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GLOBAL PRODUCTION NETWORKS AND EMPLOYMENT: A DEVELOPING COUNTRY PERSPECTIVE

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ABSTRACT

This paper provides evidence of the links between Global Value Chains (GVCs) and labour market outcomes, focusing on developing economies. The literature generally indicates that firms with international linkages—which we use here as a proxy for GVC involvement—tend to employ more workers, pay higher wages, and employ more skilled workers than firms that deal exclusively with the domestic market. Our results are consistent with existing evidence found in developed economies, with internationalised firms tending to hire more workers and pay higher wages in developing economies as well. We also find a positive significant relationship between the number of skilled workers and firms with international linkages but not in certain key economies. However, this comes more from firms who are importers, exporters and foreign affiliates rather than engaging in any of these activities individually. We attribute this finding to the predominance of assembly work performed in many of the economies under consideration, where unskilled workers tend to dominate. Finally, we see a strong, positive association between shares of female workers and firms with international linkages. Engaging in international activity is shown to provide greater opportunities for women to enter the formal labour market.

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The purpose of this paper is to provide econometric evidence on the links between Global Value Chains (GVCs) and labour markets, focusing on developing economies, particularly the OECD's Key Partner countries (Brazil, India, Indonesia, China, and South Africa). The literature generally indicates that firms with international linkages—which we use here as a proxy for GVC involvement—tend to employ more workers, pay higher wages, and employ more skilled workers than firms that deal exclusively with the domestic market. Because of their capacity to act as vectors of skill-biased technical change, internationalisation of firms can also be associated with increased wage inequality. All of these findings depend to some extent, however, on the countries involved and the types of activities undertaken by the firms involved in the study. The labour market impacts of assembly operations—which are relatively low wage and low skill—are different from those of more high technology production processes, which tend to be associated with stronger relative demand for skilled labour and higher relative wages.

Overall our results are consistent with existing evidence found in developed economies. Internationalised firms tend to hire more workers and pay higher wages in developing economies as well. We also find a positive significant relationship between the number of skilled workers and firms with international linkages. However, this comes more from firms who are importers, exporters and foreign affiliates rather than engaging in any of these activities individually. We attribute the latter finding to the predominance of assembly work performed in many of the economies under consideration, where unskilled workers tend to dominate. Finally, we see a strong, positive association between shares of female workers and firms with international linkages. Engaging in international activity is shown to provide greater opportunities for women to enter the formal labour market.

From a policy point of view, our findings suggest that GVCs have considerable potential to promote desirable labour market outcomes, particularly in lower income countries. However, it is important to stress that complementary policies are likely to play a vital role. The fact that firm internationalisation tends to increase the relative demand for skilled labour could be a factor tending to increase wage inequality. Likewise, the absence of education and training policies designed to promote workforce and human capital development may reinforce the negative relationships observed in some outcomes.

This leads to a second policy implication: the place a firm occupies within a GVC is likely to be a crucial determinant of the labour market effects of GVC participation. Firms and countries involved primarily in simple assembly tasks are likely to see different labour market outcomes from those involved in offshored research and development activities. Policies that are designed to help firms—in a non-distortionary way—move through GVCs to positions of higher value added are likely to help promote the beneficial labour market effects of GVC participation. Education and training have already been mentioned as important complementary policies. Other examples include infrastructure development and regulation of backbone services sectors, both of which can provide firms with the foundation they need to successfully internationalise in high value added activities.

I.   Introduction

1.   The rise of global value chains (GVCs) in a variety of industries has been a salient feature of the world economy over recent years (World Bank, 2003; de Backer and Yamano, 2012). GVCs are characterised by a fragmentation of research and development, production, and assembly processes across different countries, with distribution taking place on a largely global basis.[1] GVCs, like the famous one used to produce Apple's iPhone, are inherently complex phenomena: they do not rely on a linear supply chain, but instead use a network-based approach in which components move across borders multiple times during the production process, and component production takes place in different locations from where assembly is undertaken.

2.   This fragmentation and geographical expansion of international production and trade networks in the global economy has had a marked effect on labour markets. The types of jobs demanded as well as where these jobs are placed is shifting at an ever increasing rate (Roach, 2003 and A.T. Kearney, 2011). The increase in job mobility has occurred at the same time as a massive shift in the size and composition of the global labour market. Following the break-up of the former Soviet Union in 1989 and the end of the Cold War, about three billion workers from China, India, Russia and Eastern Europe – half of the world's labour force – joined the capitalist world economy, creating a labour supply shock on a scale unlike anything experienced before. Freeman (2006) estimates that the entry of China in the WTO alone increased global labour supply by an amount equivalent to about a third of the OECD labour force. Technological changes associated with the Internet allowed a dramatic expansion of outsourcing and offshoring options in services in addition to those existing in manufacturing.

II.   Global Value Chains and Developing Economies

3.   Developing economies are increasing their role in global trade of intermediate goods, a widely used indication of GVC participation. If we look at trade in parts and components (P&C), a subset of intermediate goods trade, we see that non-OECD economies have increased their share of this trade steadily over the past 20 years (Figure 1). Between 1990 and 2010, the share of BRIICS economies in the exports of P&C increased from 0.78% to over 14%. Non-OECD, non-BRIICS, Asia more than doubled their share in the same time period, from 4.6% to over 9% in 2010. OECD countries' share, at the same time, declines from over 92% of all exports of P&C to 70% by 2010. While the export story is well known, the import side is important as well, for it is often an indication of GVC participation (Cattaneo et al., 2010). For most of these economies, their share of imported P&C trade has increased. Here the share of OECD economies fell to a similar extent as exports (from 86% to 64%) while the share of BRIICS and rest of Asia increased significantly.

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[1]   The concept of GVCs is closely related to those of global production networks (GPNs) and global commodity chains (GCCs). The main difference is that the GVC concept is inherently non-linear, as it is based on complex network interactions. However, we make use of findings from the literature on GPNs and GCCs as appropriate, in light of the closely linked nature of these concepts.

Figure 1.   (a) Share of Parts and Components Exports
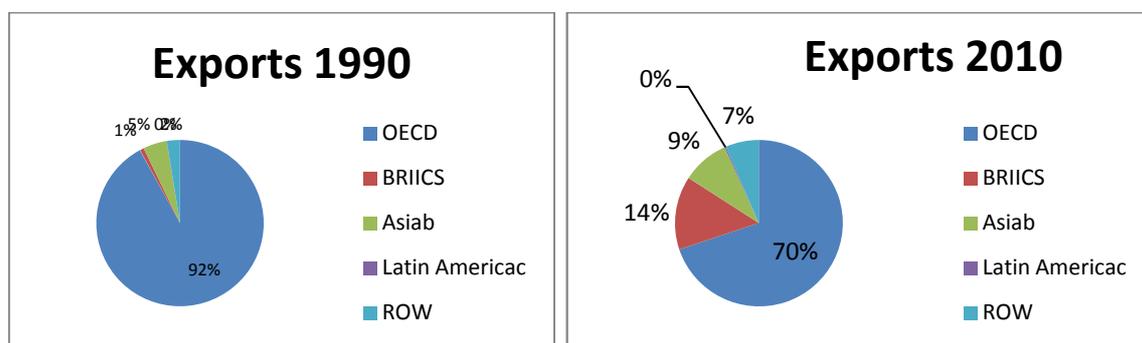
**(b) Share of Parts and Components Imports**
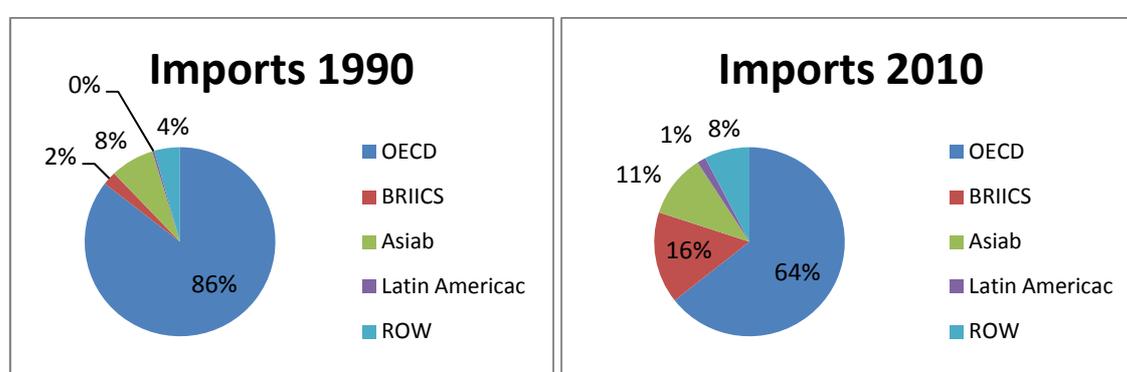
Source: UN COMTRADE.

4.   Increasing participation in GVC activity has benefits to the domestic economy.[2] The trade, investment and knowledge flows that underpin GVCs can be conduits for rapid learning, innovation and industrial upgrading, leading to better job outcomes in developing economies (Lall, 2000; Humphrey and Schmitz, 2002). GVCs can provide better access to information, open up new markets, and create opportunities for fast technological learning and skill acquisition. GVC-linked transactions and investments typically come with quality control systems and prevailing global business standards that can exceed those in domestic economies. Thus, suppliers and individuals can be "pushed" to acquire new competencies and skills through their participation in GVCs (Flanagan and Khor, 2012). In the most deeply linked developing countries, these business process improvements can be felt beyond the immediate exporting firms and sectors. Local firms can achieve greater success in their own markets by combining domestic and foreign intermediate inputs and creating economies of specialisation that leverage cross-border complementarities. Indeed, Kimura and Obashi (2011) argue that the success of GVCs in East Asia, especially compared with Latin America, relies heavily on these inter-linkages with the domestic and foreign market (Figure 2). Thus the opportunity for positive employment impacts generated by GVCs goes beyond their immediate circle.

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2   Citing such domestic benefits, APEC recently announced its intention to expand its participation in GVC by increasing supply chain efficiency by 10% by 2015.

Figure 2. Production Networks: Mexico versus East Asia
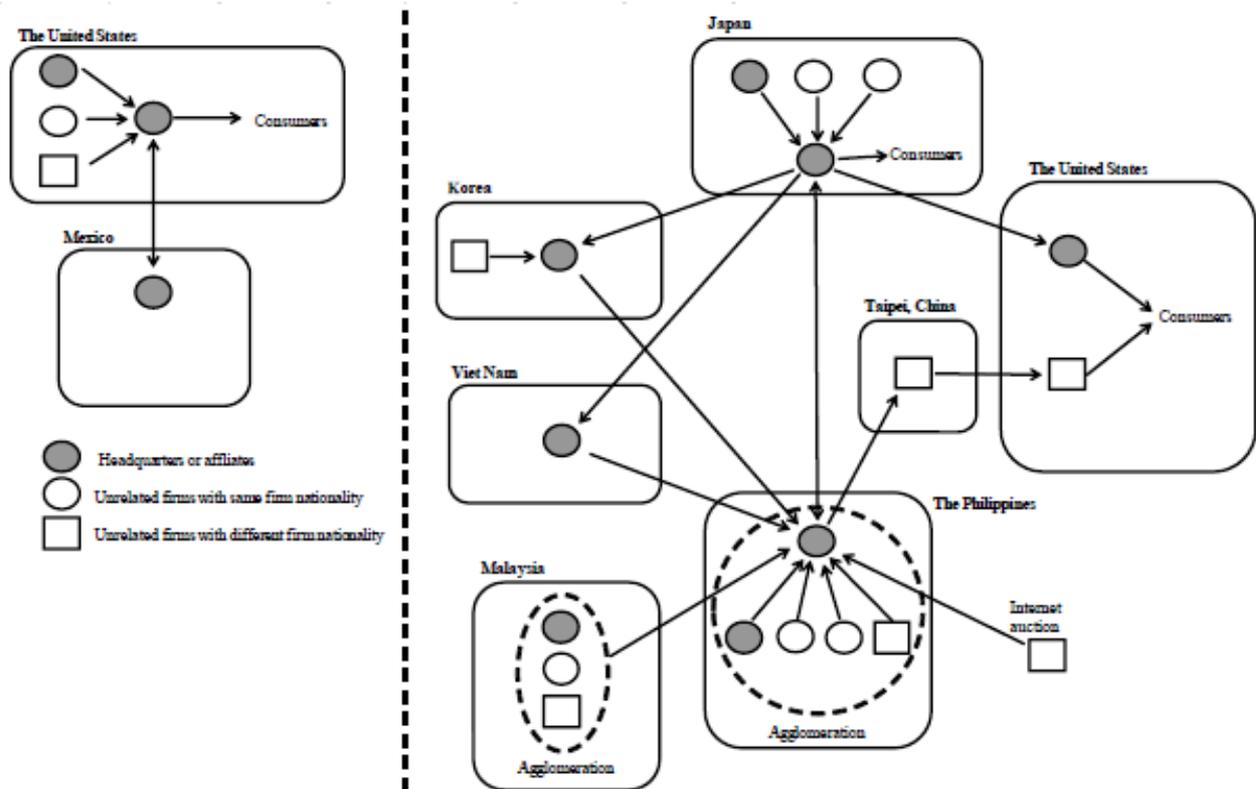
Source: Kimura and Ando (2005).

5.   GVC-driven trade has clearly brought investments in new productive capacity and massive infrastructure improvements in developing economies (OECD, 2011). Key producing countries such as China, have developed enormous factory complexes whose output is sent to world markets through vast new port facilities. Participation in GVC activities has boosted employment, enabled increased specialisation and larger scale production, driven more efficient geographical allocation of industrial activities, and increased the availability of a variety of intermediate goods in the developing world (Gereffi, 2006). As a result, GVCs tend to "compress" the development experience, making non-linear catch up possible, as has been the case in China (Whittaker et al., 2010). Still, GVCs are not necessarily a panacea for development. On the negative side, compressed development can create a host of new policy challenges in the realms of economic and social development (Whittaker et al., 2010).

Employment Effects of GVCs: Evidence thus far

6.   For a full review of the literature on the employment effects of GVCs in developing countries, see Shepherd (Forthcoming). As a starting point, the impact of GVCs on developing countries' labour markets often depends on the activity undertaken. Using offshoring as an indication of GVC activity, Bronfenbrenner and Luce (2004) looked at the labour market impacts in three main offshoring destinations for production shifts from the United States: China, India and Mexico. Each of these countries attracts a different mix of industries and jobs. China was the preferred location for the broadest range of industries: it captured all production shifts for sporting goods and toys; 40% of production in electronics and electrical equipment, apparel and footwear; and one-third of US production shifts in aerospace, appliances, household goods, and wood and paper products. While the range of industry is broad, the majority of jobs

associated with this offshoring have been filled by low-skilled workers. Mexico won out in a different set of industries but similar type jobs: auto parts (68% of US shifts), plastics, glass and rubber (58%), appliances (56%), industrial equipment and machinery (53%), and wood and paper products (50%). Meanwhile, India accounted for nearly all US production shifts in finance, insurance, and real estate, and one-third of those in communications and information technology (Bronfenbrenner and Luce, 2004), and while these jobs were higher-skilled, they were not always 'high' skilled.

7.   A different set of job opportunities emerged in the 1980s and 1990s as lead firms in capital- and technology-intensive value chains, such as automobiles and electronics, set up international production networks not only to assemble their finished goods, but also to develop a supply base for key intermediate products and sub-assemblies. At the uppermost tiers of these production networks, the suppliers tend to be very large and technologically sophisticated. Global contract manufacturers in electronics and mega-suppliers in the motor vehicles industry established an international presence that has created a demand for different kinds of jobs than was characteristic of the labour-intensive, buyer-driven value chains (Gereffi, 2006).

8.   While these new global supply systems created higher paying, higher skilled job opportunities, this model of supplier-oriented upgrading also has some negative implications for jobs in the developing world (Sturgeon and Lester, 2004). First, industry co-evolution drives consolidation in the global supply base. Large and technologically sophisticated suppliers tend to concentrate "good" jobs in relatively few locations. The hard disk drive industry illustrates this pattern. Jobs in the US hard disk drive industry migrated to South-east Asia over a 20-year period beginning in the late 1970s. By the mid-1990s, 80% of the jobs (which tended to be higher skilled and better paying than traditional offshored jobs) shifted to Singapore and Malaysia (Gereffi, 2006).

9.   So what does all of this mean for jobs in developing economies? The evidence of offshoring in general is one of expanding opportunities for both developed and developing economies (Newfarmer and Sztajerowska, 2012). Yet, there are certainly job losses associated with these changes. Most studies find a moderate, negative impact on employment in developed economies from global outsourcing (e.g. Amiti and Wei, 2005 and Liu and Trefler, 2008), but there is also evidence of sector and occupation specificity in outcomes (Molnar et al., 2008). However, there is less evidence for what is happening in developing economies (McMillan, 2010). There are quite a few studies that cover a specific country and/or a specific agreement (for example the work by Gordon Hanson examining the effect of NAFTA on Mexico (e.g. Hanson, 2007)) but these often relate to a specific industry or country and thus the generalisability of the results are open to question. Indeed, according to Hoekman and Winters (2005) surprisingly little evidence is available on the nature and extent of employment impacts in developing countries. The labour market effects of GVCs have become increasingly important from a policy point of view, as they are closely linked to the concepts of economic upgrading and social upgrading within GVCs. Barrientos et al. (2010) and Milberg and Winkler (2011) provide reviews of the issues in this area. They argue that economic upgrading—the process of moving into higher value-added activities within a GVC—only sometimes translates into improvements for workers.

10.   The purpose of this paper is to provide econometric evidence on the links between GVCs and labour markets, focusing on certain OECD and developing economies, particularly the OECD's Key Partner countries (Brazil, India, Indonesia, China, and South Africa). Since a companion paper (Shepherd, *Forthcoming*) provides a full review of the available literature on this question as it affects developing countries, we do not repeat that exercise in detail here. We simply note that there is already a wealth of econometric evidence on the nature of firms that export, import, and have foreign investor involvement, and that there is an emerging literature on the labour market effects of such firms. Specifically, the literature generally indicates that firms with international linkages—which we use here as a proxy for GVC involvement—tend to employ more workers, pay higher wages, and employ more skilled workers than

firms that deal exclusively with the domestic market. Because of their capacity to act as vectors of skill-biased technical change, internationalisation of firms can also be associated with increased wage inequality. All of these findings depend to some extent, however, on the countries involved and the types of activities undertaken by the firms involved in the study. The labour market impacts of assembly operations—which are relatively low wage and low skill—are different from those of more high technology production processes, which tend to be associated with stronger relative demand for skilled labour and higher relative wages.

11.   This paper builds on and extends the existing literature by using a firm-level dataset from the World Bank's Enterprise Surveys project to investigate four questions concerning the labour market impacts of GVCs in developing economies:

1.   Is the internationalisation of firm activity associated with stronger labour demand?

2.   Is the internationalisation of firm activity associated with the payment of higher wages?

3.   Is the internationalisation of firm activity associated with stronger relative demand for skilled labour?

4.   Is the internationalisation of firm activity associated with stronger relative demand for female labour?

12.   As noted above, in each case we are using firm internationalisation—participation in exporting, importing and being foreign owned—as a proxy for participation in a GVC. Our dataset covers firms in the OECD's Key partner countries, a large number of other developing countries, and a small number of non-high income OECD countries. We take care to distinguish the labour market impacts of GVCs in these different subsamples. In the OECD case, however, it is important not to generalise from the experience of non-high income countries to high income countries: as noted above, GVC activities can be fundamentally different in the two cases, with corresponding differences in labour market outcomes.

13.   An additional restriction that needs to be kept in mind is that the focus of this paper is on empirical evidence and data analysis. As a result, the analysis should be interpreted as indicative of the links between GVCs and formal labour markets in developing countries. Data are generally not available on informal labour markets, even though these latter mechanisms can be important sources of employment in developing countries. Some of the policy literature expresses the concern that GVC participation might be linked with increased informality of work. This concern may, or may not, be valid, but it cannot be assessed on the basis of the data currently available. Although informality is a major issue in some developing countries, it should be remembered that it is typically the parts of the GVC performing the least sophisticated activities—and which tend therefore to be linked with other domestic firms rather than having direct international linkages—that are most likely to be involved in informal practices. Similarly, the fundamental economic forces of supply and demand for skilled and unskilled labour can sometimes have similar effects on the price of labour (wages) in informal markets as in formal markets, although the difference between the two levels can be substantial due to the failure to pay mandated benefits such as health insurance or unemployment insurance in the informal sector.

14.   With this background in mind, the paper proceeds as follows. Section 3 provides an overview of our dataset and conducts a preliminary analysis of the four research questions presented above using graphical methods. The following section presents our empirical models and discusses results. Section 5 concludes and discusses policy implications of our findings.

III.   Data and Preliminary Analysis

15.   Despite their importance for the world economy, GVCs are relatively understudied by economists due to the difficulty in obtaining data on intra-network transactions. Most of the extensive research that has been carried out in other disciplines on GVCs and related concepts tends to be based on case studies or policy analysis, rather than data and quantification. In this paper, we prefer to focus on the second path in analyzing the labour market implications of GVCs using firm-level data and econometric methods. Due to data limitations, it is necessary, however, to proceed by analogy, focusing on the types of firms and activities that GVCs would typically involve, even though it is impossible to tell in the data whether or not those firms are actually involved in particular GVCs or not. For example, our dataset contains rich firm-level information on the characteristics of firms that export, import, and have foreign investor involvement: all three activities are commonly observed within GVCs, and many GVC participants engage in all three activities simultaneously. From information on the behaviour of these types of firms, it is possible to make inferences about the likely impacts of GVCs on national economies, including labour markets.

16.   In this section, we present the dataset used for the empirical analysis, and conduct some preliminary tests using descriptive statistical and graphical methods. Our data source for the econometric analysis below is the World Bank's Enterprise Surveys dataset. The full dataset currently has information on over 100 000 firms from 115 mostly developing and transition economies, including all five key partner countries. We take the 2006-2010 sample, which covers 108 countries and then add earlier data for China (2003) and India (2006).[3] Our sample is limited to 14 manufacturing industries only, and we exclude services firms from the dataset.[4] Countries listed for more than one year are included more than once in the database. That is because the same firms are not surveyed every year so we can treat these as different samples for our exercise.

17.   The Enterprise Surveys dataset provides basic information on firm performance that allows us to analyze factors such as labour demand (employment), wages, skill composition of the workforce, and gender issues. The data also identify firms with international linkages in a number of areas. Specifically, we can identify firms that export part of their production, those that import part of their intermediate input supply, and those that are majority foreign owned. The data do not specifically identify firms that are part of GVCs, so there is no way for us to explicitly estimate the impacts of participation in networked production on employment outcomes. However, we can use these international linkages variables and their interactions as proxies for the types of relationships that are common in GVCs, and then analyze the connections between these proxies and labour market outcomes in order to draw some inferences about the likely labour market impacts of GVCs. Specifically, we can create a dummy variable that distinguishes those firms that both export and import, as well as having foreign ownership, which is a typical structure for firms involved in GVCs. However, all our findings remain subject to the caveat that they relate primarily to international linkages of the type commonly found in GVCs, but do not capture the impact of production networks explicitly.

18.   In the remainder of this section, we examine the associations between firm international linkages and labour market variables of interest using graphical methods. It is important to note that we do not make any causal claim. The causal relationships among these variables are likely to be complex, and endogeneity may be an important issue. As we note below, current data limitations mean that it is currently impossible to present results that go further than presenting associations and correlations, rather than causal links.

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3   See Data Annex for details.

4   Service firms provide no information on import levels thus it is not possible to infer anything about GVC linkages.

19.   The first hypothesis we examine in the data is whether internationally-linked firms tend to employ more workers than those that deal with the domestic market only. As an example, we compare firms that do not export, import, or have majority foreign ownership with those that do using kernel densities (Figure 3).[5] The density for internationally linked firms is clearly shifted to the right, which shows that they tend to employ more workers than domestic firms.

Figure 3.   Kernel densities of log(employees) for firms without and with strong international linkages
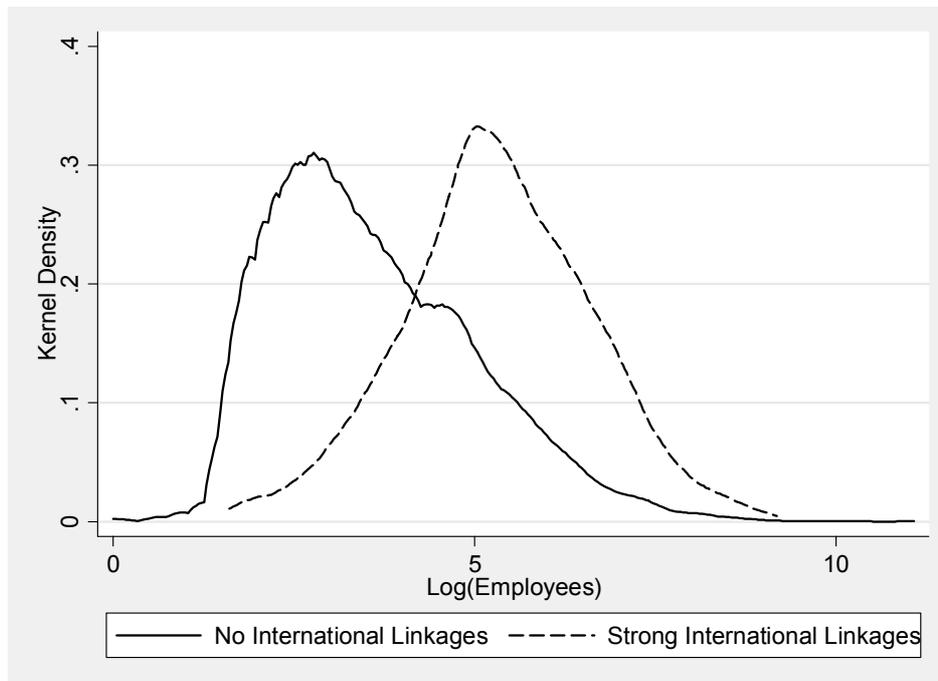
Source: Authors' calculations. *Note*: Firms with strong international linkages are defined as those that export, import, and have majority foreign ownership.

20.   Figure 4 repeats the same exercise for wages. Again, we see that the density for internationalised firms is shifted to the right, although the difference is not as great as in the case of firm size (number of employees). This finding is consistent with the idea that internationalised firms tend to pay higher wages than those firms that operate exclusively in the domestic market.

21.   In Figure 5 we present kernel densities for the percentage of skilled workers in a firm's total workforce, distinguishing between firms with strong international linkages and those without. In this case, the graphical evidence is inconclusive: there is no obvious difference between the densities in the two cases. This preliminary analysis therefore does not indicate strongly either way if the hypothesis that internationally linked firms employ a greater proportion of skilled workers than domestic firms is valid. We emphasise, however, that this finding is indicative and that the econometric analysis conducted below, which controls for a range of other influences that are excluded from this simple graphical analysis is more reliable.

22.   Finally, we use kernel densities to examine the hypothesis that internationalised firms tend to employ a higher percentage of female workers (Figure 6). Although the two curves are close together, the density for those firms with strong international linkages is slightly shifted towards the right. This finding

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5   In this section, we do not provide graphical analysis for all international linkage variables, but simply take representative examples of each hypothesis for illustrative purposes.

therefore provides some preliminary evidence that firms with international linkages tend to have relatively higher shares of female labour.

Figure 4.   Kernel densities of log(wage) for firms without and with strong international linkages
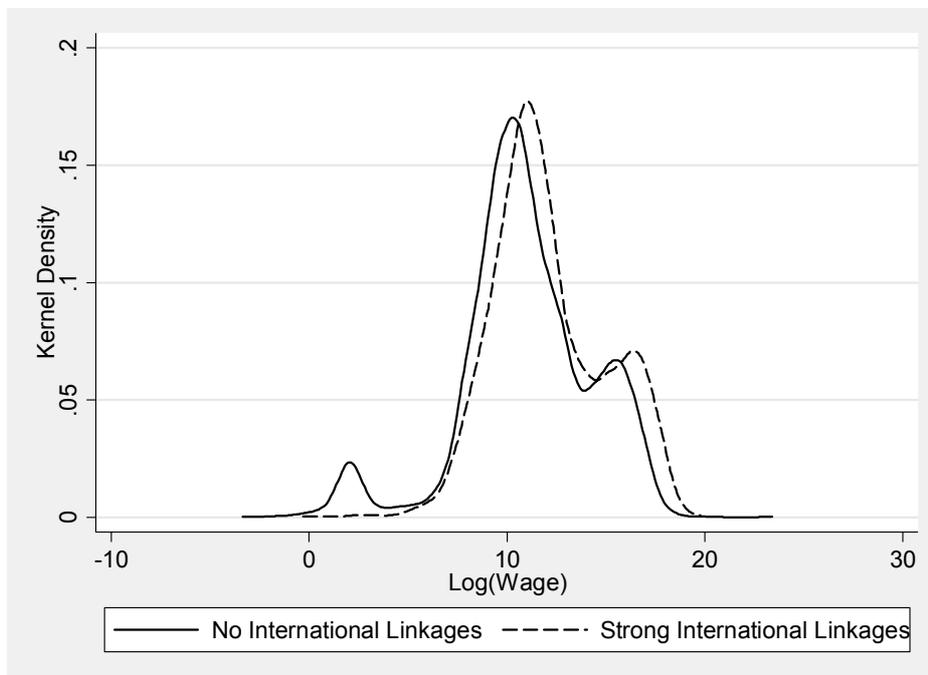
Source: Authors' calculations. *Note*: Firms with strong international linkages are defined as those that export, import, and have majority foreign ownership.

Figure 5.   Kernel densities of the percentage of skilled workers for firms without and with strong international linkages
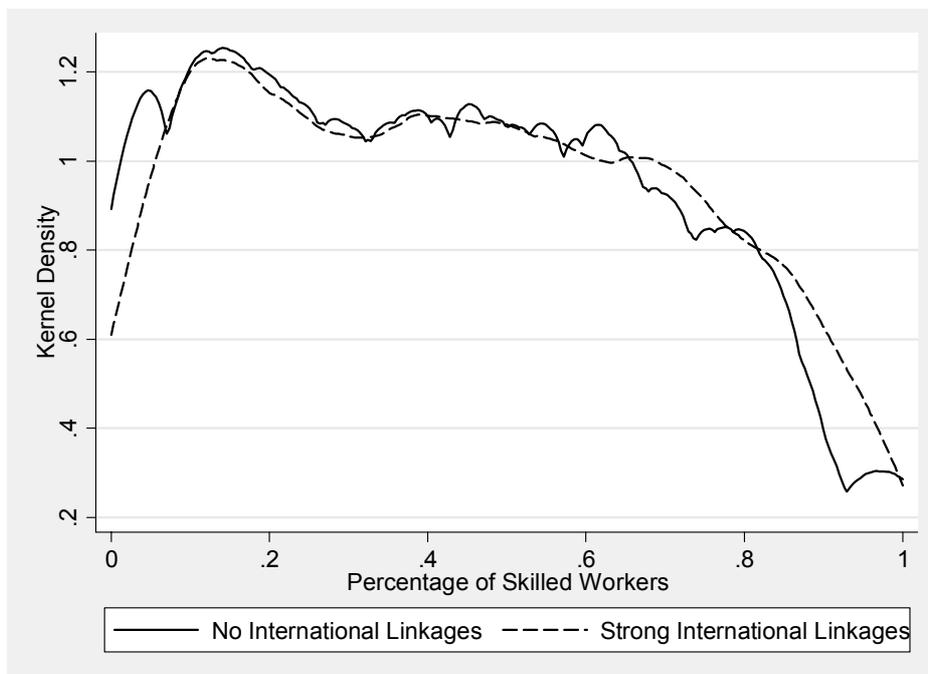
Source: Authors' calculations. *Note*: Firms with strong international linkages are defined as those that export, import, and have majority foreign ownership.

Figure 6. Kernel densities of the percentage of female workers for firms without and with strong international linkages
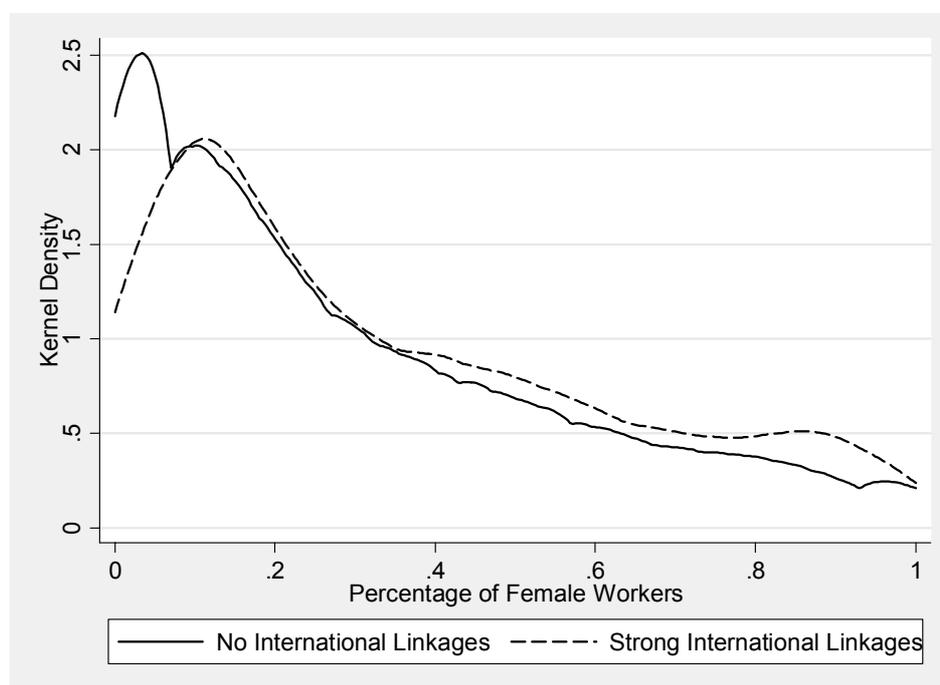
Source: Authors' calculations. *Note*: Firms with strong international linkages are defined as those that export, import, and have majority foreign ownership.

23.   This graphical analysis provides some preliminary evidence suggesting that international linkages of the type found in GVCs are associated with stronger labour demand, higher wages, and higher female employment. We investigate these hypotheses in detail below using fully-specified econometric models that account for a range of other influences that are not included in this simple graphical analysis. We also examine the impact of internationalisation of firm activities on the demand for skilled labour, even though the graphical analysis was inconclusive on that point.

IV.   Econometric Models and Results

24.   This section provides a more detailed analysis of the associations between international linkages and employment outcomes at the firm level using the Enterprise Surveys data. We deploy a series of econometric models that control for other influences, in addition to capturing the impact of international linkages on employment, wages, and skill. It is important to use fully-specified models in addition to the descriptive work in the previous section because it accounts for intervening factors that might also affect employment, but which cannot be picked up in simple bivariate analysis of the type used above. We first examine the links between international linkages and employment demand, then we move on to look at wages, skill composition of the workforce, and finally we consider the gender makeup of the workforce.

25.   One important caveat in relation to the econometric analysis is that the regression results we present are descriptive only, and we make no causal claims in relation to them. As is clear from the specifications, data limitations mean that there is significant potential for reverse causality, which may influence our results. However, the presentation of descriptive regressions is commonplace in the literature on firms in international trade (e.g. Bernard et al., 2007), and it is clearly of value to present some initial information on a variety of developing countries in the knowledge that future research with more detailed data for individual economies will be able to identify causal chains more precisely.

13

Labour Demand Model

26.   In order to examine whether internationally-linked firms tend to employ more workers than firms working exclusively with the domestic market, we adopt a standard labour demand specification augmented with variables designed to capture international linkages of the sort that commonly define GVCs. We focus in particular on firms that export, those that import intermediates, and those that are foreign owned. As noted above, the Enterprise Surveys data allow us to identify these international linkages even though they do not specifically distinguish between firms that are part of GVCs and those that are not.

27.   Our labour demand model takes the following form, which is similar to Stone and Bottini (2012):

$$(1)\ \log\left(Employees_{fsct}\right)$$
$$= f_{cst} + b_1 \log(sales_{fcst}) + b_2 \log(labour\ productivity_{fcst}) +$$
$$+ b_3 \log(wage_{fcst}) + b_4 \log(capital_{fcst}) + b_5 importer * exporter * foreign_{fcst}$$
$$+ b_6 importer * exporter * not\ foreign_{fcst} + b_7 exporter\ only_{fcst}$$
$$+ b_8 foreign\ only_{fcst} + b_9 importer\ only_{fcst} + e_{fcst}$$

where employees is the total number of workers employed by the firm (*f*); sales is the value of total sales; labour productivity is calculated as firm value added per employee; wage is the firm's average wage per worker; capital is the firm's total capital stock proxied by the net book value of total assets; importer-exporter-foreign is a dummy variable equal to unity for firms that export directly (i.e. not through an intermediary), import intermediates, and are majority foreign owned; importer-exporter-not foreign is a dummy variable equal to unity for firms that both export and import but are not foreign owned; exporter only is a dummy equal to unity for firms that export directly but do not import and are not foreign owed; foreign is a dummy variable equal to unity for firms that are foreign owned but which do not export or import; and importer only is a dummy variable equal to unity for firms that import intermediates but which do not export and are not foreign owned. The setup of the dummy variables is driven by the need to identify different activities and their combinations, and to avoid a perfect correlation among any of the resulting interaction terms. The interaction structure we have used is based on, for example, Breinlich and Criscuolo (2011). The final term *e* is a residual satisfying standard assumptions. We estimate the model by OLS, using a full set of fixed effects by country-sector-year (*c, s ,t*) to control for factors that are common to firms within each sector, such as macroeconomic fluctuations and regulatory measures.

28.   Results are presented in Table 1. Column 1 includes all countries for which data are available, while column 2 is limited to Brazil, India, Indonesia, China, and South Africa, column 3 includes all countries that are neither OECD members nor key partners, and column 4 includes only OECD member countries for which data are available (Chile, the Czech Republic, Hungary, Mexico, Poland, the Slovak Republic, Slovenia, and Turkey).[6] Taking the full sample results first, we see that bigger firms (higher sales) tend to employ more workers, as do those with larger capital stocks. Similarly, more productive firms and those that pay higher wages tend to employ less workers. These results are in line with expectations. In terms of our variables of interest, we find that four of the five international linkages dummy variables—all except foreign only—have the expected signs and statistically significant coefficients. By comparing coefficients across the dummy variables, we can see that those firms with the strongest international linkages (importer-exporter-foreign) show the strongest positive relationship with employment than all other types

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[6]   Due to relatively small sample sizes, it is not feasible to present separate results for each OECD member, or to separate European OECD members from others. In the interests of maximizing the estimation sample, results for the OECD subsample are therefore presented based on data pooled across all countries.

of firms. To the extent that this variable proxies participation in GVCs, it is suggestive of a relationship between inclusion in a GVC and stronger labour demand at the firm level.

29.   Results for the key partner countries in column 2 are largely in line with the full sample results: larger firms, and those with larger capital stocks tend to employ more workers, but those that are more productive and pay higher wages employ fewer workers. Again, we find that firms with international linkages tend to employ more workers than those that are limited in scope to the domestic market. Indeed, the result is stronger than for the full sample because all of the internationalisation dummies have statistically significant coefficients. Again, the largest coefficient is associated with the importer-exporter-foreign dummy variable, which is suggestive of a link between GVC participation and higher employment at the firm level. Interestingly, all of the international linkages coefficients are significantly larger for the key partner regression than the full-sample regression, which indicates that international linkages have a stronger positive association with labour demand in those countries than they do on average elsewhere. Although we are not directly able to isolate the effect of GVCs due to lack of data, this result is consistent with a mechanism in which labour markets in emerging markets benefit more strongly than those in developed markets due to the offshoring of parts of the production process.

30.   Results for countries that are neither OECD subsample nor key partners are in column 3. The coefficients on the firm-level control variables have the same signs as in columns 1 and 2, and are all statistically significant. Three of the five internationalisation dummies have statistically significant coefficients. Although all significant coefficients are smaller in magnitude than the corresponding results for key partner countries, the overall pattern remains the same: the coefficient on importer-exporter-foreign is larger than for the other dummy variables, which is consistent with a positive association between GVC participation and employment at the firm level. However, the fact that the key partner country coefficients are significantly larger than for the other countries suggests that the main employment associations of GVC participation might be in the larger emerging markets.

31.   Results for the non-high income OECD (NHI-OECD) in column 4 are again in line with expectations. The control variables have the expected signs and are statistically significant. Four of the five internationalisation dummies have statistically significant coefficients. Again, the coefficient on the importer-exporter-foreign dummy variable is the largest one. However, its magnitude is considerably less than in the key partners regression. Evidence from the NHI-OECD therefore confirms the impression that the primary employment association of GVC participation—as proxied by strong international linkages— are felt in the larger emerging markets. One important caveat is that data availability for OECD countries is limited to those considered by the World Bank to be non-high income countries, so it is unlikely that these results generalise to OECD countries at higher income levels than those in the sample, which tend to be sources for offshoring, rather than host countries.

Table 1.   Labour demand regression results

	(1)	(2)	(3)	(4)
	All	**Key Partner**	**Not Key Partner or OECD**	**NHI-OECD**
Log(Sales)	0.574***	0.550***	0.555***	0.673***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Labour Productivity)	-0.207***	-0.128***	-0.200***	-0.300***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Wage)	-0.286***	-0.413***	-0.267***	-0.205***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Capital)	0.098***	0.099***	0.103***	0.065***
	(0.000)	(0.001)	(0.000)	(0.000)
Importer-Exporter-Foreign	0.370***	0.705***	0.347***	0.249***
	(0.000)	(0.002)	(0.000)	(0.005)
Importer-Exporter	0.290***	0.434***	0.267***	0.239***
	(0.000)	(0.002)	(0.000)	(0.000)
Exporter Only	0.170***	0.406***	0.117***	0.200**
	(0.000)	(0.001)	(0.002)	(0.019)
Foreign Only	0.050	0.563***	-0.027	0.131
	(0.450)	(0.008)	(0.716)	(0.165)
Importer Only	0.031*	0.144**	-0.004	0.081**
	(0.051)	(0.011)	(0.801)	(0.040)
Observations	15858	1284	11804	2770
R2	0.703	0.734	0.685	0.729

Notes: The dependent variable is log(employees) in all cases. Estimation is by OLS with fixed effects by country-sector-year. P-values based on robust standard errors clustered by country-year-sector are in parentheses below the parameter estimates. Statistical significance is indicated by: * (10%), ** (5%), and *** (1%).

Wage Model

32.   In the second part of our analysis, we examine whether firms with international linkages tend to pay higher wages than other firms. Our model takes the following form:

$$(2)\ \log\left(wage_{fcst}\right)$$
$$= f_{cst} + b_1 \log\left(sales_{fcst}\right) + b_2 \log\left(labour\ productivity_{fcst}\right) +$$
$$+ b_3 \log\left(capital_{fcst}\right) + b_4 importer * exporter * foreign_{fcst} + b_5 importer$$
$$* exporter * not\ foreign_{fcst} + b_6 exporter\ only_{fcst} + b_7 foreign\ only_{fcst}$$
$$+ b_8 importer\ only_{fcst} + e_{fcst}$$

where all variables are defined as above.

33.   Results are presented in Table 2 with column groupings as defined in Table 1. Taking column 1 first, as expected we find that larger firms and those that are more productive pay higher wages. However, the coefficient sign on the capital stock and its lack of statistical significance is contrary to expectations: we would normally assume that firms with more capital tend to pay higher wages. The reason appears to be the very strong correlation between capital stock and sales (0.86), which tends to produce unbiased estimates but inflated standard errors, i.e. a lack of precision as indicated by the high p-value for the capital variable. Three of the five international linkages variables have negatively signed coefficients that are statistically significant and whose magnitudes are approximately the same.. Taking these results in combination with those from the labour demand regressions suggests that the primary labour market association of GVC participation—proxied by firm internationalisation—is through the level of

employment, rather than wages. If anything, internationalisation tends to be associated with paying slightly lower wages. Some evidence of this impact has already been reported (Sturgeon and Lester, 2004) This result would be consistent with a mechanism in which many internationalised firms participate in processing activities that are relatively labour intensive (higher employment) but pay low wages.

Table 2.   Wage regression results

	(1) All	(2) Key Partner	(3) Not Key Partner or OECD	(4) NHI-OECD
Log(Sales)	0.184***	0.336***	0.178***	0.091***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Labour Productivity)	0.189***	0.332***	0.162***	0.212***
	(0.000)	(0.000)	(0.000)	(0.000)
Log(Capital)	-0.003	-0.014	-0.005	0.010
	(0.633)	(0.648)	(0.441)	(0.359)
Importer-Exporter-Foreign	-0.090*	-0.523	-0.067	0.214**
	(0.081)	(0.108)	(0.176)	(0.048)
Importer-Exporter	-0.085***	-0.403***	-0.075**	0.078
	(0.003)	(0.005)	(0.013)	(0.199)
Exporter Only	-0.095**	-0.279**	-0.116**	-0.009
	(0.018)	(0.036)	(0.012)	(0.931)
Foreign Only	-0.037	-0.331	-0.067	0.182
	(0.659)	(0.148)	(0.499)	(0.410)
Importer Only	-0.001	-0.104	-0.010	0.063
	(0.973)	(0.231)	(0.634)	(0.148)
Observations	15858	1284	11804	2770
R2	0.794	0.729	0.793	0.772

Notes: The dependent variable is log(wages) in all cases. Estimation is by OLS with fixed effects by country-sector-year. P-values based on robust standard errors clustered by country-year-sector are in parentheses below the parameter estimates. Statistical significance is indicated by: * (10%), ** (5%), and *** (1%).

34.   Results for the key partner countries are in column 2. The three control variables—size, capital stock, and productivity—have the same signs and significance as in the full sample regression. However, only two of the five international linkages variables have statistically significant coefficients. Again, they are negative. These results again suggest that the primary labour market outcome associated with GVC participation—as proxied by firm-level international linkages—is labour demand rather than wages. The reason for this result could be that labour supply is relatively elastic at the skill levels primarily involved in internationalised production, although we stress that given the data available, this possibility remains a matter of conjecture. It would be necessary to use industry-level or economy-wide data, rather than firm-level data, to investigate such a possibility.

35.   Results for countries that are neither OECD members nor key partners are in column 3. They basically reflect the experience of the key partner countries in terms of sign and significant of coefficients in terms of international linkages. However, the internationalisation coefficients are noticeably smaller in terms of absolute value, which suggests that internationalisation is associated with weaker wage associations in these countries.

36.   Results for the subsample of NHI-OECD countries in column 4 are different from those of the other two sub-samples. The control variables have the same statistical significance as in the other regressions; although the capital stock has a positive sign, which is in line with expectations, its coefficient is not statistically significant. The main difference is in terms of the internationalisation dummy variables. Although only one has a statistically significant coefficient—importer-exporter-foreign—it is positively

signed. This result suggests that in certain OECD countries, firm internationalisation is associated with both stronger labour demand and the payment of higher wages. The implication of this finding is that the types of activities undertaken by internationalised firms in NHI-OECD countries are quite different—and involve different types of labour—than those undertaken in developing countries, a finding reported in the literature (Gereffi, 2006). As mentioned above, however, caution is required in generalising these results since they are based on data for OECD countries that are not in the World Bank's high income group, and results may well be different for high income OECD economies.

Skill Model[7]

37.   A third way in which international production linkages could impact employment is through the skill composition of the workforce. It is possible that internationally-linked firms tend to employ more skilled workers than other firms, which would be advantageous for the economy by creating increased incentives for individuals to develop their human capital and increase productivity, but could also contribute to wage inequality as it shifts the relative demand for skilled workers. We test the hypothesis that internationally linked firms have stronger skill shares with the following equation:

$$(3) \quad \frac{skilled\ production\ workers_{fcst}}{employees_{fcst}}$$
$$= f_{cst} + b_1 \log(sales_{fcst}) + b_2 \log(labour\ productivity_{fcst}) +$$
$$+ b_3 \log(wage_{fcst}) + b_4 \log(capital_{fcst}) + b_5 importer * exporter * foreign_{fcst}$$
$$+ b_6 importer * exporter * not\ foreign_{fcst} + b_7 exporter\ only_{fcst}$$
$$+ b_8 foreign\ only_{fcst} + b_9 importer\ only_{fcst} + e_{fcst}$$

where all variables are defined as in the previous sections. Because the dependent variable is bounded between zero and unity, OLS will not provide consistent estimates. We therefore use the fractional logit model of Papke and Wooldridge (1996). To provide an intuitive measure of model fit, R2 is calculated as the squared correlation between the actual and fitted values of the dependent variable.

38.   Results are in Table 3. As in the previous sections, the first column includes all countries for which data are available, the second is limited to Brazil, China, India, Indonesia, and South Africa only, the third is limited to countries that are neither OECD members or key partners, and the third includes only those NHI-OECD countries for which data are available. Taking column 1 first, we see that larger firms tend to have a smaller proportion of skilled production workers in total employment. This is perhaps a surprising result, but it might stem from the fact that large firms have significant numbers of relatively unskilled employees performing functions such as assembly. More importantly, we find that firms that pay higher wages and those that are more productive tend to have a more skilled workforce. These results are in line with expectations. Again, the capital stock variable is statistically insignificant, but it has the expected sign. Of the internationalisation variables, only two have statistically significant coefficients: importer-exporter-foreign is positively signed, but importer only is negatively signed. The first result is in line with expectations: a high level of firm internationalisation is associated with greater skill intensity in employment. The second result suggests that those firms that only import intermediates are likely to be engaged in assembly activities that are relatively intensive in unskilled labour. The first result is consistent with a mechanism in which GVC participation—proxied by a high degree of internationalisation—is

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[7]   A skilled is defined as having some special knowledge or (usually acquired) ability in their work. A skilled worker may have attended a college, university or technical school. Or, a skilled worker may have learned his skills on the job.

associated with greater relative use of skilled labour, and might even be a vector of skill-biased technological change in the way set out in some of the previous literature on wage inequality.

39.   Results for the key partner countries in column 2 are weaker than for the full sample. The control variables have the same signs and statistical significance, except for labour productivity, which has a statistically insignificant coefficient. In this case, however, none of the internationalisation variables has a statistically significant coefficient, which suggests that any skill association with GVC participation might be taking place in the smaller and less developed emerging markets, rather than in the larger and generally more developed key partners.

40.   This hypothesis seems to be borne out by results for the other developing countries in column 3. The control variables have the same signs and statistical significance as in the full sample regression. In addition, three of the five internationalisation dummies have statistically significant coefficients. The dummy for firms that import, export, and are foreign owned has a positive coefficient, which indicates that this type of internationalisation is associated with a more intensive use of skilled labour. By contrast, firms that only export or only import tend to employ lower proportions of skilled labour. As noted above, the reason is perhaps that such firms are engaged mainly in assembly activities that are relatively intensive in their use of unskilled labour.

41.   Results for the NHI-OECD are noticeably different from those of the other sub-samples (column 4). The four control variables have the same signs as in the first regression, but wages have a statistically insignificant coefficient and the capital stock has a statistically significant one. Of the international integration variables, only the dummy for firms that are foreign owned but do not trade and those that import only are statistically significant. Foreign-owned firms show a strong positive association with skill share while importers have a small negative effect. This result suggests that in the NHI-OECD subsample, foreign-owned firms tend to employ more skilled workers regardless of their trade orientation. The presence of larger and richer domestic markets might be one reason for this result: it is rational for firms to perform higher value added operations locally, by contrast with the assembly operations that are common in developing countries. Again, caution is required in extrapolating these results to the high income OECD countries that are not included in the sample.

Table 3.   Skill regression results

	(1)	(2)	(3)	(4)
	All	**Key Partner**	**Not Key Partner or OECD**	**NHI-OECD**
Log(Sales)	-0.064***	-0.053**	-0.071***	-0.062***
	(0.000)	(0.037)	(0.000)	(0.000)
Log(Wage)	0.071***	0.049**	0.103***	0.007
	(0.000)	(0.019)	(0.000)	(0.780)
Log(Labour Productivity)	0.026***	-0.011	0.024**	0.061***
	(0.001)	(0.667)	(0.011)	(0.003)
Log(Capital)	0.009	0.017	0.002	0.036***
	(0.142)	(0.157)	(0.775)	(0.007)
Importer-Exporter-Foreign	0.096**	-0.005	0.145**	-0.056
	(0.050)	(0.982)	(0.011)	(0.604)
Importer-Exporter	-0.049	0.006	-0.041	-0.079
	(0.148)	(0.959)	(0.290)	(0.287)
Exporter Only	-0.082	-0.187	-0.110*	0.093
	(0.117)	(0.195)	(0.059)	(0.487)
Foreign Only	0.135	-0.114	0.135	0.424***
	(0.156)	(0.592)	(0.240)	(0.002)
Importer Only	-0.067***	-0.142	-0.053*	-0.083*
	(0.006)	(0.193)	(0.057)	(0.095)
Observations	14434	1279	10401	2754
R2	0.242	0.102	0.272	0.182

Notes: The dependent variable is % skilled workers in all cases. Estimation is by fractional logit with fixed effects by country-sector-year. P-values based on robust standard errors clustered by country-year-sector are in parentheses below the parameter estimates. Statistical significance is indicated by: * (10%), ** (5%), and *** (1%). R2 is calculated as the square of the correlation coefficient between the actual and fitted values of the regression.

Gender Model

42.   Gender represents an additional way in which a firm's international linkages could impact the labour market. Specifically, internationalised firms might be more or less intensive in female labour than other firms, which would have implications for female labour demand and thus for the possibility for women, particularly in developing countries, to participate in the formal labour market. We examine this possibility using a gender share equation of the following form:

$$(4) \quad \frac{female\ workers_{fcst}}{employees_{fcst}}$$
$$= f_{cst} + b_1 \log(sales_{fcst}) + b_2 \log(labour\ productivity_{fcst}) +$$
$$+ b_3 \log(wage_{fcst}) + b_4 \log(capital_{fcst}) + b_5 importer * exporter * foreign_{fcst}$$
$$+ b_6 importer * exporter * not\ foreign_{fcst} + b_7 exporter\ only_{fcst}$$
$$+ b_8 foreign\ only_{fcst} + b_9 importer\ only_{fcst} + e_{fcst}$$

where all variables are defined as in the previous sections. As for the skill share equation, we estimate using the fractional logit model of Papke and Wooldridge (1996) to take account of the fact that the dependent variable is bounded between zero and unity. To provide an intuitive measure of model fit, R2 is calculated as the squared correlation between the actual and fitted values of the dependent variable.

43.   Results are in Table 4. Results for key partner countries are not reported because China and India have no reported data on employment by gender. As in the previous sections, the first column includes all countries for which data are available. We see that more productive firms and those with a higher capital stock generally employ a lower proportion of female workers, and the associations are statistically significant at the 1% level. By contrast, firms that pay higher wages tend to employ more female workers (statistically significant at the 1% level). Four of the five international linkage variables have positive and statistically significant coefficients. Of these, the dummy for importer-exporter-foreign has the largest coefficient. This result suggests that GVC participation—as proxied by a higher level of firm internationalisation—is associated with a more intensive use of female employment. As such, internationalisation—including through the growth of GVCs—could be a positive force for bringing women into the formal labour market.

44.   Column 2 of Table 6 contains results for countries that are neither OECD members nor key partner countries. The coefficients on all control variables in the model have the same statistical significance and sign as those for the full sample with the exception of capital stock, which is still negative but no longer statistically significant. Again, four of the five internationalisation dummies have positive and statistically significant coefficients. The largest association again comes from the importer-exporter-foreign dummy. The data therefore show a consistent strong association between firm internationalisation and increased female employment in developing countries.

45.   Column 3 presents results limited to the NHIOECD countries for which data are available. Results are generally weaker than for the other regressions. Firm size, wages, and capital stock do not have statistically significant coefficients in this case. However, as in the full sample regression, labour productivity is negatively associated with the proportion of female employees. Of the five internationalisation dummies, only importer-exporter has a positive and statistically significant coefficient. There is thus some evidence that firms with some kinds of international linkages tend to use female labour relatively intensively in the NHI-OECD. Development of international linkages through exporting and importing—as through the growth of GVCs—could therefore have positive implications for the female labour market in NHI-OECD countries. Again, however, these results cannot automatically be generalised to the OECD as a whole.

Table 4.   Gender regression results*

	(1)	(2)	(3)
	All	**Not Key Partner or OECD**	**NHI-OECD**
Log(Sales)	0.002	0.003	0.003
	(0.833)	(0.839)	(0.911)
Log(Wage)	0.028**	0.040**	0.010
	(0.037)	(0.026)	(0.707)
Log(Labour Productivity)	-0.040***	-0.042***	-0.041**
	(0.000)	(0.000)	(0.042)
Log(Capital)	-0.015**	-0.011	-0.005
	(0.046)	(0.236)	(0.698)
Importer-Exporter-Foreign	0.279***	0.334***	0.074
	(0.000)	(0.000)	(0.433)
Importer-Exporter	0.251***	0.280***	0.171**
	(0.000)	(0.000)	(0.020)
Exporter Only	0.229***	0.273***	0.167
	(0.000)	(0.000)	(0.214)
Foreign Only	0.092	0.151	0.014
	(0.310)	(0.203)	(0.914)
Importer Only	0.097***	0.135***	0.014
	(0.005)	(0.002)	(0.782)
Observations	15330	11326	2739
R2	0.473	0.510	0.341

Notes: The dependent variable is % female workers in all cases. Estimation is by fractional logit with fixed effects by country-sector-year. P-values based on robust standard errors clustered by country-year-sector are in parentheses below the parameter estimates. Statistical significance is indicated by: * (10%), ** (5%), and *** (1%). R2 is calculated as the square of the correlation coefficient between the actual and fitted values of the regression. * Results for key partner countries are not reported because China and India have no reported data on employment by gender.

V.   Conclusion and Policy Implications

46.   This paper has examined the labour market implications of GVCs using firm internationalisation—participation in exporting, importing, and being foreign owned—as a proxy for GVC participation. It is necessary to proceed by proxy due to current data limitations that make it impossible to identify particular firms or transactions that exist within the structure of a particular GVC. Specifically, this paper contributes four sets of findings on the labour market effects of GVCs, covering the following areas: labour demand, wages, demand for skilled labour, and demand for female labour.

47.   First, we find that firm internationalisation is associated with stronger labour demand. Using data for all countries, we find that firms that are jointly engaged in exporting, importing intermediate goods, and being foreign owned tend to employ more workers than other types of firms. Quantitatively, this effect is stronger than any of the other internationalisation variables considered individually. These findings are largely replicated in sub-samples of the key partner countries, non-OECD and non-key partner countries, and non-high income OECD countries respectively. Interestingly, the positive effects of internationalisation on labour demand are stronger in the key partner countries than elsewhere, which suggests that the continued progress of GVCs could be a particularly favourable factor for labour markets in the large emerging markets.

48.   Second, our data show that firms with international linkages tend to pay higher wages than those that deal with the domestic market only in the NHI-OECD subsample, but the reverse is true in the developing

world. We interpret these results as showing that the primary impact of firm internationalisation is felt through employment impacts, rather than wages, in the developing world. Our results are also consistent with the prevalence of assembly and re-export activities in many parts of the developing world, which tend to be relatively intensive in low-skilled labour, and thus pay lower wages than higher skilled activities.

49.   Third, we find that firms in the developing world that are highly internationally integrated—i.e. they engage in exporting, importing, and are foreign owned—in fact tend to employ larger proportions of skilled workers than other firms. Elsewhere, the association between internationalisation and skill appears to be relatively weak. One reason for this outcome is perhaps that the data on worker skill are measured poorly in some countries, perhaps due to different local definitions of what counts as a skilled worker. Data limitations inherent in the Enterprise Surveys sample used here make it impossible to investigate the issue further, but we expect that future work using country-specific data may be able to shed more light on the question.

50.   Finally, we use data on workforce composition to show that firm internationalisation also affects the demand for female labour. In the full sample and in the non-OECD non-key partners sample, firm internationalisation is strongly associated with a greater proportion of female workers. In the NHI-OECD subsample, firms that both import and export also tend to employ more female workers. We interpret these results as providing some preliminary evidence to the effect that GVCs can have gender implications in developed and developing economies alike, but that there appears to be some support for the proposition that labour force growth due to GVCs is relatively intensive in female labour. This finding clearly has positive implications from a gender equity standpoint, as it indicates the inclusion of greater numbers of women in the formal labour market.

51.   It is important to be clear about one caveat to these results. There is the possibility of endogeneity in each of the models estimated. Indeed, the causal linkages among variables are likely to be complex and could run in both directions simultaneously. The results presented here therefore highlight associations in the data, but do not establish a causal relationship. To establish such relationships, a different empirical approach would be required, for instance using instrumental variables techniques. However, data limitations—particularly the lack of availability of true panel data for firms—mean that it is not possible to proceed with such strategies using the Enterprise Surveys data. Despite these drawbacks, important and empirically tractable, policy implications can be drawn from these results.

52.   From a policy point of view, our findings suggest that GVCs have considerable potential to promote desirable labour market outcomes, such as greater employment opportunities, especially for women. Shepherd (*Forthcoming*) reaches a similar conclusion based on a review of the existing evidence. As in that paper, however, it is important to stress that complementary policies are likely to play a vital role. The fact that firm internationalisation tends to increase the relative demand for skilled labour could be a factor tending to increase wage inequality, and it would have stronger effects in the absence of education and training policies designed to promote workforce and human capital development.

53.   A second policy implication, which is again linked to the findings of the literature review by Shepherd (*Forthcoming*), is that the place a firm occupies within a GVC is likely to be a crucial determinant of the labour market effects of GVC participation. Firms and countries involved primarily in simple assembly tasks are likely to see different labour market outcomes from those involved in offshored research and development activities. Policies that are designed to help firms—in a non-distortionary way— move through GVCs to positions of higher value added are likely to help promote the beneficial labour market effects of GVC participation. Education and training have already been mentioned as important complementary policies. Other examples include infrastructure development and regulation of backbone services sectors, both of which can provide firms with the foundation they need to successfully internationalise in high value added activities.

54.   The research presented here gives rise to a number of promising avenues for further investigation, which are outside the scope of this project. First, data limitations have made it impossible to examine the impact of GVC participation on labour market outcomes in the high income OECD countries. There is already an emerging body of research on that subject, which tends to suggest that wage effects, for example, differ substantially according to skill category (e.g. Geishecker and Gorg, 2011). However, much more research using highly detailed and country-specific data is required in this area.

55.   Second, this research has used data at the firm level, and therefore provides evidence on the association between firm internationalisation and labour variables of interest at the firm level. It will also be important to supplement this work with research at the level of industries and countries, to examine whether spillover effects are important. Such work could also examine the broader social implications of international linkages, such as the possibility of increasing wage inequality, and differing impacts across different social and demographic groups.

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DATA ANNEX

1.   The World Bank Enterprise Surveys would be used to study the behaviour of firms in manufacturing activities. The World Bank's *Enterprise Surveys* dataset includes survey information as recent as 2010. This dataset currently has information on over 100 000 firms from 115 mostly developing and transition economies, including all five Key Partner countries. The Enterprise Surveys sample firms from official government statistics offices, tax authorities or licensing authorities in each country. In some cases, lists are obtained from Chamber of Commerce and business associations or other non-governmental sources.

2.   The sample is obtained using stratified random sampling with replacement to generate a sample representative of the whole non-agriculture, non-governmental, economy. The surveys are stratified according to three criteria.

Sector of activity from a population of industries including the manufacturing sector, construction, services, transport and storage, communications and computer and related activities.

Firm size from a population including small firms (5-19 employees), medium firms (20-99 employees) and large firms (over 100 employees).[1]

Geographic location selected based on centres of economic activity within each country.

Table A1. Country coverage in the 2006-2010 Enterprise Surveys sample (bold = OECD member or key partner country)

Afghanistan 2008	**Chile 2006**	Guinea 2006	Micronesia 2009	**Slovak Republic 2009**
Albania 2007	**Chile 2010**	Guinea Bissau 2006	Moldova 2009	**Slovenia 2009**
Angola 2006	Colombia 2006	Guyana 2010	Mongolia 2009	South Africa 2007
Angola 2010	Colombia 2010	Honduras 2006	Montenegro 2009	St Kitts and Nevis 2010
Argentina 2006	Congo 2009	Honduras 2010	Mozambique 2007	St Vincent and Grenadines 2010
Argentina 2010	Costa Rica 2010	**Hungary 2009**	Namibia 2006	Swaziland 2006
Armenia 2009	Croatia 2007	**Indonesia 2009**	Nepal 2009	Tajikistan 2008
Azerbaijan 2009	**Czech Republic 2009**	Ivory Coast 2009	Nicaragua 2006	Tanzania 2006
Bahamas 2010	DRC 2006	Jamaica 2010	Nicaragua 2010	Timor Leste 2009
Bangladesh 2007	DRC 2010	Kazakhstan 2009	Niger 2009	Togo 2009
Belarus 2008	Dominican Republic 2010	Kenya 2007	Nigeria 2007	Tonga 2009
Benin 2009	Ecuador 2006	Kosovo 2009	Panama 2006	Trinidad and Tobago 2010
Bhutan 2009	Ecuador 2010	Kyrgyz Republic 2009	Panama 2010	**Turkey 2008**
Bolivia 2006	El Salvador 2006	Lao PDR 2009	Paraguay 2006	Uganda 2006
Bolivia 2010	El Salvador 2010	Latvia 2009	Paraguay 2010	Ukraine 2008
Bosnia and Herzegovina 2009	Eritrea 2009	Lesotho 2009	Peru 2006	Uruguay 2006
Botswana 2006	**Estonia 2009**	Liberia 2009	Peru 2010	Uruguay 2010
Botswana 2010	Fiji 2009	Lithuania 2009	Philippines 2009	Uzbekistan 2008
Brazil 2009	FYR Macedonia 2009	Madagascar 2009	**Poland 2009**	Vanuatu 2009
Bulgaria 2007	Gabon 2009	Malawi 2009	Romania 2009	Venezuela 2006
Bulgaria 2009	Gambia 2006	Mali 2007	Russia 2009	Venezuela 2010
Burkina Faso 2009	Georgia 2008	Mali 2010	Rwanda 2006	Viet Nam 2009
Burundi 2006	Ghana 2007	Mauritania 2006	Samoa 2009	Yemen 2010
Cameroon 2009	Grenada 2010	Mauritius 2009	Senegal 2007	Zambia 2007
Cape Verde 2009	Guatemala 2006	**Mexico 2006**	Serbia 2009	
Chad 2009	Guatemala 2010	**Mexico 2010**	Sierra Leone 2009	

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[1]   The choice of a minimum of 5 employees was to limit the survey to the formal sector. However, often firms shrink over the survey period and thus 1.8% of our sample report less than 5 employees.

Table A2. Variable definitions and sources

Variable	Definition	Year	Source
% Female Workers	Number of female permanent production and non-production workers divided by the number of employees for the last fiscal year. Not reported for India or China.	Various	Enterprise Surveys
% Skilled Workers	Number of skilled production workers divided by the number of employees for the last fiscal year	Various	Enterprise Surveys
Exporter Only	Dummy variable equal to unity for firms that recorded non-zero direct exports as a percentage of total sales for the last fiscal year but did not import intermediate goods and were not majority foreign owned	Various	Enterprise Surveys
Foreign Only	Dummy variable equal to unity for firms that were owned more than 50% by foreign private individuals, companies, or organisations, but did not export directly or import intermediates	Various	Enterprise Surveys
Importer-Exporter Only	Dummy variable equal to unity for firms that both directly exported and imported intermediates, but which were not majority foreign owned	Various	Enterprise Surveys
Importer-Exporter-Foreign	Dummy variable equal to unity for firms that exported directly, imported intermediates, and were majority foreign owned	Various	Enterprise Surveys
Importer Only	Dummy variable equal to unity for firms that had non-zero imports as a percentage of total intermediate goods purchases for the last fiscal year, but no direct exports or majority foreign ownership	Various	Enterprise Surveys
Log(Capital)	Logarithm of the net book value of total assets for the last fiscal year	Various	Enterprise Surveys
Log(Employees)	Logarithm of the total number of permanent full time employees and full time seasonal/temporary workers for the last fiscal year	Various	Enterprise Surveys
Log(Labour Productivity)	Logarithm of total sales for the last fiscal year less raw material use, divided by the total number of employees	Various	Enterprise Surveys
Log(Sales)	Logarithm of total sales for the last fiscal year	Various	Enterprise Surveys
Log(Wage)	Logarithm of the total annual cost of labour, including wages, salaries, bonuses, and social payments for the last fiscal year	Various	Enterprise Surveys

Table A3. Summary Statistics

Variable	Observations	Mean	Standard Deviation
Foreign Owned	319	0.99%	0.093
Direct Exporters only	1370	3.79%	0.191
Importers only	10864	30.05%	0.458
Importers and Exporters	5086	14.1%	0.347
Importers, Exporters and Foreign Owned	1358	3.76%	0.190
Number of Employees	35906	145.4	627.6
Share of Skilled Workers	29936	42.5%	27.5%
Share of Female Workers	27359	28.8%	26.7%
Log Sales	33436	16.14	3.97
Log Labour Productivity	33243	12.48	3.72
Log Wages	30792	14.71	3.47
Log Capital	21927	15.80	3.43