Decomposing the Impact of Trade on Aggregate Skill Demand: Plant-level Evidence from Indonesia[*]

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Abstract

This paper studies the impact of plant-level trade on the aggregate demand for skilled workers among Indonesian manufacturers. We combine regression methods with standard decomposition techniques to counterfactually quantify the impact of *plant-level* integration into import and export markets on the *aggregate* demand for skilled labour. Our analysis reveals four striking results: (1) the aggregate demand for skilled labour in the Indonesian manufacturing sector grew by 14 percentage points over the 1996-2006 period; (2) plant-level import and export decisions could have induced a change in the demand for skilled labour of a similar magnitude; (3) the observed import and export decisions did not significantly affect the aggregate demand for Indonesian skilled labour between 1996 and 2006; (4) importing affects skill upgrading largely through changes in within-plant skill-intensity, while exporting affects both across-plant reallocation and within-plant skill-intensity. Counterfactual policy experiments suggest that a 10 percent reduction in internal shipping costs would induce a 0.5-8 percentage point increase in aggregate skill demand through changes in import behavior. Similarly, the elimination of tariffs on Indonesian exporters would induce a 4-17 percentage point increase in aggregate skill growth through changes in plant-level export decisions.

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1 Introduction

How does trade affect skilled and unskilled workers? Answering this question has long been a key objective of researchers and policymakers alike. The genesis of this research agenda typically starts with the classical notion that a nation's comparative advantage, at least in part, is determined by it's relative supply of skilled labour. In developing countries, for example, trade promotion is often predicted to expand industries which use unskilled labour intensively and, in turn, increase the relative wages of unskilled labour. Rather, numerous studies report that trade liberalization has caused the skill premium to rise (Harrison and Hanson, 1999, Gindling and Robbins, 2001 and Attanasio et al., 2004).[1] Consistently, the relative demand for skilled labour within individual industries has also been found to increase in response to trade liberalization (Sanchez-Paramo and Schady, 2003, Goldberg and Pavcnik, 2007). Nonetheless, the mechanisms through which trade affects aggregate employment and wages remain largely uninvestigated. Do these changes manifest themselves solely as within-firm changes in the mix of skilled and unskilled workers? Or, rather does the reallocation of workers across heterogeneous firms act as a primary determinant of aggregate skill growth?

This paper quantitatively assesses the aggregate impact of plant-level import and export decisions on the industry-wide demand for skilled and unskilled labor through within-plant changes and worker reallocation across plants by conducting counterfactual decomposition analysis. On one hand, a number of recent papers confirm that the plant-level decision to export (Bustos, 2011) or import (Kasahara et al., 2016) can induce greater demand for skilled workers within individual Argentinean and Indonesian manufacturing plants, respectively. On the other hand, numerous papers examine the impact of plant-level export or import decisions on labour allocation across heterogenous firms.[2] However, there remains little evidence whether these plant-level decisions as well as their induced labour reallocation account for an economically meaningful change in the industry-level demand for skilled workers. This paper aims to fill this gap.

To meet this objective, we develop a simple and transparent counterfactual decomposition methodology to quantify the *aggregate* impact of *plant-level* changes in the demand for skilled labour induced by changes in plant-level integration into international markets. Our approach has the advantage of directly linking robust microeconometric regression

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[1] In contrast, Amiti and Cameron (2012) find that falling input tariffs have caused the wage skill premium within firms that import intermediates to fall.

[2] See Becker and Muendler (2010), Hummels et al. (2014), Fajgelbaum (2016), Felbermayr et al. (2016), Hummels et al. (2016), Helpman et al. (2017) among others.

estimates to macroeconomic consequences without directly specifying a particular parametric model structure, providing an easily implementable strategy to check the veracity of the quantitative macroeconomic outcomes from heterogenous firm models. Moreover, our work bridges the literature which uses decomposition methodologies (c.f., Olley and Pakes, 1996; Melitz and Polanec, 2015) to characterize the impact of firm growth on macroeconomic aggregates with studies that isolate the impact of changes in individual firm behavior (e.g. importing) on firm outcomes (e.g. firm productivity growth).

As a plant changes the degree of its engagement with international markets we find that skilled and unskilled workers are differentially affected. For example, while both new exporters and plants leaving import markets tend to differentially increase their relative demand for skill, our results indicate that this occurs through very different margins. We find that new exporters tend to increase the relative employment of skilled labour by hiring a disproportionate number of skilled workers, while those plants which stop importing tend to reduce the size of their labour force by letting go of unskilled workers. Our decomposition exercise further quantifies the extent to which these differential plant-level changes affect the aggregate relative demand for skill by changing the average intensity of skilled workers among Indonesian manufacturers or reallocating workers across heterogeneous plants.

Our work is naturally related to numerous papers which use decomposition methods to characterize the evolution of macroeconomic aggregates over time. For instance, Bernard and Jensen (1997) provide a pioneering decomposition of the aggregate demand for skilled labour and there exists a rich literature which decomposes aggregate productivity into terms which quantify trend growth and reallocation across firms (Olley and Pakes, 1996; Foster, Haltiwanger and Krizan, 2001; Pavcnik, 2002; Foster, Haltiwanger and Syverson, 2008; Petrin and Levinsohn, 2012; Melitz and Polanec, 2015). Our decomposition exercise builds directly on the productivity decomposition framework in Melitz and Polanec (2015), but is applied to changes in relative employment growth across skilled and unskilled workers. Our contribution here is not in the framing of the aggregate decomposition, but rather extending these common methods to quantify the impact of firm or plant-level decisions on industry aggregates.

We also contribute to the literature which characterizes the impact of trade on labour allocation (Revenga 1992; Harrison and Hanson, 1999; Goldberg and Pavcnik 2007; Topalova 2007; Autor et al. 2013; Kovak 2013; Dix-Carneiro and Kovak 2017). Our research is different from prior studies in two important dimensions. First, we are interested in the *relative* demand of skilled and unskilled workers. As such, we do not focus on the gross flows of workers across plants or industries, but aggregate changes in the mix of skilled and unskilled workers used in Indonesian manufacturing. Second, we are not aware of any research which attempts to quantify the aggregate impact of plant-level entry decisions in international markets. In this sense, we are similarly interested in the aggregate impact of trade on labour allocation, but instead focus on the relationship of macroeconomic outcomes with plant-level export or import decisions.

Our work is inherently related firm or plant-level studies of trade, wages and the demand for skilled workers (Bernard and Jensen, 1997; Yeaple, 2005; Verhoogen, 2008; Frías et al., 2012; Bustos, 2011; Vannoorenberghe, 2011; Kasahara et al, 2016; Helpman et al., 2017). Our focus, however, is not on the within-firm change in the demand for skilled labour, but highlights the relationship between plant-level entry decisions to economy-wide changes in the demand for skilled labour.[3] In this sense our research links a broad set of papers which study firm or plant-level hiring decisions in response to entry into international markets to macroeconomic outcomes without assuming a specific model structure.

As emphasized in a wide set of research, understanding how trade affects inequality remains a key unresolved issue in both developed and developing countries.[4] Our findings suggest that shocks to the economic environment, such as trade liberalization, induce changes within-firm skill upgrading and across-firm labour reallocation. By linking data on policy-relevant variables to plant-specific trade behaviour, we can quantify the extent each margin, within-plant changes and across-plant resource reallocation, uniquely induced by entry into international markets, would contribute to aggregate skill upgrading.

Our data are well suited to characterizing the changes in the relative demand for skilled labour within the Indoenesian manufacturing industry. Although numerous papers have previously focussed on changes across occupation categories, such as non-production or white-collar workers, to construct a proxy for skilled labour (Bernard and Jensen, 1997; Harrison and Hanson, 1999; Pavcnik, 2003; Biscourp and Kramarz, 2007), we use a much more precise measure of plant-level skill. The Indonesian panel data record the education-level of every worker in every manufacturing plant with at least 20 employees. Increasingly,

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[3] Our work is likewise related to studies of trade, employment and wages (Trefler, 2004; Gonsaga et al., 2006; Bernard et al, 2007; Egger and Kreikemeier, 2009; Davis and Harrigan, 2011; Felbermayr et al., 2011; Amiti and Davis, 2012).

[4] See, for example, Bernard and Jensen (1997), Harrison and Hanson (1999), Sanchez-Paramo and Schady (2003), Goldberg and Pavcnik (2005), Chor (2010), Bloom et al. (2011), Amiti and Cameron (2012), Krishna et al (2011), Feenstra and Hanson (1999), Matsuyama (2007), Martins and Opromolla (2009), Costinot and Vogel (2010), Burstein et al. (2013), Burstein and Vogel (2017), Cosar (2013), or Parro (2013), Frazer (2013), Hummels et al. (2014) or Ebenstein et al (2014).

the education mix of workers is found to be particularly important along which plants adjust when entering international markets (Bustos 2011; Kasahara et al. 2016; Koren and Csillag 2017).

We find four striking results. First, we document that the aggregate demand for skilled labour in the Indonesian manufacturing sector grew by 14 percentage points over the 1996-2006 period. This occurred at the same time that Indonesia was joining the World Trade Organization and, with the exception 1997-1998 Asian crisis, Indonesia generally experienced growth in both aggregate exports and imports. As such, it is plausible that plant-level entry decisions in international markets had an important role in determining aggregate changes in the relative demand for skilled labour.

Second, our counterfactual decomposition exercises indicate that plant-level import and export decisions could have induced a change in the demand for skilled labour of a similar magnitude. Specifically, eliminating all trade from Indonesia is predicted to cause a 23 percentage point decline in the aggregate demand for skilled labour between 1996 and 2006. In this sense decisions to enter into or exit from international markets are found to potentially have a large impact on aggregate outcomes.

Nonetheless, our third result indicates that the observed import and export decisions among Indonesian manufacturers did *not* significantly affect the demand for skilled labour during this period. That is, while plant-level entry has the potential to affect aggregate skill upgrading, these changes did not drive the growth in the aggregate demand for skilled labour in the Indonesian context. This is not to suggest that trade did not have any role in the aggregate manufacturing skill growth, but rather only that it was not manifest through entry and exit decisions in international markets per se.

Fourth, import status changes tend to affect skill upgrading almost exclusively through changes in within plant skill-intensity, but have very little impact on the reallocation of labour across plants. In contrast, exporting affects both reallocation and skill-intensity. In this sense changes in the propensity to import influence macroeconomic outcomes very differently than changes in the propensity to export. This is further reflected in our policy experiments. Although infrastructure investments (which induce further importing) and improvements in export market access (which encourage entry into export markets) are both predicted to significantly increase the aggregate demand for skilled workers, the margins by which this occurs are very different. In particular, only 5 percent of the first experiment can be attributed to labour reallocation rather than within-plant skill upgrading; over 30 percent can be attributed across-plant labour reallocation in the latter policy experiment.

The next section describes the data we use for our empirical exercises. Section three documents our benchmark decomposition exercise which links aggregate demand for skilled labour to plant-level trade decisions. Section four presents our regression framework and documents the causal impact of trade status changes on the plant-level demand for skilled labour. The fifth section links plant-level changes in exporting or importing to the decomposition framework and documents a series of counterfactual decomposition exercises. The seventh section studies the impact of policy change on aggregate skill growth. Section seven concludes.

2 Data

2.1 Data Sources

Our empirical work relies heavily on the manufacturing survey between 1995 and 2007, where we focus on data recorded in the census years 1996 and 2006 because, in these two years, the Indonesian manufacturing survey records the number of workers with primary, secondary and post-secondary education in each plant. We use this data to directly measure the skill composition of the labour force based on the workers' education levels.

This data has a number of advantages for our study. First, it is uncommon to observe plant-level, education-based measures of employee-skill in a developing country. Second, the Indonesian manufacturing sector grew rapidly into world markets after joining the WTO in 1995. As such, a substantial fraction of plants change their import and export behavior over our period of study. Third, the Indonesian manufacturing survey captures all manufacturing plants with at least 20 employees and, even by 2006, 93 percent of plants recorded in the data are single-plant firms. This allows us to precisely characterize the nature of labour reallocation across formal manufacturing establishments without the common concerns of missing firms or within-firm reallocation across plants. Fourth, the data set captures a wide set of additional plant-level characteristics which we use to capture various dimensions of plant heterogeneity. In particular, the survey records all expenditures on imported intermediate materials and the percentage of revenues from export sales. It also includes plant-level input and output variables, such as total revenues, capital stock, domestic materials, and other plant-level information capturing the percentage of ownership held by foreign investors, total plant-level expenses on research and development (R&D), and total plant-level expenditures on worker training.[5]

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[5] See the Supplementary Appendix of Kasahara et al. (2016) for a detailed description of our variable

There are two limitations of our data that are important to note from the outset. In particular, the manufacturing survey data do not provide a measure of wages by education level. As a result, we cannot directly measure differences in labour market conditions as summarized by differences in local wage premia. To overcome this limitation, we follow Kasahara et al. (2016) and augment the manufacturing survey with the Indonesian household survey. The Indonesian household survey covers a nationally representative sample of households and documents key labour force information including gender, age, location, educational attainment and labour force experience. We use the household survey to develop a measure of the skill premium in each location and year.

Additionally, although the manufacturing survey has a complete record of all plants with at least 20 employees, it invariably misses informal and small manufacturers. Should there be a large degree of trade-induced reallocation among these plants, our exercises will not be able to speak to the nature of reallocation across these plants. We are nonetheless confident that our empirical exercises will be able to characterize the broad majority of trade-based reallocation since (a) most exporting and importing plants are formal plants and (b) small and informal firms typically lack a skilled labour force.[6]

2.2 Worker Education

Table 1 documents plant-level differences in the relative demand for skilled labour across education-based (highest attainment) categories and four different types of firms: importers, exporters, two-way traders and non-traders. Two-way traders are defined as firms which both import and export, while non-traders are firms which purchase all inputs from domestic sources and receive all revenues from domestic sales. We document that trading plants, on average, consistently hire a greater fraction of skilled workers. Relative to non-traders, the workforce of trading firms is almost always composed of a smaller fraction of workers in each educational category below high school and a greater fraction of workers with high-school diplomas, college degrees and post-graduate education. Across trading firms, two-way traders tend to be the most skill-intensive firms followed by importers and exporters, respectively.[7]

Despite the apparent skill-intensity of trading plants, Table 1 also indicates the relative scarcity of these establishments. Only 31 percent of the nearly 30 thousand plants

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construction: `http://faculty.arts.ubc.ca/hkasahara/workingpapers/skill_JIE_appendix.pdf`.

[6] See McCaig and Pavcnik (2015, 2017) for studies of informal manufacturing.

[7] Further documentation of differences in the educational composition across Indonesian manufacturers can be found in Kasahara et al. (2016).

surveyed are engaged in any form plant-level trade and just over 5 percent of all plants import and export. Therefore, it is not obvious that plant-level changes in trade status would have a significant impact on aggregate demand for skilled labour over the 1996-2006 period. Moreover, as outlined by the last three columns of Table 1, trading plants also tend to differ from non-traders across other dimensions. As such, we might expect that significant differences in skill-intensity may be driven by firm characteristics (e.g. productivity) that may not be directly affected by trade status.

Due to data limitations, numerous plant or firm-level studies typically use occupational categories, such as the fraction of non-production workers, as a proxy for the skill-intensity of individual plants. This choice is often supported by the close relationship between the intensity of non-production employement and educational achievement of workers, as documented in Table 1. Nonetheless, whether we can use this proxy to satisfactorily characterize the demand for skilled labour requires on a stable relationship between skill and occupational class over time and industries.

As shown in Figure 1, the share of Indonesian manufacturing workers with at least a high-school diploma has increased by almost 20 percentage points between 1996 and 2006 but the fraction of non-production workers has been stable over the entire period, indicating no clear aggregate relationship between the intensity of non-production occupations and educational achievement. As argued in Kasahara et al. (2016) highschool education is a much more relevant metric of skill in the context of Indonesian manufacturing and, hence, the main focus of the remainder of this study although we also examine how differences in the measure of skill would affect our conclusions.[8]

3 Aggregate Skill-Upgrading

Our first quantitative exercise decomposes the contribution from within-plant changes and reallocation across plants and quantifies the degree to which each trade margin contributes to the observed reallocation and within-firm changes.[9]

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[8] We also consider using the share of college-educated workers. However, since the share of college-educated workers increases by a relatively small amount over the 1996-2006 and represents less than 5 percent of the total workforce we do not focus on this measure of skill intensity hereafter.

[9] For simplicity, we abstract from the contribution of entry and exit here. In a robustness check, entry and exit were always found to contribute very little to aggregate skill-upgrading. Both new entrants and plants exiters tend to use very little skilled labour.

3.1 Plant-Level Aggregation

Let the subscripts i and t index plants and time, respectively. Likewise, in each year let total plant employment and the plant's employment of skilled workers be denoted by L_{it} and $L_{s,it}$, respectively. Using these objects we define plant-level employment shares, ϕ, and skilled worker shares, S, as

$$\phi_{it} \equiv \frac{L_{it}}{\sum_i L_{it}}, \quad S_{it} \equiv \frac{L_{s,it}}{L_{it}}.$$

Summing over Indonesian plants we then compute aggregate employment levels,

$$L_t \equiv \sum_i L_{it}, \quad L_{s,t} \equiv \sum_i L_{s,it},$$

and the aggregate skill share accordingly:

$$S_t \equiv \frac{L_{s,t}}{L_t} = \sum_i \frac{L_{s,it}}{L_{it}} \frac{L_{it}}{L_t} = \sum_i S_{it}\phi_{it}. \tag{1}$$

3.1.1 Trade Margins

Among continuing plants, we define four types of plants that differ according to their import history:

- $NI - NI$: Plants that never import intermediates;
- $NI - I$: Initial non-importers that start importing;
- $I - NI$: Initial importers that stop importing;
- $I - I$: Plants which always import.

We similarly define four types of exporting plants: plants that never export ($NE - NE$), initial non-exporters that start exporting ($NE - E$), initial exporters that stop non-exporting ($E - NE$), and plants that always export ($E - E$). We summarize plant-level import and export dynamics through the import status variable $G^I = \{NI - NI, NI - I, I - NI, I - I\}$ and the export status variable $G^E = \{NE - NE, NE - E, E - NE, E - E\}$. The aggregate skill share (7) can then be transparently tied to trade margins as:

$$S_t = \sum_{g \in G^k} \sum_{i \in \mathcal{N}^g} S_{it}\phi_{it} \quad \text{for} \quad k \in \{I, E\}, \tag{2}$$

where $\mathcal{N}^g$ indicates a set of plants whose import or export history is g. Implicitly there are three margins through which trade status may affect industry aggregates: (1) changes in skill-intensity, S_{it}, (2) changes in labor share, ϕ_{it}, and (3) systematic changes in the propensity for importing or exporting, G^I and G^E. In our sample we document that there are significant changes in each of these dimensions among Indonesian manufacturers.

3.2 Benchmark Decomposition

Consider two periods, 1 and 2, where each period corresponds to our sample years, 1996 and 2006, respectively. Following Melitz and Polanec (2015) we decompose the total change in the aggregate skill into terms capturing within-plant changes in the skill share ("intensity") and labour reallocation across plants ("reallocation") as

$$\begin{aligned} S_2 - S_1 &= \underbrace{\sum_{g \in G^k} \sum_{i \in \mathcal{N}^g} (\phi_{i2} - \phi_{i1}) \bar{S}_i}_{\text{reallocation}} + \underbrace{\sum_{g \in G^k} \sum_{i \in \mathcal{N}^g} (S_{i2} - S_{i1}) \bar{\phi}_i}_{\text{intensity}} \qquad (3) \\ &= \sum_{g \in G^k} N_g \left[\frac{1}{N_g} \sum_{i \in \mathcal{N}^g} (\phi_{i2} - \phi_{i1}) \bar{S}_i \right] + \sum_{g \in G^k} N_g \left[\frac{1}{N_g} \sum_{i \in \mathcal{N}^g} (S_{i2} - S_{i1}) \bar{\phi}_i \right] \quad \text{for} \quad k \in \{I, E\}. \end{aligned}$$

where $\bar{S}_i \equiv \frac{1}{2}(S_{i1} + S_{i2})$ is the average plant-level skill share across both periods, $\bar{\phi}_i \equiv \frac{1}{2}(\phi_{i1} + \phi_{i2})$ is the average firm-level employment share across both periods, and N_g is the number of plants in group g. The terms inside square brackets respectively capture the per-plant reallocation ('between-plants') and intensity ('within-plant') contributions to the aggregate skill share change. Comparing these terms across trade margins allows us to characterize which groups of plants had the largest impact on the evolution of aggregate skilled labour demand.

Panel A of Table 2 presents our first set of decomposition results across trade margins. The first column documents that aggregate demand for skilled workers among Indonesian manufacturers rose by 13.7 percentage points over the 1996-2006 period. This represents a large and economically meaningful change in the skill composition of the Indonesian manufacturing workforce, particularly in a context where skilled labour is scarce. The following two columns document the contributions of across-plant reallocation and within-plant changes in skill intensity. Remarkably, almost all of change in aggregate skill demand is driven by within-firm changes; of the 13.7 percentage point change in aggregate skill demand only 0.9 percentage points can be attributed to cross-plant reallocation.

The fourth and fifth columns characterize the per plant contribution of within-firm changes and resource reallocation to aggregate skill upgrading. While these again reflect the much larger relative contribution of within-firm changes relative to reallocation, these statistics will prove particularly useful when decomposing each source of skill upgrading by plant-level trade status.

The second to fifth rows of Table 2 characterize the contribution of import status changes to aggregate skill upgrading. For instance, the second row of Panel A documents the contribution of continuous non-importers to aggregate skill upgrading through resource reallocation and within-plant skill growth. Rows three through five present the same information for new importers, plants that stop importing and continuous importers. In the second column it is clear that over the 1996-2006 period labour has been reallocated towards continuous and new importers and away from non-importing plants and plants which stop importing. Nonetheless, the change in employment shares has a relatively small impact on aggregate skill upgrading since importers represent less than a quarter of all plants.

In contrast, within-plant skill upgrading has had a relatively large impact on aggregate skill upgrading. Skill intensity has increased across all groups over the 1996-2006 period suggesting a general trend towards employing higher skill workers in the Indonesian manufacturing sector. Continuous non-importers and continuous importers, rather than firms which change import status, make the largest contributions to the growth in aggregate skill intensity. In the former case, the large aggregate contribution is due to small within-firm changes (Column 5) over a large number of plants (Column 6). In the latter case it is exactly the opposite: large within-firm changes among a small number of continous importers result in a substantial aggregate contribution.

The fourth and fifth columns document the average differences between plants which are directly linked to international markets relative to those that do not import or export. Consistent with existing plant-level evidence, it is clear from Table 1 that both new importers and plants which stop importing make economically meaningful contributions to skill upgrading over the 1996-2006 period. However, it is particularly striking that both the per plant and aggregate contribution of plants which stop importing is larger than the comparable figures for new importers. Although the employment share of former importers is declining, they appear to be keeping a disproportionate number of their skilled workers. We may interpret this as skilled-labour hoarding among former importers. Moreover, during the 1996-2006 period a large number of Indonesian manufacturers stopped importing intermediate products. This is not surprising: the 1997-1998 Asian financial crisis period was characterized by a reduction in credit and a sharp depreciation of the Indonesia rupiah (Iriana and Sjöholm, 2002), both of which raise the cost of importing. Together, these two effects, the contraction from import markets and skilled labor hoarding, resulted in former importers contributing more to aggregate skill growth than new importers.

Panel B of Table 2 repeats this exercise across export dynamics. We observe a very similar pattern to that documented across imports status: the employment shares of continuous non-exporters and plants that stop exporting shrink, while the employment shares of new exporters and continuous exporters grow. Likewise, although the skill-intensity increases across all types of firms grows over the 1996-2006 period, the largest per-plant contributions come from continuous exporters and former exporters which hoard skilled labour as they retract out of international markets. Overall, within-firm skill upgrading again proves to be the primary source of skill-upgrading across all types of plants, though it is particularly pronounced in plants with experience in international markets.

3.3 Discussion

Overall, plants engaged in international markets drive changes in aggregate skill upgrading. For instance, despite the fact that only 33 percent of plants have experience importing, plants tied to import markets ($I-NI$, $I-NI$, $I-I$) account for 65 percent of all skill upgrading in the Indonesian manufacturing sector. It similarly striking that although only 32 percent of Indonesian plants export in our sample, these exporters are likewise responsible for 65 percent of aggregate skill upgrading.

Nonetheless, it is potentially misleading to attribute changes in the relative demand for skill or the plant-level employment share to changes in import or export behaviour. In particular, plants which enter international markets either by exporting their goods abroad or importing foreign inputs are consistently measured as larger, more productive, capital-intensive, R&D-intensive, etc. As such, it is quite plausible that the trends observed in Table 2 are driven entirely by correlated plant-level characteristics. As such, encouraging further integration of the Indonesian manufacturing sector into international markets may have little direct impact on aggregate skill upgrading unless it also affects other underlying plant attributes.

Similarly, our benchmark decomposition suggests that within-plant skill-upgrading was the primary determinant of aggregate skill-upgrading in Indonesia. However, it would likewise be erroneous to conclude that exporting and importing affect aggregate skill demand equally through within-firm changes and reallocation. Rather, we would generally expect them to be different. While a change in import status typically implies a change in within-firm technology applied to the same markets, entry into export markets, in contrast, suggests that plants may use a particular skill mix over a larger set of markets. Although the former may naturally linked to within-firm changes, the latter should be more closely tied to resource reallocation. Standard decomposition methodologies do not allow us to distinguish these different margins in that we cannot isolate one type of change (e.g. exporting) from the observed changes in all plant-level characteristics.

Note that the use of precise measures of education in the definition of skilled workers is crucial for these decomposition results. Because most upgrading happens within occupations (as found in Kasahara et al. 2016 and Helpman et al. 2017), decompositions based on occupational categories will tend to attribute to much of the observed change in skill demand to changes "between" plants rather than those "within" plants.[10] To see this more clearly, we perform the same decomposition exercise, but instead define a skilled worker as a non-production worker and an unskilled worker as a production worker. Table 3 confirms that the observed change in occupation shares were small, with most of the change being directly caused by the reallocation of production and non-production workers between plants. As we confirm in our counterfactual decomposition below, entry into international markets is predicted to have a substantial effect on aggregate skill upgrading, but is not predicted to have a large impact on occupational shares.

4 Importing, Exporting and Plant-Level Employment

This section estimates the impact of plant-level trade integration on plant-level employment. Using standard regression methodology we first estimate the effect that importing or exporting has on the demand for skilled and unskilled labour, respectively. This step allows us to disentangle the impact of entering or exiting international markets from contemporaneous changes in other plant-level characteristics on plant-level labour demand.[11] Using our estimates we then construct a counterfactual data series under different sets

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[10] For example, Bernard and Jensen (1997).

[11] For instance, suppose productive plants tend to increase their demand for skilled labour at a faster rate than their less productive counterparts and are simultaneously integrated to a greater degree in import and export markets. Our benchmark decomposition may attribute too much of the observed skill upgrading to changes in trade status if we do not isolate the impact of trade alone on plant-level demand for skill.

of assumptions regarding plant export and import dynamics. The subsequent section will then employ this data and our benchmark decomposition to identify the impact of plant-level changes on the aggregate demand for skilled labour.

4.1 Plant-Level Responses to Importing and Exporting

We consider a simple log-linear empirical specification where the demand for skilled or unskilled workers are a function of plant-characteristics, including import and export status:[12]

$$Y_{06} = \alpha_1 \mathrm{imp}_{06} + \alpha_2 \mathrm{imp}_{96} + \beta_1 \mathrm{exp}_{06} + \beta_2 \mathrm{exp}_{96} + \theta X + prov + ind + \epsilon \qquad (4)$$

where Y_{06} captures the total employment of skilled (L_s) or unskilled (L_u) workers in 2006, $Y \in \{\ln(L_s), \ln(L_u)\}$, imp_t and exp_t are import and export status in year t, respectively, the vector X includes capital, plant-level productivity, and the initial demand of skilled or unskilled labour in 1996, Y_{96}, and *prov* and *ind* capture province and industry fixed effects.[13]

In this specification, plants which do not import or export are the baseline group and the impact of trade on employment is measured relative to this set of plants. Specifically, α_1 represents the impact of starting to import ($NI - I$) on the plant-level employment of skilled or unskilled workers, α_2 quantifies the impact from exiting import markets ($I - NI$), and the sum $\alpha_1 + \alpha_2$ measures the impact of importing among continuous importers ($I - I$). Likewise, β_1, β_2 and $\beta_1 + \beta_2$ respectively capture the impact of starting to export ($NE - E$), exiting export markets ($E - NE$), and continuously exporting ($E - E$).

There are a number of implied restrictions in specification (4). In particular, the impact of counterfactually changing a plant's import path from continuously importing to not importing in 2006 (a reduction of α_2) is exactly the opposite of that from switching

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[12] See Kasahara et al. (2016) for a theoretical framework which would lead to a labour demand function as in equation (4).

[13] We purposefully choose to focus on the full sample of all 2006 plants. Alternatively, it may be tempting to restrict the sample according to the initial import or export conditions. However, in doing so, we may bias the estimated impact of importing or exporting in the level regressions. This would in turn prevent us from mapping the plant-level regression findings into our counterfactual decompositions. For example, if we consider separate regressions for initial non-importers, $\mathrm{imp}_{96} = 0$, and initial non-exporters, $\mathrm{exp}_{96} = 0$. For a plant where $\mathrm{imp}_{96} = 0$ *and* $\mathrm{exp}_{96} = 0$, it is not clear which regression to follow for generating its counterfactual employment unless we were to estimate a different labour demand function for every possible permutation of trade status.

a continous non-importer to an importer in 2006 (an increase of α_2). The same is true for export dynamics. As such, we also consider a more flexible plant-level labor demand function which allows for the labour demand among continuous importers/exporters to evolve independantly from those new or former importers/exporters:

$$\begin{aligned} Y_{06} &= \alpha_1 \text{imp}_{06} + \alpha_2 \text{imp}_{96} + \alpha_3 \text{imp}_{06} \times \text{imp}_{96} + \beta_1 \text{exp}_{06} + \beta_2 \text{exp}_{96} + \beta_3 \text{exp}_{06} \times \text{exp}_{96} \\ & \quad + \theta X + prov + ind + \epsilon \end{aligned} \tag{5}$$

Note that if there are systematic differences in the *intensity* with which new and continuous importers use imported foreign intermediates, and this in turn differentially affects labour demand, specification (5) will capture these differences, on average. Similarly, to the extent that continuous exporters are, on average, more integrated into export markets relative to exporters, and this affects labour demand, the above specification will likewise capture these differences.

4.1.1 Benchmark OLS results

Our benchmark OLS results from the estimation of equation (4) are reported in Table 4 where the level of skilled and unskilled workers are respectively used as dependent variables. In the first two columns we observe that firms which start importing hire more skilled and more unskilled workers than comparable non-importers, though there is a much larger impact on the demand for skilled workers. In contrast, there is no statistically significant change in the demand for skilled and unskilled workers among plants which stop importing. Both current and past exporters are also estimated to hire a greater number of skilled and unskilled workers, though, as with importers, the estimated premium on skilled workers is noticeably larger than the comparable estimate for unskilled workers. In either case, our first set of findings suggest that trade status may well affect the demand for either skilled or unskilled labour and this effect is particularly large for skilled workers.[14]

Columns (3)-(4) repeat the first two regression exercises, but replace province fixed effects with more disaggregated county fixed effects. The use of disaggregated regional fixed effects helps control for unobserved local labour market conditions which are not sufficiently addressed by our measures of local skilled or unskilled wages. In each case,

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[14] An alternative approach for estimating the impact of trade on plant-level employment would be to estimate the impact of trade on total employment L and skill share $\frac{L_s}{L}$. This alternative approach produced very similar results and, as such, further discussion of this alternative is omitted hereafter.

the results from columns (3) and (4) very closely resemble those from the corresponding exercise in columns (1) and (2).

The first two columns of Table 7 consider the OLS estimation of specification (5) where the labour demand of continuous importers (exporters) evolves independently from new and former importers (exporters). We again observe that both new and continuing importers experience large increases in the demand for skilled labour, though this appears to be largest for new importers. There does not appear to be a corresponding increase in the demand for unskilled labour among new importers, though the estimates suggest a moderate increase among continuing importers. There is no perceptible difference in the labour demand of former importers.

In contrast, the OLS estimates indicate that past, new and continuing exporters all employ more skilled and unskilled workers relative to non-traders. As in Table 4, starting to export appears to have a particularly large impact on the demand for skilled labour. Comparing the coefficients in Table 4 to those in columns (1)-(2) of Table 7, we find that the implied magnitudes are generally very similar. For instance, in column 1 of Table 4 new importers and continuing importers are predicted to increase their employment of skilled workers by 27 percent, respectively, while in column 1 of Table 7 the demand for skilled labour among the same groups of plants is predicted to increase by 32 percent. The impact of importing on the demand for unskilled labour is considerably smaller with point estimates ranging between 2-6 percent for new importers and is roughly 8 percent for continuing exporters in each specification. In all cases, plants which stop importing are not estimated to change their demand for skilled workers, as relevant coefficients are both small and are estimated to be insignificantly different from zero.

A similar degree of consistency is also found among the estimated export coefficients. New and continuing exporters are respectively predicted to increase the employment of skilled workers by 19-25 percent and 36-37 percent across experiments, while demand among former exporters is also predicted to increase by 18-22 percent. In general, larger point estimates will later imply a larger aggregate impact from entry into export markets in our counterfactual decompositions.

4.1.2 IV results

Assuming that plants make import, export and employment decisions period by period, the 1996 import and export status variables are predetermined in the estimation of equations (4)-(5). Current import and export status, however, are clearly endogeneous to the plant's employment decision and, as such, our OLS estimates may suffer from endogeneity bias. We address this issue through the use of instruments. In particular, current import and export status are accordingly instrumented by transportation costs and two sets of tariff changes.[15]

Our measure of transportation costs is taken from Kasahara et al. (2016) and captures the cost of shipping goods to and from the nearest port while taking into account the road structure and topography of Indonesia. Specifically, we first divide Indonesia into one kilometer squared cells and assign a value of 1-10 to each cell. The highest cost cells (Steepness of Slope, Sea vs. Land) are assigned a value of "10". We then use ArcGIS to find the least accumulative-cost path between any plant and its nearest port. Last, our measure of transport cost is obtained by dividing the least accumulative-cost by the sample standard deviation.

We also compute two tariff-based instruments. First, we match each plant in the manufacturing survey to product-level (5-digit ISIC) input tariffs constructed by Amiti and Konings (2007). We then use the change in input tariff rates between 1996 and 2001 as an instrument. Second, as in Kasahara et al. (2016) we also consider a industry-level market access instrument for Indonesian exporters in destination markets. For each industry and year, we calculate the weighted average tariff faced by plants in export markets where export shares are used as weights. The change in industry-level export market access between 1996 and 2006 is then used an instrumental variable. The first stage results for our IV estimates are reported in Table 5.

Using these estimates, we construct three different instrument sets defined as follows:

1. **IV1**: Transport costs alone.
2. **IV2**: Input tariff rates and market access tariff rates.
3. **IV3**: Transport costs, input tariff rates and market access tariff rates.

We use the above instrument sets to test the robustness of our results to various endogeneity assumptions.

Table 6 presents two stage least squares estimates for different sets of instrumental variables. We first instrument for import and export status *individually*. Specifically, in columns (1)-(2) we estimate equation (4) using transport costs as an instrument for the current import decision. Columns (3)-(4) likewise treat exporting as an endogenous

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[15] Detailed descriptions of the construction of each instrumental varaible can be found in Kasahara et al. (2016).

variable and instrument for it with tariff changes. The last two columns, columns (5) and (6), treat both exporting and importing as endogenous.

There are two striking differences with our OLS results. First, there are a small, but important, number of changes in the estimated sign of the model parameters. Second, in almost all cases the point estimates take a much larger absolute value. In column (1) the coefficient for former importers, α_2, is estimated to be negative and statistically significant once we instrument current import status. Likewise, the same effect is found on the coefficient for former exporters, β_2, once we instrument current export status in column (3). This result indicates that as plants exit international markets, they also reduce the number of skilled workers in their labour force. The second and fourth columns demonstrate, however, that this is not necessarily true for unskilled workers. Rather, an exit from export markets appears to have little statistically significant impact on unskilled employment, while plants that stop importing are consistently found to hire more unskilled workers.

Examining the coefficients which identify the impact of starting to import, α_1, or export, β_1, on the demand for each type of labour, we find nearly opposite results. Starting to import is found to have a *postive* impact on the demand skilled labour, while it simultaneously is found to have a *negative* effect on the demand for unskilled labour. Both coefficients are very large in absolute value and precisely estimated. Similarly, starting to export is found to have a positive impact on the demand for skilled and unskilled workers, though the impact on skilled workers is much larger and is the only export coefficient estimated to be significantly different from zero.

Columns (5)-(6) of Table 6 report our IV estimates when we simultaneously instrument both current import and export status. The sign and significance of the estimates in Columns (5)-(6) are the same as those in Columns (1)-(4) in almost every case, although the magnitude of the coefficients are somewhat different. In particular, we emphasize that the impact on starting to import, α_1, on the demand for skilled labour is somewhat larger in column (5) than in column (1).

Overall, the IV estimates are very large in magnitude and suggest that changes in plant-level integration in international markets may have a very large effect on the mix of skilled and unskilled workers within individual manufacturing plants. This is consistent with the evidence in Kasahara et al. (2016) which argues that given the existing stocks of skilled workers in 1996, changes in import status over the subsequent decade induced large shifts in the relative demand for skilled labour within plants. We further investigate the robustness of our results by comparing the IV estimates of equation (4) with those from the estimation of equation (5), which allows for differences between new, former and continuous importers or exporters.[16] The second set of IV results pertaining to equation (5) are reported in Table 9. Across both sets of IV regressions we find that plants which stop importing reduce their employment of skilled labour by 40-49 percent, while those that start importing increase their employment of skilled labour by over 400 percent. When interpreting these coefficients it is important to recall that the initial stock of skilled labour is often very small and, as such, large percentage increases in the employment of skilled labour is quite feasible for many plants by only hiring a small number of new, skilled workers. We similarly find that plants which exit export markets reduce skilled employment by 28-33 percent, while those that enter export markets increase skilled employment by at least 388 percent.

As noted above, trade has nearly the opposite effect on the demand for unskilled workers. The IV estimates imply that the average demand for unskilled workers among plants which stop importing increases by over 90 percent relative to plants which never import. When plants begin importing the demand for unskilled labour falls; columns (2) and (6) of Table 6 indicate a 75-76 percent decline in the demand for unskilled labour when plants begin importing foreign intermediates. In contrast, we do not find any evidence of a statistically significant impact of changes in export status on unskilled labour demand.

4.2 Constructing Counterfactual Data

Despite the large size of our IV estimates, it is not obvious if there is an aggregate impact on the relative demand for skill. Rather, as demonstrated in Section 3 it is unclear whether (a) the point estimates, large as they may be, were key determinants of the observed changes in plant-level changes in skill demand relative to other plant-level characteristics, (b) there was a sufficient number of internationally integrated plants to have a meaningful aggregate impact, and (c) the changes in plant-level trade status were consistent with growing demand for skilled workers.

To address each of these issues, we generate data which predicts what each plant's skilled and unskilled labour demand would have been in different counterfactual settings. For example, we first consider a case where Indonesia is cutoff from import markets after 1996 (in our counterfactual framework amounts to assuming that no plant imports in 2006). We predict each plant's labour demand using the estimates from equation (4)

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[16] First stage results for the IV estimation of equation (5) are reported in Tables 7-8. Note that instrument set includes the plant's initial trade status (imp_{96} or exp_{96}) interacted with the tariff and transport cost instruments.

accordingly:

$$\hat{Y}_{06} = \hat{\alpha}_1\widehat{\text{imp}}_{06} + \hat{\alpha}_2\text{imp}_{96} + \hat{\beta}_1\text{exp}_{06} + \hat{\beta}_2\text{exp}_{96} + \hat{\theta}X + \widehat{prov} + \widehat{ind} + \hat{\epsilon}, \tag{6}$$

where $\widehat{\text{imp}}_{06} = 0$ captures our counterfactual assumption on plant-level import dynamics and $\hat{Y}_{06}$ is the predicted (skilled or unskilled) log labour demand. Note that even though we choose an alternative path for plant-level importing, plant-level labour can continue to evolve over the 1996-2006 period due to a wide set of alternative determinants as captured by export status, exp_t, other plant-level characteristics (e.g. productivity), X, or industry/provincial trends.

Using the counterfactual data series we then consider it's aggregate implications. Specifically, let $\hat{L}_{s,it}$, $\hat{L}_{u,it}$ and $\hat{L}_{it} \equiv \hat{L}_{s,it} + \hat{L}_{u,it}$ respectively represent the predicted plant-level demand for skilled, unskilled, and total employment in levels. We use the benchmark decomposition approach to compute counterfactual aggregate employment levels,

$$\hat{L}_t \equiv \sum_i L_{it}, \quad \hat{L}_{s,t} \equiv \sum_i \hat{L}_{s,it},$$

and the counterfactual aggregate skill share:

$$\hat{S}_t \equiv \frac{\hat{L}_{s,t}}{L_t} = \sum_i \frac{\hat{L}_{s,it}}{\hat{L}_{it}} \frac{\hat{L}_{it}}{\hat{L}_t} = \sum_i \hat{S}_{it}\hat{\phi}_{it}, \tag{7}$$

where $\hat{\phi}_{it} = \frac{\hat{L}_{it}}{\hat{L}_t}$ is the counterfactual employment share of plant i. We can then use these counterfactual decomposition components to identify the impact of particular plant-level mechanisms, such as the use of imported intermediates, on the aggregate demand for skilled labour. The underlying assumptions are nearly identical to those employed in the regression itself. First, the counterfactual data capture the true causal impact of importing or exporting on plant-level employment. Second, any additional determinants of plant-level employment are either captured by the control variables (e.g. productivity) or are sufficiently small that we can safely abstract from them (e.g. general equilibrium effects). We return to these issues when we consider the implications of our counterfactual decompositions.

5 The Aggregate Impact of Plant-Level Trade

In this section, we quantify the aggregate impact of plant-level trade on the relative demand for skilled labour. In particular, we reconsider the benchmark decomposition exercise, described in Section 2, but use counterfactual data in place of the observed data. The counterfactual data allows us to isolate the impact of plant-level import and export decisions on overall level of demand for skilled labour across plants and quantify the aggregate impact of these decisions separately from other concurrent within-plant changes (e.g. trend skill-biased technological change).

We consider six specific counterfactual experiments that evaluate the relationship between plant-level decisions and aggregate outcomes. As above, we let $\widehat{\mathrm{imp}}_{06}$ and $\widehat{\mathrm{exp}}_{06}$ respectively represent counterfactual import and export status and characterize scenarios where

1. All plants *stop importing in 2006* (no importing), but export decisions are exactly as they are in the data, $\widehat{\mathrm{imp}}_{06} = 0$, $\widehat{\mathrm{exp}}_{06} = \mathrm{exp}_{06}$.
2. All plants *stop exporting in 2006* (no exporting), but import decisions are exactly as they are in the data, $\widehat{\mathrm{exp}}_{06} = 0$, $\widehat{\mathrm{imp}}_{06} = \mathrm{imp}_{06}$.
3. All plants *stop importing and exporting in 2006* (no importing or exporting), $\widehat{\mathrm{imp}}_{06} = \widehat{\mathrm{exp}}_{06} = 0$.
4. All *import decisions in 2006* are the same as those in 1996 (no import switching), but export decisions are exactly as they are in the data, $\widehat{\mathrm{imp}}_{06} = \mathrm{imp}_{96}$, $\widehat{\mathrm{exp}}_{06} = \mathrm{exp}_{06}$.
5. All *export decisions* in 2006 are the same as those in 1996 (no export switching), but import decisions are exactly as they are in the data, $\widehat{\mathrm{exp}}_{06} = \mathrm{exp}_{96}$, $\widehat{\mathrm{imp}}_{06} = \mathrm{imp}_{06}$.
6. All *import and export decisions in 2006* are the same as those in 1996 (no import or export switching), $\widehat{\mathrm{imp}}_{06} = \mathrm{imp}_{96}$, $\widehat{\mathrm{exp}}_{06} = \mathrm{exp}_{96}$.

Experiments (1)-(3), though extreme, capture the total impact of plant-level import and/or export decisions on the aggregate demand for skilled labour. Although we are implicitly abstracting from general equilibrium changes in the skill premium due to the counterfactual policies, it is worth noting that manufacturing represents roughly a quarter of Indonesian GDP and at most 18 percent of total employment over our sample period. As such, we may not expect large changes in equilibrium wages even in the presence of an extreme change in the behavior of internationally integrated manufacturing plants. Alternatively, should there be a significant change in equilibrium wages our estimates would represent an upper bound on its impact on the aggregate demand for skilled labour because the equilibrium wage adjustment would tend to weaken the impact of plant-level decisions on the aggregate demand.

Similarly, experiments (4)-(6) isolate the impact of observed changes in trade status on the aggregate demand for skilled labour in Indonesia from other confounding covariates. By assuming that all Indonesian manufacturers maintain the import (or export) status chosen in 1996 we can identify the collective contribution of individual plant-level trade status changes to the broader aggregate skill upgrading in the manufacturing sector. For example, consider our fourth experiment where we hypothesize that the entry of plants into import markets over the 1996-2006 period significantly increased the aggregate demand for skilled labour. Our counterfactual decomposition equation is:

$$\begin{aligned} \hat{S}_2 - S_1 &= \underbrace{\sum_{g \in G^k} \sum_{i \in \mathcal{N}^g} (\hat{\phi}_{i2} - \phi_{i1}) \hat{\bar{S}}_i}_{\text{c.f. reallocation}} + \underbrace{\sum_{g \in G^k} \sum_{i \in \mathcal{N}^g} (\hat{S}_{i2} - S_{i1}) \hat{\bar{\phi}}_i}_{\text{c.f. intensity}} \qquad (8) \\ &= \sum_{g \in G^k} N_g \left[\frac{1}{N_g} \sum_{i \in \mathcal{N}^g} (\hat{\phi}_{i2} - \phi_{i1}) \hat{\bar{S}}_i \right] + \sum_{g \in G^k} N_g \left[\frac{1}{N_g} \sum_{i \in \mathcal{N}^g} (\hat{S}_{i2} - S_{i1}) \hat{\bar{\phi}}_i \right] \quad \text{for} \quad k \in \{I, E\}. \end{aligned}$$

where $\hat{\bar{S}}_i \equiv \frac{1}{2}(S_{i1} + \hat{S}_{i2})$ is the counterfactual average plant-level skill share across both periods and $\hat{\bar{\phi}}_i \equiv \frac{1}{2}(\phi_{i1} + \hat{\phi}_{i2})$ is the counterfactual average firm-level employment share across both periods.

It is important to recognize that although we change the plant's labour demand according to our counterfactual assumptions, we do not alter its group assignment from what was observed in the original data. As such, the group level reallocation and intensity components continue to apply to the exact same set of plants in both the benchmark and counterfactual decompositions. If importing drove the increase in aggregate skill upgrading then we would expect that by eliminating importing altogether, the counterfactual growth in the aggregate demand for skilled labour, $\hat{S}_2 - S_1$, would be significantly smaller than what we observed in the data, $S_2 - S_1$. In this sense, we are able to answer the question as to whether entry into international markets appears to have driven broader aggregate skill upgrading and, as such, was potentially a source of rising wage inequality. Moreover, because the reallocation and intensity components continue to apply to the same set of plants in each case, it is straightforward to characterize the relative importance of each of these mechanisms and quantify which groups of plants contribute most to aggregate skill growth.

5.1 Does Plant-Level Trade Affect the Aggregate Demand for Skill?

5.1.1 Import Restrictions

Table 10 quantifies the aggregate implications of our first counterfactual experiment. In Panel A we display our benchmark decomposition across import groups as a basis for comparison with the counterfactual exercises. In Panels B and C we generate a counterfactual data where importing is restricted for all plants ($\text{imp}_{06} = 0$), but exporting proceeds just as it did in the data. In Panels B1 and B2 the counterfactual data is constucted using the OLS estimates documented in columns (1) and (2) of Table 4 and Table 9, while in Panels C1 and C2 the counterfactual data based on the IV estimates in columns (1) and (2) of Table 6 and columns (3) and (4) of Table 9.

Across Panel B1 and B2, we observe very similar results from either set of OLS based data. For instance, Panels B1 and B2 indicate that restricting firms from import markets would cause the aggregate demand for skilled labour to fall by 2.1-2.9 percentage points once importing is eliminated. While this change is admittedly modest it represents a 16-21 percent decline in the aggregate demand for skilled labour. Almost all of the change in the aggregate demand for skilled labour is concentrated in changes in the demand for skilled labour within plants and suggests a very small role for resource reallocation across plants.

In constrast, Panels C1 and C2, based on IV estimates, suggest that eliminating all access to import markets has a very large impact on the aggregate demand for skill; in this case, the growth in aggregate demand for skilled labour is predicted to decline by 18-30 percentage points. The difference in the magnitude of the overall change in aggregate skill demand can be directly traced back to the differences between the OLS and IV estimates. Similarly, the variance in the overall outcome across experiments reflects the difference on the import status coefficients in the IV regressions.

However, in both C1 and C2, we also observe a significant change in the implied mechanisms that drive aggregate skill growth. While within-firm skill upgrading still accounts for the largest part of the change in aggregate skill growth in each panel, resource reallocation across plants now accounts for 30-32 percent of the overall change.

5.1.2 Export Restrictions

Turning to our second counterfactural exercise, Table 11 reports the aggregate labour demand implications from restricting all Indonesian firms from export markets in 2006. The findings again imply a significant decline in the demand for skilled labour; the OLS based counterfactual data indicate that restricting Indonesian manufacturers from export markets would cause a 0.25-1 percentage point (2.4-7.1 percent) decline in the growth of aggregate demand for skilled labour, while, in comparison, our IV estimates suggest that an end to exporting would 5.6-13.2 percentage point (40-97 percent) fall.

Tables 10 and 11 indicate that there are a number of nuanced differences between import and export restrictions. When all plants are restricted from export markets the fall in the aggregate demand for skilled labour is substantially smaller than that when we restrict all plants from import markets. The explanation for this result can be traced back to the OLS and IV regressions where new and continuous importers are predicted to have stronger skill demand growth *within plants* relative to new and continuous exporters in both the OLS and IV specifications. This is a somewhat subtle effect as we need to consider the impact of importing and exporting on both skilled and unskilled workers. Although both 2006 importers and 2006 exporters are both predicted to hire a similarly large number of skilled workers, only 2006 importers are also predicted to reduce the number of unskilled workers by a much greater extent across regressions.

We also observe intuitive changes in labour allocation. When a firm begins exporting, there is a greater increase in total employment and the relative employment of skilled workers. As such, our decomposition suggests that plants which are counterfactually restricted from export markets do so in a fashion which leads them to reduce their skilled labour force in a disproportionate fashion.

5.1.3 Import and Export Restrictions

Our third counterfactual experiment investigates the complementary impact importing and exporting where we again rely on both our OLS results and IV findings to quantify the counterfactual plant-level demand for skilled labour and characterize the degree of reallocation across plants. For brevity we focus on the IV-based decompositions in Panels C1 and C2 of Tables 12-13 document the aggregate implications of the plant-level changes across import and export groups, respectively.

Identifying the complementarity between importing and exporting requires comparing the results in each table to both the observed changes in the data and the counterfactual results from the first two experiments. Our IV estimates suggest that eliminating all trade induces a reduction in aggregate skill demand by 22.8-33.8 percentage points. This decline is a much greater change than that observed when we eliminate exporting alone, but only a 3.3-4.5 percentage points more than what we observed when only importing was prohibited. This result reflects the two features highlighted above. First, the growth of aggregate skill demand is primarily driven by changes in within-firm skill-intensity. Second, importing has a much larger impact on within-plant skill-intensity.

This does not imply that labour reallocation is of little importance. Rather, labour reallocation accounts for 22-30 percent of aggregate skill upgrading. Examining Table 12 there is little reallocation effects among plants restricted from import markets by the counterfactual policy (and, if any, the opposite effect to the overall impact). In contrast, Table 13 reflects that the labour contraction among plants restricted from export markets is a primary driver of the aggregate reallocation effect. For example, in Panel C1 we find that reallocation among continuous exporters accounts for a 4.6 percentage point decline in aggregate skill demand and explains 92 percent of the reallocation effect in this experiment.

5.1.4 Discussion

In each of the above scenarios, we leverage our regression analysis to pin down changes in labour demand. This has the advantage that it allows us to isolate the degree to which plant-level trade may affect aggregate skill demand with few model-specific assumptions. To facilitate the comparison across experiments, Table 18 documents the *percentage* change in the aggregate skill growth rate for each experiment and computes the percentage of the counterfactual change accounted for by within (intensity) and across-plant (reallocation) changes in relative skill demand. Likewise, Table 19 measures the percentage of each counterfactual change which can be attributed to plants whose trade status was counterfactually altered in the experiment and documents the degree to which these plants adjust through the intensity and reallocation margins.

Examining the first three experiments in Table 18 we note that the elimination of import restrictions always has a large impact on aggregate skill growth; across all specifications aggregate skill growth was at least 16 percent higher when importing was allowed. Export restrictions, in constrast, are individually found to have a relatively small impact on aggregate skill growth. In all but the IV estimation of equation (5), export restrictions are only found to change aggregate skill growth by less than 7 percent.

Table 18 further reflects the degree to which different estimation assumptions imply substantially different aggregate outcomes. For instance, restricting both trade margins leads to aggregate skill growth declines which are 2-6 percent larger than those when we restrict importing alone in the OLS based experiments and 24-33 percent larger than those under import restrictions alone in the IV based experiments. Likewise, we observe a significantly larger role for labour reallocation when we use the IV based estimates, particularly in the first and third counterfactual of Table 18, where labour reallocation accounts for 21-32 percent of aggregate skill growth.

Given the above findings, one might suspect that the plants who are counterfactually restricted from import markets, are predicted to actively reduce the size of the labour force in response to the trade restrictions by a substantial extent. This, however, would be erroneous. As documented in Table 19, within-plant changes explain almost all (if not all) of the contribution among plants which are restricted from import markets. Although these two results may seem contradictory, the explanation is relatively straightforward. Importing substantially changes the skill intensity of given plant, but only has a modest impact on total employment as skilled workers are replaced with unskilled workers. The absence of this source of demand for skill inherently reduces the contribution of importing plants to aggregate skill growth and increases the relative contribution of non-importing plants, which are, on average, more reallocation intensive.

Table 19 also documents that the impact of restricting importers from import markets is much larger than that of restricting exporters from export markets. This effect is particularly striking in the IV based exercises where the effect of restricting exporters from export markets is predicted to decrease the aggregate skill demand among 2006 exporters, but increase the skill demand among non-exporting plants. As exporters retreat from export markets they reduce their skilled labour force, but there is relatively little contraction of the unskilled labour demand. In contrast, non-exporters continue to grow in skill-intensity and, as such, skilled labour is disproportionally reallocated towards these plants.

5.2 Did Importing and Exporting Drive Aggrgate Skill Growth?

This section attempts to answer the question whether plant-level entry decisions into import and export markets can account for a significant amount of the observed aggregate skill growth in Indonesia.

5.2.1 No Import Switching

Table 14 documents our findings for the fourth experiment where all plant-level import decisions in 2006 are counterfactually set to be the same as they were in 1996 (no import switching), but export decisions are exactly as they are in the data. Similar to our first counterfactual, if an increase in importing drove aggregate skill upgrading in Indonesia over the 1996-2006 period we would expect that aggregate skill upgrading would be substantially smaller when we set $\widehat{\text{imp}}_{06} = \text{imp}_{96}$. Rather, our OLS based decompositions in Table 14 suggest that aggregate skill upgrading would have been roughly the same or even slightly *larger* if Indonesian plants had kept their 1996 import status. Similarly, the IV based decompositions indicate that eliminating all of the plant-level changes in import status over the 1996-2006 period would imply a rise in aggregate skill demand of nearly 4-9 percentage points above what we observe in the data.

This counterintuitive finding relates directly to the historical Indonesian context; during the 1997-1998 Asian crisis many plants stopped importing and, in turn, reduced Indonesian integration with international markets. In fact, over the 1996-2006 period 660 plants stopped importing in our sample, while only 425 initial non-importers started importing intermediate materials. As such, since our counterfactual experiment implies a greater number of importers *after* the counterfactual change and each importer demands a slightly larger amount of skilled labour, our decomposition suggests that the increase in importing would have induced small increase in the aggregate demand for skilled labour. From this result alone it appears unlikely that plant-level changes import behavior had a significant impact on the aggregate demand for skilled labour over the 1996-2006 period.

5.2.2 No Export Switching

Table 15 presents our findings for the fifth counterfactual experiment where export histories are fixed at their 1996 status (no export switching). Similar to the preceding counterfactual, Panels B1 and B2 suggest very little change in aggregate skill demand when using the OLS series of counterfactual data, while Panels C1 and C2 indicate that, if anything, export status changes mitigated what would have been an otherwise been a much larger rise in aggregate skill demand over the 1996-2006 period. This finding can again be traced directly to the 1997-1998 Asian crisis where many plants exited export markets; our data indicate a general decline in the propensity to export between 1996 and 2006.

5.2.3 No Import or Export Switching

Tables 16 and 17 present counterfactual decomposition findings for the sixth experiment where both import and export histories are fixed at their 1996 status. The OLS-based decompositions show that the aggregate demand for skilled labour grew by 13.21-14.36 percentage points. In contrast, our IV findings in Tables 16-17 indicate nearly a 27-29 percentage point increase in aggregate skill demand by maintaining 1996 import and export status. This increase in aggregate skill growth is 5-12 percentage points higher than that predicted in our counterfactual which restricts importing alone (Table 14). Similarly, it is 2-10 percentage points larger than that identified by the corresponding export counterfactual (Table 15).

These differences across experiments are directly attributable to the nature of import and export complementarity. For instance, Table 17 indicates a significant degree of labour reallocation across plants as exporters grow into export markets. As in the experiment where we change export status alone, Table 15 similarly demonstrates a large contribution from the reallocation of workers across import groups. This is almost entirely driven by importers who are simultaneous exporters. Focussing on the group of plants which we observe leaving import markets over the 1996-2006 period, we find that these manufacturers are predicted to have contributed a 14-18 percentage point increase in aggregate skill demand through reallocation alone. In contrast, Table 14 suggests this effect is nearly 2-9 percentage points smaller when we fix importing behavior at its 1996 status and allow exporting to evolve as it did in the data. The difference across experiments captures the fact that plants that left one international market (e.g. import markets) are also likely to simultaneously exit the other (e.g. export markets).

Similarly, while the relative contribution of within-plant skill upgrading to the aggregate demand for skilled labour is smaller when both importing and exporting are fixed at their 1996 values (Tables 16-17), its absolute impact is roughly 2-6 percentage points larger than the experiment where we fix import status to its 1996 value alone (Table 14).

5.2.4 Discussion

We observe in columns (4)-(6) of Table 18 that in each case, the OLS based counterfactuals predicted relatively modest changes in aggregate skill growth, while the IV based exercises indicate that restricting import and export switching would have induced even greater increases in aggregate skill growth than what was observed in the data. Across IV-based counterfactuals, our estimates imply that aggregate skill growth would have been 17-

30 percent higher without import or export switching than what was observed in the benchmark decomposition exercise.

Regardless of the estimating assumptions, within-plant intensity changes are the primary determinant of aggregate skill growth. Even among the IV experiments, where labour reallocation has a moderately larger impact, we find that within-plant changes account for 70-83 percent of aggregate skill growth.

It merits comment, however, that among plants affected by the policy change (plants which switch their import or export status), the IV-based results indicate that labour reallocation accounts for 58-68 percent of the their contribution to aggregate skill growth. This reflects two important features of our analysis. First, treated plants are predicted to change the size of their labour force in a fashion which reinforces the impact of within-firm skill-intensity changes. Second, a large majority plants did not switch their import or export status. These non-switchers contributed significantly to aggregate skill growth and did so primarily though within-plant changes in skill-intensity rather than growing (or shrinking) their labour force.

5.3 Empirical Caveats

It is important to recognize the limitations of our approach. First, our exercise does not imply that the impact emphasized by our counterfactual experiments are the only changes induced by trade openness. Rather, we would expect that a large number of plants would react to changes in the broader economic environment, such as trade liberalization, without necessarily entering or exiting import and export markets. The general effects of trade liberalization are subsumed into the common effects across all plants. In this sense, it is not surprising that even non-trading plants are increasing their demand for skilled workers over this period, although we do not claim that this is sole source of trend skill demand.

Second, we are implicitly abstracting from general equilibrium effects of the coutner-factual policies we consider. However, even in this presence of general equilibrium effects, the counterfactual decomposition sheds light on the relative importance of this particular mechanism, entry to import and export markets, as a source of aggregate skill-upgrading for the larger economy. Further, given that the manufacturing sector represents at most 18 percent of total employment over our sample period it is plausible that manufacturing-specific changes would induce modest general equilibrium effects on labor allocation across industries.

Third, the counterfactual decompositions crucially depend on the point estimates of the coefficients in equations (4) or (5). Although the regression results reflect that each coefficient has economically meaningful standard errors around the estimated point estimate, we did not characterize how uncertainty in the point estimates may affect our recovered aggregate decompositions. We address this concern next.

5.4 Standard Errors in the Counterfactual Decompositions

To compute standard errors for the counterfactual decompositions we perform the following 5-step bootstrap process:

1. Draw a bootstrap sample of plants (with replacement) from the benchmark data.
2. Estimate equations (4) and (5) by OLS or IV as described in Section 4.1.
3. Compute the aggregate decomposition using the bootstrap sample of plants and the point estimates from step (2).
4. Calculate the difference between each component of the bootstrapped aggregate decomposition and the benchmark (data-based) aggregate decomposition (Table 2).
5. Compute bootstrap standard errors of the changes in skill growth using the saved differences from step (4) for each bootstrap sample.

In practice, the standard errors for the aggregate decompositions are based on 100 bootstrap samples. To conserve on space we focus on specification (4) and restrict attention to counterfactual experiments 3 (no trade) and 6 (no trade status switching). Bootstrapped standard errors for these experiments are reported in Tables 20 and 21. Similar results for the remaining counterfactual experiments are reported in the Appendix.

In Table 20 we consider the third counterfactual experiment where Indonesian plants are cutoff from both import and export markets. The top half of Panel A reports the difference between the observed, data-based decomposition (Panel A of Table 12) and the OLS based counterfactual decomposition in experiment 3 (Panel B1 of Table 12) across import groups. Similarly, the bottom half of Panel A reports the same differences across export groups using Panels A and B1 of Table 13. Panel B reports analogous findings for the IV based decompositions in Tables 12 and 13. Beneath the computed differences are the bootstrapped standard errors for the aggregate changes (in parentheses). Table

21 reports the same the information for the sixth counterfactual where Indonesian plants do not switch their import or export status over the 1996-2006 period.

To best understand the information in these tables first consider the estimated total change in column (1) of Table 20. The change is computed by taking the observed increase in aggregate skill growth, 13.59 percentage points, and substacting the counterfactual aggregate skill growth in the OLS based decomposition, 10.72 percentage points. This difference is positive since the observed aggregate skill growth was larger than that in counterfactual. In contrast, in Table 21 the observed differences are generally negative reflecting our previous finding that holding trade status fixed at the 1996 value for each plant is predicted to increase aggregate skill growth on average.

Examining Tables 20-21 reveals at least two results that merit further comment. First, just as the aggregate impact of trade is an order of magnitude larger in the IV-based decompositions, so are the magnitudes of the bootstrapped standard errors. As one might expect this reflects the differences in the precision of the underlying OLS and IV regressions. However, it nonetheless has an important economic implication in this setting: In Panel B of Table 21 it is no longer clear that holding trade status fixed at its 1996 value for all plants causes aggregate skill growth to rise since the standard error on the total change is relatively large.

Second, our ability to precisely characterize the individual contributions of particular groups of plants also strongly depends on the precision and robustness of the underlying regression estimates. Across both Tables 20 and 21 we observe that the standard error on an individual group's contribution to aggregate skill growth is often larger than the point estimate in the IV-based decompositions. This is particularly true for groups of plants with a small number of members, such as continuous importers or continuous exporters.

This section should not be interpreted as invalidating our previous conclusions, per se. However, it does provide a note of caution for practitioners when using counterfactual decomposition analysis to draw aggregate conclusions with respect to microeconomic behaviour. For instance, all of our decomposition conclusions continue to hold in Panel A of Tables 20-21. Thus, should we prefer the OLS-based assumptions we can be confident in our aggregate conclusions as well. In constrast, only a subset of our previous aggregate conclusions continue to hold in Panel B of each table. When we examine the third counterfactual in Table 20, the direction of change, the primary mechanism contributing to aggregate skill growth (within-plant skill upgrading), and the vast majority of key group contributions plants are all unchanged from our benchmark analysis even when considering our IV-based decompositions. In Table 21 this is often not the case;

important exceptions include new importers and new exporters where the contributions appear to be precisely estimated. This potentially reflects the power of our instruments across different types of plants and the challenge in finding a suitable set of instruments for a set of highly differentiated producers.

6 Policy Change and Aggregate Skill Growth

This section extends our methodology to consider the impact of policy change on plant-level trade behavior and, consequently, aggregate skill growth. For instance, we leverage our policy-related instruments to evaluate whether further improvements in shipping infrastructure would increase import rates and consequently increase the relative demand for skilled labour among Indonesian manufacturers.[17]

Conducting policy evaluation in this context directly extends the counterfactual decomposition analysis by one additional step to link policy change to plant-level trade decisions. Specifically, for a given policy change (tariff reduction, infrastructure investment, etc) we proceed as follows:

1. For a pre-determined $x\%$ change in the policy related instrument Z_{it}, compute the expected probablility of importing (or exporting) in 2006, $\hat{p}_{i,06}$, using the first stage results from the IV-based estimation routine.

2. Use $\hat{p}_{i,06}$ and the second stage specifications to predict each plant's skilled and unskilled labour demand.

3. Perform the counterfactual decomposition analysis described in Section 4.

A key feature of this procedure is that it intentionally restricts attention to the economic mechanism of interest. That is, we strictly characterize the impact of policy change on aggregate skill demand through changes in trade status alone. Should infrastructure investment, for example, also induce plant-level skill upgrading through investment in R&D this will be omitted from our decomposition analysis so that the aggregate change in the demand for skilled labour only reflects impact of changes in plant-level trade status.

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[17] Additional policy experiments are reported in the Appendix, but omitted from the main text for brevity.

6.1 A Reduction in Internal Shipping Costs

We first consider the impact of reducing internal shipping cost by 10% on aggregate skill demand through changes in plant-level import behaviour. We conduct our policy experiment for both empirical specifications (equations (4) and (5)) and each assumption on the exogeneity of plant-level export decisions. The counterfactual decomposition results across all specifications and instrument sets are reported in Table 22.

Panel A of Table 22 again reports the decomposition based on the observed data, while Panels B-E report our counterfactual decompositions across import groups. Panels B and C focus on specification (4), but respectively treat exporting as an exogenous variable and an endogenous variable. Similarly, Panels D snd E repeat the exercise across instrument sets for specification (5).

We observe that a 10 percent reduction in internal shipping costs has a modest, but economically important impact on aggregate skill growth. In panels B and D, where the underlying plant-level labour demand regressions only instrument import status, we observe an additional 0.5 percentage point increase in aggregate skill growth relative to the benchmark decomposition. Although small, this increase represents 4 percent of the observed increase in Indonesia over the 1996-2006 period. In contrast, panels C and E, which instrument both import and export decisions, suggest a 5-8 percentage point increase in aggregate skill demand above the benchmark figure.

Across all specifications, within-plant skill-intensity continues to be the primary determinant of aggregate skill growth. As new plants enter import markets, they increase their within-plant demand for skilled labour rapidly. This in turn increases their group's contribution to the aggregate demand for skill. These same new importers also benefit from importing and tend to increase their labour holdings, which in turn slows the reallocation of labour from observed non-importers and former importers towards the observed new importers and continuing importers.

Across all groups, continuous non-importers tend to show the largest increase in their group contribution to aggregate skill growth. This is primarily driven by the fact that this group demonstrates the largest total increase in the number plants which begin importing. Former importers, by comparison, tend to have a larger per-plant impact on aggregate skill growth when they choose to import due to the change in policy. However, they are a sufficiently small group that, in sum, the non-importers are the largest source of change in aggregate growth relative to the benchmark case.

6.2 An Increase in Export Market Access

Our second policy experiment evaluates the impact of an increase in export market access on aggregate skill demand through changes in plant-level export behaviour. Specifically, we consider a setting where tariffs are eliminated for all markets and industries (Δ Mkt. Access $= -$Mkt. Access$_{96}$). The counterfactual decomposition results for each specification and instrument set are reported in Table 23.

We immediately observe that the impact of an improvement in export market access induces a large increase in aggregate skill upgrading relative to the benchmark decomposition. Across all specifications and instrument sets our counterfactual decomposition analysis suggests that aggregate skill demand grows at least 4.16 percentage points faster after the increase in export market access. This represents a 31 percent increase in the growth of aggregate skill demand relative to the benchmark case. Similarly, unlike the previous experiment, the change in export market access induces significantly larger reallocation of labour across plants. Although only 5 percent of aggregate skill upgrading is due to labour reallocation in the benchmark decomposition, panels B-E suggest that after the policy change 15-32 percent of aggregate rise in demand for skilled labour is determined by across-plant reallocation.

Examining panels B-E further reveals that three of four variations on our counterfactual decomposition predict very similar results. The primary difference arises when we consider the specification (5) but treat import status as an exogenous variable. In all other cases we observe a further increase in aggregate skill growth of 4.2-7.5 percentage points, with roughly similar contributions from skill upgrading (15.1-16.6 percentage points) and labour reallocation (2.6-4.5 percentage points). However, in panel D, we observe much larger aggregate skill growth (30.97 percentage points). The difference across panels is primarily driven by an increase in labour reallocation, which, in this case, contributes 9.8 percentage points alone. Mirroring the previous policy exercise, continuous non-exporters demonstrate the largest increase in their group contribution to aggregate skill growth. This again reflects the fact that this group demonstrates the largest total increase in the number plants which begin exporting after the policy change.

7 Concluding Remarks

This paper studies the impact of plant-level trade on the aggregate demand for skilled workers among Indonesian manufacturers. We combine regression methods with standard decomposition techniques to counterfactually quantify the impact of *plant-level* integration in import and export markets on the *aggregate* demand for skilled labour. We document four striking results. First, the aggregate demand for skilled labour in the Indonesian manufacturing sector grew by 14 percentage points over the 1996-2006 period. Our decomposition exercise suggests that within plant-changes are the largest source of aggregate skill upgrading. Second, plant-level import and export decisions could have induced a change in the demand for skilled labour of a similar magnitude. In fact, our estimates, which are not tied to any particular economic theory, suggest that eliminating all importing and exporting would cause the aggregate demand for skilled labour to fall by 23-34 percentage points across experiments. Within plant skill-upgrading is found to be the primary mechanism underlying aggregate skill-upgrading; 70-78 percent of aggregate skill growth can be attributed to within-plant changes with the remainder due to labour reallocation across plants. Third, the observed import and export decisions did not significantly affect the aggregate demand for Indonesian skilled labour between 1996 and 2006. In fact, if anything, the turnover of manufacturing plants in import and export markets appears to have mitigated stronger aggregate growth in the demand for skilled labour. Fourth, across experiments we consistently find that importing affects skill upgrading largely through changes in within-plant skill-intensity, while exporting affects both across-plant reallocation and within-plant skill-intensity.

Counterfactual policy experiments suggest that a 10 percent reduction in internal shipping costs would induce a 0.5-8 percentage point increase in aggregate skill demand through changes in import behavior. Similarly, the elimination of tariffs on Indonesian exporters would induce a 4-17 percentage point increase in aggregate skill growth through changes in plant-level export decisions. In the former experiment, within-plant skill upgrading determines all but 5 percent of the growth in aggregate skill demand. In the latter case within-plant skill upgrading accounts for 70 percent of aggregate skill demand with across-plant labour reallocation explaining the remainder. In either case, we find that plant-level entry into international markets can significantly affect the aggregate demand for skilled labour, though the underlying mechanisms vary significantly across the margins through which plants enter international markets.

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8 Figures

Figure 1: Skilled Worker Shares Over Time

Data Source: 1996-2006 Indonesia Census of Manufacturing Plants and labour Force Survey. Sample of the labour Force Survey is restricted to employed workers in the manufacturing sector.

9 Tables

Table 1: Importing and Skill Intensity, 2006, full sample

	Highest Degree Completed/Fraction						Training	R&D	Non-Prod	Obs.
	No Primary	Primary	Jr. High	High	College	Grad.	Worker	Worker	All Workers	
Non-Traders	0.065	0.291	0.309	0.302	0.033	0.00002	15.6	12.6	0.132	20,262
	(0.158)	(0.309)	(0.252)	(0.291)	(0.078)	(0.0056)	(383.0)	(183.9)	(0.163)	
Exporters	0.030	0.190	0.293	0.437	0.050	0.0003	65.0	46.5	0.150	3,690
	(0.102)	(0.239)	(0.227)	(0.292)	(0.075)	(0.0034)	(1,141.0)	(613.4)	(0.160)	
Importers	0.018	0.072	0.333	0.511	0.066	0.0004	40.6	41.6	0.184	3,993
	(0.084)	(0.186)	(0.214)	(0.232)	(0.088)	(0.0031)	(260.8)	(461.2)	0.148)	
Two-way Traders	0.007	0.069	0.222	0.609	0.091	0.0011	150.7	158.2	0.184	1,519
	(0.044)	(0.124)	(0.208)	(0.235)	(0.103)	(0.0065)	(1,310.4)	(1,826.3)	(0.159)	

Notes: Standard deviations are in parentheses. The first column indicates current import and export status, where "non-traders" denotes plants that do not export or import, "exporters" captures plants that export but do not import in the current year, "importers" captures plants that import but do not export in the current year, and "two-way traders" captures plants that export and import in the current year.

Table 2: Skill Composition and Reallocation across Trade Status (skill = highschool+)

Import Status	Aggregate Change $S_2 - S_1$ (1)	Reallocation $\sum_{i\in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	Intensity $\sum_{i\in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	Reallocation per 1000 plants $1000 * (2)/N_g$ (4)	Intensity per 1000 plants $1000 * (3)/N_g$ (5)	# of plants N_g (6)
Panel A: Import Groups						
All plants	0.137	0.009	0.128	0.001	0.015	8296
$NI - NI$		-0.012	0.050	-0.002	0.009	5567
$I - NI$		-0.013	0.017	-0.016	0.021	820
$NI - I$		0.005	0.010	0.010	0.018	551
$I - I$		0.028	0.051	0.021	0.038	1358
Panel B: Export Groups						
All Plants	0.137	0.009	0.128	0.001	0.015	8296
$NE - NE$		-0.006	0.049	-0.001	0.008	5610
$E - NE$		-0.010	0.023	-0.012	0.027	845
$NE - E$		0.009	0.012	0.016	0.021	567
$E - E$		0.016	0.044	0.012	0.035	1274

Notes: This table presents the decomposition results described by equation (3). $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers. Likewise, $NE - NE$, $E - NE$, $NE - N$, $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 3: Skill Composition and Reallocation across Trade Status (skill = non-production workers)

Import Status	Aggregate Change $S_2 - S_1$ (1)	Reallocation $\sum_{i\in g}(\phi_{i2}-\phi_{i1})\bar{S}_i$ (2)	Intensity $\sum_{i\in g}(S_{i2}-S_{i1})\bar{\phi}_i$ (3)	Reallocation per 1000 plants $1000 * (2)/N_g$ (4)	Intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Import Groups						
All plants	-0.003	-0.007	0.003	-0.003	0.003	8296
$NI - NI$	-0.007	-0.007	0.000	-0.001	0.000	5567
$I - NI$	-0.006	-0.006	0.000	-0.008	0.000	820
$NI - I$	0.002	0.001	0.000	0.002	0.000	551
$I - I$	0.009	0.005	0.003	0.004	0.002	1358
Panel B: Export Groups						
All plants	-0.003	-0.007	0.003	-0.001	0.000	8296
$NE - NE$	-0.001	-0.006	0.004	-0.001	0.001	5610
$E - NE$	-0.004	-0.004	0.000	-0.004	-0.001	845
$NE - E$	0.002	0.002	0.000	0.003	0.000	567
$E - E$	0.001	0.001	0.000	0.001	0.000	1274

Notes: This table presents the decomposition results described by equation (3). $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers. Likewise, $NE - NE$, $E - NE$, $NE - N$, $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 4: Level regressions, OLS

	OLS 1		OLS 2	
	(1)	(2)	(3)	(4)
Dep. Var.	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$
imp_{06}	0.266***	0.064*	0.226***	0.098***
	[0.030]	[0.034]	[0.029]	[0.034]
imp_{96}	-0.002	0.012	-0.005	0.004
	[0.030]	[0.033]	[0.029]	[0.033]
exp_{06}	0.255***	0.189***	0.278***	0.172***
	[0.032]	[0.036]	[0.031]	[0.036]
exp_{96}	0.135***	0.184***	0.145***	0.218***
	[0.031]	[0.035]	[0.030]	[0.034]
Capital	0.179***	0.109***	0.176***	0.109***
	[0.008]	[0.007]	[0.008]	[0.007]
TFP	0.207***	0.200***	0.197***	0.218***
	[0.023]	[0.024]	[0.023]	[0.024]
Wage_{06}	-0.162**	-0.079		
	[0.077]	[0.061]		
Wage_{96}	-0.250***	0.195**		
	[0.095]	[0.082]		
$\ln(L_{s,96})$	0.515***		0.505***	
	[0.010]		[0.010]	
$\ln(L_{u,96})$		0.571***		0.556***
		[0.013]		[0.013]
Obs.	7,187	7,744	7,689	8,209
R-squared	0.708	0.581	0.723	0.595
Region FE	Prov.	Prov.	Cnty.	Cnty.
Ind. FE	Yes	Yes	Yes	Yes

Notes: Columns (1)-(4) report the OLS estimates of equation (4). $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province dummies are included in columns (1) and (2), while county level dummies are included in columns (3) and (4). 3-digit ISIC industry dummies are also included.

Table 5: First Stage Regressions for equation (4) IVs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	imp_{06}	imp_{06}	exp_{06}	exp_{06}	imp_{06}	exp_{06}	imp_{06}	exp_{06}
Δ Input Tariff			-0.006***	-0.005***	-0.000	-0.007***	-0.000	-0.005***
			[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Δ Mkt. Access			-0.012***	-0.009***	-0.005*	-0.013***	-0.003	-0.009***
			[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.002]
Distance to port	-0.051***	-0.054***			-0.046***	0.039***	-0.050***	0.032***
	[0.009]	[0.008]			[0.009]	[0.010]	[0.008]	[0.009]
Obs.	7,149	7,705	6,502	6,869	6,474	6,474	6,841	6,841
Prov. FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind. FE	YES	YES	YES	YES	YES	YES	YES	YES
F-stat Exc. IVs	35.83	48	24.86	19.68	9.578	21.27	12.62	16.64

Notes: Columns (1)-(4) correspond to columns (1)-(4) in Table 6, while columns (5) and (6) correspond to column (5) in Table 6 and columns (7) and (8) correspond to column (6) in Table 6. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province dummies and 3-digit ISIC industry dummies are also included.

Table 6: Level regressions, IV

	IV 1		IV 2		IV 3	
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$
imp_{06}	1.463***	-1.414***	0.112*	0.100	1.828***	-1.376**
	[0.518]	[0.463]	[0.063]	[0.062]	[0.697]	[0.544]
imp_{96}	-0.503**	0.670***	0.024	0.006	-0.673**	0.641***
	[0.219]	[0.208]	[0.038]	[0.035]	[0.296]	[0.246]
exp_{06}	0.142**	0.326***	1.786***	0.034	1.357***	0.355
	[0.061]	[0.060]	[0.480]	[0.508]	[0.448]	[0.490]
exp_{96}	0.127***	0.207***	-0.407**	0.232	-0.327*	0.193
	[0.035]	[0.041]	[0.175]	[0.181]	[0.179]	[0.190]
Capital	0.165***	0.132***	0.141***	0.116***	0.124***	0.135***
	[0.011]	[0.011]	[0.014]	[0.014]	[0.020]	[0.020]
TFP	0.167***	0.267***	0.196***	0.199***	0.137***	0.269***
	[0.031]	[0.033]	[0.028]	[0.026]	[0.042]	[0.039]
Wage_{06}	-0.166**	-0.095	-0.279***	-0.056	-0.246**	-0.096
	[0.084]	[0.067]	[0.093]	[0.068]	[0.101]	[0.076]
Wage_{96}	-0.312***	0.229**	-0.310***	0.169*	-0.378***	0.195*
	[0.105]	[0.093]	[0.118]	[0.092]	[0.134]	[0.105]
$\ln(L_{s,96})$	0.496***		0.481***		0.461***	
	[0.013]		[0.016]		[0.023]	
$\ln(L_{u,96})$		0.569***		0.576***		0.570***
		[0.014]		[0.020]		[0.022]
Obs.	7,149	7,705	6,502	6,869	6,474	6,841
R-squared	0.651	0.458	0.607	0.585	0.538	0.467
Prov. FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes
Import IV	Transport	Transport	-	-	Transport	Transport
Export IV	-	-	Tariff	Tariff	Tariff	Tariff

Notes: Columns (1) and (2) treat importing as an endogenous variable, columns (3) and (4) treat exporting as an endogenous variable, and last two columns treat both importing and exporting as endogenous variables. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province dummies and 3-digit ISIC industry dummies are also included.

Table 7: First Stage Regressions for equation (5), IV1 and IV2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	imp_{06}	imp_{06} × imp_{96}	imp_{06}	imp_{06} × imp_{96}	exp_{06}	exp_{06} × exp_{96}	exp_{06}	exp_{06} × imp_{96}
Δ Input Tariff					-0.006***	-0.003***	-0.005***	-0.002***
					[0.001]	[0.001]	[0.001]	[0.001]
Δ Mkt. Access					-0.013***	-0.010***	-0.010***	-0.008***
					[0.003]	[0.002]	[0.002]	[0.002]
exp_{96} × Δ Input Tariff					-0.006*	-0.005	-0.006*	-0.005
					[0.003]	[0.003]	[0.003]	[0.003]
exp_{96} × Δ Mkt. Access					0.007	0.013**	0.006	0.014**
					[0.006]	[0.005]	[0.006]	[0.005]
Distance to port	-0.051***	-0.017***	-0.053***	-0.016***				
	[0.008]	[0.005]	[0.008]	[0.004]				
imp_{96} × Distance to port	-0.007	-0.042*	-0.007	-0.041*				
	[0.021]	[0.023]	[0.021]	[0.024]				
Obs.	7,149	7,149	7,705	7,705	6,502	6,502	6,869	6,869
Prov. FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind. FE	YES	YES	YES	YES	YES	YES	YES	YES
2nd stage	$\ln(L_{s,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{u,06})$
F-stat Exc. IVs	18.74	8.584	25.36	8.789	13.69	12.35	10.89	10.33

Notes: Columns (1)-(4) correspond to columns (2)-(3) in Table 9, while columns (5)-(8) correspond to columns (4)-(5) in Table 9. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province dummies and 3-digit ISIC industry dummies are also included.

Table 8: First Stage Regressions for equation (5), IV3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	imp_{06}	$\text{imp}_{06} \times \text{imp}_{96}$	imp_{06}	$\text{imp}_{06} \times \text{imp}_{96}$	exp_{06}	$\text{exp}_{06} \times \text{exp}_{96}$	exp_{06}	$\text{exp}_{06} \times \text{imp}_{96}$
Δ Input Tariff	0.000	-0.000	-0.006***	-0.003***	-0.000	-0.000	-0.005***	-0.002***
	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Δ Mkt. Access	-0.004	-0.002	-0.013***	-0.010***	-0.002***	-0.002	-0.010***	-0.008***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]
exp_{96} × Δ Input Tariff	-0.005*	-0.001	-0.005	-0.005	-0.004	0.000	-0.006*	-0.005
	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]
exp_{96} × Δ Mkt. Access	-0.003	-0.004	0.006	0.013**	-0.003	-0.004	0.006	0.014**
	[0.004]	[0.003]	[0.006]	[0.005]	[0.004]	[0.003]	[0.006]	[0.006]
Distance to port	-0.046***	-0.015***	0.041***	0.017***	-0.050***	-0.015***	0.033***	0.013**
	[0.009]	[0.005]	[0.010]	[0.007]	[0.008]	[0.005]	[0.009]	[0.006]
imp_{96} × Distance to port	-0.005	-0.037	-0.020	-0.009	-0.004	-0.035	-0.015	-0.005
	[0.021]	[0.023]	[0.018]	[0.014]	[0.022]	[0.024]	[0.018]	[0.014]
Obs.	6,474	6,474	6,474	6,474	6,841	6,841	6,841	6,841
Prov. FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind. FE	YES	YES	YES	YES	YES	YES	YES	YES
2nd stage	$\ln(L_{s,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{u,06})$
F-stat Exc. IVs	5.550	2.638	11.67	10.03	6.919	2.769	9.080	8.336

Notes: Columns (1)-(4) correspond to columns (2)-(3) in Table 9, while columns (5)-(8) correspond to columns (4)-(5) in Table 9. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province dummies and 3-digit ISIC industry dummies are also included.

Table 9: Level regressions, OLS and IV

	OLS 1		IV 1		IV 2		IV 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$	$\ln(L_{s,06})$	$\ln(L_{u,06})$
imp_{06}	0.322***	0.021	1.400*	-0.663	0.073	0.019	2.687**	0.798
	[0.043]	[0.047]	[0.786]	[0.697]	[0.103]	[0.087]	[1.156]	[0.901]
imp_{96}	0.041	-0.016	-0.576	1.431**	0.065	-0.013	-0.399	1.789**
	[0.037]	[0.040]	[0.581]	[0.717]	[0.049]	[0.043]	[0.761]	[0.831]
$\text{imp}_{06}\times \text{imp}_{96}$	-0.116**	0.081	0.174	-1.896	-0.051	0.064	-1.100	-3.678**
	[0.058]	[0.066]	[1.369]	[1.580]	[0.092]	[0.076]	[1.859]	[1.858]
exp_{06}	0.403	0.250***	0.259***	0.440***	3.151***	0.468	2.518**	1.654
	[0.046]	[0.051]	[0.081]	[0.087]	[0.944]	[0.895]	[1.008]	[1.015]
exp_{96}	0.244***	0.225***	0.210***	0.301***	0.261	-0.018	0.278	0.424
	[0.038]	[0.041]	[0.046]	[0.062]	[0.445]	[0.393]	[0.543]	[0.511]
$\text{exp}_{06}\times \text{exp}_{96}$	-0.286***	-0.117*	-0.230***	-0.192**	-2.070*	0.171	-1.830	-1.256
	[0.062]	[0.070]	[0.078]	[0.092]	[1.252]	[1.163]	[1.487]	[1.445]
Capital	0.178***	0.109***	0.164***	0.126***	0.128***	0.105***	0.104***	0.088***
	[0.008]	[0.007]	[0.011]	[0.012]	[0.016]	[0.017]	[0.025]	[0.027]
TFP	0.204***	0.199***	0.164***	0.272***	0.169***	0.199***	0.100**	0.223***
	[0.023]	[0.024]	[0.031]	[0.036]	[0.034]	[0.031]	[0.051]	[0.053]
Wage_{06}	-0.160**	-0.078	-0.162*	-0.106	-0.245**	-0.059	-0.223*	-0.085
	[0.077]	[0.061]	[0.085]	[0.072]	[0.105]	[0.071]	[0.115]	[0.091]
Wage_{96}	-0.254***	0.193**	-0.318***	0.236**	-0.356***	0.140	-0.429***	0.152
	[0.095]	[0.082]	[0.106]	[0.100]	[0.133]	[0.094]	[0.153]	[0.128]
$\ln(L_{s,96})$	0.512***		0.493***		0.454***		0.427***	
	[0.010]		[0.013]		[0.023]		[0.033]	
$\ln(L_{u,96})$		0.570***		0.570***		0.561***		0.546***
		[0.013]		[0.016]		[0.022]		[0.027]
Obs.	7,187	7,744	7,149	7,705	6,502	6,869	6,474	6,841
R-squared	0.710	0.581	0.648	0.364	0.529	0.576	0.425	0.255
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Import IV			Transport	Transport	—	—	Transport	Transport
Export IV			—	—	Tariff	Tariff	Tariff	Tariff

Notes: Columns (1)-(2) report the OLS estimates of equation (5), while columns (3)-(6) report IV estimates for the same specification. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard deviations are in square brackets. Province and 3-digit ISIC industry dummies are included in each regression.

Table 10: Counterfactual 1: No Importing, $\text{imp}_{06} = 0$, $\text{exp}_{06} = \text{exp}_{06}$

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NI - NI$	0.0355	-0.0129	0.0484	-0.0028	0.0107	4530
$I - NI$	0.0044	-0.0121	0.0166	-0.0184	0.0251	660
$NI - I$	0.0185	0.0081	0.0104	0.0191	0.0246	425
$I - I$	0.0774	0.0233	0.0541	0.0211	0.0492	1100
Panel B1: OLS, Specification (4)						
Total	0.1072	-0.0040	0.1112	-0.0006	0.0166	6715
$NI - NI$	0.0521	0.0016	0.0505	0.0003	0.0112	4530
$I - NI$	0.0113	-0.0060	0.0172	-0.0090	0.0261	660
$NI - I$	0.0101	0.0032	0.0069	0.0076	0.0162	425
$I - I$	0.0337	-0.0028	0.0365	-0.0026	0.0332	1100
Panel B2: OLS, Specification (5)						
Total	0.1146	-0.0024	0.1170	-0.0004	0.0174	6715
$NI - NI$	0.0506	0.0003	0.0503	0.0001	0.0111	4530
$I - NI$	0.0107	-0.0065	0.0172	-0.0098	0.0260	660
$NI - I$	0.0074	0.0021	0.0053	0.0050	0.0125	425
$I - I$	0.0459	0.0017	0.0442	0.0015	0.0401	1100
Panel C1: IV1, Specification (4)						
Total	-0.1828	-0.0554	-0.1274	-0.0083	-0.0190	6715
$NI - NI$	-0.0031	-0.0465	0.0434	-0.0103	0.0096	4530
$I - NI$	-0.0115	-0.0265	0.0150	-0.0401	0.0227	660
$NI - I$	-0.0242	0.0070	-0.0311	0.0164	-0.0732	425
$I - I$	-0.1441	0.0106	-0.1548	0.0097	-0.1407	1100
Panel C2: IV1, Specification (5)						
Total	-0.3049	-0.0963	-0.2086	-0.0143	-0.0311	6715
$NI - NI$	-0.0682	-0.1033	0.0351	-0.0228	0.0077	4530
$I - NI$	-0.0384	-0.0508	0.0124	-0.0769	0.0188	660
$NI - I$	-0.0283	-0.0160	-0.0123	-0.0376	-0.0290	425
$I - I$	-0.1700	0.0738	-0.2438	0.0671	-0.2216	1100

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 1. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (1) and (2) of Table 9, (d) Panel C2 uses columns (3) and (4) of Table 9. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table 11: Counterfactual 2: No Exporting, $\text{imp}_{06} = \text{imp}_{06}$, $\text{exp}_{06} = 0$

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084
Panel B1: OLS, Specification (4)						
Total	0.1263	0.0020	0.1243	0.0003	0.0185	6715
$NE - NE$	0.0617	0.0102	0.0516	0.0023	0.0116	4437
$E - NE$	0.0293	0.0032	0.0260	0.0044	0.0357	730
$NE - E$	0.0102	0.0034	0.0068	0.0073	0.0146	464
$E - E$	0.0251	-0.0148	0.0399	-0.0137	0.0368	1084
Panel B2: OLS, Specification (5)						
Total	0.1326	0.0040	0.1286	0.0006	0.0192	6715
$NE - NE$	0.0567	0.0058	0.0509	0.0013	0.0115	4437
$E - NE$	0.0260	0.0003	0.0257	0.0004	0.0352	730
$NE - E$	0.0018	-0.0031	0.0049	-0.0067	0.0105	464
$E - E$	0.0481	0.0009	0.0472	0.0009	0.0435	1084
Panel C1: IV2, Specification (4)						
Total	0.0040	-0.0040	0.0080	-0.0006	0.0012	6715
$NE - NE$	0.0993	0.04259	0.05668	0.00960	0.01277	4437
$E - NE$	0.05357	0.02504	0.02853	0.03430	0.03908	730
$NE - E$	-0.02867	-0.00956	-0.01911	-0.02060	-0.04118	464
$E - E$	-0.12014	-0.06204	-0.05811	-0.05723	-0.05360	1084
Panel C2: IV2, Specification (5)						
Total	0.0796	0.0017	0.0779	0.0003	0.0116	6715
$NE - NE$	0.1152	0.0564	0.0588	0.0127	0.0133	4437
$E - NE$	0.0639	0.0343	0.0296	0.0470	0.0405	730
$NE - E$	-0.0385	-0.0159	-0.0226	-0.0344	-0.0486	464
$E - E$	-0.0610	-0.0730	0.0120	-0.0673	0.0111	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (3) and (4) of Table 9, (d) Panel C2 uses columns (5) and (6) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 12: Counterfactual 3: No Trade, $\text{imp}_{06} = 0$, $\text{exp}_{06} = 0$ (Import Groups)

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NI - NI$	0.0355	-0.0129	0.0484	-0.0028	0.0107	4530
$I - NI$	0.0044	-0.0121	0.0166	-0.0184	0.0251	660
$NI - I$	0.0185	0.0081	0.0104	0.0191	0.0246	425
$I - I$	0.0774	0.0233	0.0541	0.0211	0.0492	1100
Panel B1: OLS, Specification (4)						
Total	0.0982	-0.0080	0.1062	-0.0012	0.0158	6715
$NI - NI$	0.0560	0.0061	0.0500	0.0013	0.0110	4530
$I - NI$	0.0098	-0.0069	0.0167	-0.0104	0.0253	660
$NI - I$	0.0082	0.0019	0.0063	0.0045	0.0147	425
$I - I$	0.0242	-0.0091	0.0333	-0.0083	0.0303	1100
Panel B2: OLS, Specification (5)						
Total	0.1115	-0.0047	0.1162	-0.0007	0.0173	6715
$NI - NI$	0.0529	0.0027	0.0502	0.0006	0.0111	4530
$I - NI$	0.0104	-0.0070	0.0173	-0.0106	0.0263	660
$NI - I$	0.0056	0.0006	0.0050	0.0013	0.0117	425
$I - I$	0.0426	-0.0010	0.0437	-0.0009	0.0397	1100
Panel C1: IV3, Specification (4)						
Total	-0.2276	-0.0498	-0.1778	-0.0074	-0.0265	6715
$NI - NI$	-0.0081	-0.0352	0.0271	-0.0078	0.0060	4530
$I - NI$	-0.0220	-0.0286	0.0066	-0.0433	0.0099	660
$NI - I$	-0.0289	0.0057	-0.0346	0.0134	-0.0815	425
$I - I$	-0.1685	0.0083	-0.1769	0.0076	-0.1608	1100
Panel C2: IV3, Specification (5)						
Total	-0.3377	-0.1023	-0.2355	-0.0152	-0.0351	6715
$NI - NI$	-0.0816	-0.1091	0.0274	-0.0241	0.0061	4530
$I - NI$	-0.0462	-0.0557	0.0096	-0.0844	0.0145	660
$NI - I$	-0.0327	-0.0236	-0.0090	-0.0556	-0.0212	425
$I - I$	-0.1773	0.0861	-0.2634	0.0783	-0.2395	1100

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (1) and (2) of Table 9, (d) Panel C2 uses columns (3) and (4) of Table 9. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table 13: Counterfactual 3: No Trade, $\text{imp}_{06} = 0$, $\text{exp}_{06} = 0$ (Export Groups)

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084
Panel B1: OLS, Specification (4)						
Total	0.0982	-0.0080	0.1062	-0.0012	0.0158	6715
$NE - NE$	0.0614	0.0127	0.0488	0.0029	0.0110	4437
$E - NE$	0.0211	-0.0003	0.0214	-0.0004	0.0293	730
$NE - E$	0.0072	0.0023	0.0049	0.0050	0.0105	464
$E - E$	0.0085	-0.0227	0.0312	-0.0210	0.0288	1084
Panel B2: OLS, Specification (5)						
Total	0.1115	-0.0047	0.1162	-0.0007	0.0173	6715
$NE - NE$	0.0574	0.0083	0.0491	0.0019	0.0111	4437
$E - NE$	0.0204	-0.0023	0.0227	-0.0032	0.0311	730
$NE - E$	-0.0005	-0.0039	0.0034	-0.0084	0.0074	464
$E - E$	0.0342	-0.0068	0.0410	-0.0063	0.0378	1084
Panel C1: IV3, Specification (4)						
Total	-0.2276	-0.0498	-0.1778	-0.0074	-0.0265	6715
$NE - NE$	-0.0079	-0.0015	-0.0064	-0.0003	-0.0014	4437
$E - NE$	-0.0397	0.0027	-0.0425	0.0038	-0.0582	730
$NE - E$	-0.0341	-0.0051	-0.0290	-0.0110	-0.0624	464
$E - E$	-0.1459	-0.0459	-0.1000	-0.0423	-0.0923	1084
Panel C2: IV3, Specification (5)						
Total	-0.3377	-0.1023	-0.2355	-0.0152	-0.0351	6715
$NE - NE$	-0.0771	-0.0444	-0.0327	-0.0100	-0.0074	4437
$E - NE$	-0.0702	0.0024	-0.0725	0.0032	-0.0994	730
$NE - E$	-0.0411	-0.0240	-0.0172	-0.0516	-0.0370	464
$E - E$	-0.1494	-0.0363	-0.1130	-0.0335	-0.1043	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (5) and (6) of Table 9, (d) Panel C2 uses columns (7) and (8) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 14: Counterfactual 4: No Import Switching, $\text{imp}_{06} = \text{imp}_{96}$, $\text{exp}_{06} = \text{exp}_{06}$

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NI - NI$	0.0355	-0.0129	0.0484	-0.0028	0.0107	4530
$I - NI$	0.0044	-0.0121	0.0166	-0.0184	0.0251	660
$NI - I$	0.0185	0.0081	0.0104	0.0191	0.0246	425
$I - I$	0.0774	0.0233	0.0541	0.0211	0.0492	1100
Panel B1: OLS, Specification (4)						
Total	0.1396	0.0078	0.1318	0.0012	0.0196	6715
$NI - NI$	0.0336	-0.0145	0.0482	-0.0032	0.0106	4530
$I - NI$	0.0256	0.0022	0.0233	0.0034	0.0353	660
$NI - I$	0.0059	-0.0006	0.0065	-0.0014	0.0154	425
$I - I$	0.0745	0.0206	0.0538	0.0188	0.0489	1100
Panel B2: OLS, Specification (5)						
Total	0.1346	0.0068	0.1279	0.0010	0.0190	6715
$NI - NI$	0.0344	-0.0138	0.0483	-0.0031	0.0107	4530
$I - NI$	0.0205	0.0000	0.0205	0.0000	0.0311	660
$NI - I$	0.0040	-0.0011	0.0051	-0.0027	0.0120	425
$I - I$	0.0757	0.0217	0.0540	0.0198	0.0491	1100
Panel C1: IV1, Specification (4)						
Total	0.1757	0.0292	0.1465	0.0043	0.0218	6715
$NI - NI$	-0.0012	-0.0449	0.0437	-0.0099	0.0096	4530
$I - NI$	0.1801	0.0941	0.0860	0.1425	0.1303	660
$NI - I$	-0.0240	0.0073	-0.0314	0.0173	-0.0738	425
$I - I$	0.0209	-0.0273	0.0482	-0.0248	0.0438	1100
Panel C2: IV1, Specification (5)						
Total	0.2244	0.0496	0.1748	0.0074	0.0260	6715
$NI - NI$	0.0028	-0.0414	0.0442	-0.0091	0.0098	4530
$I - NI$	0.2175	0.1193	0.0982	0.1808	0.1487	660
$NI - I$	-0.0231	0.0067	-0.0164	-0.0158	-0.0386	425
$I - I$	0.0272	-0.0217	0.0489	-0.0197	0.0444	1100

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 1. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (1) and (2) of Table 9, (d) Panel C2 uses columns (3) and (4) of Table 9. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table 15: Counterfactual 5: No Export Switching, $\text{imp}_{06} = \text{imp}_{06}$, $\text{exp}_{06} = \text{exp}_{96}$

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i\in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i\in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084
Panel B1: OLS, Specification (4)						
Total	0.1398	0.0081	0.1317	0.0012	0.0196	6715
$NE - NE$	0.0387	-0.0097	0.0485	-0.0022	0.0109	4437
$E - NE$	0.0458	0.0156	0.0302	0.0213	0.0414	730
$NE - E$	0.0038	-0.0026	0.0064	-0.0056	0.0138	464
$E - E$	0.0514	0.0048	0.0466	0.0044	0.0430	1084
Panel B2: OLS, Specification (5)						
Total	0.1332	0.0062	0.1270	0.0009	0.0189	6715
$NE - NE$	0.0441	-0.0051	0.0492	-0.0011	0.0111	4437
$E - NE$	0.0317	0.0060	0.0257	0.0083	0.0352	730
$NE - E$	-0.0012	-0.0060	0.0047	-0.0128	0.0102	464
$E - E$	0.0585	0.0112	0.0474	0.0103	0.0437	1084
Panel C1: IV2, Specification (4)						
Total	0.2785	0.0772	0.2013	0.0115	0.0300	6715
$NE - NE$	-0.0143	-0.0556	0.0413	-0.0125	0.0093	4437
$E - NE$	0.3473	0.2118	0.1355	0.2902	0.1856	730
$NE - E$	-0.0354	-0.0211	-0.0144	-0.0454	-0.0310	464
$E - E$	-0.0191	-0.0580	0.0389	-0.0535	0.0359	1084
Panel C2: IV2, Specification (5)						
Total	0.1698	0.0380	0.1317	0.0057	0.0196	6715
$NE - NE$	0.0138	-0.0312	0.0451	-0.0070	0.0102	4437
$E - NE$	0.1777	0.1147	0.0630	0.1572	0.0862	730
$NE - E$	-0.0401	-0.0208	-0.0193	-0.0448	-0.0416	464
$E - E$	0.0183	-0.0247	0.0430	-0.0228	0.0396	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (3) and (4) of Table 9, (d) Panel C2 uses columns (5) and (6) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 16: Counterfactual 6: No Import or Export Switching, $\text{imp}_{06} = \text{imp}_{96}$, $\text{exp}_{06} = \text{exp}_{96}$ (Import Groups)

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i\in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i\in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NI - NI$	0.0355	-0.0129	0.0484	-0.0028	0.0107	4530
$I - NI$	0.0044	-0.0121	0.0166	-0.0184	0.0251	660
$NI - I$	0.0185	0.0081	0.0104	0.0191	0.0246	425
$I - I$	0.0774	0.0233	0.0541	0.0211	0.0492	1100
Panel B1: OLS, Specification (4)						
Total	0.1436	0.0095	0.1341	0.0014	0.0200	6715
$NI - NI$	0.0331	-0.0153	0.0484	-0.0034	0.0107	4530
$I - NI$	0.0264	0.0024	0.0240	0.0036	0.0363	660
$NI - I$	0.0047	-0.0019	0.0066	-0.0044	0.0155	425
$I - I$	0.0794	0.0242	0.0552	0.0220	0.0501	1100
Panel B2: OLS, Specification (5)						
Total	0.1321	0.0067	0.1255	0.0010	0.0187	6715
$NI - NI$	0.0328	-0.0142	0.0470	-0.0031	0.0104	4530
$I - NI$	0.0204	-0.0002	0.0205	-0.0003	0.0311	660
$NI - I$	0.0022	-0.0026	0.0047	-0.0060	0.0111	425
$I - I$	0.0768	0.0236	0.0532	0.0215	0.0484	1100
Panel C1: IV3, Specification (4)						
Total	0.2948	0.0894	0.2054	0.0133	0.0306	6715
$NI - NI$	-0.0089	-0.0591	0.0502	-0.0130	0.0111	4530
$I - NI$	0.2945	0.1772	0.1173	0.2685	0.1778	660
$NI - I$	-0.0278	-0.0029	-0.0249	-0.0068	-0.0587	425
$I - I$	0.0370	-0.0258	0.0627	-0.0234	0.0570	1100
Panel C2: IV3, Specification (5)						
Total	0.2712	0.0740	0.1972	0.0110	0.0294	6715
$NI - NI$	0.0077	-0.0373	0.0450	-0.0082	0.0099	4530
$I - NI$	0.2431	0.1360	0.1070	0.2061	0.1622	660
$NI - I$	-0.0309	-0.0220	-0.0089	-0.0518	-0.0210	425
$I - I$	0.0513	-0.0027	0.0540	-0.0025	0.0491	1100

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (1) and (2) of Table 9, (d) Panel C2 uses columns (3) and (4) of Table 9. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table 17: Counterfactual 6: No Import or Export Switching, $\text{imp}_{06} = \text{imp}_{96}$, $\text{exp}_{06} = \text{exp}_{96}$ (Export Groups)

skill = high school+

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)
Panel A: Real Data						
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084
Panel B1: OLS, Specification (4)						
Total	0.1436	0.0095	0.1341	0.0014	0.0200	6715
$NE - NE$	0.0406	-0.0090	0.0496	-0.0020	0.0112	4437
$E - NE$	0.0472	0.0163	0.0309	0.0223	0.0424	730
$NE - E$	0.0029	-0.0032	0.0061	-0.0069	0.0132	464
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084
Panel B2: OLS, Specification (5)						
Total	0.1321	0.0067	0.1255	0.0010	0.0187	6715
$NE - NE$	0.0446	-0.0047	0.0492	-0.0011	0.0111	4437
$E - NE$	0.0320	0.0065	0.0255	0.0089	0.0350	730
$NE - E$	-0.0025	-0.0066	0.0041	-0.0142	0.0088	464
$E - E$	0.0581	0.0114	0.0467	0.0105	0.0430	1084
Panel C1: IV3, Specification (4)						
Total	0.2948	0.0894	0.2054	0.0133	0.0306	6715
$NE - NE$	0.0210	-0.0333	0.0543	-0.0075	0.0122	4437
$E - NE$	0.2788	0.1716	0.1072	0.2350	0.1468	730
$NE - E$	-0.0301	-0.0230	-0.0070	-0.0497	-0.0152	464
$E - E$	0.0251	-0.0258	0.0509	-0.0238	0.0469	1084
Panel C2: IV3, Specification (5)						
Total	0.2712	0.0740	0.1972	0.0110	0.0294	6715
$NE - NE$	0.0671	0.0000	0.0671	0.0000	0.0151	4437
$E - NE$	0.1562	0.0900	0.0663	0.1232	0.0908	730
$NE - E$	-0.0373	-0.0350	-0.0022	-0.0755	-0.0048	464
$E - E$	0.0851	0.0190	0.0661	0.0176	0.0610	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B and C report the decomposition results described by equation (8) for counterfactual experiment 2. Counterfactual data is generated from the following regressions: (a) Panel B1 uses columns (1) and (2) of Table 4, (b) Panel B2 uses columns (1) and (2) of Table 6, (c) Panel C1 uses columns (5) and (6) of Table 9, (d) Panel C2 uses columns (7) and (8) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 18: Comparison of Counterfactual Experiments: Aggregate Changes

	CF1 No Import	CF2 No Export	CF3 No Trade	CF4 No Import Switch	CF5 No Export Switch	CF6 No Trade Switch
			OLS, Specification (4)			
% Δ Aggregate Change	-0.211	-0.070	-0.277	0.027	0.029	0.057
% Intensity	1.037	0.984	1.081	0.944	0.942	0.934
% Reallocation	-0.037	0.016	-0.081	0.056	0.058	0.066
			OLS, Specification (5)			
% Δ Aggregate Change	-0.157	-0.054	-0.180	-0.010	-0.020	-0.028
% Intensity	1.021	0.970	1.042	0.950	0.953	0.950
% Reallocation	-0.021	0.030	-0.042	0.050	0.047	0.050
			IV, Specification (4)			
% Δ Aggregate Change	-2.345	0.029	-2.675	0.293	1.049	1.169
% Intensity	0.697	2.000	0.781	0.833	0.722	0.697
% Reallocation	0.303	-1.000	0.219	0.167	0.278	0.303
			IV, Specification (5)			
% Δ Aggregate Change	-3.244	-0.414	-3.485	0.651	0.249	0.996
% Intensity	0.684	0.979	0.697	0.779	0.776	0.727
% Reallocation	0.316	0.021	0.303	0.221	0.224	0.273

Notes: This table documents the percentage change in aggregate skill growth across counterfactual experiments. Δ Aggregate Change is computed as Δ Aggregate Change = $(\Delta S - \widetilde{\Delta S})/\Delta S$ where $\widetilde{\Delta S}$ captures the counterfactual aggregate skill growth. % Intensity measures the percentage of counterfactual skill growth captured by within-plant changes, while % Reallocation measures the percentage accounted by across-plant changes.

Table 19: Comparison of Counterfactual Experiments: Trade Margins

	CF1 No Import	CF2 No Export	CF3 No Trade	CF4 No Import Switch	CF5 No Export Switch	CF6 No Trade Switch
			OLS, Specification (4)			
% Due to Δ Trade Status	0.409	0.279	0.389	0.226	0.355	0.467
% Intensity	0.991	0.279	1.455	0.226	0.355	0.890
% Reallocation	0.009	0.721	-0.455	0.774	0.645	0.110
			OLS, Specification (5)			
% Due to Δ Trade Status	0.465	0.376	0.514	0.182	0.229	0.336
% Intensity	0.894	1.044	1.156	1.049	0.997	1.118
% Reallocation	0.016	-0.044	-0.156	-0.049	0.003	-0.118
			IV, Specification (4)			
% Due to Δ Trade Status	0.921	-37.250	1.130	0.888	1.120	1.194
% Intensity	1.105	0.518	0.872	0.350	0.388	0.419
% Reallocation	-0.105	0.482	0.128	0.650	0.612	0.581
			IV, Specification (5)			
% Due to Δ Trade Status	0.648	-1.252	0.825	0.866	0.799	0.917
% Intensity	1.291	0.107	0.967	0.421	0.323	0.521
% Reallocation	-0.291	0.893	0.033	0.579	0.677	0.479

Notes: This table documents the fraction of aggregate skill growth which can be explained by plants whose trade status was counterfactual changed. % Intensity measures the percentage of counterfactual skill growth captured by within-plant changes among plants whose status was counterfactually changed, while % Reallocation measures the percentage accounted by across-plant changes among the same set of plants.

Table 20: Standard errors in Counterfactual 3: No Trade, $\text{imp}_{06} = 0$, $\text{exp}_{06} = 0$

	Panel A: OLS, Specification (4)			**Panel B: IV3, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i\in g}\Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i\in g}\Delta S_{it}\bar{\phi}_i$ (3)	overall change ΔS_t (4)	reallocation $\sum_{i\in g}\Delta\phi_{it}\bar{S}_i$ (5)	intensity $\sum_{i\in g}\Delta S_{it}\bar{\phi}_i$ (6)	# of plants N_g (7)
Total	0.0377	0.0144	0.0233	0.3635	0.0562	0.3073	6715
	(0.0070)	(0.0021)	(0.0070)	(0.0887)	(0.0198)	(0.0861)	(33)
$NI - NI$	-0.0205	-0.0189	-0.0016	0.0436	0.0224	0.0213	4530
	(0.0027)	(0.0020)	(0.0015)	(0.0523)	(0.0396)	(0.0179)	(44)
$I - NI$	-0.0054	-0.0052	-0.0001	0.0265	0.0165	0.0100	660
	(0.0014)	(0.0010)	(0.0007)	(0.0190)	(0.0135)	(0.0089)	(22)
$NI - I$	0.0104	0.0062	0.0042	0.0475	0.0024	0.0451	425
	(0.0016)	(0.0011)	(0.0011)	(0.0087)	(0.0193)	(0.0180)	(20)
$I - I$	0.0532	0.0324	0.0208	0.0404	0.0490	-0.0086	1100
	(0.0067)	(0.0040)	(0.0050)	(0.0725)	(0.0634)	(0.0123)	(30)
$NE - NE$	-0.0184	-0.0187	0.0003	0.0509	-0.0045	0.0554	4437
	(0.0029)	(0.0023)	(0.0013)	(0.0493)	(0.0364)	(0.0184)	(44)
$E - NE$	-0.0040	-0.0074	0.0034	0.0569	-0.0104	0.0672	730
	(0.0024)	(0.0016)	(0.0016)	(0.0233)	(0.0160)	(0.0169)	(24)
$NE - E$	0.0115	0.0079	0.0036	0.0528	0.0153	0.0374	464
	(0.0019)	(0.0013)	(0.0013)	(0.0075)	(0.0123)	(0.0167)	(19)
$E - E$	0.0486	0.0326	0.0160	0.2029	0.0557	0.1472	1084
	(0.0064)	(0.0045)	(0.0044)	(0.0275)	(0.0347)	(0.0514)	(27)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 12) and the OLS based counterfactual decomposition in experiment 3 (Panel B1 of Table 12) across import groups. The bottom half of Panel A reports the difference observed decomposition (Panel A of Table 12) and the OLS based counterfactual decomposition in experiment 3 (Panel B1 of Table 13) across export groups. Panel B reports analogous findings for the IV based decompositions in Tables 12) and 13). Bootstrapped standard errors are reported in parentheses. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 21: Standard Errors in Counterfactual 6: No Import or Export Switching, $\text{imp}_{06} = \text{imp}_{96}$, $\text{exp}_{06} = \text{exp}_{96}$

	Panel A: OLS, Specification (4)			**Panel B: IV3, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i\in g} \Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i\in g} \Delta S_{it}\bar{\phi}_i$ (3)	overall change ΔS_t (4)	reallocation $\sum_{i\in g} \Delta\phi_{it}\bar{S}_i$ (5)	intensity $\sum_{i\in g} \Delta S_{it}\bar{\phi}_i$ (6)	# of plants N_g (7)
Total	-0.0077	-0.0031	-0.0046	-0.1589	-0.0830	-0.0758	6715
	(0.0017)	(0.0010)	(0.0016)	(0.1081)	(0.0582)	(0.0523)	(33)
$NI - NI$	0.0024	0.0024	0.0000	0.0444	0.0462	-0.0018	4530
	(0.0011)	(0.0009)	(0.0004)	(0.0407)	(0.0350)	(0.0080)	(44)
$I - NI$	-0.0219	-0.0145	-0.0074	-0.2901	-0.1893	-0.1008	660
	(0.0029)	(0.0021)	(0.0015)	(0.2070)	(0.1506)	(0.0573)	(22)
$NI - I$	0.0138	0.0100	0.0038	0.0464	0.0110	0.0354	425
	(0.0019)	(0.0015)	(0.0010)	(0.0087)	(0.0193)	(0.0180)	(20)
$I - I$	-0.0020	-0.0010	-0.0010	0.0404	0.0490	-0.0086	1100
	(0.0019)	(0.0015)	(0.0008)	(0.0725)	(0.0634)	(0.0123)	(30)
$NE - NE$	0.0025	0.0030	-0.0006	0.0220	0.0273	-0.0053	4437
	(0.0011)	(0.0009)	(0.0004)	(0.0305)	(0.0235)	(0.0092)	(44)
$E - NE$	-0.0301	-0.0239	-0.0062	-0.2616	-0.1792	-0.0824	730
	(0.0040)	(0.0031)	(0.0023)	(0.1331)	(0.0872)	(0.0508)	(24)
$NE - E$	0.0158	0.0134	0.0024	0.0488	0.0333	0.0155	464
	(0.0023)	(0.0021)	(0.0011)	(0.0086)	(0.0146)	(0.0151)	(19)
$E - E$	0.0042	0.0044	-0.0002	0.0320	0.0356	-0.0037	1084
	(0.0018)	(0.0014)	(0.0007)	(0.0403)	(0.0327)	(0.0122)	(27)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 12) and the OLS based counterfactual decomposition in experiment 3 (Panel B1 of Table 12) across import groups. The bottom half of Panel A reports the difference observed decomposition (Panel A of Table 12) and the OLS based counterfactual decomposition in experiment 3 (Panel B1 of Table 13) across export groups. Panel B reports analogous findings for the IV based decompositions in Tables 12) and 13). Bootstrapped standard errors are reported in parentheses. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table 22: Infrastructure Investment, Distance to port = 0.9 × Distance to port

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i\in g}(\phi_{i2}-\phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i\in g}(S_{i2}-S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000*(2)/N_g$ (4)	intensity per 1000 plants $1000*(3))/N_g$ (5)	# of plants N_g (6)	2006 Importers $(Y = l_s)$ N_{06}^{imp} (7)	2006 Importers $(Y = l_n)$ N_{06}^{imp} (8)
Panel A: Real Data								
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715	-	-
$NI-NI$	0.0355	-0.0129	0.0484	-0.0028	0.0107	4530	-	-
$I-NI$	0.0044	-0.0121	0.0166	-0.0184	0.0251	660	-	-
$NI-I$	0.0185	0.0081	0.0104	0.0191	0.0246	425	-	-
$I-I$	0.0774	0.0233	0.0541	0.0211	0.0492	1100	-	-
Panel B: IV1, Specification (4)								
Total	0.1411	0.0071	0.1340	0.0011	0.0200	6715	1578	1578
$NI-NI$	0.0414	-0.0110	0.0524	-0.0024	0.0116	4530	48	48
$I-NI$	0.0055	-0.0117	0.0172	-0.0177	0.0260	660	5	5
$NI-I$	0.0183	0.0078	0.0104	0.0185	0.0245	425	425	425
$I-I$	0.0759	0.0219	0.0540	0.0199	0.0491	1100	1100	1100
Panel C: IV3, Specification (4)								
Total	0.1908	0.0230	0.1678	0.0034	0.0250	6715	2098	2101
$NI-NI$	0.1025	0.0194	0.0832	0.0043	0.0184	4530	514	516
$I-NI$	0.0191	-0.0038	0.0229	-0.0058	0.0347	660	59	60
$NI-I$	0.0142	0.0043	0.0100	0.0100	0.0234	425	425	425
$I-I$	0.0550	0.0032	0.0518	0.0029	0.0471	1100	1100	1100
Panel D: IV1, Specification (5)								
Total	0.1408	0.0073	0.1336	0.0011	0.0199	6715	1576	1578
$NI-NI$	0.0426	-0.0098	0.0524	-0.0022	0.0116	4530	48	49
$I-NI$	0.0045	-0.0123	0.0168	-0.0187	0.0255	660	3	4
$NI-I$	0.0182	0.0078	0.0104	0.0183	0.0245	425	425	425
$I-I$	0.0755	0.0216	0.0539	0.0196	0.0490	1100	1100	1100
Panel E: IV3, Specification (5)								
Total	0.2171	0.0365	0.1807	0.0054	0.0269	6715	2101	2101
$NI-NI$	0.1740	0.0744	0.0996	0.0164	0.0220	4530	518	518
$I-NI$	0.0280	0.0029	0.0250	0.0045	0.0379	660	58	58
$NI-I$	0.0055	-0.0035	0.0090	-0.0082	0.0211	425	425	425
$I-I$	0.0097	-0.0374	0.0470	-0.0340	0.0428	1100	1100	1100

Notes: Panel A reports the observed decomposition from equation 3. Panels B-E report the decomposition results described by equation 8 for the first counterfactual policy experiment. Counterfactual data is generated from the following regressions: (a) Panel B uses columns (1) and (2) of Table 9, (b) Panel C uses columns (5) and (6) of Table 6, (c) Panel D uses columns (3) and (4) of Table 9, (d) Panel E uses columns (7) and (8) of Table 9. $NI-NI$, $I-NI$, $NI-I$ and $I-I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table 23: Improvement in Export Market Access, ΔMkt. Access $= -$Mkt. Access$_{96}$

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)	2006 Exporters $(Y = l_s)$ N_{06}^{exp} (7)	2006 Exporters $(Y = l_n)$ N_{06}^{exp} (8)
Panel A: Real Data								
Total	0.1359	0.0064	0.1295	0.0010	0.0193	6715	-	-
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437	-	-
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730	-	-
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464	-	-
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084	-	-
Panel B: IV2, Specification (4)								
Total	0.2111	0.0447	0.1663	0.0067	0.0248	6715	2349	2295
$NE - NE$	0.0977	0.0254	0.0723	0.0057	0.0163	4437	692	643
$E - NE$	0.0888	0.0453	0.0435	0.0621	0.0596	730	109	104
$NE - E$	0.0079	0.0002	0.0077	0.0004	0.0167	464	464	464
$E - E$	0.0166	-0.0261	0.0428	-0.0241	0.0395	1084	1084	1084
Panel C: IV3, Specification (4)								
Total	0.1775	0.0264	0.1511	0.0039	0.0225	6715	2364	2312
$NE - NE$	0.0774	0.0141	0.0634	0.0032	0.0143	4437	706	658
$E - NE$	0.0600	0.0244	0.0356	0.0334	0.0488	730	110	106
$NE - E$	0.0112	0.0032	0.0080	0.0069	0.0172	464	464	464
$E - E$	0.0289	-0.0152	0.0441	-0.0140	0.0407	1084	1084	1084
Panel D: IV2, Specification (5)								
Total	0.3097	0.0980	0.2116	0.0146	0.0315	6715	2332	2284
$NE - NE$	0.2233	0.1168	0.1064	0.0263	0.0240	4437	683	644
$E - NE$	0.1340	0.0721	0.0619	0.0987	0.0848	730	101	92
$NE - E$	-0.0073	-0.0140	0.0067	-0.0302	0.0144	464	464	464
$E - E$	-0.0403	-0.0768	0.0366	-0.0709	0.0337	1084	1084	1084
Panel E: IV3, Specification (5)								
Total	0.2008	0.0380	0.1628	0.0057	0.0242	6715	2346	2302
$NE - NE$	0.1454	0.0690	0.0764	0.0156	0.0172	4437	696	660
$E - NE$	0.0769	0.0363	0.0405	0.0498	0.0555	730	102	94
$NE - E$	-0.0018	-0.0089	0.0071	-0.0191	0.0152	464	464	464
$E - E$	-0.0197	-0.0585	0.0388	-0.0540	0.0358	1084	1084	1084

Notes: Panel A reports the observed decomposition from equation 3. Panels B-E report the decomposition results described by equation 8 for the second counterfactual policy experiment. Counterfactual data is generated from the following regressions: (a) Panel B uses columns (3) and (4) of Table 9, (b) Panel C uses columns (5) and (6) of Table 6, (c) Panel D uses columns (5) and (6) of Table 9, (d) Panel E uses columns (7) and (8) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

A Entry and Exit

This section investigates the extent to which exit and entry contributed to aggregate skill growth in Indonesia relative to continuing plants over the 1996-2006 period.[18] We proceed to decompose the aggregate change in the demand for skilled labour to quantify the contribution from continuing plants, exiting plants and entering plants.[19] The decomposition method follows Melitz and Polanec (2014), which was first proposed to decompose changes in aggregate productivity change in the presence of firm entry and exit. The decomposition breaks down the change in aggregate skill demand into components for the three groups of plants: continuing plants (C), entrants (E) and exiters (X). Using subscript i to index individual plants and the superscript s to index skilled workers, for two periods $t \in \{1, 2\}$ and three types of plants $G \in \{C, E, X\}$, we define $S_{Gt} \equiv L^s_{Gt}/L_{Gt} = \frac{\sum_{i \in \mathcal{N}^g} L^s_{it}}{\sum_{i \in \mathcal{N}^g} L_{it}}$ to be the share of skilled workers among workers in plants G, and $\Phi_{Gt} \equiv L_{Gt}/L_t = \frac{\sum_{i \in G} L_{it}}{\sum_i L_{it}}$ to be the employment share of plants G among all plants. The skill share in period t , $S_t = \frac{\sum_i L^s_{it}}{\sum_i L_{it}}$ can be decomposed as:

$$S_1 = \Phi_{C1}S_{C1} + \Phi_{X1}S_{X1} = S_{C1} + \Phi_{X1}(S_{X1} - S_{C1})$$
$$S_2 = \Phi_{C2}S_{C2} + \Phi_{E2}S_{E2} = S_{C2} + \Phi_{E2}(S_{E2} - S_{C2}).$$

From this, we have the skill share change being decomposed into the three components:

$$\Delta S = \underbrace{(S_{C2} - S_{C1})}_{\text{cont. plants}} + \underbrace{\Phi_{X1}(S_{C1} - S_{X1})}_{\text{exiters}} + \underbrace{\Phi_{E2}(S_{E2} - S_{C2})}_{\text{entrants}}. \tag{9}$$

Since we do not observe the skill share among entrants in the first period or that of the exiters in the second period by construction, the skill shares of continuing plants in the two periods are used as benchmarks. Entrants/exiters contribute to the overall skill demand change only if their skill intensities are different from the contemporaneous skill intensities of continuing plants. Consider a hypothetical example of an economy with same relative demand for skilled labour among all plants. If the skill share of the representative plant increases by the same amount, adding entry and exit of identical plants will not change the aggregate rate of skill upgrading. Our decomposition assigns zero contribution to the entry and exit of plants under a scenario entrants and exiting plants are identical to the representative plant.[20]

Table A.1 documents skilled worker shares among survivors, entrants and exiters in both 1996 and 2006, together with the decomposition results of equation (9). The upper panel defines skilled workers as those with more than high-school education and the lower panel uses

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[18] Researchers find that reallocation of resources across heterogeneous firms is an important driver of productivity changes (See Bartelsman et al. 2013). Also, less productive plants typically exit after trade liberalization, while productive plants tend to grow. This process induces a significant reallocation of resources across plants and an increase in aggregate productivity (e.g. Melitz (2003), Pavcnik (2002)).

[19] Note that because our data only includes plants that hire at least 20 workers, the entry and exit we observe could be a result of plants growing/shrinking across this threshold.

[20] See Melitz and Polanec (2014). compare their decomposition method with those implied by Griliches and Regev (1995) and Foster et al. (2001) and demonstrate that other methods can bias the contribution of continuing plants downwards by assigning positive contributions to entrants and exiters in an economy with homogeneous firms.

Table A.1: Decompose Skill Share Changes, by Production Dynamics of Plants

	Skill Shr.: S_{Gt}		Emp. Shr.: Φ_{Gt}		Decomposition	
	1996	2006	1996	2006		
Skilled: High-School+						
All Plants	0.430	0.567			$S_2 - S_1$	0.137
Cont. Plants	0.448	0.582	0.679	0.586	$S_{C2} - S_{C1}$	0.135
Exiters	0.393	-	0.321	-	$\Phi_{X1}(S_{C1} - S_{X1})$	0.018
Entrants	-	0.546	-	0.414	$\Phi_{E2}(S_{E2} - S_{C2})$	-0.015
Skilled: College+						
All Plants	0.040	0.062			$S_2 - S_1$	0.021
Cont. Plants	0.045	0.064	0.679	0.586	$S_{C2} - S_{C1}$	0.020
Exiters	0.031	-	0.321	-	$\Phi_{X1}(S_{C1} - S_{X1})$	0.004
Entrants	-	0.058	-	0.414	$\Phi_{E2}(S_{E2} - S_{C2})$	-0.003

[a.] Data Source: Indonesia Manufacturing Survey in 1996 and 2006.

the college threshold. Between 1996 and 2006, the share of workers with at least high-school education increased from 0.430 to 0.567, and that of workers with more than college degree increased from 0.04 to 0.062. For both education thresholds, the increase in the skill demand of continuing plants counts for more than 95 percent of the overall change (0.135 out of 0.137 for workers with more than high-school education, and 0.020 out of 0.021 for workers with more than college education). Given that exiting plants employ 32 percent of all the workers in 1996, and new entrants employ 41 percent of all the workers in 2006, their small contributions to the overall changes are mainly caused by the small difference between their skill demand and that of the contemporaneous continuing plants.[21] The evidence suggests that new entrants are not necessarily more skill intensive than exiters.

Based on the decomposition results that suggest little contribution of entrants and exiters to the aggregate skill share change, we focus on the continuing plants in the main text. Unless explicitly noted, we restrict the sample to balanced panel, and omit the subscript C for notation simplicity.

B Standard Errors for Decomposition Components

Section 5.4 characterizes the variance in the aggregate change in skill demand, the variance in the underlying within and across-plant mechanisms, and the degree to which different groups of plants contribute to aggrgate skill growth for the third (no trade) and sixth counterfactuals (no trade status switching). To quantify the underlying variance in the counterfactual decompositions we perform the following 5-step bootstrap process:

1. Draw a bootstrap sample of plants (with replacement) from the benchmark data.

2. Estimate equations (4) by OLS or IV as described in Section 4.1.

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[21] We repeat the same decomposition exercises for production and non-production workers separately, the results also suggest insignificant roles of entry and exit in the aggregate skill demand change.

3. Compute the aggregate decomposition using the bootstrap sample of plants and the point estimates from step (2).
4. Calculate the difference between each component of the bootstrapped aggregate decomposition and the benchmark (data-based) aggregate decomposition (Table 2).
5. Compute bootstrap standard errors of the changes in skill growth using the saved differences from step (4) for each bootstrap sample.

In practice, the standard errors for the aggregate decompositions are based on 100 bootstrap samples. The main text addresses counterfactual experiments 3 (no trade) and 6 (no trade status switching), Tables B.2-B.5 document bootstrap results for counterfactual experiments 1, 2, 4 and 5 below.[22]

As discussed in the main text, the magnitudes of the bootstrapped standard errors are an order of magnitude larger in the IV-based decompositions relative to the OLS-based decompositions across all counterfactual exercises. Again, this reflects the differences in the precision of the underlying OLS and IV regressions. In all cases, the general conclusions regarding the importance of trade to aggregate upgrading and the degree to which this is driven by within-plant changes rather than across-plant reallocation remains unchanged.

In contrast, the individual contributions of particular groups of plants varies significantly. Across both Tables B.2-B.5 we observe that the standard error on an individual group's contribution to aggregate skill growth is often larger than the point estimate in the IV-based decompositions. As documented in the main text, this is particularly true for groups of plants with a small number of members, such as continuous importers or continuous exporters.

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[22] The bootstrap standard errors for counterfactual experiments based on equation (5) are also available upon request from the authors.

Table B.2: Variance in Counterfactual 1: No Importing, $\text{imp}_{06} = 0$, $\text{exp}_{06} = \text{exp}_{06}$

	Panel A: OLS, Specification (4)				**Panel B: IV1, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (3)	# of plants ΔS_t (4)	overall change $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (5)	reallocation $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (6)	intensity N_g (7)	# of plants (8)
Total	0.0287	0.0104	0.0184	6715	0.3188	0.0618	0.2570	6715
	(0.0052)	(0.0014)	(0.0052)	(37)	(0.0658)	(0.0154)	(0.0571)	(35)
$NI - NI$	-0.0165	-0.0144	-0.0021	4530	0.0386	0.0337	0.0050	4530
	(0.0021)	(0.0018)	(0.0003)	(46)	(0.0348)	(0.0303)	(0.0045)	(41)
$I - NI$	-0.0068	-0.0062	-0.0007	660	0.0159	0.0144	0.0016	660
	(0.0011)	(0.0010)	(0.0001)	(28)	(0.0142)	(0.0128)	(0.0014)	(23)
$NI - I$	0.0084	0.0049	0.0036	425	0.0427	0.0011	0.0416	425
	(0.0013)	(0.0007)	(0.0009)	(20)	(0.0066)	(0.0064)	(0.0103)	(19)
$I - I$	0.0437	0.0261	0.0176	1100	0.2215	0.0126	0.2089	1100
	(0.0059)	(0.0032)	(0.0045)	(31)	(0.0274)	(0.0255)	(0.0445)	(30)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 10) and the OLS based counterfactual decomposition in experiment 1 (Panel B1 of Table 10) across import groups. Panel B reports the difference observed decomposition (Panel A of Table 10) and the IV based counterfactual decomposition in experiment 1 (Panel C1 of Table 10) across import groups. Bootstrapped standard errors are reported in parentheses. $NI - NI$, $I - NI$, $NI - I$ and $I - I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table B.3: Variance in Counterfactual 2: No Exporting, $\text{imp}_{06} = \text{imp}_{06}$, $\text{exp}_{06} = 0$

	Panel A: OLS, Specification (4)				**Panel B: IV2, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (3)	# of plants ΔS_t (4)	overall change $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (5)	reallocation $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (6)	intensity N_g (7)	# of plants (8)
Total	0.0096	0.0044	0.0052	6715	0.1319	0.0104	0.1215	6715
	(0.0048)	(0.0012)	(0.0049)	(37)	(0.0622)	(0.0208)	(0.0638)	(29)
$NE - NE$	-0.0187	-0.0162	-0.0025	4437	-0.0563	-0.0486	-0.0076	4437
	(0.0026)	(0.0022)	(0.0004)	(45)	(0.0364)	(0.0314)	(0.0050)	(45)
$E - NE$	-0.0121	-0.0109	-0.0012	730	-0.0364	-0.0327	-0.0037	730
	(0.0015)	(0.0014)	(0.0002)	(29)	(0.0234)	(0.0209)	(0.0025)	(25)
$NE - E$	0.0085	0.0068	0.0017	464	0.0474	0.0198	0.0276	464
	(0.0015)	(0.0012)	(0.0011)	(19)	(0.0095)	(0.0097)	(0.0131)	(20)
$E - E$	0.0319	0.0247	0.0073	1084	0.1772	0.0719	0.1053	1084
	(0.0049)	(0.0034)	(0.0037)	(29)	(0.0353)	(0.0353)	(0.0479)	(32)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 11) and the OLS based counterfactual decomposition in experiment 2 (Panel B1 of Table 11) across export groups. Panel B reports the difference observed decomposition (Panel A of Table 11) and the IV based counterfactual decomposition in experiment 1 (Panel C1 of Table 11) across export groups. Bootstrapped standard errors are reported in parentheses. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table B.4: Variance in Counterfactual 5: No Import Switching, $\text{imp}_{06} = \text{imp}_{96}$, $\text{exp}_{06} = \text{exp}_{06}$

	Panel A: OLS, Specification (4)				**Panel B: IV1, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i\in g}\Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i\in g}\Delta S_{it}\bar{\phi}_i$ (3)	# of plants ΔS_t (4)	overall change $\sum_{i\in g}\Delta\phi_{it}\bar{S}_i$ (5)	reallocation $\sum_{i\in g}\Delta S_{it}\bar{\phi}_i$ (6)	intensity N_g (7)	# of plants (8)
Total	-0.0037	-0.0014	-0.0023	6715	-0.0398	-0.0228	-0.0170	6715
	(0.0010)	(0.0006)	(0.0009)	(37)	(0.0659)	(0.0385)	(0.0290)	(35)
$NI-NI$	0.0019	0.0017	0.0002	4530	0.0386	0.0321	0.0047	4530
	(0.0005)	(0.0004)	(0.0001)	(46)	(0.0206)	(0.0179)	(0.0027)	(41)
$I-NI$	-0.0211	-0.0144	-0.0068	660	-0.1756	-0.1062	-0.0695	660
	(0.0030)	(0.0021)	(0.0016)	(28)	(0.1096)	(0.0819)	(0.0283)	(23)
$NI-I$	0.0126	0.0087	0.0039	425	0.0426	0.0008	0.0418	425
	(0.0018)	(0.0012)	(0.0010)	(20)	(0.0078)	(0.0154)	(0.0154)	(19)
$I-I$	0.0029	0.0026	0.0003	1100	0.2215	0.0126	0.2089	1100
	(0.0009)	(0.0008)	(0.0001)	(31)	(0.0308)	(0.0276)	(0.0034)	(30)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 14) and the OLS based counterfactual decomposition in experiment 1 (Panel B1 of Table 14) across import groups. Panel B reports the difference observed decomposition (Panel A of Table 14) and the IV based counterfactual decomposition in experiment 1 (Panel C1 of Table 14) across import groups. Bootstrapped standard errors are reported in parentheses. $NI-NI$, $I-NI$, $NI-I$ and $I-I$ represent four groups of plants by import status: continuous non-importers, former importers, new importers and continuous importers.

Table B.5: Variance in Counterfactual 5: No Export Switching, $\text{imp}_{06} = \text{imp}_{06}$, $\text{exp}_{06} = \text{exp}_{66}$

	Panel A: OLS, Specification (4)				**Panel B: IV2, Specification (4)**			
	overall change ΔS_t (1)	reallocation $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (2)	intensity $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (3)	# of plants ΔS_t (4)	overall change $\sum_{i \in g} \Delta\phi_{it}\bar{S}_i$ (5)	reallocation $\sum_{i \in g} \Delta S_{it}\bar{\phi}_i$ (6)	intensity N_g (7)	# of plants (8)
Total	-0.0038	-0.0017	-0.0022	6715	-0.1426	-0.0708	-0.0718	6715
	(0.0014)	(0.0008)	(0.0013)	(37)	(0.0686)	(0.0371)	(0.0328)	(29)
$NE - NE$	0.0043	0.0037	0.0006	4437	0.0573	0.0495	0.0078	4437
	(0.0007)	(0.0006)	(0.0001)	(45)	(0.0286)	(0.0247)	(0.0040)	(40)
$E - NE$	-0.0286	-0.0232	-0.0054	730	-0.3302	-0.2195	-0.1107	730
	(0.0039)	(0.0029)	(0.0023)	(29)	(0.1402)	(0.0982)	(0.0457)	(25)
$NE - E$	0.0149	0.0128	0.0021	464	0.0541	0.0313	0.0229	464
	(0.0023)	(0.0020)	(0.0011)	(19)	(0.0094)	(0.0108)	(0.0111)	(20)
$E - E$	0.0057	0.0050	0.0006	1084	0.0762	0.0678	0.0083	1084
	(0.0011)	(0.0010)	(0.0001)	(29)	(0.0391)	(0.0349)	(0.0044)	(32)

Notes: The top half of Panel A reports the difference observed decomposition (Panel A of Table 15) and the OLS based counterfactual decomposition in experiment 2 (Panel B1 of Table 15) across export groups. Panel B reports the difference observed decomposition (Panel A of Table 15) and the IV based counterfactual decomposition in experiment 1 (Panel C1 of Table 15) across export groups. Bootstrapped standard errors are reported in parentheses. $NE-NE$, $E-NE$, $NE-E$ and $E-E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

C Policy Change and Aggregate Skill Growth: Alternative Experiments

Section 6 of the main text describes two decomposition exercises based on counterfactual policy experiments. This sections investigates two alternative experiments omitted from the main text for brevity. Specifically, we consider settings where

1. Indonesian input tariffs are eliminated (Δ Input Tariff $= -$Input Tariff$_{96}$).
2. Both market access and input tariffs are eliminated (Δ Input Tariff $= -$Input Tariff$_{96}$ and Δ Mkt. Access $= -$Mkt. Access$_{96}$).

Since both of these variables are used to instrument the decision to export in the main text, we report the decomposition analysis across export groups here. In both alternative cases, the overall patterns and observed magnitudes are very similar to those reported in Section 6.2 and, as such, we do not further describe the outcomes of the decomposition analysis below. Rather, we refer the reader to Section 6.2 for a longer discussion.

Table C.6: An Elimination of Input Tariffs (ΔInput Tariff $= -$Input Tariff$_{96}$)

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i\in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i\in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)	2006 Exporters $(Y = l_s)$ N_{06}^{exp} (7)	2006 Exporters $(Y = l_n)$ N_{06}^{exp} (8)
Panel A: Real Data								
Total	0.1359	0.0064	0.1295	0.0193	0.1068	6715	-	-
$NE - NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437	-	-
$E - NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730	-	-
$NE - E$	0.0187	0.0102	0.0085	0.0220	0.0183	464	-	-
$E - E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084	-	-
Panel B: IV2, Specification (4)								
Total	0.1942	0.0369	0.1573	0.0292	0.1223	6715	2252	2229
$NE - NE$	0.0971	0.0274	0.0697	0.0062	0.0157	4437	616	598
$E - NE$	0.0611	0.0251	0.0359	0.0345	0.0492	730	88	83
$NE - E$	0.0103	0.0024	0.0079	0.0052	0.0170	464	464	464
$E - E$	0.0257	-0.0181	0.0438	-0.0167	0.0404	1084	1084	1084
Panel C: IV3, Specification (4)								
Total	0.1711	0.0251	0.1460	0.0270	0.1157	6715	2279	2253
$NE - NE$	0.0756	0.0138	0.0617	0.0031	0.0139	4437	638	619
$E - NE$	0.0497	0.0181	0.0316	0.0248	0.0433	730	93	86
$NE - E$	0.0124	0.0043	0.0080	0.0094	0.0173	464	464	464
$E - E$	0.0334	-0.0112	0.0446	-0.0103	0.0412	1084	1084	1084
Panel D: IV2, Specification (5)								
Total	0.2932	0.0937	0.1995	0.0344	0.1498	6715	2230	2216
$NE - NE$	0.1989	0.1010	0.0979	0.0228	0.0221	4437	598	586
$E - NE$	0.1307	0.0735	0.0572	0.1007	0.0783	730	84	82
$NE - E$	-0.0050	-0.0118	0.0068	-0.0254	0.0148	464	464	464
$E - E$	-0.0315	-0.0690	0.0375	-0.0637	0.0346	1084	1084	1084
Panel E: IV3, Specification (5)								
Total	0.1908	0.0340	0.1568	-0.0014	0.1195	6715	2253	2236
$NE - NE$	0.1302	0.0575	0.0727	0.0130	0.0164	4437	619	603
$E - NE$	0.0737	0.0364	0.0373	0.0498	0.0512	730	86	85
$NE - E$	-0.0000	-0.0072	0.0072	-0.0156	0.0155	464	464	464
$E - E$	-0.0131	-0.0526	0.0395	-0.0485	0.0365	1084	1084	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B-E report the decomposition results described by equation (8) for the first counterfactual policy experiment in the appendix. Counterfactual data is generated from the following regressions: (a) Panel B uses columns (3) and (4) of Table 9, (b) Panel C uses columns (5) and (6) of Table 6, (c) Panel D uses columns (5) and (6) of Table 9, (d) Panel E uses columns (7) and (8) of Table 9. $NE - NE$, $E - NE$, $NE - E$ and $E - E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

Table C.7: An Elimination of Input and Market Access Tariffs (ΔInput Tariff $= -$Input Tariff$_{96}$ & ΔMkt. Access $= -$Mkt. Access$_{96}$)

	overall change $S_2 - S_1$ (1)	reallocation $\sum_{i \in g}(\phi_{i2} - \phi_{i1})\bar{S}_i$ (2)	intensity $\sum_{i \in g}(S_{i2} - S_{i1})\bar{\phi}_i$ (3)	reallocation per 1000 plants $1000 * (2)/N_g$ (4)	intensity per 1000 plants $1000 * (3))/N_g$ (5)	# of plants N_g (6)	2006 Exporters $(Y = l_s)$ N_{06}^{exp} (7)	2006 Exporters $(Y = l_n)$ N_{06}^{exp} (8)
Panel A: Real Data								
Total	0.1359	0.0064	0.1295	0.0193	0.1068	6715	-	-
$NE-NE$	0.0430	-0.0060	0.0490	-0.0014	0.0111	4437	-	-
$E-NE$	0.0171	-0.0076	0.0248	-0.0105	0.0339	730	-	-
$NE-E$	0.0187	0.0102	0.0085	0.0220	0.0183	464	-	-
$E-E$	0.0571	0.0098	0.0472	0.0091	0.0436	1084	-	-
Panel B: IV2, Specification (4)								
Total	0.2280	0.0494	0.1786	0.0443	0.1408	6715	2546	2469
$NE-NE$	0.1120	0.0324	0.0796	0.0073	0.0179	4437	870	801
$E-NE$	0.1030	0.0534	0.0496	0.0732	0.0680	730	128	120
$NE-E$	0.0055	-0.0021	0.0076	-0.0045	0.0163	464	464	464
$E-E$	0.0075	-0.0343	0.0418	-0.0316	0.0386	1084	1084	1084
Panel C: IV3, Specification (4)								
Total	0.1875	0.0285	0.1590	0.0285	0.1269	6715	2578	2502
$NE-NE$	0.0865	0.0186	0.0679	0.0042	0.0153	4437	896	830
$E-NE$	0.0700	0.0301	0.0399	0.0412	0.0547	730	134	124
$NE-E$	0.0093	0.0014	0.0078	0.0031	0.0169	464	464	464
$E-E$	0.0217	-0.0216	0.0433	-0.0200	0.0400	1084	1084	1084
Panel D: IV2, Specification (5)								
Total	0.3339	0.1033	0.2306	0.0299	0.1751	6715	2488	2408
$NE-NE$	0.2340	0.1203	0.1137	0.0271	0.0256	4437	812	744
$E-NE$	0.1645	0.0891	0.0754	0.1220	0.1033	730	128	116
$NE-E$	-0.0109	-0.0173	0.0064	-0.0373	0.0139	464	464	464
$E-E$	-0.0537	-0.0888	0.0351	-0.0819	0.0324	1084	1084	1084
Panel E: IV3, Specification (5)								
Total	0.2113	0.0374	0.1739	-0.0086	0.1338	6715	2513	2437
$NE-NE$	0.1525	0.0712	0.0812	0.0161	0.0183	4437	835	770
$E-NE$	0.0958	0.0475	0.0483	0.0651	0.0661	730	130	119
$NE-E$	-0.0051	-0.0119	0.0068	-0.0257	0.0147	464	464	464
$E-E$	-0.0319	-0.0694	0.0375	-0.0640	0.0346	1084	1084	1084

Notes: Panel A reports the observed decomposition from equation (3). Panels B-E report the decomposition results described by equation (8) for the second counterfactual policy experiment in the appendix. Counterfactual data is generated from the following regressions: (a) Panel B uses columns (3) and (4) of Table 9, (b) Panel C uses columns (5) and (6) of Table 6, (c) Panel D uses columns (5) and (6) of Table 9, (d) Panel E uses columns (7) and (8) of Table 9. $NE-NE$, $E-NE$, $NE-E$ and $E-E$ represent four groups of plants by export status: continuous non-exporters, former exporters, new exporters and continuous exporters.

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