

## **Export markets and labor allocation in a low-income country\***

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### **Abstract**

We study the effects of an export shock on labor allocation across household businesses and employers in the formal enterprise sector in a low-income country, Vietnam. We find that workers reallocate from household businesses to employers in the formal enterprise sector, with greater reallocation in industries that experience larger declines in U.S. tariffs on Vietnamese exports due to the United States-Vietnam Bilateral Trade Agreement. The reallocation is greater for workers in more internationally integrated provinces and in younger cohorts. Labor productivity of household businesses is relatively low, so our findings suggest this reallocation increases aggregate labor productivity.

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## 1. Introduction

Low-income countries have dramatically increased their participation in world trade over the last two decades, with their share of total world exports growing from 21 to 43 percent and the export growth outpacing output growth in these economies between 1992 and 2008 (Hanson (2012)). In these countries, about 70-80 percent of employment is in informal, household-run businesses, which are known to be substantially less productive than their formal-sector counterparts.<sup>1</sup> Studies document a systematic negative relationship between the prevalence of household business employment and economic development and attribute aggregate income differences across countries to inefficient allocation of inputs across sectors and firms.<sup>2</sup> As a result, the reallocation of workers from household businesses toward more productive establishments can increase aggregate productivity.

International trade can contribute to economic development if it promotes the reallocation of workers out of household businesses toward relatively more productive establishments. Unfortunately, while a large literature has examined how trade affects labor markets in less developed countries (see Goldberg and Pavcnik (2007), Harrison, McLaren, and McMillan (2011) for surveys), data availability has limited most of this work to employment by firms in the formal enterprise sector, thereby completely missing an important dimension of the labor reallocation process through which trade affects economic development. In addition, employment in the formal enterprise sector and international trade both tend to expand during the process of growth and urbanization in low-income countries, making it difficult to identify the causal effect of international trade on worker allocation across employers.

This paper examines the relationship between international trade and the allocation of labor across employers in the household business and formal enterprise sectors in a low-income country setting. The paper overcomes the above challenges by focusing on Vietnam, which has a nationally representative worker survey that includes the informal, household business sector, and which was subjected to a large, plausibly exogenous (but positive) export shock with the 2001 U.S.-Vietnam Bilateral Trade Agreement.

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<sup>1</sup> See Gollin (2002, 2008), Banerjee and Duflo (2005), Hsieh and Klenow (2009), Nataraj (2011) and La Porta and Shleifer (2008, 2014).

<sup>2</sup> See Gollin (2002, 2008), La Porta and Shleifer (2008, 2014), Banerjee and Duflo (2005), Restuccia and Rogerson (2008), Hsieh and Klenow (2009), McMillan and Rodrik (2011)).

We use labor force modules from several rounds of the Vietnam Household Living Standards Surveys (VHLSS), which are nationally representative and comprehensively cover workers in all industries and in all types of employers. Importantly, the surveys record whether a worker works for an employer in the household business sector or the registered enterprise sector.<sup>3</sup> In Vietnam, about 85% of Vietnamese workers economy-wide and 66% in manufacturing were employed in household businesses at the onset of the agreement, allowing us to examine the reallocation of workers from household enterprises to the more formal enterprise sector.<sup>4</sup>

We use this data in conjunction with large and plausibly exogenous variation in declines in export costs induced by the U.S.-Vietnam Bilateral Trade Agreement (henceforth, the BTA). The principle trade policy change in the BTA was a significant, immediate drop in U.S. tariffs on Vietnamese exports, averaging 21.1 percentage points, which substantially lowered the cost of exporting Vietnamese products to the United States. This resulted in a substantial shock to Vietnam's trade: its exports to the United States grew from 7.1 to 19.0 percent of total exports (see Figures 1 and 2) and exports to the United States grew from 3.6 to 10.4 percent of Vietnam's GDP between 2001 and 2004.

Our empirical setting overcomes key challenge in empirically identifying the effect of exporting on the allocation of workers by using heterogeneity in policy-driven export cost reductions across industries; indeed, Vietnamese industries that faced greater declines in U.S. tariffs observed greater export growth (Figure 3). The agreement lowered industry-specific tariffs by the United States moving Vietnam from the pre-existing Column 2 to the pre-existing MFN U.S. tariff schedule, rather than by industry-specific contemporaneous negotiations over tariff lines (McCaig (2011)), so that the industry-specific declines in U.S. tariffs were plausibly exogenous and not precipitated by industry-specific economic conditions in Vietnam during the early 2000s (see Section 3 for details). Importantly, tariff changes are not spuriously correlated with pre-existing or concurrent global demand or supply shocks to Vietnamese products that occur in industries with greater declines in U.S. tariffs. While Vietnamese industries that faced larger declines in U.S. tariffs

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<sup>3</sup> In Vietnam a household business is a business that has not registered as an enterprise under Vietnam's Enterprise Law. Not all businesses are required to register as an enterprise. See Section 4 for details. In general, aggregate cross-country facts on economic development and informality/household business employment/self-employment are robust to several definitions of informality and household businesses across countries (La Porta and Shleifer (2014), Hsieh and Olken (2014)).

<sup>4</sup> Administrative matched employee-employer data provide detailed information about workers in formal registered firms, but do not cover workers in the informal household business sector.

observed greater export growth (driven by U.S. export expansion), we show that U.S tariff declines were not predictive of Vietnamese export growth prior to the agreement, nor were they correlated with Vietnamese export growth to the European Union, another high-income export destination.

Our results suggest that the reallocation of labor from household businesses to employers in the enterprise sector provides an important margin of adjustment to new exporting opportunities. The estimated magnitudes imply that expanded export opportunities increased employment in the enterprise sector in manufacturing by 15% during the period of the study. The aggregate share of workers in household businesses declined in Vietnam during the early 2000s, with approximately half of this decline attributed to the reallocation of labor from household businesses to employers in the enterprise sector within industries.<sup>5</sup> The within-industry component is particularly pronounced in manufacturing. Importantly, workers in industries that experience larger declines in tariffs on Vietnamese exports to the U.S. observe a greater decrease in household business employment. As we discuss in detail in Section 5, our findings are robust to several robustness and falsification checks. The findings do not reflect pre-existing or concurrent global demand shocks affecting Vietnamese products and we find no effects of the BTA prior to its implementation. Moreover, the results are robust to controls for sorting of workers that differ in observable and time-invariant unobservable worker characteristics.

Our results are consistent with models that predict a reallocation of workers away from self-employment into wage employment and towards larger, more productive firms in response to rising aggregate labor demand. For example, Lucas (1978) shows an increase in labor demand raises the opportunity cost of self-employment and induces a reallocation of individuals from self-employment toward wage work in establishments run by managers with greater managerial talent. Likewise, Melitz (2003) style models predict that by increasing the economy-wide demand for labor, trade through exporting leads to a reallocation of labor toward more productive establishments.<sup>6</sup> This mechanism is further supported by evidence of wage increases and poverty reductions in McCaig (2011), where BTA-induced declines in US tariffs are associated with greater decreases in poverty and increases in wages (especially for less educated workers) in areas of Vietnam more

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<sup>5</sup> The remaining half of the decline owes to the relative contraction of industries that tend to organize production in small household businesses, namely agriculture and aquaculture.

<sup>6</sup> See also Verhoogen (2008), Bustos (2011), and Brambilla, Lederman, and Porto (2012) for evidence on effects of exporting on formal enterprises and Brambilla, Porto, and Tarozi (2012) on the effects of exporting on informal, household business producers.

exposed to exporting. We find that not all individuals are affected equally by exporting opportunities. Individuals living in more internationally integrated provinces and younger workers are more likely to reallocate from household businesses toward employers in the enterprise sector in response to lower export costs. This heterogeneity is consistent with lower adjustment costs to trade shocks among the young and with lower geographic trade costs (Hanson (1996)). More generally, our analysis suggests that demand-side policies such as declines in export costs, which are expected to disproportionately benefit initially more productive firms (Melitz (2003)), provide a potentially important policy impetus for the relative contraction of employment in the less productive household-business sector and expansion of jobs in the registered enterprise sector in low-income countries (see also Hsieh and Olken (2014)).

Existing trade literature has found limited or no industry employment adjustment in response to tariff declines in the short run.<sup>7</sup> Our results suggest that the inclusion of workers in the household business sector in the analysis provides new insights on this employment response. We also do not find shifts in the structure of total industry employment with declines in export costs. However, employment shifts toward industries with greater declines in export costs among Vietnamese employers in the enterprise sector, a sector with employers most directly impacted by the agreement. Our analysis, which includes data on employers in both sectors, shows that this expansion of the employment in the formal sector occurs through the reallocation of workers previously employed in household businesses (rather than from out of the workforce or unemployed). Analysis covering only formal enterprise sector could not detect such reallocation.<sup>8</sup>

Finally, our results relate to the recent literature that emphasizes the role of distortions for aggregate productivity differences across countries (Restuccia and Rogerson (2008), Hsieh and Klenow (2009)).<sup>9</sup> While this literature has emphasized the role of distortions and firm heterogeneity for aggregate productivity differences across countries, the exact nature of these distortions is less clear. Given this state of affairs, it is natural to empirically examine the extent to which reductions in trade barriers to exporting – a product market distortion that

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<sup>7</sup> See Harrison and Hanson (1999), Attanasio, Goldberg, and Pavcnik (2004), Topalova (2007, 2010), Menezes-Filho and Muendler (2011), Kovak (2011), and survey by Goldberg and Pavcnik (2007).

<sup>8</sup> Several studies examine compliance with labor regulation among employers in the formal enterprise sector (see Goldberg and Pavcnik (2003), Menezes-Filho and Muendler (2011), Paz (2014)).

<sup>9</sup> Part of the literature focuses on the role of agriculture and the gap in productivity of agriculture (relative to non-agriculture) in explaining aggregate productivity differences across countries. See Caselli (2005), Restuccia, Yang, and Zhu (2008), Golin, Lagakos, and Waugh (2012), and McMillan and Rodrik (2011).

disproportionately lowers the profitability of more productive establishments (Melitz (2003)) – provide an impetus for the reallocation of workers from household businesses toward more productive firms in the registered enterprise sector. The prevalence of very small, informal household-run, low-productivity firms that account for a large share of aggregate employment and the scarcity of large productive establishments is a particularly notable component of the firm distribution in low-income countries (see Hsieh and Olken (2014), La Porta and Shleifer (2014)).<sup>10</sup> Our estimates imply a .1 to 5.5 percent annual increase in aggregate manufacturing labor productivity (as measured by revenue per worker) stemming from the reallocation of workers from household businesses to firms in the enterprise sector as a result of reductions in export tariffs.

The rest of the paper is organized as follows. Section 2 summarizes a conceptual framework. Section 3 provides a detailed description of the BTA. Section 4 describes the data. Section 5 discusses our empirical methodology and results. Section 6 concludes.

## **2. A conceptual framework**

We briefly discuss why tariff reductions on exports from a low-income country (corresponding to the main trade policy change in the BTA) could affect the composition of employment between the household business and formal enterprise sectors within an industry. This discussion guides the empirical framework and analysis in Section 5.

A reduction in tariffs on exports from a low-income country will increase product demand and labor demand in the country. If firms differ in underlying profitability due to heterogeneity in marginal costs of production and face a fixed cost of exporting, the reduction in variable export costs disproportionately raises the profitability of firms with a lower marginal cost of production (Melitz (2003)). Firm-specific marginal cost differences might stem from differences in entrepreneurial ability of the owner/manager (Lucas (1978)) or underlying productivity (Melitz (2003)). Household businesses differ from firms in the enterprise sector in many dimensions and exhibit substantially lower productivity, perhaps owing in part to lower education or managerial ability of owners.<sup>11</sup> In this setting, only initially more productive firms benefit from declines in policy-induced variable export costs because only they earn high enough profits from increased

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<sup>10</sup> Many studies focus on the effects of supply-side constraints on the growth of microenterprises and their formalization (see survey by Banerjee and Duflo (2005) and de Mel, McKenzie, Woodruff (2013a, 2013b)).

<sup>11</sup> See Gollin (2008), La Porta and Schleifer (2008), and de Mel, McKenzie, Woodruff (2013a).

exports to cover the fixed cost of exporting. Declines in tariffs increase product and labor demand (and profitability) among these more productive firms, while increasing the labor costs and reducing profitability of inefficient firms that only serve the domestic market. This is predicted to shift the composition of employment away from less productive employers (such as household businesses) toward more productive employers in the enterprise sector.<sup>12</sup>

This mechanism does not require that household businesses and formal enterprises compete in the product market. A framework such as Melitz (2003) assumes product-market competition among the firms, implying that household businesses produce products that are imperfect substitutes for varieties produced by firms in the enterprise sector, including exported varieties. This is clearly a strong assumption. Even if household businesses and formal enterprises do not compete in product markets, exporting could affect employment in household businesses through the general equilibrium labor demand effects of trade. In fact, evidence from Vietnam suggests that exporting opportunities from the BTA raise wages (McCaig (2011)). If household businesses compete for labor with firms in the enterprise sector (which disproportionately benefit from declines in export costs (Melitz (2003))) the increased labor demand among firms in the enterprise sector increases the opportunity cost of working for a household businesses, resulting in a relative contraction of employment in household businesses (see also Lucas (1978), Gollin (2008)). This discussion abstracts from frictions that might impede the mobility of individuals from the household business to the enterprise sector. To the extent that such frictions exist, these frictions dampen the reallocation in response to declines in export costs, making it more difficult to empirically detect reallocation across this margin of employment after tariff declines.

Reductions in trade costs also influence the relative size of industries, as emphasized in the neoclassical trade models, and this too may influence the allocation of labor between the household business and enterprise sectors. In general, the effect of trade on the composition of aggregate employment across employers via this neoclassical channel depends on the nature of the trade liberalization and the relative prevalence of household business employment in industries subject to larger declines in trade frictions. For example, production in agriculture is more prone to be organized around household businesses than the apparel industry. If the trade agreement

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<sup>12</sup> Mrazova and Neary (2013) show that the selection effects in Melitz style models are very robust to functional form assumptions and market structure, requiring supermodularity of the profit function in marginal production costs and market access costs (export).

reduces the export cost of apparel (relative to agriculture), trade shifts the structure of employment away from agriculture toward apparel, reducing the aggregate share of jobs in household businesses. Our empirical framework accounts for such compositional changes.

### **3. Background on the U.S.-Vietnam Bilateral Trade Agreement**

In this section we describe the U.S.-Vietnam Bilateral Trade Agreement (BTA) and highlight its key features that we utilize in our empirical methodology and identification strategy in Section 5.

The BTA was implemented on December 10, 2001.<sup>13</sup> The agreement led to negligible changes in Vietnam's import tariff commitments to the U.S. because Vietnam already applied Most Favored Nation (MFN) tariffs on U.S. imports.<sup>14</sup> The main trade policy change was for the U.S. to immediately grant Vietnam Normal Trade Relations (NTR) or MFN access to the U.S. market. Prior to the BTA Vietnam was subject to tariffs according to Column 2 of the U.S. tariff schedule. With the BTA, Vietnam became subject to MFN tariff rates. In our analysis, we use industry-level U.S. import ad-valorem equivalent tariffs applied to Vietnamese exports constructed from these two tariff schedules by McCaig (2011) as the main policy variable to measure the industry-level policy cost of accessing export markets.<sup>15</sup>

Our identification strategy in Section 5 relies on several features of the U.S. tariff declines. Table 1 summarizes industry tariff levels and changes overall and for broad sectors. First, the U.S. tariff cuts were large, as the BTA on average reduced tariffs by 21.1 percentage points from 23.4 to 2.4 percent. The large magnitude of tariff cuts makes it ex-ante plausible to separate the effects of changes in tariffs from confounding changes in the Vietnamese economy. Our empirical methodology in Section 5 relies on the heterogeneity of tariff declines across industries to identify

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<sup>13</sup> See STAR-Vietnam (2003) and McCaig (2011) for an extensive discussion of the BTA.

<sup>14</sup> The BTA required Vietnam to reduce import tariffs on approximately 250 (out of approximately 6000) 6-digit HS agricultural and manufactured food products. As these tariff cuts were small in comparison to the U.S. tariff cuts and only affected a relatively small number of products, we do not discuss them in detail. Our results are robust to controlling for these tariff cuts. As part of the BTA, Vietnam was required to implement various regulatory and legal changes over a period of 10 years following the implementation of the BTA. These included commitments to improve market access in services such as banking and telecommunication, intellectual property rights, and protection of foreign direct investment (STAR-Vietnam (2003)).

<sup>15</sup> McCaig (2011) uses detailed information on U.S. tariffs for both of these tariff schedules from the U.S. International Trade Commission's online Tariff Information Center and computes the ad valorem equivalent of any specific tariffs. He then matches the tariff lines to industries by the concordance provided by the World Bank via the World Integrated Trade Solution database to construct industry-level tariffs according to 2-digit ISIC industry nomenclature. This classification closely matches the industry classification in the VHLSSs.



the effects of lower exporting costs on labor allocation across employers. Thus, a second useful feature of the BTA is that the tariff cuts varied widely across industries. As Table 1 suggests, the standard deviation of the industry tariff decline is 17.9 percentage points. Industries within manufacturing experienced the largest average tariff cut of 30.3 percentage points, with the average tariff falling from 33.8 to 3.4 percent.

Importantly, these tariff declines significantly impacted the volume and structure of Vietnamese exports to the U.S. and worldwide. During this period, Vietnam's aggregate worldwide exports were expanding, but the exports to the U.S. grew even more. Figures 1 and 2, also reported in Fukase (2013), show the value and the share, respectively, of Vietnamese exports to the U.S. from 1997 through 2006. The implementation of the BTA led to a significant surge in exports, which is evident from the break in trend in 2001 in Figure 1. This break is especially pronounced for manufactured exports, which experienced substantially larger BTA tariff cuts than primary sector exports. Figure 2 indicates that the share of Vietnamese exports going to the U.S. grew rapidly from 5.1 percent in 2000 to 19.0 percent in 2004 and this increase was primarily driven by manufacturing, where U.S. exports accounted for 26.1 percent of Vietnamese exports by 2004.<sup>16</sup> The top eight exports to the U.S. according to 2004 value by industry were apparel; footwear; textiles; food products and beverages; furniture; agriculture; refined petroleum; and office, accounting and computing machinery.

Figure 3 shows the relationship between growth in exports to the US between 2001 and 2004 and tariff cuts across 2-digit ISIC industries. A strong negative relationship suggests that industries with greater tariff cuts experienced faster export growth. Appendix Table A.1 reports the industry-level regression of the change in log exports to the U.S. between 2001 and 2004 on the change in U.S. tariffs, which yields a statistically significant estimate of the coefficient on the change in US tariffs for traded industries and for manufacturing. The estimate in column 1 implies that an industry with the average tariff cut, 21.1 percentage points, experienced average annual export growth to the U.S. of 48 percent.

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<sup>16</sup> As a non-member of GATT and the WTO, Vietnam was not subject to the Multi-Fibre Agreement and did not initially face any export quotas for textile and apparel products destined for the U.S. In July 2003 a bilateral textile agreement came into force, which imposed quotas on Vietnamese textile and apparel exports to the U.S. This agreement is likely responsible for the reduction in the rate of growth of the share of US-bound Vietnamese manufacturing exports following 2003. In the analysis below, this is one of the reasons why we restrict our period to the two years immediately following the implementation of the BTA. To the extent these quotas affected Vietnamese households in 2003 they would likely attenuate our findings.

This BTA-related expansion of U.S. exports is not driven by industry-specific global demand shocks. Appendix Table A.1 also reports results for Vietnamese exports to the European Community as an outcome variable. Unlike exports to the U.S., Vietnamese exports to the E.U. were already subject to MFN tariffs prior to the implementation of the BTA (STAR-Vietnam (2003)). As a high-income export market destination, the E.U. likely faces similar industry-specific demand for low-income country exports as the U.S. market. To the extent that U.S. tariff changes are correlated with these shocks, BTA-induced tariff changes would also be spuriously correlated with Vietnamese exports to the EU. However, the coefficients on tariffs reported in columns 3 and 4 are statistically insignificant and an order of magnitude smaller than the corresponding coefficients in columns 1 and 2, indicating no association between the changes in U.S. tariffs and changes in Vietnamese exports to the EU. It is therefore unlikely that BTA-induced tariff changes are spuriously correlated with industry-specific global demand shocks for Vietnamese goods.

A fourth useful feature of the U.S. tariff cuts induced by the BTA is that the usual concern about the political economy of protection and the endogeneity of tariff changes are potentially less severe. Industry-specific tariff cuts occurred by the U.S. granting Vietnam the status of Normal Trade Relations (i.e., Most Favored Nation status). The U.S. tariff cuts were presented as an all-or-nothing package whereby exports from Vietnam into the U.S. would immediately be covered by MFN tariff rates (negotiated among the WTO members in a round that concluded by 1995) instead of Column 2 tariff rates (i.e. originating from the US tariff rates from the Tariff Act of 1930 (Pregelj (2005), McCaig (2011))). The movement of Vietnam from one pre-existing U.S. tariff schedule to a second pre-existing U.S. tariff schedule implies that neither U.S. nor Vietnamese industries had an opportunity to influence the tariff cuts faced by specific industries at the time of the implementation of the BTA.

We further confirm the lack of correlation between BTA-induced tariff changes and pre-existing industry trends and levels. In particular, BTA-induced tariff changes do not appear to be related to pre-existing trends in Vietnamese exports to the U.S nor to other high-income destinations such as the E.U. A falsification check of growth of exports to the US between 1997 and 2000, where the industry-level pre-BTA tariffs are matched with exports in 1997 and the post-BTA tariffs are matched with exports in 2000, yields a substantially smaller in magnitude and in insignificant coefficient on the change in tariffs (see Appendix Table A.1, Panel B, columns 1 and 2). A similar finding is obtained for growth of exports to the E.U. between 1997 and 2000 (see

Appendix Table A.1, Panel B, columns 3 and 4).<sup>17</sup> Thus, the export growth to the U.S. following the BTA is not simply the continuation of pre-existing trends. In addition, we regressed the change in U.S. tariffs on a measure of the unskilled labor intensity of an industry (measured by the share of workers with less than 10 years of education) and the share of workers within the industry working in household businesses prior to the implementation of the BTA. The respective partial correlations, all statistically insignificant, are 0.090, and 0.073. Overall, neither contemporaneous growth in demand for Vietnamese exports from other high-income countries, nor pre-existing trends in industry exports, nor baseline industry characteristics are statistically correlated with the BTA-induced industry tariff changes.

#### **4. Data and Aggregate Trends in Household Business Employment**

##### **4.1 Definition of a household business**

In Vietnam, firms either operate in the household business sector or the registered enterprise sector. The registered enterprise sector covers firms of four ownership categories: state, collective, foreign, and (domestic) private as defined by the Enterprise Law.<sup>18</sup> All state, collective, and foreign businesses have to legally register as an enterprise. Private businesses can legally operate either as a household business or a registered private enterprise. Thus, a household business is a private business that is not registered as a private enterprise. The legal guidelines for when a private business must register as an enterprise are at times vague, but they consistently require registration as an enterprise for private businesses that regularly employ workers or employ more than 10 workers, or businesses that operate in more than one location.<sup>19</sup> Thus, while small, single-location businesses may operate as household businesses or enterprises, all larger businesses are required to operate as enterprises. Being a household business therefore does not necessarily imply that a business operates illegally (although some private businesses required to register might not do so and illegally operate as a household business). Household businesses can operate in the physical premise of a household (or farm), market stalls, industrial zones, trade centers, and in variable locations (e.g., street vendors).

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<sup>17</sup> A similar regression for worldwide exports between 1997 and 2000 also yields statistically insignificant findings.

<sup>18</sup> See law No. 13-1999-QH10 Law on Enterprises.

<sup>19</sup> Decrees No. 02/2000/ND-CP of 3 February 2000 and No. 109/2004/ND-CP of 2 April describe household business and enterprise registration requirements during our study period.

Most household businesses are household farms in agriculture and aquaculture. Non-farm household businesses predominately operate in services (70%). Of the 30% of household businesses in manufacturing, the most common activities are production of food and beverages, wood processing, clothing, furniture, and textiles. The difference in registration status is predictive of important differences in underlying firm characteristics in the household business and enterprise sectors. Consistent with other studies on household businesses (Gollin (2008), La Porta and Shleifer (2008), de Mel, McKenzie, Woodruff (2013a)), Vietnamese household businesses are substantially smaller and have lower labor productivity than firms in the enterprise sector. The average household business has only two workers, while the average employment size for employers in the enterprise sector is 72. Household businesses in manufacturing have on average ten times lower labor productivity than enterprises.<sup>20</sup>

Registered enterprises are required by the Enterprise Law to follow formal accounting standards and to report comprehensive information about their financial position, including information on their workforce. Consequently, as in other low-income countries, in Vietnam workers in the enterprise sector are captured in the conventional firm-level datasets based on administrative records covering the formal sector, whereas workers in the household business sector are not. The next section describes how we use comprehensive household surveys to observe workers in both sectors.

## **4.2 Data Description**

We use two waves of the Vietnam Household Living Standards Surveys (VHLSS) conducted by the General Statistics Office (GSO) of Vietnam in 2002 and 2004 as our primary data source. The surveys are nationally representative, have a 12 month recall, and cover 2001/2002 and

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<sup>20</sup> The estimates of the number of workers come from the 2004 VHLSS and the end of year employment in the 2003 enterprise data. The productivity estimates are from the 2002 VHLSS and the 2001 enterprise data. See Appendix B for further information regarding the productivity calculation.

2003/2004.<sup>21</sup> While the VHLSS is a repeated cross section of households, it also contains a smaller panel subsample, which we employ in several specification checks.<sup>22</sup>

We focus on employed individuals, ages 20 to 64, in their main job (i.e., the most time consuming).<sup>23,24</sup> We create variables on workers' demographic and educational characteristics (gender, age, highest level of completed education, ethnic minority status), geographic location (urban residence, province), occupation, and industry affiliation. The survey distinguishes between 60 2-digit ISIC (Rev 3) industries overall, 34 in the traded sector, and 22 of which are in manufacturing. We use industry affiliation to link individual-level data to industry-level U.S. tariffs on Vietnamese exports, described in Section 3.

We construct the main variable of interest, an indicator for whether a worker works for a household business from a survey question about the worker's employer type. The question distinguishes whether a worker is self-employed, works for another household, the state sector, the collective sector, the private enterprise sector, or the foreign sector. The indicator takes the value one if an individual works in his/her own household business or in another household's business, and zero otherwise. This definition of employment in a household business is consistent with the distinction between household businesses and registered enterprises as per Vietnam's Enterprise Law as discussed in Section 4.1.<sup>25</sup>

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<sup>21</sup> The BTA was implemented on December 10, 2001. The 2002 survey interviewed households throughout the year. With a recall period of 12 months, individuals interviewed at the start of 2002 have a recall period that almost entirely precedes the BTA, while individuals interviewed at the end of 2002 have a recall period almost exclusively after the implementation of the BTA. Our results thus potentially underestimate the full impact that the BTA has had on labor reallocation.

<sup>22</sup> In robustness checks, we rely on two additional data sources: the 1992/93 and 1997/98 Vietnam Living Standard Surveys (VLSS), predecessors to the VHLSS, and Vietnam's Enterprise Survey for 2000 and 2003, a firm-level dataset that covers all registered firms in the enterprise sector.

<sup>23</sup> For each individual in the household the survey collects information on whether the individual is employed, unable to find work or out of the labor force. Unemployment is very infrequent in our data. For example, among individuals age 20 to 64 in the 2004 VHLSS, 89.3 percent report working during the past 12 months while only 6.2 percent of those not working (or 0.7 percent of the age group) report being unable to find a job.

<sup>24</sup> Among workers age 20 to 64 in the 2004 VHLSS, 43 percent reported working more than one job during the past 12 months. Among these individuals the average annual hours worked was 1355 and 511 in their primary and secondary jobs respectively as compared to 1907 hours for workers that reported working only one job.

<sup>25</sup> The 2004 VHLSS distinguishes between self-employment in a household business and self-employment in a private enterprise, while the 2002 VHLSS does not. To be consistent across surveys we classify all self-employed individuals as working for a household business. This is not a very egregious grouping since self-employment in the private sector is only 0.7 percent of self-employment across all industries and 1.6 percent of self-employment in manufacturing in the 2004 VHLSS.

One potential problem with the construction of a household business indicator is that the individuals might not know whether they work for a household business or a private enterprise. While this is a concern, the survey provides detailed instructions to the enumerators about how to record the answers to questions. Furthermore, most workers in household businesses work for their own business and presumably know its registration status.<sup>26</sup> If measurement error was severe, one would not expect to observe differences in worker outcomes such as earnings and benefits for workers in household businesses and other establishments. In unreported analysis, we find notable differences in wages and benefits received between workers in the household business and enterprise sectors.<sup>27</sup> For example, workers in a household business earn about 14 percent less than observationally equivalent workers working in the same industry, province, and occupation. Controlling for unobserved worker characteristics, workers that switch to work for an enterprise tend to earn 5 percent more than when they work for a household business. Workers that work for household businesses also receive lower benefits, which is consistent with the literature on firm size and earnings and on informality (Marcouiller, Ruiz de Castilla, and Woodruff (1997) and Goldberg and Pavcnik (2003)). To the extent that there is some measurement error in our dependent variable, it would reduce the precision of our estimates and bias us toward finding no significant impact. Appendix Table A.2 provides summary statistics for the sample of 152,388 workers in 2001/02 and 96,407 workers 2003/04.

Finally, while we can capture worker allocation between employers in the household business and enterprise sectors – a margin that is not observed in conventional firm-level or matched employee-employer administrative data – we do not observe the allocation of workers across firms within employer types. Our study thus complements the literature on labor allocation across heterogeneous employers in the formal sector.

#### **4.3. Aggregate trends in household business employment**

Table 2, Panel A reports the aggregate share of individuals that work in household businesses in Vietnam in 2001/02 and 2003/04 and motivates the importance of this employment margin. The results are presented for workers in all industries, in industries other than agriculture and aquaculture, and in manufacturing. The major fact to emerge is that employment in household

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<sup>26</sup> In a subset of our analysis we also rely on an indicator for whether an individual is self-employed.

<sup>27</sup> This also holds if we compare workers in household businesses and private enterprises.

businesses is very high in Vietnam. Economy-wide, 85 percent of workers are employed in household businesses in 2001/02. The prevalence of employment in household businesses does not merely reflect the large overall share of employment in agriculture and aquaculture, as the share continues to be high, at 67 percent, when we exclude agriculture and aquaculture.<sup>28</sup> We observe similarly high levels of working for household businesses, 66 percent, within manufacturing, consistent with evidence from India and Ghana (Nataraj (2011), Gollin (2008)). Thus, even in manufacturing, the sector that is the focus of most of the existing work on trade and labor allocation, the usual analysis of formal enterprise firms captures a small share of employment.

The second key fact to emerge from Table 2 is the decline in the prevalence of working in household businesses between 2001/02 and 2003/04. Economy-wide, the share of workers in household businesses fell by 3.3 percentage points (or 4 percent). The drop was particularly pronounced in manufacturing, where the share of workers employed in household businesses fell by 5.6 percentage points (or 9 percent). The conceptual framework in Section 2 emphasizes that trade can influence the composition of employment through the reallocation of employment across employers within industries and between industries with differential prevalence of household business employment. We examine whether the observed aggregate changes in the incidence of employment in household businesses stems from changes in the structure of employment across industries (e.g., expansion of employment in industries that tend to organize their production in formal enterprises) or from within-industry reallocation of workers across employers. We decompose the change in the share of workers in household businesses in total employment between 2001/02 and 2003/04, denoted by  $\Delta H$ , into within and between industry shifts, respectively:  $\Delta H_t = H_t - H_{t-1} = \sum_j \Delta h_{jt} I_j + \sum_j \Delta I_{jt} h_j$ , where  $I_{jt}$  is the share of industry  $j$ 's employment in total employment at time  $t$ ,  $h_{jt}$  is the share of workers in household businesses in total employment in industry  $j$ ,  $I_{j.} = .5(I_{jt} + I_{j,t-1})$ , and  $h_{j.} = .5(h_{jt} + h_{j,t-1})$ . The first summation term captures the importance of mobility of workers across employers *within* an industry and the second summation term captures the prevalence of mobility of workers *across* industries as sources of changes in aggregate employment in household businesses.

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<sup>28</sup> The middle panel also excludes forestry, a very small sector; for brevity, we refer to agriculture and aquaculture only.

Panel B of Table 2 presents the results of the decomposition. Economy-wide, both channels contribute equally toward the decline in the aggregate share of household business employment. The between-industry component accounts for 48 percent of the aggregate decline and mainly reflects the relative contraction of employment in agriculture and aquaculture, where almost all workers work in household farms. Exclusion of agriculture and aquaculture raises the contribution of the within-industry channel from 52 to 87 percent. The within-industry reallocation of workers across employers from household business to the registered enterprise sector plays an even larger role in manufacturing, where it accounts for the entire decline in the aggregate share of household business employment. Overall, these aggregate trends motivate our empirical analysis, which we turn to next.

## 5. Empirical Implementation

This section first describes our empirical methodology and main results, followed by discussing several robustness and falsification checks. The section concludes with a discussion of the implications of the BTA for industry employment and aggregate manufacturing productivity.

### 5.1 Empirical Methodology and Main Results

We exploit large heterogeneity across industries in declines in U.S. tariffs on Vietnamese exports induced by the BTA to investigate the relationship between exporting costs and the allocation of workers between employers in the household business and enterprise sector. The empirical methodology relies on a comparison of the probability that a worker works for a household business before and after implementation of the BTA across Vietnamese industries differentially exposed to the declines in U.S. tariffs. In the initial empirical specifications, we estimate the following linear probability model:

$$H_{ijt} = X_{ijt}\delta + tariff_{jt}\beta + \gamma_p + \lambda_j + \theta_t + \varepsilon_{ijt}. \quad (1)$$

$H_{ijt}$  is an indicator for whether a worker  $i$  employed in industry  $j$  at time  $t$  works for a household business,  $X_{ijt}$  is a vector of worker characteristics (this vector includes age, age squared, and indicators for education (primary, lower secondary, upper secondary, with no formal education as the excluded category), gender, ethnic minority status, an indicator for whether a person lives in a rural area),  $tariff_{jt}$  is the U.S. tariff on Vietnamese exports in industry  $j$  at time  $t$ . The specification also includes province ( $\gamma_p$ ), industry ( $\lambda_j$ ), and post-BTA ( $\theta_t$ ) fixed effects. The main parameter of interest is the coefficient on tariffs. A positive coefficient implies that a decline in tariffs is associated



with a decline in the probability of working in a household business and the reallocation of labor away from household businesses. Standard errors are clustered by industry to account for general forms of heteroskedasticity and serial correlation in the error term within an industry.

Inclusion of individual worker demographic characteristics in equation (1) sweeps out differences in worker composition across industries, employers, and time that could simultaneously affect the allocation of labor and be spuriously correlated with tariff levels. The post-BTA fixed effect controls for aggregate economy-wide adjustments in household business employment coinciding with the implementation of the BTA agreement. Province fixed effects absorb any time-invariant features of provinces affecting labor market conditions in a province, while industry-level fixed effects capture all time-invariant industry characteristics correlated with tariff levels and prevalence of household business employment. In this set up, the empirical strategy identifies the coefficient on tariffs by comparing effects of tariff declines on workers with the same observable characteristics within provincial labor markets, some of whom worked in industries that experience large tariff cuts and others who worked in industries with smaller tariff cuts.

Any potential threats to the underlying identification assumption would stem from industry specific time-varying factors that covary with industry tariff changes and independently influence industry-specific changes in the propensity to work for a household business. As discussed in detail in Section 3, the institutional implementation of the BTA-induced tariff cuts eliminated the ability of industry-specific contemporaneous conditions in Vietnam or the US to influence the magnitude of industry tariff cuts through the political economy of tariff formation. One could potentially still be concerned about spurious correlation between industry tariff changes and contemporaneous industry-specific changes in global demand for Vietnamese exports. In Section 3, we also show that U.S. tariff changes are not spuriously correlated with contemporaneous industry-specific changes in global demand for Vietnamese exports: the U.S. tariff declines lead to a strong increase in Vietnam's exports to the U.S, but are not associated with changes in export growth to the EU. This also likely eliminates the role of contemporaneous supply shocks in Vietnam, which would be affecting all global destinations. We also find no statistically significant association between U.S. tariff changes and industry baseline characteristics, such as the share of household business workers in industry employment and the unskilled-labor intensity of the industry, prior to the implementation of the BTA, nor between U.S. tariff changes and pre-existing industry-specific time

trends in Vietnamese exports to the U.S., the E.U., and worldwide. These results, discussed in detail in Section 3, further validate the identification strategy in equation (1).

Figures 4 and 5 present scatterplots of the change in the share of household business workers in an industry and the BTA-induced change in U.S. tariffs for all traded industries and for manufacturing, respectively.<sup>29</sup> The size of the circles reflects the employment size of each industry. The slope of the displayed regression lines is equivalent to the estimate of the coefficient on tariffs  $\beta$  based on equation (1) without controlling for worker characteristics and province fixed effects.<sup>30</sup> The figures show a clear positive relationship: industries with larger tariff cuts experienced larger reductions in the share of workers working in household businesses.

The relationships shown in the scatterplots continue to hold once we estimate the coefficient on tariffs as specified in equation (1) and reported in Table 3. Column 1 presents estimates of equation (1) for traded industries. We find that workers in industries that faced greater reductions in U.S. tariffs experienced larger decreases in the probability of employment in household businesses relative to observationally equivalent workers in industries with smaller tariff reductions. The magnitude of the coefficient (.21) suggests that an industry that experienced the average reduction in tariffs, 21.1 percentage points, saw the probability of working in a household business fall by 4.4 percentage points relative to an industry facing no reduction in tariffs. In Column 2 we report the estimates of equation (1) for workers in all industries, including non-traded industries. The non-traded sectors were not directly impacted by the tariff cuts and observed no change in tariffs.<sup>31</sup> Their inclusion in the analysis is therefore expected to dampen the effects of the BTA. As expected, the inclusion of non-traded sectors dampens the magnitude of the coefficient relative to the estimate based on the traded sector alone, although the coefficient continues to be positive and statistically significant. Lastly, in column 3 we estimate equation (1) for the manufacturing sector, a sample that is more comparable to the samples used in most studies of labor reallocation in response to trade reform. The estimated coefficient suggests that the average

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<sup>29</sup> Both figures exclude industry 12 (mining of uranium and thorium ores) from the display, but not from the regression line, as it is an extreme outlier and a very small industry in terms of employment. Removing it from the figure makes it easier to display the variation in the data for the remaining industries.

<sup>30</sup> The industry observations are weighted by  $n_j^{2002} n_j^{2004} / (n_j^{2002} + n_j^{2004})$  where  $n_j$  is the number of workers in industry  $j$  in the indicated year.

<sup>31</sup> We assign a tariff of 0 to non-traded industries in both years. Equation (1) includes industry fixed effects, which implies that non-traded industries experience no tariff change.

reduction in manufacturing tariffs of 30.3 percentage points is associated with a 5.0 percentage point reduction in the probability of employment in a household business in that industry.<sup>32</sup>

## 5.2 Falsification Test

The above results are not driven by differential employment trends across industries that differ in their propensity to organize production in household businesses, nor do they capture pre-existing industry-specific trends in the incidence of household business employment. As discussed in Section 3, the industry changes in U.S. tariffs are not related to initial industry conditions, such as the share of household business workers within an industry or industry skill intensity, nor pre-BTA growth in exports to the U.S. A falsification test that uses two rounds of data covering a pre-reform period further finds no evidence that changes in industry tariffs are correlated with pre-existing trends in household business employment across industries. We perform this test using information from the 1993 and 1998 Vietnam Living Standards Surveys (VLSSs).<sup>33</sup> The employment module for the 1993 VLSS does not separately identify employment in a household business from employment in a private sector business.<sup>34</sup> Consequently, we use an indicator for being self-employed as the dependent variable. Self-employment is highly correlated with working in a household business in the 2002 and 2004 surveys, which contain the needed data to construct both measures.

We begin by estimating equation (1) with the indicator for self-employment as the dependent variable using data from 2002 and 2004 VHLSSs to examine the effect of tariffs on self-employment during the period of the BTA's actual implementation. The estimated coefficients on tariffs are presented in columns 1-3 in the top panel of Table 4. The coefficients are positive, statistically significant, and of similar magnitudes as the corresponding coefficients on tariffs in Table 3. The similar magnitudes of the coefficients suggests that movement out of working for household businesses reflects both movements from self-employment and movement from working for another household's business, although movements out of self-employment play a slightly stronger role in manufacturing.

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<sup>32</sup> These results are robust to controlling for Vietnam's BTA tariff reduction commitments, which are concentrated in agriculture and the processing of food and beverages. The estimated coefficient on U.S. tariffs is 0.171, 0.130, and 0.188 on traded, all, and manufacturing industries respectively, all of which remain statistically significant at the 1 percent level.

<sup>33</sup> The 1993 and 1998 VLSSs are based on the same sampling framework, which differs from the sampling framework used for the 2002 and 2004 VHLSSs.

<sup>34</sup> Vietnam did not make a legal distinction between household businesses and private enterprises at that time.

In the falsification test, we use two-rounds of pre-BTA data (1993 and 1998) and assign the pre-BTA tariffs (Column 2 tariffs in 2001) to the 1993 data and the post-BTA tariffs (MFN tariffs in 2004) to the 1998 data. If pre-existing trends in household business employment were correlated with industry-specific U.S. tariff cuts, this specification would yield estimates of tariff coefficients of the same sign and similar magnitude to the coefficients obtained in the corresponding analysis using data surrounding the actual policy change. The results are presented in the bottom panel of Table 4. The estimated coefficients on tariffs are close to zero in magnitude, always statistically insignificant, and differ from the estimates of the corresponding coefficients based on data surrounding the period when BTA was actually implemented.<sup>35</sup> Underlying trends therefore cannot account for the strong relationship between the U.S. tariff reductions and the decrease in the probability of working for a household business that is reported in Table 3 and the top panel of Table 4, further validating the identification strategy.

### 5.3 Heterogeneity in Worker Responses to Tariff Declines

The results show that large BTA-induced declines in industry-specific export costs decrease the probability that Vietnamese workers work for a household business, leading to a reallocation of workers toward the formal enterprise sector. The overall effects analysed so far might mask heterogeneity in responses of workers. We explore potential heterogeneity in responses of workers to tariff cuts by location and by several worker characteristics: age, gender, and education.

Vietnamese provinces differ in the degree of integration with international markets and this heterogeneity in part reflects proximity to a major seaport. Provinces closer to major seaports are more internationally integrated and more exposed to export opportunities (World Bank, 2011). For example, the information on the value of manufacturing exports from the 2000 Enterprise Survey suggests that 5 provinces with or near to major seaports (Ho Chi Minh City, Dong Nai, Hanoi, Binh Duong, and Hai Phong) account for over three quarters of reported manufacturing exports. To the extent that export opportunities associated with the BTA disproportionately increase labor demand

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<sup>35</sup> The industry codes between the 1993 and 1998 VLSSs do not perfectly match. In particular, 2-digit ISIC revision 3 industries 31 and 32, 34 and 35, and 30 and 33 were merged together since the 1993 VLSS used a more aggregate industry definition in these instances. Additionally, industries 17 and 18 and 20 and 36 have also been merged since the 1998 VLSS appears to have switched assignment of some workers in some of these industries. The low point estimates of the tariff coefficient and the lack of statistical relationship in the bottom panel of Table 4 (relative to top panel of Table 4) do not simply reflect higher level of industry aggregation. When we estimate the specifications in top panel of Table 4 at the same level of industry aggregation as the bottom panel, we continue to obtain positive and statistically significant coefficients on tariffs during the period that spans the BTA (.186 (.014) for traded in column 1, .10 (.040) for all industries in column 2, and .17 (.018) for manufacturing in column 3).

in the larger firms operating in the export sector, as noted in the conceptual framework in Section 2, one would expect a relatively larger increase in labor demand among firms in the enterprise sector in more integrated provinces. Consistent with this view, McCaig (2011) finds that poverty declined and average wages increased relatively more in provinces with a higher concentration of export-oriented industries at the onset of trade reform. The impact of U.S. tariff cuts on the incidence of household business employment would then be expected to be more pronounced in more internationally integrated provinces.

To explore the possible heterogeneity of effects by location, we split Vietnam's provinces into two groups based on the median distance from one of Vietnam's three major seaports in Hai Phong, Da Nang, and Ho Chi Minh City. We estimate equation (1) in each sample. The results are presented in Panel A of Table 5. As expected, declines in U.S. tariffs are associated with larger relative declines in household business employment for individuals living in more internationally integrated provinces. While all estimates of the coefficient on tariffs are positive, the magnitudes of the coefficients are substantially larger and always statistically significant in provinces closer to major seaports. The difference in the magnitudes and statistical significance of the estimated coefficient on tariffs is particularly notable in manufacturing, the sector most exposed to the BTA tariff cuts. This finding is consistent with Hanson (1996).

We also examine heterogeneity in responses to tariff cuts by worker age, gender, and education. This heterogeneity could stem from differences in adjustment costs across workers with different demographic characteristics (see Dix-Carneiro (2014), Coşar (2014)) or it could reflect differential changes in labor demand across worker types. These results are also presented in Table 5. We split workers into five age cohorts, which we follow over time, and estimate equation (1) separately for each of the cohorts. The probability of working in a household business declines more for young workers (age 20 to 29 in 2001/02) in response to the US tariff cuts (column 1) in the traded sector and economy-wide (column 2). The heterogeneity in responses to tariffs by age appears at first less pronounced in manufacturing (column 3). However, the implied share of reallocated young workers is above, while the implied share of reallocated workers in older cohorts is below the predicted share of reallocated workers manufacturing-wide. Gender does not appear to differentially affect the responsiveness of working in a household business to tariff cuts. Estimates of equation (2) by gender in Table 5 suggest that men and women were similarly affected by tariff declines. We also estimate equation (1) separately for three education groups: 0 to 5 years

of formal education, which account for 34 percent of the total sample; workers with 6 to 9 years of formal education, which account for 43 percent of the total sample; and workers with 10 or more years of formal education, which account for 23 percent of the sample. We consistently find that workers with a medium level of education observed smaller declines in the probability of working for a household business than workers with low and workers with high levels of education.

Note that workers that live in internationally more integrated provinces, younger workers, and more educated workers are less likely to work in the household business sector even prior to the BTA. One implication is that the declines in export costs further enlarge the gap in the probability of working in a household business between workers in provinces that differ in access to international seaports and between younger and older workers. The gap in the probability of working in a household business also widens between the middle and the highest education group, but narrows between the low and middle education group.

#### 5.4 Longitudinal analysis

The VHLSS resurveyed about 30 percent of the households from 2002 in 2004.<sup>36</sup> Using this smaller longitudinal subsample, we examine the robustness of the results to selection on unobserved individual-level heterogeneity into moving out of household businesses. We restrict the analysis to individuals age 20-64 in 2001/02 that worked in both years.<sup>37</sup> We estimate a version of equation (1):

$$H_{ijt} = \text{tariff}_{jt}\beta + \lambda_j + \theta_t + \alpha_i + v_{ijt}, \quad (2)$$

where the vector of individual characteristics has been replaced by an individual fixed effect  $\alpha_i$ .

To establish comparability with the results from Section 5.1, we first estimate the specification in equation (1) using the longitudinal subsample. The results are reported in columns 1 to 3 in the top panel of Table 6 and confirm the findings from Table 3. The magnitudes of the coefficients based on the longitudinal sample are somewhat lower than the magnitudes of the corresponding coefficients based on repeated cross-sections, but they are not statistically different

<sup>36</sup> The household panel is based on a random selection of enumeration areas from the 2002 VHLSS.

<sup>37</sup> In order to be part of the household panel, the household, or at least some of its members, must reside in the same location as in 2001/02. 9.7 percent of individuals in panel households that report working in 2001/02 are not in the sample in 2003/04. The attrited individuals are more likely young and better educated, and were more likely initially employed in the enterprise sector, in industries that received larger tariff cuts, and by an enterprise in industries that received larger tariff cuts. The attrition might thus bias the coefficient on tariff in the panel estimation downward toward zero, increasing the likelihood of finding no relationship.

from each other.<sup>38</sup> The specifications so far use the tariff in a worker's contemporaneous industry at time  $t$  as a measure of exposure to industry export costs. In longitudinal data, workers' exposure to export costs can also be measured based on the workers' initial industry of employment, further allowing one to control for sorting of individuals across industries. The middle panel of Table 6 reports estimates of equation (2) based on the tariffs in the worker's initial industry of employment. The magnitudes of the coefficient on tariffs are similar to those obtained in the top panel of Table 6 with the contemporaneous industry tariff. In the remainder of this section, we measure workers' exposure to export cost shock through the initial industry of employment.

The empirical strategy so far compared effects of tariff declines on workers with the same observable characteristics within provincial labor markets, some of whom worked in industries that experienced large tariff cuts and others who worked in industries with smaller tariff cuts. Note that to the extent that workers might select to work in the enterprise sector because of higher expected earnings in this sector based on observable characteristics such as education, gender, age, minority status included in specification in equation (1), we already account for selection through inclusion of direct controls for such observable worker characteristics. In addition, any form of selection is only a concern to the extent that it is industry-specific and spuriously correlated with BTA-induced industry-specific tariff changes. The specification in equation (2) includes worker fixed effects, directly controlling for time-invariant individual-level heterogeneity in unobserved worker characteristics that might influence selection of workers into industries and the propensity to switch employers. The estimates from this specification are reported in columns 1-3 in the bottom panel of Table 6 and confirm the existing findings. Individuals initially working in industries that experience larger tariff cuts face greater declines in the probability of working for a household business than observationally equivalent individuals initially working in industries with lower tariff cuts. The inclusion of individual fixed effects somewhat reduces the estimate of the coefficient on tariffs. For example, the magnitude of the coefficient on tariffs for traded sectors falls from .14 to .11, implying that a 21.1 percentage point decline in tariffs was associated with 2.3 percentage point decline in the probability of household business employment. In manufacturing, the

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<sup>38</sup> Lower magnitudes of the coefficients based on longitudinal subsample could reflect attrition and slight differences in the composition of the longitudinal and cross-sectional samples. As discussed earlier, attrition could potentially bias our estimates downward. Second, to track the same individuals over time, the longitudinal sample includes individuals based on initial age (ages 20-64 in 2002), not contemporary age and excludes individuals that enter or exit the workforce because we only have one observation for their work status.

coefficient on tariffs drops from .18 to .09, so that a 30.3 percentage point decline in tariffs is associated with a 2.6 percentage point decline in the probability of working for a household business. Overall, greater declines in exporting costs are associated with greater reallocation of workers from household businesses to employers in the enterprise sector, although the magnitudes of the effects are attenuated in manufacturing.

### 5.5. Implications for Industry Employment

The analysis so far has examined allocation of workers between employers in the household business and enterprise sector, conditioning on the industry of employment. A natural follow up question is whether industry-specific tariff declines affect the structure of industry employment within the enterprise sector and overall. We first focus on industry structure within the registered enterprise sector by estimating the following specification:

$$s_{jt} = \text{tariff}_{jt} \beta + \lambda_j + \theta_t + \varepsilon_{jt} \quad (3)$$

where  $s_{jt}$  is the share of industry  $j$  at time  $t$  in total employment of the enterprise sector and all other notation follows previously introduced notation. We estimate equation (3) with industry employment shares obtained from the Enterprise Survey, which covers all firms in the enterprise sector.<sup>39</sup> The results are presented in Panel A of Table 7. The negative estimates of the coefficients on tariffs suggest greater expansion in employment in industries with larger tariff cuts. The coefficient estimate for the traded sector in column 1 implies that an industry that experienced a 21.1 percentage point decline in U.S. tariffs observed a 0.54 percentage point increase in its share of employment in the enterprise sector, which represents an annual average increase of 6 percent relative to the mean industry employment share.<sup>40</sup> Thus, the structure of industry employment in the enterprise sector shifts toward industries subject to greater drops in U.S. tariffs on exports.

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<sup>39</sup> To match the timeframe of this data closely to the VHLSS, we use end of year firm-level employment in 2000 and 2003. We aggregate firm-level information to compute employment shares at the industry level.

<sup>40</sup> The enterprise sector could either grow because workers are leaving household businesses for employers in the enterprise sector or because existing household businesses are formalizing and registering as private enterprises. Additional evidence suggests that the majority of workers move to the enterprise sector by finding a new job/employer in the enterprise sector. First, summary statistics suggests little mobility of household businesses to the enterprise sector. During this period, the number of registered private enterprises increased significantly, from about 35,000 in 2000 to about 84,000 in 2004 (Malesky and Taussig, 2009). Although this is an impressive growth in the number of private enterprises, it is only a small fraction of the estimated 6 to 7 million operating household businesses during this period (McCaig and Pavcnik, 2013). Second, our panel dataset of workers allows us to track movements of workers that would be consistent with a household business becoming a private enterprise. We can do this for workers that worked for another household's business in 2002. By 2004, 10.6 percent of these workers had moved to the enterprise sector and about 29.5 percent of these movers had moved to a private enterprise in



Neoclassical trade models suggest that international trade will induce workers to move toward industries that experienced greater declines in export costs. Interestingly, the magnitude of the coefficients on tariffs is virtually zero and always statistically insignificant when we consider changes in the overall industry structure of employment. These results, based on estimating equation (3) with an industry's employment share in total employment (i.e. employment in household businesses and enterprises), are presented in Panel B of Table 7. These findings are consistent with the lack of significant changes in the structure of industry employment in the short run aftermath of large trade liberalizations (Harrison and Hanson (1999), Goldberg and Pavcnik (2007), Topalova (2007, 2010), Wacziarg and Wallack (2004)). Moreover, the tariff coefficients in Panel B for overall industry employment are at least an order of magnitude lower than the coefficients obtained for the enterprise sector in Panel A. While this could in part owe to smaller sample sizes of the VHLSS than the Enterprise survey, expansion of net industry employment could be more responsive to tariff cuts among the employers in the enterprise sector, which more directly benefit from lower trade frictions (Bernard, Redding, and Schott (2007)).<sup>41</sup> More generally, our analysis, which includes data on employers in both sectors, highlights that this expansion of the employment in the formal enterprise sector occurs through the reallocation of workers previously employed in household businesses.

## 5.6. Worker Allocation and Aggregate Productivity in Manufacturing

The reallocation of workers from household businesses to employers in the enterprise sector has potential implications for aggregate output. We follow the macroeconomic growth accounting literature to assess the potential impact of the BTA through this reallocation channel on aggregate labor productivity in manufacturing.

Consider a sector composed of two types of firms, household businesses and enterprises, which differ in their underlying labor productivity. A standard accounting formula evaluates the potential contribution of reallocation to aggregate productivity stemming from the reallocation of labor across the two firm types as  $\Delta P = s_e^{BTA} \Delta p_e^{BTA}$ , where  $s_e^{BTA}$  is the share of manufacturing workers reallocated from the household business to the enterprise sector due to the BTA and  $\Delta p_e^{BTA}$  is the

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the same industry, which might be more consistent with the business they worked for transitioning from a household business to a private enterprise. Consistent with this view, existing studies suggest little job creations in micro enterprises that formalize (see del Mel, McKenzie, and Woodruff (2013a, 2013b)).

<sup>41</sup> For example, products produced by firms in the household business sector might be poor substitutes for the products of firms in the enterprise sector.

change in labor productivity for these workers as they reallocate. The details about labor productivity data and calculations are in Appendix B.

Here, we only highlight information about key ingredients. First, the coefficient on the industry tariff in column 3 of Table 3 implies that the BTA reallocated 5.2 percent of the manufacturing workforce from household businesses to enterprises by 2003/04. We use two approaches to measure the change in labor productivity,  $\Delta p_e^{BTA}$ , for reallocated workers. We first compute average labor productivity of labor based on revenue per worker from firm-level data for the enterprise sector and based on total revenue and the total number of workers in the household business sector. This is a common practice in the macroeconomic growth literature that assumes the same Cobb-Douglas production function across the two sectors – so that the gap in the marginal product of labor across the two types of establishments is proportional to the gap in the observed average product of labor across the two type of establishments (see for example Caselli (2005), Gollin, Lagakos, Waugh (2012)). Such a calculation suggests that within manufacturing, the average labor productivity in the enterprise sector is about 10 times higher than in the household business sector. In this case  $\Delta p_e^{BTA}$  is the difference in average labor productivity between the two sectors. In addition to the standard approach in the macro development literature, we also use an estimate of marginal productivity of labor based on labor earnings and the coefficient on an indicator for working for a household business from the Mincerian regression of log hourly wages. This approach suggests that workers working for a household business earn about 14 percent less than observationally equivalent workers working in the same industry, province, and occupation.<sup>42</sup> This estimate is the lower bound on the earnings gap because individuals working for household businesses do not receive social insurance contributions from their employer.

Two findings emerge. First, regardless of how we compute labor productivity, productivity is higher in the enterprise sector than in the household business sector, suggesting that reallocation of workers toward the enterprise sector would be productivity-enhancing. Higher labor productivity

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<sup>42</sup> This number reflects the estimated coefficient on the indicator for working for a household business in a Mincerian regression that regresses log wages on a household business indicator, worker characteristics (age, age squared, gender, educational indicators, ethnic minority status, urban residence indicator), and industry, occupation, province, and year fixed effects. Many self-employed individuals do not report wage earnings. To address this, we also estimate Mincerian regression only for a household head and with log income per capita (and also log expenditure per capita) as a dependent variable and obtain a coefficient of similar magnitude on the household business indicator.

among the employers in the enterprise sector is consistent with Hsieh and Olken (2014). Second, the aggregate manufacturing productivity gain implied by the BTA-induced reallocation is sizable, but the exact magnitude depends on the method to compute labor productivity. The most conservative approach to measuring labor productivity of the marginal worker implies an annual manufacturing productivity increase owing to reallocation of 0.1 to 0.9 percent. The estimates based on the common macro-development approach imply an annual gain of 5.5 percent.

## **6. Conclusion**

Vietnam's trade agreement with the U.S. provides an excellent setting to examine how declines in export costs affect the reallocation of employment across employers in a low-income country, where a majority of workers are employed in household businesses. We find that the reallocation of labor from household businesses to employers in the enterprise sector in Vietnam provides an important margin of adjustment to new exporting opportunities. Industries with bigger declines in export costs observe a greater reduction in household business employment, with workers in more internationally integrated provinces and in younger cohorts responding more strongly. Our results complement the existing literature on trade and labor reallocations among formal firms based on conventional firm-level or matched employee-employer data sets covering the manufacturing sector. Such data would cover 34 % of the manufacturing workforce in Vietnam (and 20% in India).

Our results also relate to the literature that emphasizes the implications of the inefficient allocation of resources across heterogeneous firms for aggregate productivity (see, for example, Hsieh and Klenow (2009), Hsieh and Olken (2014)). Our study shows that a large reduction in export distortions – a product market distortion which is expected to disproportionately harm the profitability of more productive firms – induces a movement of labor away from less-productive employers in the household businesses sector toward the more productive enterprise sector, leading to sizable implied increases in aggregate productivity in low-income countries.

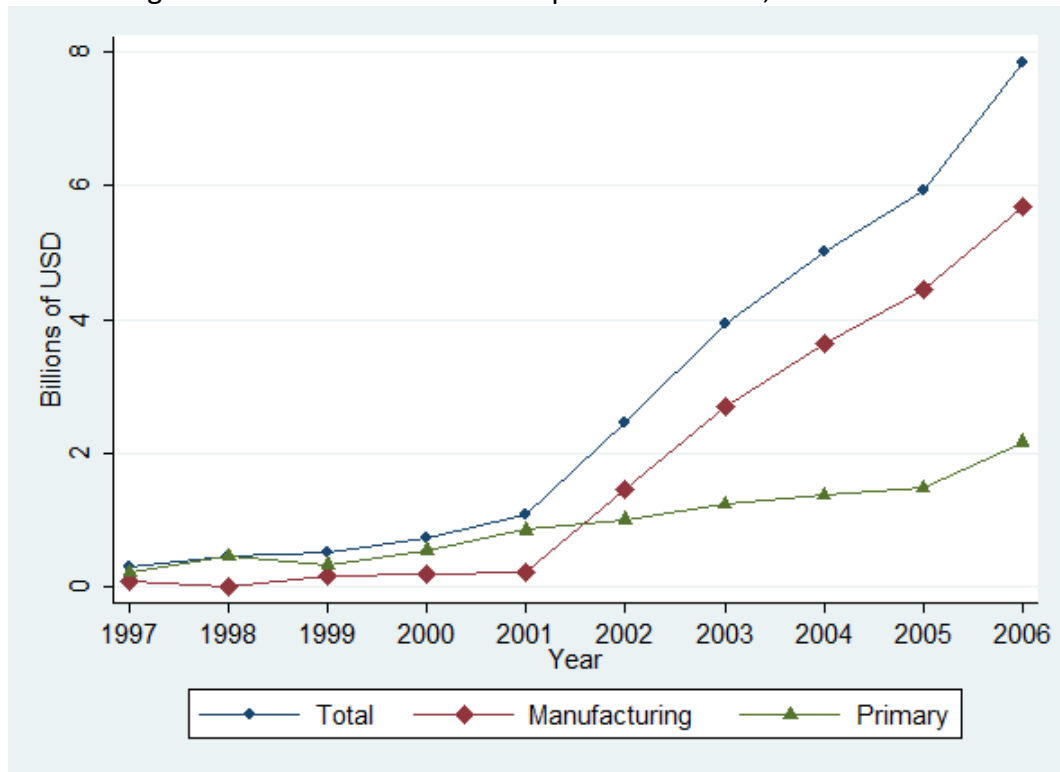
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Figure 1: Value of Vietnamese exports to the U.S., 1997 to 2006



Notes: Authors' calculations from COMTRADE.

Figure 2: Share of the United States in Vietnam's Exports

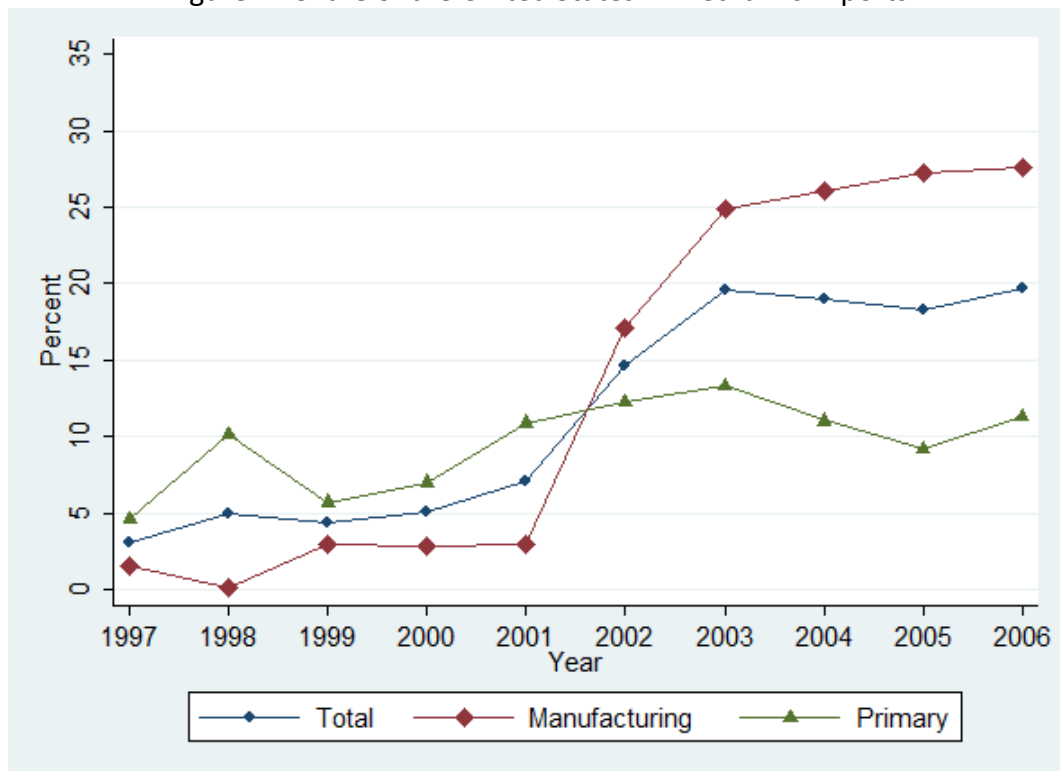
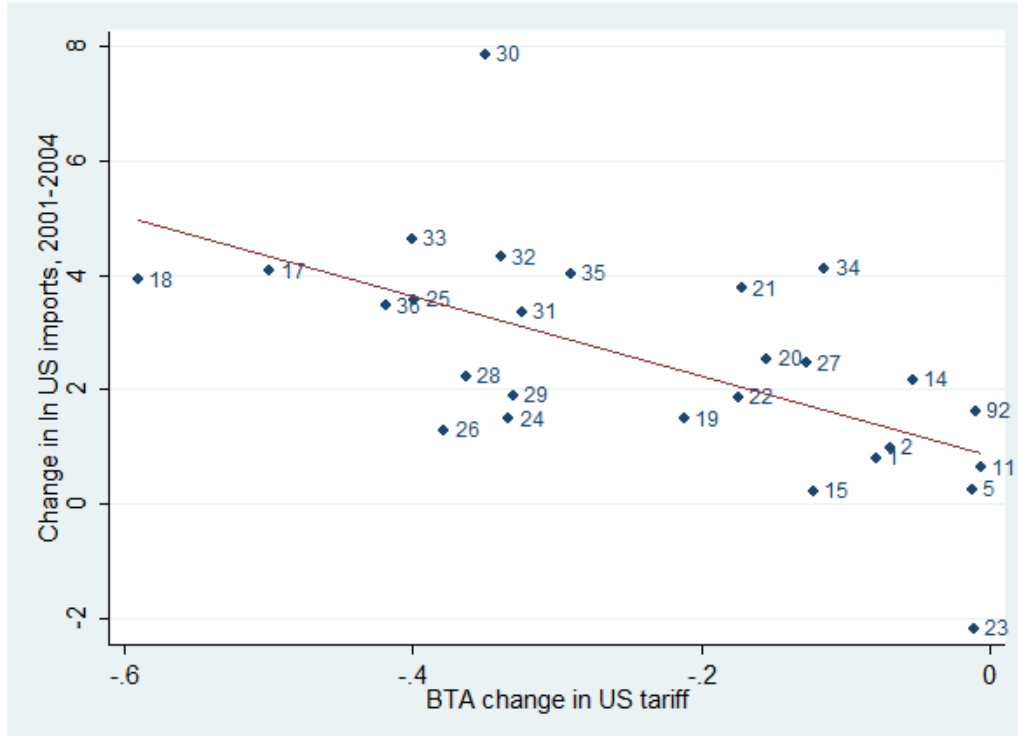
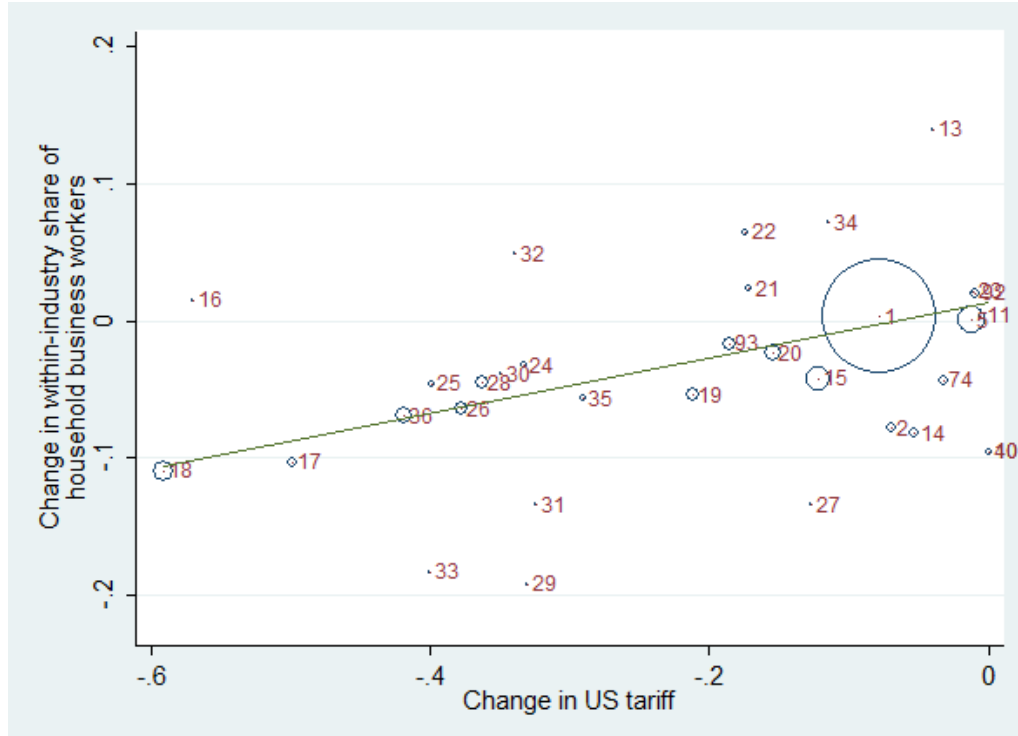


Figure 3: Growth of Vietnamese exports to the US versus US tariff cuts by industry



Notes: The industry codes correspond to ISIC revision 3.

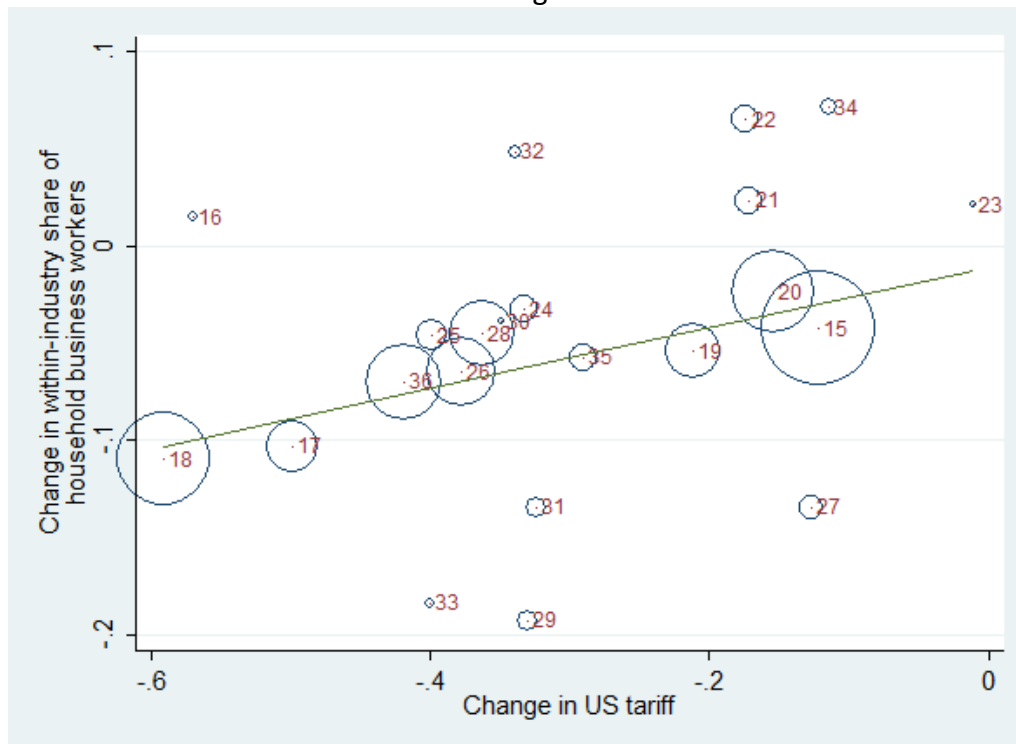
Figure 4: Change in share of household business workers and U.S. tariff reductions



Notes: The bubble sizes represent the weight given to the industry in the plotted regression line. See text for explanation. The industry codes correspond to all traded industries in ISIC revision 3.



Figure 5: Change in share of household business workers and U.S. tariff reductions, manufacturing industries



Notes: The bubble sizes represent the weight given to the industry in the plotted regression line. See text for explanation. The industry codes correspond to ISIC revision 3.

Table 1: Summary of U.S. tariffs applied to imports from Vietnam

Industry	Number of industries	Mean pre-BTA tariff (Column 2)	Mean post-BTA tariff (MFN)	Mean change in tariff	Standard deviation of tariff change
Traded industries	34	0.234	0.024	-0.211	0.179
All industries	60	0.133	0.013	-0.119	0.170
Manufacturing	22	0.338	0.034	-0.303	0.153

Notes: The tariffs reported are simple averages across the indicated set of industries. Non-traded industries, which are included in "All industries" have been assigned a tariff of 0 both before and after the BTA.

Table 2: Share of employment in household businesses

	All	Excluding agriculture and fisheries	Manufacturing
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**Panel A: Share of employment in household businesses**

2002	0.847	0.672	0.657
2004	0.814	0.626	0.601

**Panel B: Decomposing changes in household business employment**

Within industries	-0.017	-0.040	-0.059
Between industries	-0.016	-0.006	0.003
Total	-0.033	-0.046	-0.056

Notes: Authors' own estimates based on the 2002 and 2004 VHLSSs. Based on workers aged 20 to 64 inclusive. Survey sampling weights included.

Table 3: Employment in Household Businesses and Tariffs

	(1) Traded	(2) All	(3) Manufacturing
Tariff	0.210*** (0.0140)	0.125*** (0.0341)	0.164*** (0.0204)
Number of industries	34	60	22
Observations	176,546	248,793	27,072
R-squared	0.415	0.591	0.293

Notes: Standard errors are clustered at industry level; \*\*\*, \*\*, and \* denotes significance at 1, 5, and 10 percent level, respectively. The sample is restricted to workers between the ages of 20 and 64 inclusive at the time of the survey. Column (1) includes all traded industries, column (2) includes all industries, and column (3) includes all traded manufacturing industries. All regressions include worker characteristics (age, age squared, education level indicators, female indicator, ethnic minority indicator, and rural indicator), as well as industry, province and year fixed effects.

Table 4: Falsification test of the relation between tariffs and self-employment

	(1) Traded	(2) All	(3) Manufacturing
Reform Period			
Tariff	0.212*** (0.0409)	0.127*** (0.0396)	0.201*** (0.0510)
Pre-reform Period (1993-1998)			
Tariff	0.0360 (0.0337)	0.0142 (0.0350)	-0.00480 (0.102)

Notes: Standard errors are clustered at industry level; \*\*\*, \*\*, and \* denotes significance at 1, 5, and 10 percent level, respectively. The dependent variable is an indicator for whether an individual is self-employed. In the lower panel, the pre-BTA tariffs (Column 2 rates in 2001) are assigned to industries in 1993 and the post-BTA tariff (MFN rates in 2004) are assigned to industries in 1998. All regressions include worker characteristics (age, age squared, education level indicators, female indicator, ethnic minority indicator, and rural indicator), as well as industry, province and year fixed effects.

Table 5: Employment in Household Business and Tariffs by Age, Gender, Education, and Location

Sample of workers	(1) Traded	(2) All	(3) Manufacturing
<b>Panel A: Location</b>			
Less than the median distance from a major seaport	0.227*** (0.0215)	0.140*** (0.0340)	0.191*** (0.0273)
At least the median distance from a major seaport	0.149*** (0.0335)	0.0670* (0.0381)	0.0609 (0.0446)
<b>Panel B: Age</b>			
Age 20 to 29 in 2002	0.328*** (0.0508)	0.220*** (0.0425)	0.178*** (0.0621)
Age 30 to 39 in 2002	0.139*** (0.0196)	0.0780*** (0.0291)	0.0852*** (0.0224)
Age 40 to 49 in 2002	0.125*** (0.0295)	0.0385 (0.0414)	0.148*** (0.0384)
Age 50 to 59 in 2002	0.113* (0.0648)	0.0381 (0.0635)	0.165* (0.0867)
Age 60 to 64 in 2002	-0.0211 (0.109)	-0.0694 (0.0855)	-0.136 (0.180)
<b>Panel C: Gender</b>			
Males	0.230*** (0.0387)	0.101* (0.0528)	0.164** (0.0603)
Females	0.197*** (0.0178)	0.147*** (0.0219)	0.164*** (0.0340)
<b>Panel D: Education</b>			
5 or fewer years of education	0.269*** (0.0365)	0.177*** (0.0462)	0.192*** (0.0407)
6 to 9 years of education	0.177*** (0.0177)	0.106** (0.0402)	0.145*** (0.0307)
10 or more years of education	0.212*** (0.0353)	0.123*** (0.0364)	0.189*** (0.0574)

Notes: Standard errors are clustered at industry level; \*\*\*, \*\*, and \* denotes significance at 1, 5, and 10 percent level, respectively. The table shows the estimated coefficient on industry tariffs from regressing an indicator for working in a household business for the indicate sample. All regressions include the usual controls for worker characteristics, and province, industry, and year fixed effects as in Table 5.

Table 6: Household business employment and tariffs, panel-level analysis

	Coefficient on industry tariff		
	Traded	All	Manufacturing
Tariff based on contemporary industry	0.152*** (0.0256)	0.0748** (0.0319)	0.164*** (0.0552)
Tariff based on initial industry	0.144*** (0.0196)	0.0633** (0.0294)	0.180*** (0.0493)
Tariff based on initial industry, with individual fixed effects	0.111*** (0.0301)	0.0440* (0.0240)	0.0867** (0.0418)

Notes: Standard errors are clustered at industry level; \*\*\*, \*\*, and \* denotes significance at 1, 5, and 10 percent level, respectively. The sample is based on workers age 20 to 64 as of the 2002 VHLSS that reported working in the 2002 and 2004 VHLSSs. The groupings into traded, all, and manufacturing are based on the initial industry of employment reported in the 2002 VHLSS. All regressions that do not include individual fixed effects include individual covariates (age, age squared, education levels, gender, ethnic minority status, urban indicator, and province fixed effects). All regressions include industry and year fixed effects.

Table 7: Industry Employment and Tariffs

Dependent variable: Share of industry employment in the indicated set of industries

	(1) Traded	(2) All	(3) Manufacturing
<b>Panel A: Enterprise Sector (Enterprise Survey Data)</b>			
Tariff	-0.0254** (0.0114)	-0.0105* (0.00540)	-0.0235 (0.0174)
Observations	66	110	44
R-squared	0.986	0.992	0.993
<b>Panel B: Overall Employment (VHLSS Data)</b>			
Tariff	-0.00445 (0.00557)	-0.000137 (0.00256)	0.00410 (0.0336)
Observations	68	120	44
R-squared	1.000	0.998	0.984

Notes: Standard errors are clustered at industry level; \*\*\*, \*\*, and \* denotes significance at 1, 5, and 10 percent level, respectively. The dependent variable is the share of workers and is calculated as the number of workers in industry j divided by the total number of workers in the respective group. The total number of workers includes workers in (i) traded industries for column (1), (ii) all industries for column (2), and (iii) traded manufacturing industries for column (3). The dependent variable is the share of workers in an industry and is calculated as the number of workers in industry j divided by the total number of workers in the respective grouping. The industry employment shares are based on workers between the ages of 20 and 64 inclusive. All regressions include industry and year fixed effects.

## Appendix A: Appendix Tables

Appendix Table A.1: Growth of Vietnamese exports and BTA tariff changes

	(1)	(2)	(3)	(4)
Industries	Traded	Manufacturing	Traded	Manufacturing
Destination market	US	US	EU13	EU13

### Panel A: Change in ln exports 2001 to 2004

BTA tariff change	-5.595*** (1.446)	-4.237* (2.059)	0.375 (0.658)	0.153 (1.040)
Observations	24	19	24	19
R-squared	0.279	0.116	0.009	0.001

### Panel B: Change in ln exports 1997 to 2000

BTA tariff change	-0.796 (1.880)	0.187 (1.705)	0.388 (0.594)	0.861 (0.883)
Observations	24	19	24	19
R-squared	0.011	0.001	0.013	0.039

Notes: Robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. We use data on imports from Vietnam as reported by the U.S. and EU13 (EU15 excluding Belgium and Luxembourg for which data was not consistently available) in UNComtrade. We exclude industries for which imports were 0 for any of the years.

Appendix Table A.2: Descriptive statistics

Variable	All		Pre BTA Round		Post BTA Round	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Self-employed	0.686	0.464	0.701	0.458	0.672	0.469
Worked in a household business	0.830	0.375	0.847	0.360	0.814	0.389
Work in a household business or without benefits in a larger firm	0.850	0.357	0.862	0.345	0.838	0.368
Indicator for urban	0.239	0.427	0.240	0.427	0.238	0.426
Age	37.8	11.1	37.4	11.0	38.3	11.1
Indicator for female	0.505	0.500	0.507	0.500	0.503	0.500
Indicator for ethnic minority	0.123	0.328	0.121	0.326	0.124	0.329
Indicator for primary education	0.264	0.441	0.275	0.447	0.252	0.434
Indicator for lower secondary education	0.438	0.496	0.437	0.496	0.439	0.496
Indicator for upper secondary education	0.247	0.432	0.233	0.423	0.261	0.439
Indicator for agriculture, forestry and aquaculture	0.542	0.498	0.561	0.496	0.524	0.499
Indicator for manufacturing	0.123	0.329	0.118	0.322	0.128	0.334
Indicator for services	0.327	0.469	0.313	0.464	0.341	0.474
Indicator for state sector	0.118	0.322	0.115	0.319	0.120	0.325
Indicator for foreign sector	0.013	0.111	0.010	0.097	0.016	0.124
ln(hourly compensation)	1.368	0.726	1.234	0.791	1.494	0.634
Number of observations	248795		152388		96407	

Notes: The sample consists of all workers from the 2002 and 2004 VHLSS that worked and were 20 to 64 years of age inclusive at the time of the survey. The number of observations for wages is lower: 46,309 and 29,758 in pre-BTA and post-BTA survey round respectively.

## Appendix B: Supplemental Material for Section 5.6

This appendix describes calculations and data used to predict the aggregate manufacturing productivity change associated with the reallocation of labor from household businesses to enterprises in response to the BTA. We explain how we predict the share of workers reallocated from household businesses to enterprises, how we calculate labor productivity in both types of employers, and how we predict the associated aggregate productivity change.

### 1. The predicted reallocation of workers to enterprises

We estimate the share of manufacturing workers reallocated from household businesses to enterprises based on the estimated coefficient from column 3 of Table 3 (0.164) using

$$s_e^{BTA} = \sum_j -0.164 \Delta \tau_j s_j, \text{ where } \Delta \tau_j \text{ is the change in tariff for industry } j \text{ and } s_j \text{ is industry } j\text{'s share of}$$

employment in total manufacturing employment averaged over the 2002 and 2004 VHLSSs.

### 2. Average labor productivity in household business and enterprise sector

We use two approaches to measure labor productivities in the household business and registered enterprise sectors. We first compute average labor productivity of labor based on revenue per worker from firm-level data for the enterprise sector and based on total revenue and the total number of workers in the household business sector. This is a common practice in the macroeconomic growth literature that assumes the same Cobb-Douglas production function across the two sectors – so that the gap in marginal product of labor across the two types of establishments is proportional to the gap in observed average product of labor across the two type of establishments (see for example Caselli (2005), Gollin, Lagakos, Waugh (2012)).

We calculate average revenue per worker in the household business sector by calculating the sum of revenue from all household businesses and divide by the estimated number of workers in household businesses for their primary job based on data from the business and labor modules of the 2002 VHLSS, which has a 12-month recall.<sup>43, 44</sup> This estimate of revenue per worker is likely an overestimate of the true value in the household business sector, thus attenuating predicted productivity gains from reallocation.<sup>45</sup> In the enterprise sector, we calculate revenue per worker within each enterprise based on total annual revenue divided by total employment at year-end using the 2001 enterprise data. Aggregate revenue per worker within the enterprise sector is the employment-weighted sum of revenue per worker over all enterprises. Such a calculation suggests that within manufacturing, the average labor productivity in the enterprise sector,  $p_e$ , is about 10

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<sup>43</sup> All revenue values are expressed in January 2004 Dong. For the VHLSS data, household business revenue is converted to January 2004 prices using monthly CPI data based on the month of interview. For the enterprise data we convert from mid-year (i.e., July 2001) to January 2004 using monthly CPI.

<sup>44</sup> Both estimates are weighted using survey sampling weights.

<sup>45</sup> First, our estimate of aggregate revenue from household businesses includes some private enterprises because the household business module of the 2002 VHLSS covers *all* businesses operated by the household and does not allow us to distinguish from household businesses private enterprises. This is likely a very minor problem. Second, some workers are involved in household businesses as a non-primary job. However, 2002 VHLSSs did not collect information on workers engaged in household businesses for non-primary jobs.



times higher than productivity in the household business sector  $p_{hb}$  (185 million dong vs. 18.9 million dong per employee).<sup>46</sup>

In addition to the standard approach in the macro development literature, we also use an estimate of marginal productivity of labor based on labor earnings and the coefficient on an indicator for working for a household business from the Mincerian regression of log hourly wages using information from the labor module of the VHLSS. This approach suggests that workers working for a household business earn about 14 percent less than observationally equivalent workers working in the same industry, province, and occupation. See section 5.6 for details.

### 3. Associated productivity gains

We present three estimates of the productivity gains from BTA workers reallocation from the household business sector to the enterprise sector within manufacturing.

The first estimate uses the standard macro accounting approach and is based on assuming marginal productivity is equal to average productivity in respective firm types. The change in productivity implied by BTA reallocation is  $\Delta P_1 = s_e^{BTA} (p_e - p_{hb})$ , where  $s_e^{BTA}$  is the share of workers that reallocate to enterprises,  $p_e$  is average labor productivity the enterprises, and  $p_{hb}$  is average labor productivity in the household businesses. This approach predicts a 5.5 percent annual productivity gain relative to 2001 base.

The second estimate is based on assuming that marginal productivity equals average productivity in the household business sector and that the marginal productivity of a worker that leaves the household business sector for the enterprise sector increases by 14 percent relative to their productivity in the household business sector (based on the coefficient on a household business indicator in Mincerian wage regressions described in section 5.6). Under these assumptions the implied productivity gain is  $\Delta P_2 = s_e^{BTA} (1.14 p_{hb} - p_{hb}) = s_e^{BTA} (0.14 p_{hb})$ . This approach predicts a 0.1 percent annual productivity gain.

The third estimate is based on assuming that marginal productivity equals average productivity in the enterprise sector and that the marginal productivity of a worker that leaves the household business sector for the enterprise sector is 14 percent lower than the average productivity in the enterprise sector. Under these assumptions the implied productivity gain is  $\Delta P_3 = s_e^{BTA} (p_e - 1/1.14 p_e) = s_e^{BTA} (.123 p_e)$ . This approach predicts a 0.9 percent annual productivity gain.

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<sup>46</sup> The large productivity differences within the manufacturing sector between enterprises and household businesses based on this approach may in part be due to compositional differences in the manufacturing industries in which household businesses and enterprises are more likely to operate. However, a calculation performed just for one important manufacturing industry, apparel, suggests similar effects. Initial productivity is on average about five times greater in apparel enterprises than apparel household businesses, with a BTA induced reallocation productivity gain of 8% per year.