)	(.029)	(.026)
Father education	.093***	.094***	.092***	.096***	.096***	.094***
	(.014)	(.015)	(.015)	(.015)	(.015)	(.015)
Mother education	.099***	.106***	.093***	.104***	.114***	.098***
	(.025)	(.024)	(.023)	(.022)	(.021)	(.019)
Trade union	.157***	.158***	.156***	.173***	.174***	.171***
	(.017)	(.017)	(.016)	(.022)	(.021)	(.021)
Rural	-.207***	-.206***	-.202***	-.258***	-.252***	-.25***
	(.06)	(.061)	(.059)	(.073)	(.079)	(.073)
Inverse Mills				-.232**	-.204*	-.223*
				(.102)	(.097)	(.102)
Constant	2.424***	2.434***	2.425***	2.424***	2.434***	2.425***
	(.076)	(.078)	(.074)	(.076)	(.078)	(.074)
No. of Observations	8860	8824	8860	5890	5866	5890
R^2	.19	.192	.192	.215	.219	.218
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Clustered standard errors by region and sector are in parentheses*** p<.01, ** p<.05, * p<.1 RD is zero for low and medium low intensities and high for medium and medium high intensities. Skill equals 1 if the job requires a skill and zero otherwise.*