# Does Informal Employment Respond to Growth Opportunities?

## *Trade-Based Evidence from Bangladesh*

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**Abstract**

Informal employment accounts for the majority of employment in many developing countries, yet its relevance to growth, and its links with the formal sector, remain poorly understood. A widely held view is that informality eventually gives way to formality as countries develop. In this paper, we examine the effects of growth opportunities - in the form of export-induced demand in Bangladesh - on four types of employment: formal, casual, unpaid, and self-employment. At an aggregate level, export-induced demand increases the levels of *all* four types of employment. We also conduct a district-level analysis, constructing a shift-share measure of trade exposure that relies on national, industry-level variation in exports, coupled with pre-existing, district-level shares of employment by industry. We find that the direct impact of trade is to increase labor force participation and formal employment. When we also include the indirect impacts of trade, in the form of induced demand through supply chain linkages, we find an even larger impact on labor force participation. The results also suggest that trade triggers an immediate increase in *both* formal and casual employment, as well as a longer-run increase in self-employment. We conclude that labor response to growth opportunities such as trade is not limited to formal employment, and a more nuanced understanding of informality in the growth process is needed.

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# 1 Introduction

The informal sector accounts for a substantial fraction of overall employment in many developing countries (LaPorta and Shleifer 2014). The informal sector is generally characterized not only by small size (the average formal firm has 126 employees, compared with 4 for informal firms), but informal firms are also substantially less productive (LaPorta and Shleifer 2008).

The cross-country evidence suggests that as per-capita income rises, the share of informality falls (LaPorta and Shleifer 2014). Several recent studies show that one important driver of such a shift away from informality can be increasing openness to trade. Theoretically, an increase in trade induces the the least productive firms to exit and reallocates market share towards the most productive firms (Melitz 2003). In keeping with this theory, we would expect trade to induce exit among informal firms - which are typically the smallest and least productive - and a reallocation towards larger, more productive and formal firms.

However, the empirical evidence on this relationship is mixed. Recent evidence from Vietnam demonstrates that reductions in export tariffs caused a reallocation of workers away from household business enterprises towards the formal sector (McCaig and Pavcnik 2014). In contrast, Bosch et al. (2007) find little evidence of a link between trade liberalization in Brazil and informality. Similarly, Goldberg and Pavcnik (2003) find no impact of import tariff reductions in Brazil on informal employment and weak effects in Colombia.

This mixed evidence suggests that the link between trade and informality is nuanced and might vary based based on the specific circumstances - including not only the institutional and economic conditions present in the country but also the way in which informality manifests in that country. In Latin America, for example, informality is often characterized by workers who are hired without a work permit, and therefore are not entitled to certain benefits (see, for example, Goldberg and Pavcnik 2003). In South Asia, however, informality is often defined in terms of the size of the firm (e.g., Nataraj 2011), or by whether the firm is registered with government authorities (McCaig and Pavcnik 2014).

In this study, we examine the link between exports and informality in Bangladesh. Bangladesh presents an important context for examining the link between trade and informality: the economy has been transformed by growth in the export oriented ready-made garments industry (Heath and Mobarak 2015). At the same time, there has been little change in the share of formal employment during a period of substantial export growth. In this context, informality is multi-faceted. From a firm perspective, registration with municipal authorities, to obtain a trade license, is common, but registration with central authorities - for example, Certificates of Incorporation - is rare (Zohir and Choudury

2012). From a worker perspective, the benefits that employees receive are correlated with the types of firms they work for, but vary substantially (Gutierrez *et al.* 2017).

Given the imperfect correlation of worker benefits and firm registration in the Bangladeshi context, we focus on informality in terms of employment rather than firms. Our focus is on the response of the types of employment to growth opportunities, irrespective of the type of firms in which workers are employed. We define employment in terms of four categories derived from the Bangladesh Labour Force Survey (LFS): formal (regular paid employees), casual (day laborers, casual workers, apprentices, and domestic workers), self-employed (including own-account workers), and unpaid workers (typically family members working in household businesses). We consider regular paid employees to be formal, and the other three categories as informal.

Figure 1 plots the share of employment in each category against Bangladeshi exports to the OECD. Between 2002 and 2010, exports more than doubled in real terms. Across the same time period, the formal share of employment remained almost constant at around 15 percent. Between 2010 and 2013, exports continued to rise, and during this period the share of formal employment did increase substantially, to about 23 percent. Nonetheless, employment remained concentrated among self-employment and unpaid employment, which together accounted for 60 percent of the workforce.

We use detailed labor force data from the Bangladesh LFS, a nationally representative survey, from 2002, 2005, 2010 and 2013 and trade data on Bangladesh's exports to the Organisation for Economic Co-operation and Development (OECD) countries from UN Comtrade, to examine the link between export-driven growth and informal employment.[1] We begin with an industry-level analysis, and examine the relationship between Bangladesh's exports and employment in each of the four employment categories (formal, casual, unpaid and self employment). This analysis examines the aggregate *level* of employment in each category, as well as the probability that an individual is employed in each category, conditional on being employed in a particular industry.

A central empirical challenge in studying the impact of trade on labor markets is the construction of a plausibly exogenous measure of exposure to trade. A number of studies have used industry-level tariff changes as an exogenous source of variation.[2] While tariff changes can be a useful tool for causal identification, these studies identify the impact of trade *policy* on labor markets. Our focus in this paper is on the actual outcomes of trade: the observed exports from Bangladesh to other countries. Presumably, observed exports depend on factors other than trade policy, for instance, the performance of the global economy. Given our focus on employment response to the growth opportunities a country

[1]We focus on exports to the OECD since the OECD represents the main destination for Bangladeshi exports. UN Comtrade data indicates that for the time period we study, the OECD constituted close to 90 percent of Bangladesh's world exports.

[2]Some examples include Topalova (2007), Topalova (2010) and McCaig and Pavcnik (2014). For a recent review of this literature, see Goldberg and Pavcnik (2016).

actually experiences, the outcome measure is appropriate for our case. We therefore seek alternate approaches to pin down causality.

One concern with using actual export values is that they will likely be endogenous in a regression of labor market outcomes on exports. That is, sectors with a higher degree of formal employment could be preferentially experiencing higher exports. This could happen if the importing countries find it easier to trade with more formal sectors, or if, in response to domestic political and social pressures, they explicitly target their imports toward more formal sectors where employees receive more benefits. The Bangladeshi government could also be promoting more formal sectors abroad and providing them with support to increase their exports. To address this potential endogeneity, we construct an instrumental variable for Bangladeshi exports based on international trade patterns. In particular, a suitable instrument for Bangladeshi exports should reflect demand factors in destination markets but should be independent of Bangladeshi supply-side factors, such as formality. We use Indian exports to the OECD as an instrument for Bangladeshi exports to the OECD. Variation across sectors in Indian exports should reflect demand patterns in OECD markets and should predict cross-sector variation in exports from Bangladesh to the OECD. At the same time, this instrument would be unaffected by supply-side shocks in Bangladesh.

An additional consideration in examining the impact of exports on labor market outcomes is to account for the effect that export expansion in a particular industry could have on other industries through inter-industry linkages. To take a simple example, an expansion of exports in the ready-made garments industry in Bangladesh not only increases demand for garments but also for industries that provide inputs to garments such as cotton and transportation. More generally, these inter-industry linkages can play a significant role in propagating sector-specific shocks throughout an economy (Acemoglu *et al.* 2012). Consequently, it is important to take these linkages into account when examining the impact of exports on labor markets, as they can also be quite large in magnitude (Acemoglu *et al.* 2014). Furthermore, a benefit of considering inter-industry linkages is that it allows us to take into account non-traded sectors, which themselves do not export but have supply links to exporting sectors. This allows for a more comprehensive examination of the labor market effects of exports rather than focusing solely on traded sectors. In our industry-level analysis, we account for these spillover effects using the the Input-Output (IO) matrix for Bangladesh, and examine the effect of what we call *total export demand* - equal to direct demand from exporting sectors, as well as effects that are induced through supply chain links - on employment.

At the industry level, we find that a rising tide lifts all boats - that is, export demand increases employment levels across the board. A 1 percent increase in export demand increases formal employment by 0.3 percent, casual employment by 0.2 percent, unpaid employment by 0.5 percent and self employment by 0.6 percent. When examining the

probability that any given individual belongs to a particular category of employment (conditional on employment in a specific industry), we find that exports are associated with a relative decrease in the probability of working in casual employment. By construction, this decrease must be associated with increases in the probability of other types of employment. Most of the decrease in casual employment appears to be associated with an increase in formal employment, with the remainder split between unpaid and self-employment, although the results are not statistically significant. The conclusion that response to growth opportunities such as trade is not limited to formal employment is already evident from these results.

A key limitation of the industry-level analysis is that it is conditional on employment - critically, that means we cannot examine whether trade affects the extensive margin of employment, which may be particularly important for women in the Bangladeshi context. We therefore also construct a Bartik-style instrument, which measures each district's exposure to trade, by interacting national industry-level trade in a given year, with the district's pre-existing (2002) share of employment in that industry. This measure allows us to examine the short- and medium-term employment response to shocks in both direct and total export demand, and also allows us to examine how trade affects the extensive margin of employment.

Consistent with previous studies, we find that an increase in direct trade exposure contemporaneously increases labor force participation, especially among women, and that most of this increase is driven by formal employment. A key contribution of our work is to show that when we consider total trade exposure, the increase in labor force participation almost doubles, and employment shifts not only towards formal but also towards casual employment. In the year in which the trade shock hits, we find a move away from self-employment. However, using lagged trade we can also study dynamic effects, and over time, the effect of the trade shock on formal employment fades, particularly for men. In addition, we find an increased probability of self-employment, and a decreased probability of casual employment, among both men and women. And, while the labor force participation effects are attenuated over time for men, they appear to persist for women. As with the industry-level results, we draw the conclusion that the response to growth opportunities such as trade is not confined to formal employment.

These results speak to a long standing debate on what the informal sector actually represents. The traditional view (e.g. Harris and Todaro 1970, Fields 1975, Chandra and Khan 1993) regards the informal sector as a holding ground for workers shut off from formal sector jobs. An implication of this view is that as an economy develops and the pool of formal sector jobs expands, we should see a transition away from informality towards formality. Indeed, the results of McCaig and Pavcnik (2014) suggest that this might hold in the case of Vietnam. An alternative view (e.g. Fajnzylber et al. 2006, Bennett and Estrin 2007) characterizes the informal sector as allowing entrepreneurship, providing

flexible work hours/locations and providing supply links to the formal sector. This view predicts that the informal sector will continue to exist (and perhaps even thrive) as the economy develops. As mentioned above, our focus is on the type of employment rather than the firm, but our results are consistent with this alternative view of informality.

Recent empirical evidence indicates that self employment need not be regarded as employment of last resort. For instance, Falco and Haywood (2016) examine the rise in self-employment in Ghana between the years 2004 and 2011. They find that the returns to skills (both observable and unobservable) in self-employment have increased relative to wage employment. In addition, they find that over time, physical and human capital have increased among self-employed workers. Our results are also consistent with the interpretation that export growth might soften capital constraints and allow more individuals to engage in self-employment activities. Capital constraints have repeatedly been identified as of the primary barriers to entrepreneurship (Blanchflower and Oswald 1998).

Overall, our results point to a more nuanced view of the informal sector, and support the idea that some types of informal employment may grow as the economy expands. This finding is consistent with previous work by Günther and Launov (2012), who find considerable heterogeneity within what is generally considered the informal sector: using data from Cote d'Ivoire, they note that around half the country's informal sector comprises those who are voluntarily self-employed. As our results suggest, it could be the case that the opportunities generated as a result of increased export demand allows more individuals to become self-employed.

The rest of the paper is organized as follows: Section 2 describes our empirical strategy, Section 3 describes our data, Section 4 presents results and Section 5 concludes with a discussion.

# 2 Empirical Strategy

In this section, we lay out the empirical strategy that we use in both the industry-level and district-level analyses. We begin by describing how we use supply chain linkages in the industry-level analysis to construct a measure of total export demand. We then present our main industry-level specification, and subsequently turn to the district-level analysis.

## 2.1 Supply Chain Linkages

We begin by formalizing the simple intuition that an increase in export demand in one sector propagates to other sectors of the economy. Consider the following example: an increase in demand for ready made garments exports from Bangladesh naturally increases demand for garment output. It also increases output demand for sectors upstream from

the garments industry. So, increased export demand might result in increased demand for cotton, cloth dying and transportation. These upstream effects, in turn, produce their own linked effects. Thus, increased demand for cotton (or cloth dying or transportation) creates its own series of demand for other industries' output. This chain of effects can be conveniently summarized through the Leontief inverse.

To construct the Leontief inverse, we begin with the input-output (IO) matrix for the economy. Consider a simple example of an IO matrix for a three sector economy:

| | Activity L | Activity M | Activity N |
|---|---|---|---|
| Commodity L | $a_{11}$ | $a_{12}$ | $a_{13}$ |
| Commodity M | $a_{21}$ | $a_{22}$ | $a_{23}$ |
| Commodity N | $a_{31}$ | $a_{32}$ | $a_{33}$ |
| Value Added | $v_1$ | $v_2$ | $v_3$ |

This matrix tells us that one unit of industry M's output requires $a_{12}$ units of industry L's output, $a_{22}$ units of its own output and $a_{32}$ units of industry N's output. On top of these intermediate inputs, industry M adds $v_2$ units of value added. By construction, since we are considering one unit of industry M's output, $a_{12} + a_{22} + a_{32} + v_2 = 1$.

Using such a matrix, we can write down the relationship between output, intermediate demand and final demand. Let $Y$ represent the output vector, $B$ a square IO matrix of the form discussed above without the value-added row, and $D$, the final demand vector. $Y$ can then be written as the sum of intermediate demand $BY$ and final demand $D$. The intermediate demand term represents the demand for a sector's output emanating from the other sectors of the economy. Consequently, output can be characterized as:

$$Y = (I - B)^{-1}D \tag{1}$$

where $I$ is the identity matrix and the term $(I - B)^{-1}$ is the Leontief inverse, which captures the chain of effects among linked industries.

For our analysis, we separate final demand into two components: domestic demand ($Dom$) and export demand ($Exp$). This implies:

$$Y = (I - B)^{-1}Dom + (I - B)^{-1}Exp \tag{2}$$

The term $(I - B)^{-1}Exp$ provides the *total export demand*. We can represent exports $Exp$ as an $N \times 1$ matrix where each element $e_i$ represents Bangladesh's exports from sector $i$. The Leontief inverse is an $N \times N$ matrix where each element $\alpha_{ij}$ represents the proportion of industry $j's$ output that is provided by industry $i$. Thus, the product $(I - B)^{-1}Exp$ is an $N \times 1$ matrix of the following form:

$$(I-B)^{-1}Exp = \begin{bmatrix} \alpha_{11}e_1 + \alpha_{12}e_2 + ... + \alpha_{1N}e_N \\ \alpha_{21}e_1 + \alpha_{22}e_2 + ... + \alpha_{2N}e_N \\ \vdots \\ \alpha_{N1}e_1 + \alpha_{N2}e_2 + ... + \alpha_{NN}e_n \end{bmatrix} \quad (3)$$

Each row of this matrix represents a sector and the summation provides the total export demand for that sector. It is constituted of a *direct* component ($\alpha_{ii}e_i$) representing demand for sector $i's$ output as a consequence of sector $i$'s exports and an *indirect* component ($(\sum_j \alpha_{ij}e_j) - \alpha_{ii}e_i$, for each $i$) representing demand for sector $i$'s output emanating from exports from other sectors.

The direct component for a given sector will be close to but not the same as the actual export value. This is because it will include both the initial export amount as well as the additional demand created by a sector for its *own* output (captured by the $a_{ii}$s in the above table). This becomes intuitive if one views each sector at the two-digit level, comprising sectors at finer levels that use each other's outputs as inputs in their own production. In other words, the $\alpha_{ii}$s in Equation 3 would typically be slightly greater than one. In Section 3, we provide a more concrete example based on Bangladeshi data.

In the following sections, we examine the relationship between the direct component, as well as total demand (direct plus indirect), on employment.

## 2.2 Industry-Level Specification

Our central interest is in examining the impact of export driven growth on employment outcomes. This can be motivated by considering how output by industry $j$ at time $t$ leads to a derived demand for employment in that industry:

$$Emp_{jt} = \alpha + \beta_1 Y_{jt} + \varepsilon_{jt} \quad (4)$$

As noted in Equation 2, $Y_{jt}$ consists of a domestic demand component and an export-demand component: $(I-B)^{-1}Dom$ and $(I-B)^{-1}Exp$. Our focus is on the vector $TotDem_t^{BGDexpOECD} = (I-B)^{-1}Exp$, which represents the total demand effect of Bangladesh's exports to the OECD.

This leads to the empirical specification we use, which examines the relationship between total OECD export demand for industry $j$ in industry group $m$, $TotDem_{jmt}^{BGDexpOECD}$, and the (natural log of the) level of employment $Emp_{jmt}^{Type}$, where
$Type \, \epsilon \, \{formal, \, casual, \, unpaid, \, self-employment\}$:

$$Emp_{jmt}^{Type} = \alpha + \beta_1 TotDem_{jmt}^{BGDexpOECD} + \alpha_t + \delta_m + \varepsilon_{jmt} \quad (5)$$

The key explanatory variable, $TotDem_{jmt}^{BGDexpOECD}$, is the $jth$ element of $TotDem_t^{BGDexpOECD}$,

which is calculated by multiplying the vector of Bangladeshi exports to the OECD at time $t$ with the Leontief inverse calculated from the Bangladeshi I-O table. We control for shocks that are common to each year ($\alpha_t$). Given that most Bangladeshi exports are restricted to a few industries, the main variation in our industry-level data comes from the cross-sectional variation in exports across industries, rather than the within-industry variation in exports over time. Therefore, we include dummies for 8 broadly defined industry groups (e.g., agriculture, forestry, manufacturing), $\delta_m$. Our identification strategy - which we describe in detail below - does not rely on variation in exports within each individual sector, but rather on exogenous variation across industries in total export demand.

$TotDem_{jmt}^{BGDexpOECD}$ is potentially endogenous in Equation 5. For instance, due to social or political pressures, OECD countries might choose to import more from sectors which have higher formal employment and provide a broad array of employee benefits, which would generate reverse causality between employment in a particular category and exports. Alternatively, sector-specific unobservables might confound our results. To take a simple example, Bangladesh has built up a substantial amount of capital (human as well as physical) for making garments. This pre-existing capital could affect exports to the OECD and also drive the domestic volume of production, both of which would affect employment.

To address these challenges, we construct an instrumental variable, drawing on the fact that OECD imports from Bangladesh, while influenced by supply-side factors in Bangladesh, would primarily reflect OECD's demand preferences. To isolate the demand-side effects, we use India's exports to the OECD - interacted with the Leontief inverse of *India's* IO table - as an instrument for total OECD export demand for Bangladeshi goods.[3]

Our first stage is therefore given by:

$$TotDem_{jmt}^{BGDexpOECD} = \beta_1 TotDem_{jmt}^{INDexpOECD} + \tau_t + \delta_m + \varepsilon_{jmt} \tag{6}$$

where $TotDem_{jmt}^{BGDexpOECD}$ is the $jth$ element of $TotDem_t^{BGDexpOECD} = (I - B^{BGD})^{-1} Exp^{BGD}$ and $TotDem_{jmt}^{INDexpOECD}$ is the $jth$ element of $TotDem_t^{INDexpOECD} = (I - B^{IND})^{-1} Exp^{IND}$. We estimate Equations 5 and 6 to study the effect of total export demand on employment levels in each of our four categories of interest. Standard errors are clustered at the industry level.

In addition to the industry level analysis, we also examine the impact of export-driven demand on the probability that an individual is employed in a particular category, conditional on being employed in a particular industry:

$$Pr_{ijmt}^{Type} = \beta_1 TotDem_{jmt}^{BGDexpOECD} + X_i + \tau_t + \delta_m + \varepsilon_{ijmt} \tag{7}$$

[3] Acemoglu et al. (2014) use a similar intuition: to instrument for Chinese exports to the US, they use exports from China to a set of high income countries other than the United States.

where $Pr_{ijmt}^{Type}$ is equal to 1 if an individual who works in industry $j$ (in industry group $m$) at time $t$, is working in employment category, $Type$. In these individual level specifications, we also include a vector of individual level controls $X_i$ (gender, age and age squared, education level, marital status). As in the industry-level regressions, standard errors are clustered by industry.[4]

## 2.3 District-Level Specification

The industry-level analysis outlined above suffers from three key limitations. First, we can only measure the relationship between industry-level exports and the probability of employment in a particular sector, conditional on the individual working in that industry. That is, we cannot examine the extent to which exports affect the *extensive* margin of employment. Second, given the relatively limited number of industries in which Bangladesh has substantial exports, we cannot separately identify the employment effects of direct export demand versus total export demand (which include the supply-chain effect captured by the Leontief inverse). Third, again given the limited number of industries that exhibit substantial exports, we do not have sufficient power to detect the dynamic impact of export shocks on employment, and the identification at the industry level comes from the cross-section. In that sense, we can think of the industry-level results as representing a long-run relationship between exports and employment type.

To overcome these challenges, we turn to an analysis at the zila (district) level. This analysis is based on a Bartik-style measure of trade exposure, which exploits changes in export-induced demand over time, coupled with pre-existing employment in a zila. We construct measures of direct and total trade exposure for zila $k$ at time $t$ as follows:

$$z_{kt}^{direct} = \sum_j s_{jk} ln\left(Y_{jkt}^{direct}\right), z_{kt}^{total} = \sum_j s_{jk} ln\left(Y_{jkt}^{total}\right) \tag{8}$$

where $s_{jk}$ is employment in industry $j$ in zila $k$, divided by total employment in zila $k$, in the base year (2002):

$$s_{jk} = \frac{Emp_{jk}^{2002}}{\sum_j Emp_k^{2002}} \tag{9}$$

$Y_{jkt}^{direct}$ and $Y_{jkt}^{total}$ represent the $jth$ elements of the vectors $Y_{kt}^{direct}$ and $Y_{kt}^{total}$, respectively, which give the direct and total demand induced in zila $k$ by national exports of industry $j$ in year $t$ ($E_{jt}$).

If we use the national exports $E$ without modification in calculating the $Y$s, we will

[4]For age, we create 5 age groups defined as follows: 15 to 29, 30 to 44, 45 to 59, 50 to 75 and 75 and above. Similarly, we create 5 categories of educational attainment: no education, grades 1 to 5, grades 6 to 9, secondary to intermediate (i.e. grades 10 to 12) and college graduate and above. Our indicators for marital status include categories for being married, separated or single.

be assuming that the trade exposure is uniform across zilas. However, this is unlikely to be true. Recall our aim is to capture export exposure via supply-chain linkages. For instance, even though transportation is a non-traded sector, we would like to capture the effect on transportation induced by exports in the garment sector. At the same time, we do not want to give credit for the transportation sector in a zila where there is no garment (or other exporting) sector, since the effect on the non-traded sector is likely to be localized. If we use the national exports uniformly across zilas this is exactly what we would be doing. To avoid this, we define $\theta_{jk}$ to capture how large a role zila $k$ plays in industry $j$ in 2002:

$$\theta_{jk} = \frac{Emp_{jk}^{2002}}{\sum_k Emp_j^{2002}} \tag{10}$$

We then define $Y_{jkt}^{direct}$ and $Y_{jkt}^{total}$ as:

$$Y_{kt}^{direct} = \begin{bmatrix} Y_{1kt} \\ Y_{2kt} \\ Y_{3kt} \\ \vdots \\ Y_{jkt} \end{bmatrix} = \begin{bmatrix} \theta_{1k}E_{1t} \\ \theta_{2k}E_{2t} \\ \theta_{3k}E_{3t} \\ \vdots \\ \theta_{jk}E_{jt} \end{bmatrix}, \; Y_{kt}^{total} = \begin{bmatrix} Y_{1kt} \\ Y_{2kt} \\ Y_{3kt} \\ \vdots \\ Y_{jkt} \end{bmatrix} = (I-B)^{-1} \times \begin{bmatrix} \theta_{1k}E_{1t} \\ \theta_{2k}E_{2t} \\ \theta_{3k}E_{3t} \\ \vdots \\ \theta_{jk}E_{jt} \end{bmatrix} \tag{11}$$

The inclusion of $\theta_{jk}$ weights ensures that we assign trade shocks to zilas in proportion to the importance of each exporting industry in that zila. To return to the above example, if there is a zila with no employment in the garment industry, but substantial employment in transportation, $\theta_{jk}$ will be 0 for the garment industry, and no credit will be given from additional garment exports to the transportation industry in that zila.

Armed with the variables we construct above, we estimate the following relationship between direct OECD demand for exports and probability of employment:

$$Pr_{ikt}^{Type} = \beta_1 z_{kt}^{direct} + X_i + \alpha_k + \alpha_t + \varepsilon_{ikt} \tag{12}$$

and between total OECD demand for exports and employment:

$$Pr_{ikt}^{Type} = \beta_1 z_{kt}^{total} + X_i + \alpha_k + \alpha_t + \varepsilon_{ikt} \tag{13}$$

where $\alpha_k$ and $\alpha_t$ represent zila and year dummies. In both cases, in addition to the four employment categories discussed earlier, there is now a new category: not working. In other words, $Type \, \epsilon \, \{formal, \, casual, \, unpaid, \, self-employment, \, not \, working\}$. Therefore, $Pr_{ikt}^{Type}$ is equal to 1 if an individual who works in zila $k$ at time $t$, is working in employment category, $Type$. We also include the same individual controls $X_i$ as we did in the industry-level analysis.

We first explore the contemporaneous relationship between export demand and employment.[5] We might expect contemporaneous demand to have an impact on employment if employers hire more workers, or individuals start or expand their businesses, in order to fulfill new export-driven orders. But we also examine the effects of lagged trade shocks on employment for two reasons. First, strong exports in a prior year might induce individuals to start a business, join the labor force, or switch industry or type of employment, after some period of time. Second, supply-chain effects in particular may take time to propagate across industries. We therefore estimate Equations 12 and 13 using trade data lagged by 1, 2, and 3 years, in addition to contemporaneous data.

# 3 Data

## 3.1 Data Sources

Our data on the Bangladeshi labor force come from multiple waves of the Bangladesh Labour Force Survey (LFS). The LFS is a nationally representative sample containing information on individuals aged 15 and above, including workers, the unemployed and those not in the labor force. Importantly, the LFS also contains information on the types of jobs in which individuals are engaged (i.e. formal, casual, unpaid or self-employed). We use data from three waves of the survey (2005, 2010 and 2013) in our analysis; we also use data from 2002 to construct the pre-existing district-level trade exposure measure (Section 2.3).

In the industry-level analyses, we restrict our sample to employed workers. We define employed workers as those who either worked for at least one hour in the past 7 days or if they did not work in the past 7 days, were attached to a job or business. Employment categories are based on responses about employment status. We categorize a worker as formal if (s)he reported working as an "employer" or "regular paid employee". Those who report being "unpaid family workers" are categorized as unpaid labor. The self-employed are defined as those who report their status as "own account worker/self-employed" and we categorize as casual labor those who report their status as "paid casual workers/day laborers", "domestic workers" or "paid/unpaid apprentices". In the event that a given worker reports multiple jobs, we only use information on their main activity i.e. the activity where the worker spent most of his/her time. The district-level analyses also include those who are not working, either because they are unemployed or not in the labor force.

Table 1 presents aggregate statistics on employment over time. Until 2010, formal employment accounts for the lowest share of employment (approximately 15 percent).

[5] Given the timing of each LFS survey, the 2005 (actually, 2005-06) and 2013 surveys were conducted towards the end of the periods for which we have trade data; the 2010 survey was conducted near the beginning to middle of the period for which we have trade data.

Although the formal share of employment increases to 23 percent in 2013, self employment represents the dominant mode of employment in Bangladesh, accounting for over 40 percent of employment in each year, while unpaid employment accounted for another 20 percent.

Table 2 shows summary statistics (weighted) at the individual level for 2005, 2010 and 2013. The median age in Bangladesh is 36, and education levels are quite low, although rising over time. In 2005 and 2010, 40 percent of the population reported no education; by 2013, this share had fallen to 29 percent.

We supplement the LFS data with trade data from UN Comtrade. For each year, we extracted data on exports (at the 6 digit HS 1996 product category level) from Bangladesh to all OECD countries. We then used the 2007 IO table from Bangladesh to calculate how these exports translate into direct and total trade-induced demand.[6] The IO matrix presents linkages between 86 sectors ranging from agriculture (e.g. paddy cultivation, jute cultivation) to manufacturing (e.g. pharmaceuticals, fertilizers, chemicals) and services (e.g. professional services, communication). For each of these 86 sectors, the matrix presents the monetary value of inputs drawn from all sectors of the economy. The matrix also provides the value added by each sector, imports for that sector, import duty and total supply from that sector. To calculate the matrix of input-use coefficients (matrix $B$ in Equation 2), we divided the input use amounts by the gross output of the industry (i.e. output before imports). We then calculated the Leontief inverse and applied it to exports to calculate both direct and total demand, as described in Section 2.1.[7] For the instrumental variables analysis, we performed a similar analysis using Indian exports to the OECD, along with the Indian IO table.

Table 1 shows that between 2002 and 2013, Bangladesh's exports to the OECD (in 2010 US$) grew substantially, from 5.9 billion to 19.7 billion. Ready made garments and knitting accounted for the vast majority of these exports. Table 1 also shows how these overall exports translate into direct and indirect export demand. Recall that direct export demand reflects a sector's demand for its own output and indirect export demand reflects

[6]It is important to note that while the rest of our data vary over time, we fix the IO coefficients at the year 2007. We do this to account for the fact that the structure of inter-industry linkages might react endogenously in response to changes in exports.

[7]To take a concrete example: In 2007, the total supply of wheat cultivation in Bangladesh was 46,960 million Taka. Of this total, input use from other sectors was 9,624 million Taka: 4,434 million from wheat cultivation, 67 million from livestock rearing, 926 million from fertilisers, 391 million from petroleum refining, 77 million from machinery and equipments, 60 million from electricity and water generation, 787 million from wholesale trade, 1406 million from retail trade, 105 million from water transport, 1101 million from land transport, 16 million from railway transport, 4 million from public administration and defense, 11 million from bank insurance and real estate, 1 million from professional services and 238 million from other services. In addition to this input use, the wheat cultivation industry itself provided 6,659 million Taka of value added. The sector had 29,449 million Taka in imports and 1,228 million Taka in import duty. The input use coefficients for wheat cultivation are calculated by dividing the monetary inputs from each sector (4,434 million Taka from wheat cultivation itself, 67 million Taka from livestock rearing, 926 Taka million from fertilisers, etc.) by the gross output for the wheat cultivation sector (16,283 million Taka which is the sum of 9,624 million Taka in input use and 6,659 million Taka in value added).

demand for a sector's output emanating from other sectors. Direct export demand rose from 6.1 billion US$ in 2002 to 20.5 billion US$ in 2013. As explained in Section 2.1, these direct export demands combine both the initial export amount as well as the additional demand created by a sector for its own output and are therefore slightly larger than the figures in the previous row in the table.[8]

This table also shows indirect export demand, which is, in fact, larger than the direct component: from 2002 to 2013, the indirect component increased from 7.4 billion US$ to 24.1 billion US$. The substantial size of the indirect demand underscores the importance of accounting for sectors that themselves might not export but have supply-chain relationships to exporting sectors. For instance, we find that while ready made garments and knitting account for the majority of observed exports, they account for a negligible portion of the indirect export demand. Instead, indirect demand is driven by sectors such as wholesale and retail trade, cloth milling, jute cultivation and land transport.

To underscore this point, Figure 2 presents a scatterplot of exports and indirect demand for 2002. On one end of the spectrum (lower right) are industries like ready-made garments with large amounts of exports (3.1 billion US$ for ready made garments) but no indirect demand. At the other end (upper left), we have industries like wholesale and retail trade with zero exports but sizable indirect demand (1.7 billion US$). In defining total export demand, we add the direct and indirect export components.

## 3.2 Concordances

We created concordances between the trade data, which use 6 digit HS 1996 product categories, and the LFS data, which use 4-digit Bangladesh Standard Industrial Classification (BSIC) codes.[9] In addition, we created a concordance between the BSIC categories and the 86 industry codes in the Bangladesh IO matrix. In order to create a unique mapping, we first aggregated the 86 IO industry codes to 65 consolidated IO industry codes.[10] After creating these consolidated IO industry codes, we allocated each 4-digit BSIC code (separately for Revision 3 and Revision 4) to one of the 65 consolidated IO industry codes. To match our trade data with the IO sector codes, we carried out a similar mapping exercise: we first mapped 6-digit HS 1996 codes to 4-digit HS 2002 codes (using concordances provided by UN Comtrade). Next, we used reported HS 2002 and IO sector mappings for Bangladesh (Policy Research Institute of Bangladesh 2014) to map the export data to the IO sector codes. Since our analyses are conducted using consolidated IO codes,

[8] We expect the export and direct demand figures to track each other fairly closely since sectors generally use a small portion of their own output.

[9] Two waves of the LFS data (2002 and 2005) use the BSIC Revision 3 classification while 2010 and 2013 use the BSIC Revision 4 classification.

[10] For example, BSIC Rev 3 code 111 refers to "Growing of cereal crops". On IO sector side, we have three categories that BSIC 111 could be mapped to: "Paddy Cultivation", "Wheat Cultivation" and "Other Grain Cultivation". We consolidated these three IO codes into one code, "Grain Cultivation" and mapped BSIC 111 to this sector.

we first calculated total export demand at the 86 code level and then aggregated up to the consolidated IO sector level. In the results reported below, IO industries refers to the consolidated IO codes. The concordances are available from the authors upon request.

# 4 Results

## 4.1 Aggregate Industry-Level Analysis

Table 3 shows results from the industry-level regressions of employment levels on total export demand, by industry, following Equation 5.[11] For each category of employment, we first present OLS results followed by our IV results, where we instrument Bangladesh's exports to the OECD using Indian exports to the OECD. The F-statistics which are above 30 in all cases, suggest a strong first stage.[12]

The OLS and IV results are similar in magnitude and, for formal and self-employment, are both significant at the 1 percent level. The coefficients suggest that a 10 percent increase in total export demand would be associated with a 2.5 percent increase in formal employment, and a 3 percent increase in self-employment. The coefficients on casual and unpaid employment also suggest increases on the order of 1.2 and 1.5 percent, respectively, although the IV results are not significant at conventional levels. These findings are consistent with the notion that export growth creates employment opportunities overall (e.g. Fu and Balasubramanyam 2005, Fukase 2013). An important point, however, is that trade-induced demand not only increases formal employment, but increases employment of all types, particularly self-employment. In the next section, we consider how the increases in employment types compare with one another, by examining how trade exposure affects a given individual's probability of employment in each category.

## 4.2 Individual-Level Industry Analysis

Table 4 presents the results of the individual-level regressions shown in Equation 7. As in Table 3, we show both the OLS and the IV results. The first-stage F-statistics are once again strong, suggesting that Indian exports predict Bangladeshi export to the OECD

[11] For the employment level analysis, we take a log transformation of employment level, which drops IO industry - year cells that have zero employment for a particular employment category. Further, in constructing the sector-year level total export demand, we have three industries that exhibit no supply links to other sectors in the 2007 Bangladesh IO matrix (Entertainment, Education Service and Handloom Cloth). We also observe no exports for these industries. Finally, in merging LFS data with the IO industry codes, one industry is dropped for one year since we do not observe the associated BSIC codes in the LFS data for that year. Consequently, we have 185 IO industry-year combinations instead of the full 3 x 65 = 195.

[12] As noted above, we take a log transformation of the dependent variable; thus, when employment is zero in a particular employment category for a given year and industry, that observation drops out. Thus, we have slightly different observation counts for each employment category, leading to slightly different first stages.

very well. The results show a strong negative relationship between total trade exposure and casual employment; a 10 percent increase in an industry's trade exposure is associated with a reduction of 0.2-0.3 percentage points in the probability of working casually, conditional on employment in that industry. Note that this does not mean that total casual employment falls; in fact, Table 3 suggests that trade induces an increase in all types of employment, including casual employment. Nonetheless, casual employment rises less than other types of employment, leading to a lower probability of working in this type of job.

By construction, this reduced probability must be associated with an increased probability in other types of employment. The coefficient in Column (2) suggests that a 10 percent increase in an industry's trade exposure is associated with an increase of 0.18 percentage points in formal employment, although the result is not statistically significant at conventional levels. The IV coefficient on unpaid employment suggests an 0.05 percentage point increase, while the IV coefficient on self-employment suggests an 0.08 percentage point increase, although neither is significant.

Taken together the industry-level and individual-level analysis suggest that trade exposure increases employment in all sectors, but that the increase is strongest for formal employment and potentially self-employment, with a decreased probability of casual work.

## 4.3 District-Level Analysis

We now turn to a district-level analysis, which will allow us to account for the extensive margin of employment. This analysis also shifts focus away from cross-sectional variation in trade exposure, to how within-zila trade shocks affect employment.

### 4.3.1 Baseline Results

In Table 5, we present baseline results from the district-level analysis. We examine the effects of contemporaneous, export-induced demand - both direct and total - on the probability of working in one of the four employment categories (formal, casual, unpaid worker, self-employed), as well as of not working. All specifications control for gender, education level, marital status, age and age squared, as well as year and zila dummies.

In Panel A, we show the results for direct export demand. The coefficient on not working, -0.062, suggests that increased direct trade exposure increases participation in the labor force. Among employment categories, the largest increase - in terms of magnitude and statistical significance - is for formal employment, and suggests that most of the increase in the labor force is absorbed by the formal sector. Since we cannot track specific individuals over time, we cannot distinguish whether those who join the labor force contribute to the increase in formal employment, or whether those already in the labor force, but in casual employment or in family businesses, move into formal employment.

In Panel B, we examine the impact of *total* export demand on zila-level employment. The coefficient on not working, -0.11, is nearly twice as large as in Panel A, albeit only significant at the 10 percent level. This suggests that once trade shocks propagate through the supply chain, they have a much stronger impact on labor force participation. The coefficient on formal employment (0.0797) is also larger than in Panel A, as is the coefficient on casual employment (0.0464), while the coefficient on self-employment turns negative and significant(-0.0656). Overall, these results suggest that while direct trade exposure has the greatest impact on formal employment, total trade exposure has a larger impact, and not only increases formal employment, but also casual employment, while shifting labor away from self-employment. The increase in the magnitude and significance of casual employment when we go from direct to total exports suggests they are being absorbed mainly by industries within a zila that are *linked* to trade-related industries.

Table 5 focused on the contemporaneous impacts of trade on employment. We might expect firms to hire more workers, or individuals to move into or out of self-employment, based on current increases in demand and anticipated increases stemming from this. However, a prior year's trade shock could also induce longer-term changes in workforce participation or type of employment. For example, when firms first become aware of an increase in demand, they might decide to increase overtime work by current employees, but if the increase persists, they may decide to hire additional employees. Similarly, an individual considering whether to start a business may wait to see if a positive shock persists, or to raise capital, before making an investment decision.

To explore these longer-term effects of trade exposure, in Figure 3 we show the relationship between employment by type, and direct and total export demand, where we measure demand contemporaneously, as well as lagged by 1, 2, and 3 years. The figure shows regression coefficients as well as 95% confidence intervals. Panel (a) shows that the impact of both direct and total trade exposure on formal employment fade to some extent over time. Interestingly, we see opposite patterns for casual and self-employment: casual employment rises immediately in response to an increase in total export demand, but then falls over time, whereas self-employment falls immediately, but then rises. This pattern likely reflects the fact it takes time to become self-employed, while becoming a casual worker can happen quickly. The effect of direct export exposure on the probability of not working also fades over time, while the effect of total export exposure on this probability remains fairly stable, albeit noisy.

### 4.3.2 Heterogeneity by Gender

In this section, we explore heterogeneity in the zila-level effects by gender. This heterogeneity is particularly important in the Bangladeshi context; as recent evidence indicates, export-driven growth in the country has resulted in increased female labor force participation (Heath and Mobarak 2015). Mobility across employment types may also differ by

gender.

Tables 6 and 7 show the contemporaneous effects of direct and total trade exposure, respectively, by gender. Consistent with prior work on Bangladesh, Table 6 shows that the effect of direct trade exposure on labor force participation is twice as large for women as for men. Both men and women increase their participation in formal employment; however, while women also increase their participation in casual and self-employment, men tend to increase their participation in unpaid employment. In Table 6, we find that the effects of total export exposure on labor force participation are particularly large for women; the magnitude of the coefficient is, -0.164, although not significant at conventional levels, is twice the magnitude of the coefficient for women of direct export exposure. For men, we find increased participation both in formal work and in casual work, with similar magnitudes. Women exhibit similar patterns, but the magnitude of the increase is much larger for formal employment than for casual employment. Both men and women exhibit a decrease in the probability of self-employment, with the magnitude and significance being higher for men. In summary, men and women both see the probability of formal employment increase but differ in the probabilities of different types of informal employment.

Figure 4 illustrates both contemporaneous and lagged effects by gender. As in the baseline results, the impact of both direct and total trade exposure on formal employment fades over time, although the result remains positive when considering the impact of total trade exposure over time for women. For casual employment, the pattern of an initial increase, followed by a decrease, is driven by male employment. In contrast, the impact on unpaid employment, albeit noisy, appears to be larger for women. Both men and women exhibit similar patterns for self-employment, with an initial decrease followed by an increase, particularly when considering total export exposure. As with the regressions using contemporaneous trade figures, the results for men and women are more similar when it comes to formal employment than when it comes to the various categories of informal employment. Finally, as we might expect, the coefficients from the regressions of not working on total export exposure appear to be largest for women, even though the confidence intervals are large. Moreover, these effects are the most persistent over time, suggesting that even after an export shock fades, women who have joined the labor force may elect to remain there.

# 5 Conclusion

The nature of employment in the process of economic development has long attracted the attention of economists. For instance, nearly four decades ago, Lucas (1978) noted that the process of economic growth will tend to shift the balance of employment in an economy away from self-employment towards wage employment. While informal employment was

not his focus, his argument that rising real wages will increase the opportunity cost of self-employment and create incentives for wage employment is relevant for understanding the composition of employment in a developing country such as Bangladesh where self-employment is identified more with informality than formal entrepreneurship. And, as mentioned in the introduction, the view that informality will decrease with development has continued to be voiced (LaPorta and Shleifer 2014).

We conduct an empirical study in Bangladesh to shed light on the response of various types of employment to growth opportunities. Specifically, we examine the effect of the expansion in export demand on formal, casual, unpaid and self employment, as well as on labor force participation. We account for supply-chain links by using Bangladesh's input-output matrix to calculate the effect of export demand on industries which themselves do not export but supply inputs to exporting industries.

Our results suggest that export-led growth increases the levels of employment across *all* four employment categories. We also find that export growth causes the probability of casual work - conditional on working at all - to fall over time, while increasing the probability of working formally, and of being self-employed. While on one hand, these results support the conventional view that as economies grow, formal employment will rise, they suggest a more nuanced pattern of employment response to growth opportunities - one in which informality, and self-employment in particular, plays an important role in the process of economic development.

These results have important policy implications. Developing countries such as Bangladesh that experience growth cannot assume that their employment is rapidly becoming formal. Instead, they may need to continue to improve employment conditions for workers in the informal labor. Given the role played by self-employment, the government might also want to emphasize policies that aid workers who run their own household businesses, such as easing credit and informational constraints.

While we have found a causal effect of export expansion on informal employment, we have not identified the reasons for the persistence of this type of employment. For instance, what is the role played by the quality of institutions? Do workers prefer to stay informal if they do not see benefits of formality in an environment were laws may not be effectively enforced? What mechanisms, if any, do informal workers use to augment their skills and gain job-relevant knowledge? Which types of workers transit to formal employment? These would be useful research questions to pursue in the future.

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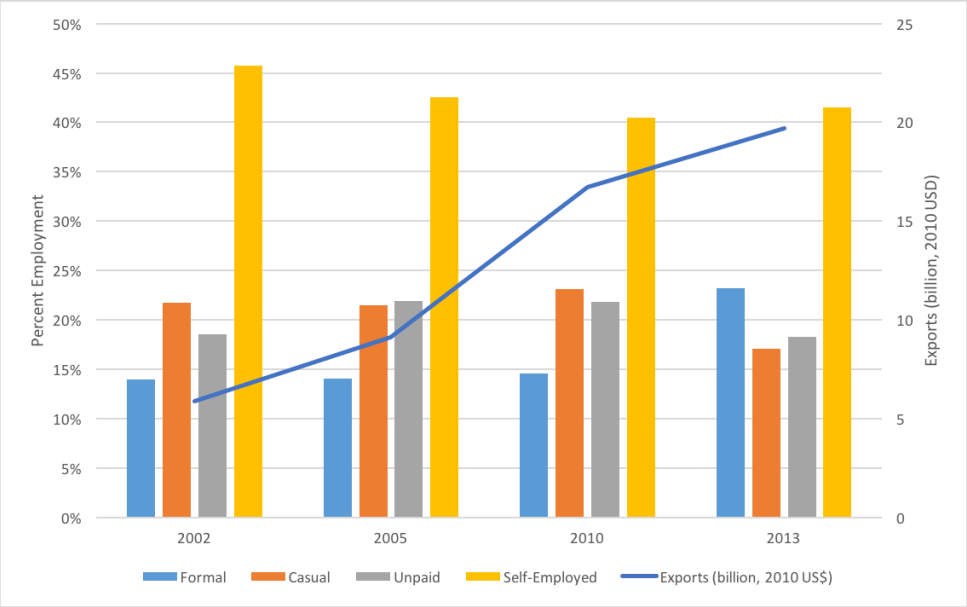
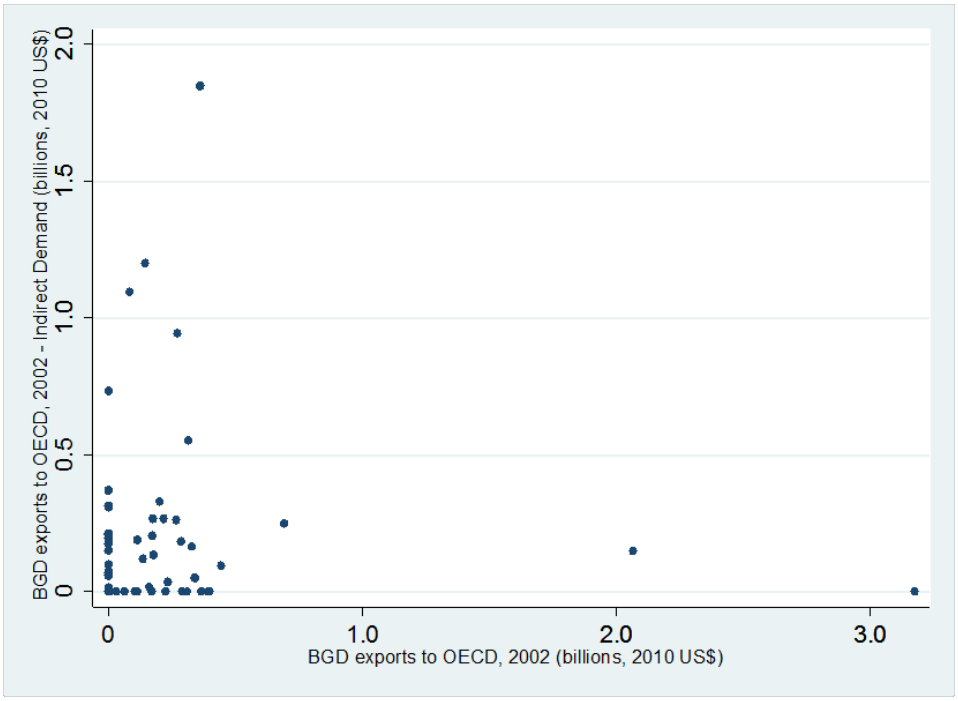
# Figures

Figure 1: Exports and Employment Types



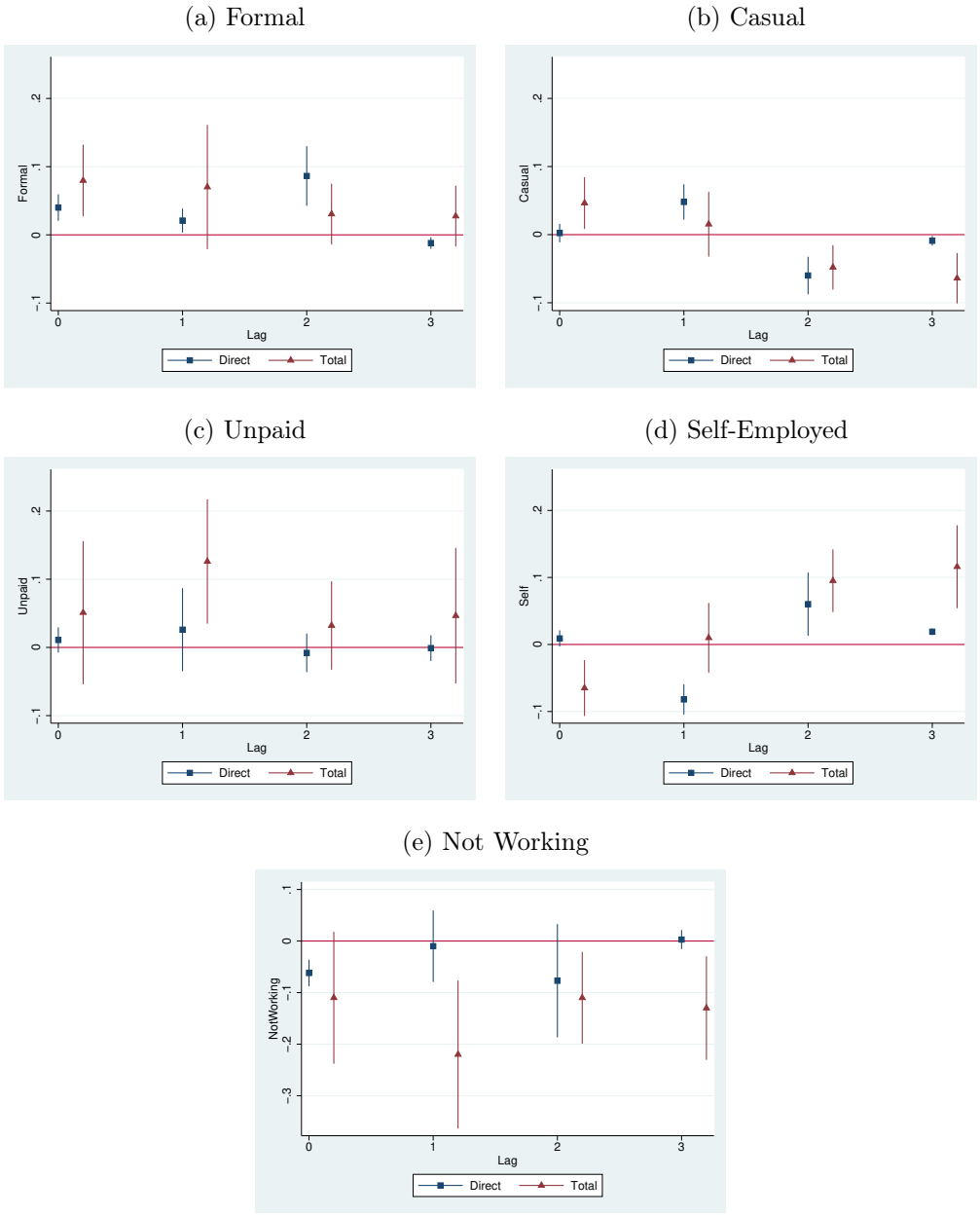

Notes: Bangladeshi exports to the OECD, and share of each type of employment in Bangladesh. Export data are from UN Comtrade and employment data are from the Bangladesh Labor Force Survey (LFS). LFS weights are used to calculate the employment shares. Exports are deflated to 2010 US$ using the US CPI.

Figure 2: Direct and Total Exports




Notes: Bangladeshi exports to the OECD and induced, indirect demand in 2002, based on 2002 UN Comtrade data and the 2007 Bangladesh IO matrix. Exports are deflated to 2010 US$ using the US CPI.

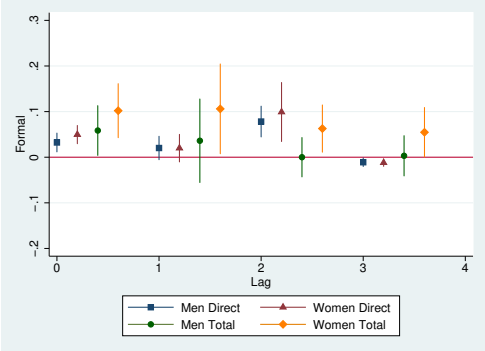
Figure 3: Impact of Export Exposure on District-Level Employment Over Time



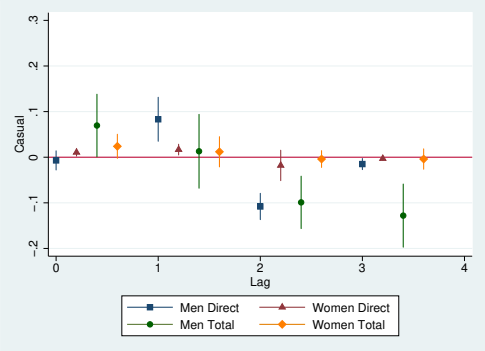

Notes: Results from regressions of individual likelihood of employment by category on district-level trade exposure. The x-axis in each graph shows the number of lags with which exports are measured, where 0 indicates contemporaneous exports, 1 indicates a 1-year lag, etc. All specifications control for gender, education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level.

Figure 4: Impact of Export Exposure on District-Level Employment Over Time, by Gender

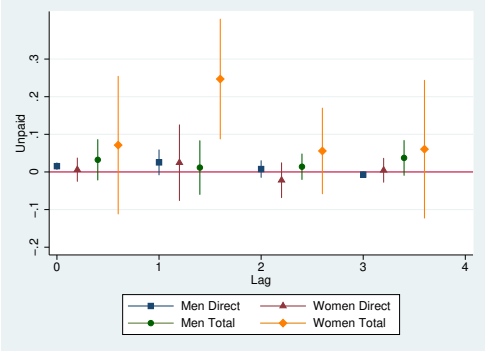
(a) Formal



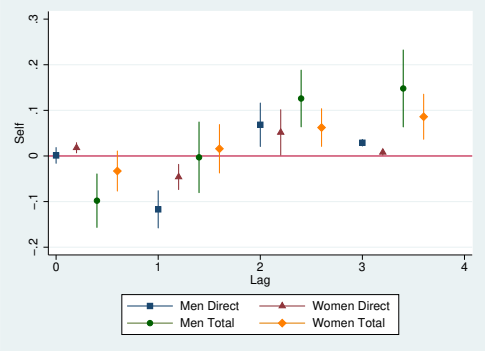

(b) Casual



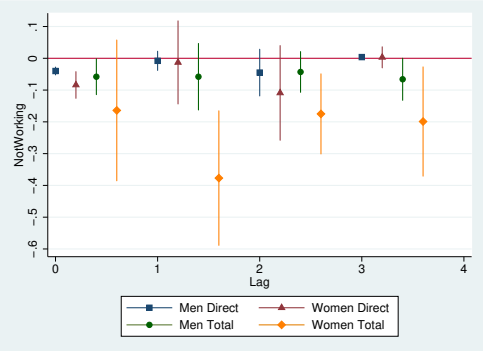

(c) Unpaid




(d) Self-Employed




(e) Not Working




Notes: Results from regressions of individual likelihood of employment by category on district-level trade exposure, by gender. The x-axis in each graph shows the number of lags with which exports are measured, where 0 indicates contemporaneous exports, 1 indicates a 1-year lag, etc. All specifications control for education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level.

# Tables

Table 1: Aggregate Statistics

| Trade | 2002 | 2005 | 2010 | 2013 |
|---|---|---|---|---|
| Exports (billion, 2010 US$) | 5.87 | 9.1 | 16.7 | 19.7 |
| Direct Demand (billion, 2010 US$) | 6.12 | 9.47 | 17.5 | 20.5 |
| Indirect Demand (billion, 2010 US$) | 7.37 | 11.2 | 20.3 | 24.1 |
| Employment Levels | | | | |
| Formal Employment (million) | 6.1 | 6.6 | 7.9 | 13.5 |
| Casual Employment (million) | 9.5 | 10.1 | 12.5 | 9.9 |
| Unpaid Employment (million) | 8.1 | 10.3 | 11.8 | 10.6 |
| Self Employment (million) | 20 | 20 | 21.9 | 24.1 |
| Employment Shares | | | | |
| Formal Employment (%) | 14 | 14 | 15 | 23 |
| Casual Employment (%) | 22 | 21 | 23 | 17 |
| Unpaid Employment (%) | 19 | 22 | 22 | 18 |
| Self Employment (%) | 46 | 43 | 40 | 41 |

Notes: Aggregate statistics on employment, based on multiple waves of the Bangladesh LFS, and trade, based on data from UN Comtrade. LFS weights are used to calculate employment figures. The 2007 IO matrix for Bangladesh is used to calculate direct and indirect demand components of exports. Monetary amounts are deflated to 2010 US$ using the US CPI.

Table 2: Summary Statistics (Individual Level)

| | 2005 | | 2010 | | 2013 | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Formal | 0.08 | 0.28 | 0.08 | 0.29 | 0.13 | 0.30 |
| Casual | 0.12 | 0.34 | 0.13 | 0.35 | 0.09 | 0.27 |
| Unpaid | 0.12 | 0.35 | 0.12 | 0.34 | 0.10 | 0.27 |
| Self | 0.24 | 0.45 | 0.23 | 0.44 | 0.23 | 0.38 |
| Not working | 0.44 | 0.53 | 0.43 | 0.51 | 0.45 | 0.45 |
| Female | 0.49 | 0.53 | 0.50 | 0.52 | 0.51 | 0.46 |
| Age | 36.15 | 16.47 | 36.13 | 16.49 | 37.05 | 15.29 |
| **Marital Status** | | | | | | |
| Married | 0.72 | 0.48 | 0.74 | 0.45 | 0.73 | 0.41 |
| Separated | 0.07 | 0.27 | 0.06 | 0.25 | 0.07 | 0.24 |
| Single | 0.21 | 0.43 | 0.20 | 0.41 | 0.20 | 0.37 |
| **Education Level** | | | | | | |
| None | 0.40 | 0.52 | 0.40 | 0.51 | 0.29 | 0.41 |
| Class 1 - 5 | 0.22 | 0.44 | 0.21 | 0.42 | 0.22 | 0.38 |
| Class 6 - 9 | 0.21 | 0.43 | 0.24 | 0.44 | 0.31 | 0.42 |
| Secondary - Intermediate | 0.12 | 0.35 | 0.12 | 0.34 | 0.13 | 0.31 |
| Graduate & above | 0.04 | 0.21 | 0.03 | 0.17 | 0.05 | 0.20 |

Notes: Summary statistics for individuals, based on the 2005, 2010 and 2013 waves of the Bangladesh LFS. Sampling weights are applied.

Table 3: Impact of Total Export Demand on Aggregate, Industry Employment Levels

| | Formal | | Casual | | Unpaid | | Self | |
|---|---|---|---|---|---|---|---|---|
| | OLS | IV | OLS | IV | OLS | IV | OLS | IV |
| **Ln (Total Demand)** | 0.265*** | 0.246*** | 0.180* | 0.117 | 0.273*** | 0.149 | 0.351*** | 0.317*** |
| | (0.0832) | (0.0885) | (0.0950) | (0.135) | (0.0841) | (0.107) | (0.0843) | (0.117) |
| First Stage Results | | | | | | | | |
| Ln (Indian Total Demand) | | 0.976*** | | 0.995*** | | 0.965*** | | 0.970*** |
| | | (0.149) | | (0.152) | | (0.160) | | (0.155) |
| F Stat | | 42.79 | | 42.99 | | 36.58 | | 38.95 |
| Observations | 177 | 171 | 176 | 171 | 153 | 151 | 175 | 171 |

Notes: OLS and IV results for regressions of log of employment levels at the industry level, on log total export demand of Bangladesh's exports to the OECD. In the IV specifications, total exports from India to the OECD are used to instrument for Bangladesh's exports to the OECD. Export values are contemporaneous. All specifications include dummies for year and broad industry groups. LFS weights are used to calculate employment levels for each industry. Standard errors are clustered at the IO industry level. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Impact of Total Export Demand on Probability of Employment by Category

| | Formal | | Casual | | Unpaid | | Self | |
|---|---|---|---|---|---|---|---|---|
| | OLS | IV | OLS | IV | OLS | IV | OLS | IV |
| **Ln (Total Demand)** | 0.0232* | 0.0179 | -0.0227*** | -0.0306*** | -0.00953 | 0.00479 | 0.00901 | 0.00798 |
| | (0.0130) | (0.0149) | (0.00535) | (0.00881) | (0.00677) | (0.0100) | (0.00650) | (0.00805) |
| First Stage Results | | | | | | | | |
| Ln (IND Export Demand) | | 1.198*** | | 1.198*** | | 1.198*** | | 1.198*** |
| | | (0.220) | | (0.220) | | (0.220) | | (0.220) |
| F-test | | 29.53 | | 29.53 | | 29.53 | | 29.53 |
| R-Squared | | | | | | | | |
| Observations | 188,857 | 185,309 | 188,857 | 185,309 | 188,857 | 185,309 | 188,857 | 185,309 |

Notes: OLS and IV results for regressions of individual likelihood of employment by category on log total export demand of Bangladesh's exports to the OECD. In the IV specifications, total exports from India to the OECD are used to instrument for Bangladesh's exports to the OECD. Export values are contemporaneous. All specifications control for gender, education level, marital status, age and age squared, as well as year and broad industry group dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the IO industry level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Impact of Export Demand on Contemporaneous District-Level Employment

(a) Panel A: Direct Export Exposure

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Exports)** | 0.0400*** | 0.00232 | 0.0109 | 0.00904 | -0.0620*** |
| | (0.00973) | (0.00676) | (0.00927) | (0.00593) | (0.0128) |
| Observations | 353,027 | 353,027 | 353,027 | 353,027 | 353,027 |

(b) Panel B: Total Export Exposure

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.0797*** | 0.0464** | 0.0510 | -0.0656*** | -0.110* |
| | (0.0265) | (0.0191) | (0.0533) | (0.0210) | (0.0649) |
| Observations | 353,027 | 353,027 | 353,027 | 353,027 | 353,027 |

Notes: Results from regressions of individual likelihood of employment by category on district-level trade exposure (calculated using direct export demand in Panel A and total export demand in Panel B). Export values are contemporaneous. All specifications control for gender, education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the IO industry level. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Impact of Direct Export Demand on Contemporaneous District-Level Employment, by Gender

(a) Panel A: Direct Export Exposure, Men

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0323*** | -0.00754 | 0.0154*** | 0.00122 | -0.0407*** |
| | (0.0105) | (0.0107) | (0.00442) | (0.00885) | (0.00632) |
| Observations | 176,457 | 176,457 | 176,457 | 176,457 | 176,457 |

(b) Panel B: Direct Export Exposure, Women

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0496*** | 0.0106** | 0.00601 | 0.0180*** | -0.0844*** |
| | (0.0102) | (0.00425) | (0.0158) | (0.00570) | (0.0214) |
| Observations | 176,570 | 176,570 | 176,570 | 176,570 | 176,570 |

Notes: Results from regressions of individual likelihood of employment by category on direct district-level trade exposure, for men (Panel A) and women (Panel B). Export values are contemporaneous. All specifications control for education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Impact of Total Export Demand on Contemporaneous District-Level Employment, by Gender

(a) Panel A: Total Export Exposure, Men

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.0585** | 0.0695* | 0.0323 | -0.0985*** | -0.0580** |
| | (0.0278) | (0.0350) | (0.0274) | (0.0299) | (0.0288) |
| Observations | 176,457 | 176,457 | 176,457 | 176,457 | 176,457 |

(b) Panel B: Total Export Exposure, Women

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.102*** | 0.0239* | 0.0713 | -0.0338 | -0.164 |
| | (0.0302) | (0.0135) | (0.0933) | (0.0224) | (0.113) |
| Observations | 176,570 | 176,570 | 176,570 | 176,570 | 176,570 |

Notes: Results from regressions of individual likelihood of employment by category on total district-level trade exposure, for men (Panel A) and women (Panel B). Export values are contemporaneous. All specifications control for education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** p<0.01, ** p<0.05, * p<0.1

# Appendix A: Heterogeneity by Age and Education

This appendix presents results from the zila-level analysis, split by age group[13] (Tables 8 and 9) and by education level (Tables 10 and 11).

Table 8 show that the impacts of direct trade exposure are particularly strong for young individuals, with the largest increases in labor force participation and formal sector employment seen among those aged 18-22. There is also a substantial increase in labor force participation among 15-17 year olds, which suggests that immediate work opportunities caused by trade-induced growth may lead to unintended consequences by increasing the probability that those of school age work - thereby potentially lowering the probability that they remain in school. Table 9 similarly shows strong results for the impact of total trade exposure on labor force participation among young workers. Those aged 18-33 are most likely to increase work in the formal sector, while the increase in casual work is particularly concentrated among the youngest and oldest groups.

Recent work also suggests that worker mobility across industries (or employment types) might be driven by factors such as educational attainment (Dix-Carneiro 2014). Table 10 examines the impacts of direct trade exposure by education level, and shows that the increase in formality is driven by those with at least some education. The most educated also exhibit a move into self-employment. With respect to total trade exposure, Table 11 shows that the increase in formal employment is largely confined to those in the middle of the educational distribution, while casual work increases across the board. In both Tables 10 and 11, we also find that the impact of trade exposure on labor force participation is driven by those with at least some education.

[13]For the results that allow for heterogeneity by age, we include age categories linearly, rather than quadratically as when age is used as a control in the main specifications.

Table 8: Impact of Direct Export Demand on Contemporaneous District-Level Employment, by Age

(a) Panel A: Direct Export Exposure, 15-17 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0318** | 0.0176 | 0.0256** | 0.0146** | -0.0893*** |
| | (0.0153) | (0.0116) | (0.00965) | (0.00623) | (0.0194) |
| Observations | 28,293 | 28,293 | 28,293 | 28,293 | 28,293 |

(b) Panel B: Direct Export Exposure, 18-22 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0760*** | 0.00717 | 0.0379*** | 0.00712 | -0.129*** |
| | (0.0170) | (0.00728) | (0.0131) | (0.00567) | (0.0214) |
| Observations | 53,641 | 53,641 | 53,641 | 53,641 | 53,641 |

(c) Panel C: Direct Export Exposure, 23-33 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0631*** | -0.00752 | 0.0188* | 0.000208 | -0.0733*** |
| | (0.0159) | (0.00790) | (0.0112) | (0.0116) | (0.0154) |
| Observations | 95,043 | 95,043 | 95,043 | 95,043 | 95,043 |

(d) Panel D: Direct Export Exposure, 34 years old and up

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0138** | 0.00494 | -0.00318 | 0.0107 | -0.0262** |
| | (0.00677) | (0.00846) | (0.00929) | (0.00805) | (0.0119) |
| Observations | 176,050 | 176,050 | 176,050 | 176,050 | 176,050 |

Notes: Results from regressions of individual likelihood of employment by category on direct district-level trade exposure, by age group. Export values are contemporaneous. All specifications control for gender, education level, and marital status, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9: Impact of Total Export Demand on Contemporaneous District-Level Employment, by Age

(a) Panel A: Total Export Exposure, 15-17 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.0165 | 0.0837** | 0.0407 | 0.0275 | -0.164** |
| | (0.0374) | (0.0405) | (0.0453) | (0.0301) | (0.0757) |
| Observations | 28,293 | 28,293 | 28,293 | 28,293 | 28,293 |

(b) Panel B: Total Export Exposure, 18-22 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.139*** | 0.0547** | 0.0792 | -0.00683 | -0.265*** |
| | (0.0522) | (0.0222) | (0.0583) | (0.0230) | (0.0993) |
| Observations | 53,641 | 53,641 | 53,641 | 53,641 | 53,641 |

(c) Panel C: Total Export Exposure, 23-33 year olds

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.157*** | 0.0202 | 0.0685 | -0.0869** | -0.156** |
| | (0.0563) | (0.0223) | (0.0719) | (0.0425) | (0.0752) |
| Observations | 95,043 | 95,043 | 95,043 | 95,043 | 95,043 |

(d) Panel D: Total Export Exposure, 34 years old and up

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.0216 | 0.0561** | 0.0352 | -0.0961*** | -0.0161 |
| | (0.0174) | (0.0241) | (0.0503) | (0.0299) | (0.0606) |
| Observations | 176,050 | 176,050 | 176,050 | 176,050 | 176,050 |

Notes: Results from regressions of individual likelihood of employment by category on total district-level trade exposure, by age group. Export values are contemporaneous. All specifications control for gender, education level, and marital status, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 10: Impact of Direct Export Demand on Contemporaneous District-Level Employment, by Education

(a) Panel A: Direct Export Exposure, No Education

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | -0.0126** | 0.0268 | 0.00842 | -0.0107 | -0.0111 |
| | (0.00500) | (0.0177) | (0.0173) | (0.0149) | (0.0220) |
| Observations | 122,912 | 122,912 | 122,912 | 122,912 | 122,912 |

(b) Panel B: Direct Export Exposure, Grades 1-10

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0492*** | -0.0126* | 0.00788 | 0.00418 | -0.0486*** |
| | (0.0134) | (0.00675) | (0.00917) | (0.00633) | (0.0107) |
| Observations | 167,018 | 167,018 | 167,018 | 167,018 | 167,018 |

(c) Panel C: Direct Export Exposure, secondary and above

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Direct Demand)** | 0.0313** | 0.00176 | 0.0141** | 0.0154*** | -0.0621*** |
| | (0.0126) | (0.00384) | (0.00638) | (0.00496) | (0.00751) |
| Observations | 63,097 | 63,097 | 63,097 | 63,097 | 63,097 |

Notes: Results from regressions of individual likelihood of employment by category on direct district-level trade exposure, by education level. Export values are contemporaneous. All specifications control for gender, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11: Impact of Total Export Demand on Contemporaneous District-Level Employment, by Education

(a) Panel A: Total Export Exposure, No Education

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | -0.0202 | 0.0629* | 0.0253 | -0.109** | 0.0444 |
| | (0.0128) | (0.0359) | (0.0782) | (0.0467) | (0.0771) |
| Observations | 122,912 | 122,912 | 122,912 | 122,912 | 122,912 |

(b) Panel B: Total Export Exposure, Grades 1-10

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.108** | 0.0307 | 0.0493 | -0.0711*** | -0.115** |
| | (0.0423) | (0.0231) | (0.0456) | (0.0249) | (0.0555) |
| Observations | 167,018 | 167,018 | 167,018 | 167,018 | 167,018 |

(c) Panel C: Total Export Exposure, secondary and above

| | Formal | Casual | Unpaid | Self | Not working |
|---|---|---|---|---|---|
| **District exposure (Total Demand)** | 0.0399 | 0.0400** | 0.0389 | 0.0277 | -0.147*** |
| | (0.0353) | (0.0167) | (0.0317) | (0.0235) | (0.0380) |
| Observations | 63,097 | 63,097 | 63,097 | 63,097 | 63,097 |

Notes: Results from regressions of individual likelihood of employment by category on total district-level trade exposure, by education level. Export values are contemporaneous. All specifications control for gender, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

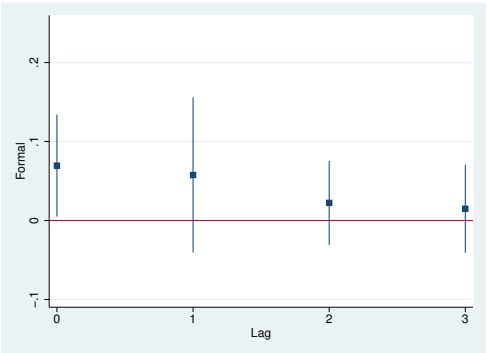
# Appendix B: Comparing District-Level and Industry-Level Results

The main manuscript presented both industry-level and zila-level results. These results are not directly comparable, as the industry results only focus on total demand effects and also, out of necessity, exclude the extensive margin of employment. To better compare the zila-level and industry-level results, Figure 5 shows the results of re-estimating the zila-level results for total trade exposure, excluding the not working category. As noted in the main text, since the industry-level regressions are driven largely by cross-sectional rather than temporal variation, we can consider them to be indicative of the long-run relationship between trade and employment. Thus, the results that are most comparable to the industry-level results are those lagged by 3 years.

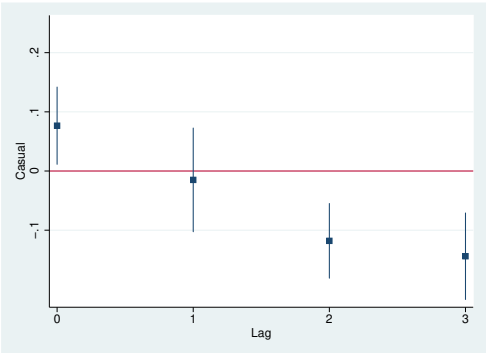
Figure 5 suggests that over time, and conditional on employment, an increase in total trade exposure decreases the probability of casual employment and increases the probability of self-employment. The probability of formal employment also rises, although the coefficient is not statistically significant at the 5% level. These findings are indeed consistent with the industry-level results (Table 4), which showed a negative impact of trade exposure on the probability of casual employment, and a slight positive impact on formal and self-employment. In other words, shutting out the extensive margin and focusing on the intensive margin recovers results in district-level regressions that are consistent with the industry-level regressions.

Figure 5: Impact of Export Exposure on District-Level Employment Over Time, Intensive Margin

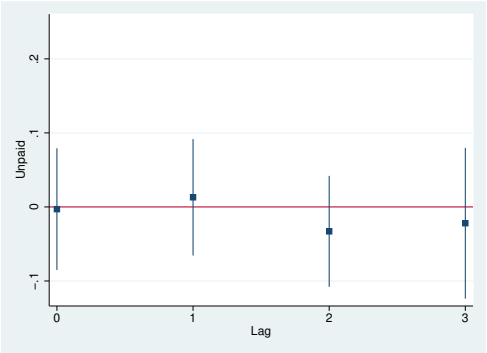
(a) Formal



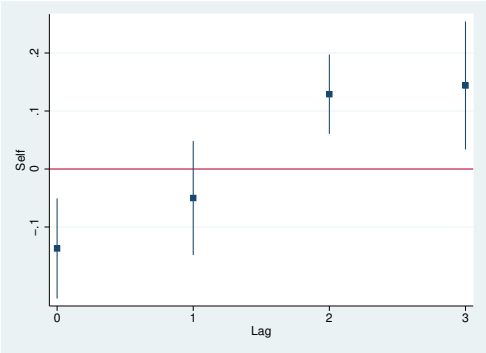

(b) Casual




(c) Unpaid




(d) Self-Employed




Notes: Results from regressions of individual likelihood of employment by category on district-level trade exposure, excluding those not working. The x-axis in each graph shows the number of lags with which exports are measured, where 0 indicates contemporaneous exports, 1 indicates a 1-year lag, etc. All specifications control for gender, education level, marital status, age and age squared, as well as year and zila dummies. Sampling weights from the LFS are applied. Standard errors are clustered at the zila level.