Local Labor Market Dynamics and Export Shocks

Theory and Evidence from Indonesia

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Abstract

This paper studies the dynamic effects of export exposure on local labor markets in Indonesia, that is, how an increase in exports affects a range of labor market indicators over time. The paper develops an empirical strategy to instrument exposure to foreign demand shocks and validates it by showing that labor market responses are consistent with what a quantitative spatial model would predict after demand shocks. The results show that employment, labor force, real wages, and real wage bills increase more in districts that are more exposed to foreign demand shocks—that is, where exports increase more—relative to the least exposed regions. Extending the analysis over multiple response horizons shows that these shocks persist six years after the foreign demand shock. Lastly, employment responses are stronger among skilled workers relative to unskilled workers and in the formal sector relative to the informal sector.

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Local Labor Market Dynamics and Export Shocks: Theory and Evidence from Indonesia

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1. Introduction

In the mid-1980s, Indonesia shifted its development strategy focus from import substitution to export orientation. This transition was accompanied by deregulation aimed to better link Indonesia with the global economy (Saryahadi, 2001). During the 1990s, the country’s employment and trade patterns evolved, with agricultural employment decreasing in relative importance and trade partners such as China and India emerging as important destinations.

In this paper, we assess the degree to which changes in exports affect labor markets in Indonesia. We estimate how exports affect a range of local labor outcomes, including wages, employment, informality, and labor force participation. Up to six years after an initial shock, we calculate Impulse Response Functions (IRFs) that capture the evolving short- and long-run impacts of export exposure on labor outcomes.

The primary analysis is based on a dataset that combines the Indonesian labor force survey (Sakernas) and industry exports (UN Comtrade) spanning from 1993 to 2014.2 To address the potential endogeneity of exports (the fact that exports are potentially correlated with unobserved characteristics of firms/regions), we isolate the exogenous part of exports using foreign demand shocks of Indonesian trade partners. Intuitively, this strategy leverages the fact that each local market in Indonesia is a small open economy; that is, they are engaged in international trade but are small relative to the world market and must take prices and global demand as given rather than trying to influence them strategically. Therefore, each region is exposed to global demand shocks, which are likely uncorrelated with the distribution of unobserved characteristics across the Indonesian districts.

The findings suggest that employment increases, the labor force expands, and unemployment declines in districts that experience an increase in exposure to foreign demand. More specifically, on average, the elasticity of employment with respect to exports is 0.1 over the short run and 0.3 over the long run. The long-run elasticity of the labor force with respect to foreign demand shocks is positive but smaller than that of employment. Six years after the foreign demand shock, the cumulative response of the labor force is about 0.17%. A 1% increase in exports induces a decrease in the unemployment rate of 0.08 percentage point six years after the shock.

Effects on real average wages are also positive, with an elasticity of 0.6 over the long run. We try to proxy for overall welfare by estimating the elasticity of the real wage bill with respect to exports: it is high and highly significant, reaching 1.2 six years after the shock.

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2 During the 1990s Indonesia experienced several liberalization efforts that boosted exports as well as a backlash induced by the currency crisis. The team considered it interesting to incorporate trade data associated to periods of boom (1993-97), recession (1998-2000), and recovery (2001-onwards) of export values for the medium- and long-run implications of the results. The second reason, finishing the study period in 2014, relates to a life-cycle project the team was planning to conduct using a representative individual-level panel (IFLS data) for the same period 1993-2014 (the last round of IFLS took place in 2014). The team considers comparing results for district-level averages with those using much more granular data between 1993-2014 would be of great interest. Extending the horizon of the current study to 2022 is doable and will be incorporated in future versions of the paper.
It should be noted that this is not the aggregate employment effect on the economy, but rather the relative effect on regions more exposed to exports relative to those least exposed. The direction of the relative effects is consistent with what a spatial model predicts after demand shock.

This study contributes to the literature on the distributional effects of trade across space. The pervasiveness of informality in Indonesia—with unskilled laborers typically engaged in the informal economy—makes the study of the relationship between trade liberalization and informality a main interest.

In exploring the mechanisms, we decompose employment responses across formalization rates of firms and education levels of workers. The elasticity of skilled employment and formal employment is higher than the elasticity of unskilled employment and informal employment. This is consistent, since exporting firms tend to be larger, are more likely to be in the formal sector, and skilled workers are more likely to be in the formal sector.

Increasing economic openness is associated with employment of skilled workers growing faster than that of unskilled workers. Following trade liberalization between 1993-2002, formalization increased in Indonesia, along with a structural reallocation of labor (Amiti and Cameron, 2012). Our results are consistent with these findings.

The remaining of this study is structured as follows: Section 2 presents stylized facts, Section 3 introduces a quantitative spatial model and discusses the expected responses of a demand shock, Section 4 elaborates on the empirical methodology, Section 5 presents the results, Section 6 discusses the margins of adjustment, and Section 7 concludes.
2. Stylized facts

Indonesia has undergone sustained structural transformation since the early 1990s. The share of agriculture, hunting, forestry, and fishing in the labor force decreased from two-thirds in 1993 to about one-half in 2014. Services expanded from 18 to 24 percent, while manufacturing expanded from 14 to 20 percent.

**Figure 2.1: Indonesia: Employment, by Aggregate Sector (1993-2014)**

Merchandise trade was, and continued to be, dominated by manufacturing. Mining and quarrying account for about 20 percent of total exports value with the primary agriculture sector counting for less than 10 percent of the total value of exports. Some of the most important export products are coal briquettes (10.9% of total value), palm oil (8.21%), petroleum gas (4.48%), gold (2.16%), and rubber (2.07%).

Indonesia’s six largest trade partners have persistently accounted for at least 60 percent of total exports value. However, the relative relevance of each partner has changed substantially over time. Japan accounted for nearly one-third of exports by value in the beginning of the period and less than 10 percent by the end. Conversely, China grew in relative relevance from less than 5 percent to more than 15 percent of export values.
Regional labor market exposure to merchandise exports varies widely in Indonesia. Some districts have large exposure of up to three standard deviations above average, while others have exposure of six standard deviations below average. Provinces located in West Papua (easternmost large island), where a large part of the mining industry concentrates, have outsized exports. A large share of exports also originates in Sumatra (westernmost large island), where palm oil production is particularly strong.

Figure 2.3: Indonesian Districts’ Labor Market Exposure to Merchandise Exports (Average 1993-2014, in standard deviations around sample average)

Source: Authors’ calculations with data from Sakernas and UNCOMTRADE. This Figure denotes a region-specific exposure to exports, defined as \[ \frac{1}{T} \sum_{t} \frac{\bar{X}_{r,t}}{L_{r,t}} = \frac{1}{T} \sum_{t} \sum_{i} \frac{L_{r,i,t}}{L_{r,t}} \bar{X}_{i,t}, \] where \( \bar{X}_{i,t} \) denotes total exports of industry \( i \) at period \( t \);
\( L_{r,i,t} \) denotes total employment in region \( r \) and industry \( i \); and \( L_{r,t} \sum_i L_{r,i,t} \) is the total aggregate employment in region \( r \). The data were then normalized by subtracting the sample average and dividing by the standard deviation.

### 3. Motivation: Demand shocks in a spatial economy

To motivate the empirical work, we resort to a simple quantitative exercise, modeled after Allen and Arkolakis (2014), but with multiple sectors. In the model, the population of each region is determined by free domestic migration. Individuals chose their place of residence depending on their tastes for the characteristics of each region (such as parks, beaches, and culture) as well as the real wage in each region. Individuals buy goods produced in every region and production and trade will determine real wages. The initial allocation of workers across sectors in each region will determine the effects of demand shocks. The full model is presented in Annex B. In our quantitative simulation, to make interpretation of results easier, we assume there are many regions and two sectors. We analyze the case in which half of the regions experience sharp increases in exports from one sector while the other half of regions do not. We label the regions fully exposed to that industry-specific shock as our “treatment group.” Of course, in general equilibrium, the non-treated group will still be affected by the shock, as prices and population will change in all regions.

Nonetheless, we can still consistently estimate the relative effect of the demand shock, using a difference-in-differences (DiD) model:

\[
O_{r,t} = \alpha + \beta 1_{\{r \in \text{Treat}\}} + \gamma 1_{\{t \geq \text{Post}\}} + \omega 1_{\{s \in \text{Treat}\} \cap \{t \geq \text{Post}\}} + \epsilon_{r,t}
\]

where \( O_{r,t} \) is some outcome variable of interest. Here, the parameter of interest that captures the relative effect—that is, the average treatment on the treated (ATT)—is \( \omega \). The results for two outcome variables—labor force, (which will be equal to employment, since there is no unemployment in the model)—and real wages are shown in Table 3.1.

### Table 3.1: DiD model on simulated outcomes of quantitative model

<table>
<thead>
<tr>
<th></th>
<th>Labor Force / Employment</th>
<th>Real wages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment Dummy</strong></td>
<td>-0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>Post Dummy</strong></td>
<td>-0.298***</td>
<td>82.755***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td>0.597***</td>
<td>121.435***</td>
</tr>
<tr>
<td>* <strong>Post Dummy (ATT)</strong></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>1.000***</td>
<td>60.064***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>R(^2)</strong></td>
<td>0.999</td>
<td>0.999</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors clustered at the district level in parentheses. * \( p<0.1; \) ** \( p<0.05; \) *** \( p<0.01 \)
The coefficient on the constant captures the initial population (assumed to be one) and real wages across regions. The zero coefficient in the treatment group reflects our assumption that, before the shock arrives, all sectors in the population are identical. This leads to symmetric outcomes for regions in the pre-treatment period.

The treatment group treatment period (Treatment*Post) interaction shows that the model predicts that total employment will expand in regions exposed to demand shocks, relative to untreated regions. In untreated regions, employment will contract – since workers will move from those regions to the regions facing the demand shock. The contraction is reflected by the negative coefficient multiplying the treatment dummy.

Real wages are also expected to increase after a foreign demand shock. In this case, however, real wages increase in every region, but they increase more in treated regions. Since the effect on other regions is positive, the ATT will be smaller than the overall increase in real wages in treated regions.

With these results in hand, we know that regions more exposed to demand shocks will be expected to see a relative increase in employment and real wages. We can now estimate empirical relative effects across regions of Indonesia.

4. Empirical strategy

A common empirical strategy to evaluate distributional impacts across geographical areas is to exploit the differential exposure of local labor markets of a given country to international trade shocks. Conceptually, these shocks typically happen at some aggregate level—say, at the industry level—and local labor markets are differentially exposed to aggregate shocks by some pre-existing characteristic—say, by the industry composition of the labor force. A weighted average of its exposure to each shock provides an estimate of local labor market exposure to industry-specific shocks.

Suppose, for instance, that there are two regions (north and south) and two industries (manufacturing and agriculture) in a country. Suppose further that the south has most of its labor force employed in agriculture and the north has most of its labor force employed in manufacturing. If foreign demand for agriculture increases exogenously, then the south will be more exposed to this international trade shock. We capture distributional effects of trade across regions by measuring the relative effect of the most exposed region relative to the least exposed region, which can be thought of as a simple differences-in-differences estimator like the in the previous section.

Methodologically, when there are many regions and sectors, we estimate the distributional effects of trade through shift-share (Bartik) regressions (for details on the methodology, see Borusyak et al., 2020). The intuition above still follows through, and the estimator can still be interpreted by DiD (cf. Chodorow-Reich, 2020). This method has become a standard in the literature used both for import shocks (Autor et al., 2013 and Dix-Carneiro and Kovak, 2015) and export shocks (Robertson et al., 2021 and Góes et al., 2023).
Formally, to measure how exports affect local labor markets, we interact export growth in different industries $i \in I$ with differential exposure to industry-specific shocks across different local labor markets. Formally, we define local labor market exposure to exports growth as:

$$\Delta \tilde{X}_{r,t} = \sum_{i \in I} \frac{L_{r,i,t-1}}{L_{r,t-1}} \cdot \Delta \tilde{X}_{i,t} = \sum_{i \in I} \frac{L_{r,i,t-1}}{L_{r,t-1}} \cdot (\tilde{X}_{i,t} - \tilde{X}_{i,t-1})$$

where $\tilde{X}_{i,t}$ denotes log total exports of industry $i$ at period $t$; $L_{r,i,t}$ denotes total employment in region $r$ and industry $i$; and $L_{r,t} = \sum_{i \in I} L_{r,i,t}$ is total aggregate employment in region $r$.\(^3\)

Given the shares $\frac{L_{r,i,t}}{L_{r,t}}$, our objective is to estimate the dynamic treatment effect of a regressor, which can be done provided that the shifters $\Delta \tilde{X}_{r,t}$ are as good as random. If this were true, we would be able to recover the dynamic treatment effect by estimating a sequence of local projection regressions as in Jordà (2005).

Given a time-series for some outcome of interest $\{O_{r,t}\}$ and a vector of control variables $\{Z'_{r,t}\}$, one could estimate a sequence of OLS regressions using:

$$O_{r,t+h} - O_{r,t-1} = \alpha_h + \beta_h \Delta \tilde{X}_{r,t} + Z'_{r,t-1} \Phi_h + \epsilon_{r,t+h}, \quad \text{for } h \in \{0,1,2,3 \ldots \}$$

Note that, in this sequence of regressions, for each $t$, the right-hand variables are fixed at the time of the shock while the dependent variable changes and denotes the cumulative change of the outcome variable since the reference period. The path of $\beta_h$ shows a cumulative impulse response function, which can be interpreted as the dynamic average treatment effect of the outcome variable.

Provided that estimation is consistent, as shown by Plagborg-Møller and Wolf (2021), local projections like the one above retrieves impulse response functions that are asymptotically identical to the ones from vector autoregressions (VARs), but with the advantage of being fully flexible models for instrumental variable estimation and not requiring identifying the full matrix of autoregressive coefficients.

Furthermore, more recently, Dube et al. (2023) have shown that a local projections design like this can be generalized as a dynamic DiD estimator. While their paper focuses primarily on a case with binary treatment, the authors argue that it extends to the continuous treatment case, the one we consider in this study with $\Delta \tilde{X}_{r,t}$.

These results hinge on the consistency of the estimator. However, there are many reasons to believe that exposure to exports can be endogenous, including the fact that they depend on local human capital, technology, and other factors of production, which can be naturally correlated with

\(^3\) For some countries, there is a time-series of observed exports by district. We could not find a time series of these data spanning the sample time we used in this work. There are, however, advantages in using the indirect measure of exposure to exports because we are directly instrumenting for production through labor force shares. In other countries regional exports are typically recorded at the last point of invoicing. If there is intermediation, then there might be some record distortion, particularly at a lower level of geographic disaggregation.
unobserved local labor market characteristics. Therefore, one needs to use some plausibly exogenous shifters that are not correlated with domestic demand to consistently estimate $\beta_h$.

We propose an instrument that tries to isolate an exogenous part of exports by leveraging the correlation between changes in exports and changes in foreign demand. The idea is that some regions are more exposed to particular industries and, furthermore, some industries are exposed to particular destinations. For instance, if most of Indonesian exports in agriculture go to China but most of manufacturing exports go to the US, changes in demand in China (such as a fiscal stimulus) will impact agriculture more than manufacturing. Similarly, those regions with most of their employment in agriculture will be more exposed to China than to the US.

Similar to Aghion et al. (2018), we use *global demand* in each particular industry as a source of exogenous variation. The application by Hummels et al (2014) is closely related to our approach in that they use the growth in global demand interacted with pre-period shares to instrument for exports. Our exposure measure, however, varies over time, as we show here.

Let $S$ be the set of countries in the world and let $s \in S$ denote the source country, Indonesia. Indonesian exports are its sales to the set of all countries other than itself $d \in S \setminus s$: $\bar{X}_{t, t} = \sum_{d \in S \setminus s} \bar{X}_{d, t, t}$. Formally, we define the instrument as:

$$
\Delta \bar{X}_{r, t} \equiv \sum_{i \in I} L_{r, i, t-1}, \sum_{d \in S \setminus s} \frac{X_{d, i, t-1}}{\bar{X}_{i, t-1}} \cdot \Delta Y_{d, t}
$$

where $\frac{X_{d, i, t-1}}{\bar{X}_{i, t-1}}$ denotes country $d$’s share of industry $i$’s exports; and $\Delta Y_{d, t}$ is the change in log U.S. dollar GDP in country $d$. Note that this instrument incorporates every country that Indonesia exports to in every industry, with a higher weight to the higher export partners—likely the six partners emphasized in Figure 2.2—but can differ for industry-specific exports.

Estimation now takes the form of two-stage least squares, with the first stage being:

$$
\Delta \bar{X}_{r, t} = \alpha + \beta \Delta \bar{X}_{r, t} + Z'_{r, t-1} \Phi + \bar{e}_{r, t}
$$

and the second stage:

$$
O_{r, t+h} - O_{r, t-1} = \alpha_h + \beta_h \Delta \bar{X}_{r, t} + Z'_{r, t-1} \Phi_h + \bar{e}_{r, t+h}, \text{ for } h \in \{0, 1, 2, 3 \ldots\}
$$

where $\Delta \bar{X}_{r, t}$ are the predicted values of the first stage regression. Estimation of $\beta_h$ is consistent if $E[\Delta \bar{X}_{r, t} \cdot \bar{e}_{r, h}, Z'_{r, t-1}, L_{r, i, t-1}, X_{d, i, t-1}] = 0$ for every $d$ and $r$ pair at every horizon $h$; that is, if past changes in foreign demand are uncorrelated with the distribution of unobserved factors that drive changes in local labor markets in Indonesia.

Intuitively, global foreign demand shocks can affect small open economies, like individual Indonesian districts. Furthermore, each Indonesian district is itself a small open economy.
Therefore, it is unlikely that changes in foreign demand are correlated with the *distribution of unobserved factors* that *differentially* drive changes in local labor markets.

As shown in the bin-scatter below, a visual representation of the first-stage regression, changes in exposure to exports growth strongly correlate with changes in exposure to foreign demand shocks. The F-statistic is 1,545, so the instrument is extremely relevant. If the instrumentation strategy is valid, then the instrument satisfies the exclusion restriction. In that case, we can interpret the results in this section as the causal dynamic effect of exports on local labor markets in Indonesia.

**Figure 4.1: Indonesian Districts’ Labor Market Exposure to Merchandise Exports**
(binscatter that partitions the support of the x-axis into 100 bins; x-axis: regional exposure to foreign demand growth, in pct change; y-axis: regional exposure to export growth, in pct change)

The underlying regression has $n = 8,558$, with unconditional $\beta = 0.697$ and $t$-stat = 39.31

Source: Authors’ calculations with data from Sakernas and UNCOMTRADE.

### 5. Main results

The results in this section should be interpreted in **relative terms**, as in a difference-in-differences estimator. Below we plot the results of a given region being relatively more exposed to exports growth (as instrumented by foreign demand shocks) over time, in other words, the causal dynamic treatment effect of exports on those outcome variables.

In each Figure we present here, the red line shows the coefficients $\beta_h$, estimated using two-stage least squares, as explained in the methodology section. The confidence interval shows 95 percent confidence bands with standard errors clustered at the district-level.
Controls include share of females, share of population with high-school or higher education, share of urban population, average age in district, and the initial share of labor force included in the analysis. We note that services exports would be systematically underrepresented since we are working with a dataset of merchandise exports. We assume, therefore, that foreign demand shocks to non-included sectors are zero and control for their initial shares (see online appendix of Borusyak et al., 2020). District and time fixed effects are not included because the data are already differenced.\textsuperscript{4} Since we are focusing on labor market effects, for consistency, we restrict the sample to individuals between 15 to 55 years old, the retirement age for the years covered.

\textit{Employment, labor force, and population}

Districts with increased exposure to exports see an increase in employment. A 1\% exogenous increase in exports induces, relative to regions nonexposed to foreign demand shocks, a 0.1\% increase in employment over the short run and a 0.3\% response over the long run. The 95\% confidence interval for the long-run elasticity ranges from 0.15 to 0.46. Adjustment does not happen immediately, with the total employment response increasing over time. Over the end of the estimated horizon, the impulse response function seems to be converging – i.e., marginal changes are small.

\textbf{Figure 5.1: Effect of Exports on Employment}  
(Elasticity of employment with respect to exposure to exports growth, by horizon)

The effect on employment is consistent with a demand shock. We also estimate the effect on total

\textsuperscript{4} As shown by Borusyak et al. (2020), including unit fixed effects may affect the consistency of the estimator. We have estimated the impulse responses with district fixed effects and the results look broadly the same.
labor force. The long run elasticity of the labor force with respect to foreign demand shocks is positive but smaller than that of employment. Six years after the foreign demand shock, the cumulative response of labor force is about 0.17%.

**Figure 5.2: Effect of Exports on the Labor Force**

(Elasticity of the labor force with respect to exposure to exports growth, by horizon)

The theoretical model does not separate between labor force and employment and suggests that after a demand shock both should expand. Hence, this result is also consistent with a demand shock. Our theoretical model makes no predictions about unemployment since it assumes full employment in every period.

However, empirically we see that districts more exposed to exports experience a decline in unemployment rates. The effect is sufficient to drive down the unemployment rate a total of 0.08 percentage points two years after the shock in comparison to least exposed regions.
Figure 5.4 shows the relative effect on district populations after a foreign demand shock. The effect is either zero or modest, likely smaller than percentage responses in employment and labor force. This differs from one of the assumptions in your theoretical model, that assumes free migration across regions. Any observed effect could be due to internal migration or to other drivers of population growth. For instance, we cannot distinguish whether changes in a district population are driven by relative changes in fertility rates or cross-district migration.\(^5\) We could only do so with individual level data. Estimating the effect of trade shocks on population changes (or lack thereof) in a developing country like Indonesia with longitudinal data of individuals would be a fruitful avenue for future research.

\(^5\) In general, the Bartik shift-share coefficient will differ from the aggregate coefficient in the presence of spillovers or heterogeneous treatment effects and cannot be extrapolated to the aggregate effect unless under very strong assumptions of no spillovers. The effect on population suggests at least cross-region spillovers. How can we interpret the stable unit treatment values assumption (SUTVA) violations in our setting? Since migration is in the same direction of the employment treatment effect, if migrants take up some of the employment, we should interpret the effect as an upper bound to the (aggregate) effect without migration. Intuitively, this is similar to the canonical DiD using simulated data: the estimated coefficient might overstate actual \textit{local} increase in employment. Note that aggregate employment growth is \textit{zero} in the quantitative model.
Wages and welfare

We first estimate the relationship between foreign demand shocks and real average wages. Consistent with demand shocks, as seen in the simulations of the quantitative model, real wages increase in relative terms in regions more exposed to shocks. The elasticity of real wages increases substantially over time, peaking at 0.6 (see Figure 5.5). Adjustment in wages build up slowly, which could be suggestive of labor market frictions.

As a proxy of welfare, we calculate the cumulative effect on the total real wage bill for a given district. This measure combined both the average real wage increase and the employment response. The effect on welfare is positive throughout the estimated horizon. It is large over the long run, with the elasticity reaching 1.2 six years after the foreign demand shock.

Both effects are consistent with what would happen after a demand shock. In the theoretical model, we expect real wages and employment to respond positively (which is in fact what we see in the data). Hence, we take this as validation of our empirical strategy.
Figure 5.5: Effect of Exports on Real Average Wages
(Elasticity of real average wages with respect to exposure to exports growth, by horizon)

Figure 5.6: Effect of Exports on Real Total Wage Bill
(Elasticity of the real total wage bill with respect to exposure to exports growth, by horizon)
6. **Margins of adjustment: Heterogeneous effects between groups**

Indonesia, like many developing countries, has a large informal sector. When decomposing effects between formal and informal employment, we observe that formal employment responds more strongly over the long run. This is intuitive, since in general exporters tend to be larger firms that are more likely to be in the formal sector.

When facing a foreign demand shock, both the formal and informal sectors in the exposed regions expand their total employment, relative to less exposed regions. The impulse response functions are estimated independently for each group and overlayed for each horizon in order to compare exports effects for each group.

Formal employment responds more strongly to foreign demand shocks throughout most of the estimated and its elasticity peaks at 0.93 in horizon 4. Conversely, the elasticity of informal employment peaks at 0.4 three years after the foreign demand shock. Over the long-run, the elasticities are 0.43 and 0.15, respectively. These results are in Figure 6.1.

![Figure 6.1: Effect of Exports on Employment](image)

Similarly, we split the sample by education level of the worker, rather than employment sector. We look at how the relationship between increasing exports and some labor market outcomes differ between high-skilled workers and low-skilled workers. Skilled workers are defined as those who have completed at least a high school education.
Responses are small over the short run but build up over time. Employment responds much more positively for skilled workers, which given the previous results is expected, as skilled workers are more likely to be in the formal sector. While the long-run elasticity of formal skilled employment is about 0.6, the long-run elasticity of informal employment is 0.2 (see Figure 6.2).

**Figure 6.2: Effect of Exports on Employment**
(ELasticity of the employment with respect to exposure to exports growth, by horizon and skill level)

Unlike the effect on employment, responses in wages for these groups are quite similar. It takes some time for average real wages to increase, but over the long run both elasticities converge to around 0.4-0.45. Both the dynamic path of the responses and their long values show that the differential impact that exists across groups in employment does not exist in wages. These results are in Figure 6.3.
7. Conclusion

We introduce an empirical methodology to estimate the dynamic treatment effect of export shocks in Indonesia. That is, we estimate how an increase in exports affects local labor market indicators at the Indonesian district level. We account for endogeneity by instrumenting regional exposure to exports with a measure of regional exposure to foreign demand shocks, leveraging the fact that each individual district in Indonesia is a small open economy.

We argue that we can interpret these shocks as demand shocks to regional labor markets. To motivate and validate our strategy, we use a quantitative spatial model with multiple sectors and to show that regions more exposed to sectoral demand shocks should experience a relative increase in real wages, employment, labor force, and population.

Our empirical findings are mostly in line with the predictions of the model. Over the long run, employment, labor force, and real wages increase more in regions where exports increase relatively more; that is, in regions more exposed to foreign demand shocks. We trace out the dynamics of the adjustment and show that these improvements in labor market outcomes are largely persistent.

Shedding light on the dynamic of how exports affect jobs in Indonesia represents a comprehensive effort to uncover the intricate threads that tie together international trade and labor market outcomes. This paper bridges the gap between empirical evidence and theoretical understanding,
providing additional perspective on the transformations that the Indonesian labor market has undergone due to its engagement with the global economy.

References


Annex A: Data

Sakernas

The Sakernas data, also known as the National Labor Force Survey (Survei Angkatan Kerja Nasional), is a comprehensive dataset for Indonesia. It is a survey conducted by the Indonesian Central Bureau of Statistics (Badan Pusat Statistik or BPS) and provides detailed information on various aspects of the labor force in the country. The survey is typically conducted bi-annually and collects data from households across Indonesia.

The Sakernas data covers a wide range of topics related to employment, unemployment, and labor force participation. It includes information on individuals' demographic characteristics, educational attainment, occupation, industry, employment status, working hours, wages, and other relevant labor-related variables.

For this study, we built a repeated cross-sectional dataset between 1993 and 2014 using the August rounds of data. We harmonized industry codes to the Klasifikasi Baku Lapangan Usaha Indonesia (KBLI) 1990 classification, the Indonesian industrial classification based on ISIC Revision 2.

UN COMTRADE

The UN Comtrade dataset, officially known as the United Nations Commodity Trade Statistics Database, is a comprehensive international trade database maintained by the United Nations Statistics Division (UNSD). This dataset provides detailed information on global merchandise trade, encompassing the import and export of goods and services between countries and regions. In this study, we limit the analysis to trade in merchandise only, since data on trade in services is very limited for the pre-2000s period.

UN Statistics Division (ISIC-HS Concordances)

The UN Statistics Division (ISIC – HS) concordances refer to a set of tables or mapping systems that establish a link between two international classification systems: the International Standard Industrial Classification of All Economic Activities (ISIC) and the Harmonized System (HS).

ISIC is a global standard for classifying economic activities. It provides a hierarchical structure that categorizes industries based on their primary economic activities. ISIC codes are used for various statistical and analytical purposes to group economic activities into meaningful categories. ISIC codes exist under four different classifications and levels of disaggregation. In this study, we use the nine-sector classification consistent with Revision 2.
The HS is an international nomenclature developed by the World Customs Organization (WCO) for classifying traded goods. It provides a standardized way of categorizing products for customs, trade, and tariff purposes.

The ISIC – HS concordances serve as a bridge between these two classification systems, allowing us to link economic activities (ISIC) from the Sakernas data to specific products or goods (HS) in the UN COMTRADE data.

*World Development Indicators Data*

The World Development Indicators (WDI) is a comprehensive dataset maintained by the World Bank that provides a wide range of economic, social, and environmental data for countries around the world. The dataset covers a variety of topics and indicators, offering insights into the development status and progress of countries over time. We use data on foreign GDPs from all commercial partners to Indonesia to build our Bartik instrument.

*FRED-PCE Deflator*

The Federal Reserve Economic Data (FRED) provides access to a wide range of economic data, including the Personal Consumption Expenditures (PCE) deflator, which is considered a more comprehensive measure of inflation by some economists due to its dynamic basket of goods and services. In this study, we use the PCE deflator to express the value of exports and wages in real terms.
Annex B: A spatial model

We introduced a simple quantitative spatial framework, modeled after Allen and Arkolakis (2014), which allows for trade and migration, and use it to add the theoretical structure to interpret our empirical results. We model exports as a foreign demand shock that lies outside the model and concentrates on the general equilibrium effects of local labor markets.

Consider a country with many regions \( r \in \mathcal{R} \). Workers are mobile across regions and trade across regions. Total utility in each of those regions is:

\[
V_d = \left( \sum_{d \in \mathcal{R}} q_{sd}^{\sigma-1} \sigma^{-1} \right) \times U_d
\]

where \( q_{sd} \) is the demand for a differentiated goods (\( q_i; i \in \mathcal{R} \)) produced in source country \( s \) and consumed at destination country \( d \) and \( U_d \) are local amenities of location \( d \). Demand for each variety is:

\[
q_{sd} = \left( \frac{P_{sd}}{P_d} \right)^{-\sigma} w_d
\]

where \( P_d = \left( \sum_{s \in \mathcal{R}} P_{sd}^{1-\sigma} \right)^{1/(1-\sigma)} \) is the ideal price index at \( d \).

Each aggregate consumption good \( q_s \) is a sectoral composite of \( g \in \mathcal{G} \) countably many sectors:

\[
q_s \equiv \prod_{g \in \mathcal{G}} (q_{s,g})^{\beta_g}, \quad s.t. \quad \sum_{g \in \mathcal{G}} \beta_g = 1
\]

Given this technology, we can write the price index as:

\[
p_s = \prod_{g \in \mathcal{G}} (p_{s,g}/\beta_g)^{\beta_g}
\]

In each region and sector, firms have a linear technology in labor. For a firm in sector \( g \), its output is:

\[
y_{s,g} = A_{s,g}^{\alpha_{s,g}} A_s^{1-\alpha_{s,g}} l
\]

where \( A_g \) denotes sector-wide productivity; \( A_s \) denotes regional average productivity; and \( l \) denotes demand for labor. We assume there is free entry and perfect competition. Given that, the equilibrium satisfies factory-gate prices equating marginal costs, or:

\[
p_{s,g} = \frac{w_s}{A_{g,s}^{\alpha_{s,g} A_s^{1-\alpha_{s,g}}}}
\]
where \( w_s \) are wages in region \( s \). In this economy consumers face iceberg trade costs. We make the standard assumption that \( \tau_{ss} = 1 \) (self-trade is costless) and \( \tau_{sd} \leq \tau_{sz} \tau_{zd} \) (trade costs satisfy the triangle inequality). Therefore, the prices satisfy:

\[
p_s = \prod_{g \in G} \left( \frac{w_s}{A_g} A_s^{1-\alpha_g} \beta_g \right)^{\beta_g}
\]

\[
p_{sd} = \tau_{sd} p_s = \tau_{sd} \prod_{g \in G} \left( \frac{w_s}{A_g} A_s^{1-\alpha_g} \beta_g \right)^{\beta_g}
\]

\[
P_d = \left( \sum_{s \in \mathcal{R}} p_{sd}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} = \left( \sum_{s \in \mathcal{R}} (\tau_{sd})^{1-\sigma} \prod_{g \in G} \left( \frac{w_s}{A_g} A_s^{1-\alpha_g} \beta_g \right)^{(1-\sigma)\beta_g} \right)^{\frac{1}{1-\sigma}}
\]

We can now write expenditure of consumers in \( d \) on goods coming from country \( s \):

\[
X_{sd} = p_{sd} q_{sd} = \left( \frac{p_{sd}}{P_d} \right)^{1-\sigma} w_d
\]

Note that we can also synthetically express expenditure in goods coming from \( s \) as a share of total expenditure, using the fact that total nominal expenditure equals total nominal income \( X_d = w_d \):

\[
\pi_{sd} = \frac{X_{sd}}{X_d} = \frac{\left(\tau_{sd}\right)^{1-\sigma} \prod_{g \in G} \left( \frac{w_s}{A_g} A_s^{1-\alpha_g} \beta_g \right)^{(1-\sigma)\beta_g}}{\sum_{k \in \mathcal{R}} (\tau_{kd})^{1-\sigma} \prod_{g \in G} \left( \frac{w_k}{A_g} A_k^{1-\alpha_k} \beta_g \right)^{(1-\sigma)\beta_g}}
\]

The trade market clearing condition is defined as:

\[
w_s L_s = \sum_{d \in \mathcal{R}} \pi_{sd} w_d L_d
\]

Finally, to define the labor market equilibrium, individuals will choose locations \( d \) that maximize their indirect utility, given by:

\[
d^* = \text{argmax}_d \left\{ W_d = \frac{w_d}{P_d} U_d \right\}
\]