Poverty, labour markets and trade liberalization in Indonesia

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Abstract

We measure the effects of trade liberalization over the period of 1993-2002 on regional poverty levels in 259 Indonesian regions, and investigate the labour market mechanisms behind these effects. The identification strategy relies on combining information on initial regional labour and product market structure with the exogenous tariff reduction schedule over four three-year periods. We add to the literature on local labour market effects of trade policies by distinguishing between tariffs for output markets and for intermediate inputs, and finding that poverty reduced especially in regions with a greater sector exposure to input tariff liberalization. Among the potential channels behind this effect, we show that work participation and increases in middle-skilled wages were more responsive to reductions in import tariffs on intermediate goods than to reductions in import tariffs on final outputs. These results point towards increasing firm competitiveness as a driving factor behind the beneficial poverty effects.

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Keywords: Trade liberalization; poverty; input tariffs; labour markets; Indonesia

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1. Introduction

Trade liberalization has been widely expected to contribute substantially to poverty reduction in developing countries (e.g., the Doha Ministerial Declaration, WTO 2001). Under a more open trade regime, rising demand for unskilled labour could benefit poor workers by increasing workers' real wages (Stolper and Samuelson 1941) as well as creating more jobs in the formal economy. However, the growing body of micro-empirical evidence on the welfare implications of trade liberalization is not unequivocal.[1] Short- to medium-run labour market effects of liberalized trade seem to be very much context specific and depend, among other things, on the previous structure of protection (Attanasio et al. 2004), regional market access (Chiquiar 2008) as well as the degree of market flexibility. For example, overregulated local labour markets that inhibited the adjustment to structural change could explain the unfavourable regional poverty effects of trade reform in India (Topalova 2010).[2] By contrast, bilateral trade liberalization between the US and Vietnam led to clear reductions in Vietnamese rural poverty, potentially also due to higher labour market mobility (McCaig 2011). In this latter case, poverty reduction resulted from large improvements in the access to the US market whereas the loss of import protection to local markets was negligible.

Studies focusing on labour market and wage effects of tariff reductions present indirect evidence on potential effects of trade liberalization on poverty, again with mixed results. Reductions in protection and increased foreign competition generally seem to have increased skill premia in Latin America (e.g., Attanasio et al. 2004, Galiani and Sanguinetti 2003, Goldberg and Pavcnik 2005), although with some exceptions (e.g., Gonzaga et al. 2006 for Brazil). While most of these studies focus on formal manufacturing employment, Goldberg and Pavcnik (2003) also document an increase in informality in the sectors most exposed to tariff cuts in Colombia, although not in Brazil. These empirical findings of increases in skill premia and informality in Latin America suggest that it is less likely that trade would have had strongly favourable poverty effects in the region. However, contrasting evidence is presented by Porto (2006) who finds pro-poor distributional effects of Mercosur in Argentina through price changes and wage responses.

Indonesia offers an interesting case to study the poverty effects of trade liberalization. It is considerably more abundant in unskilled labour than large Latin American countries such as Mexico or Brazil and hence has a more pronounced comparative advantage in unskilled-labour intensive goods. In the period that we will study in this paper, Indonesia also had relatively flexible labour

[1] See e.g., Goldberg and Pavcnik (2007) and Winters et al. (2004) for surveys of the earlier literature.
[2] In a similar vein, tariff reductions in Brazil were associated with increases in urban poverty, which anecdotal evidence attributes to adjustment frictions and rising urban unemployment (Castilho et al. 2012).

markets that could potentially restrict the adverse effects of trade reforms on poverty. Moreover, its vast geographic and economic diversity yields potentially large regional variation in the effects of trade liberalization.

With the completion of the Uruguay round in 1994, Indonesia committed itself to substantially lower its remaining tariff barriers across all tradable goods over the following ten years. The tariff reductions were concentrated in the hitherto most protected sectors and resulted in an overall convergence of sectoral protection levels; average import tariff lines decreased from around 17.2 percent in 1993 to 6.6 percent in 2002 (see Figure 1). During the same period, poverty rates also declined, although it is a priori unclear to what extent this decrease can be attributed to trade liberalization.

The existing empirical evidence suggests that trade liberalization could potentially explain a part of the reductions in Indonesian poverty during the nineties. Amiti and Cameron (2012) show that industrial skill premia (defined as the relative wage bill of nonproduction to production workers in manufacturing establishments with at least twenty employees) decreased as a response to tariff reductions. By distinguishing between tariffs on output and intermediate goods used by those firms they are also able to show that skill premia changed mostly because of improved firm competitiveness due to reductions in tariffs on intermediate goods. As a consequence, we would therefore also expect differential effects of tariff reduction through input and output markets on poverty.

Kis-Katos and Sparrow (2011) document that child labour decreased faster in regions that were relatively more exposed to trade liberalization, with indirect evidence that this was driven by positive income effects for the poor. Descriptive evidence also shows the presence of ongoing structural change and reductions in wage inequality (Suryahadi 2003) as well as improvements in labour conditions (Robertson et al. 2009) over the same time period. However, this evidence, although suggestive, does not directly address the poverty effects of trade liberalization and the relative importance of the different channels for poverty reduction.

In this study we assess the causal effects of tariff reductions on poverty in Indonesian districts in the period of 1993 to 2002. Our study extends the literature on the poverty effects of trade liberalization by explicitly distinguishing tariffs for output markets and for intermediate inputs, and analysing the effects of reducing these tariffs in a geographically diverse Southeast-Asian country with large labour mobility. Using district pseudo-panel data, we find that especially reductions in tariffs on intermediate inputs tend to reduce the extent of poverty.

In addition, our analysis focuses on the channels of labour market dynamics, wages, job creation and displacement. With regard to wage effects and job creation, we investigate the regionally differential effects of tariffs on output and intermediate goods using firm level data and labour market surveys. We find that increased competitiveness of firms due to lower import tariffs on intermediate goods is weakly related to increases in manufacturing wages. However, we also find evidence of increased poverty due to reduction in output tariffs, presumably due to costly adjustment to trade. This contributes to the empirical evidence on the effects of trade liberalization on local labour markets, in particular highlighting the differences in the mechanisms of liberalization affecting intermediate and output goods.[3]

The next section describes the context and trends in tariff reductions and poverty and outlines our expectations with respect to the effects of trade liberalization. Section 3 presents the data sources for the pseudo-panel analysis and section 4 outlines the identification strategy. The results follow in section 5, while section 6 investigates possible confounding trends, discusses caveats and potentially remaining sources of bias. Section 7 concludes.

2. Trade liberalization in Indonesia and its expected effects

2.1 Descriptive trends

Indonesia started to liberalize its trade regime from the mid-1980s, involving a first reduction in tariff lines and a slow tariffication of nontariff barriers (Basri and Hill 1996). These reforms were accompanied by reforms of fiscal policy, tax reforms and financial deregulation. The second wave of trade liberalization started in the beginning of the 1990s. By the end of the Uruguay round, Indonesia entered formal multilateral agreements to apply binding tariff ceilings of maximum 40% on 95% of its products (up from 9% of binding tariff ceilings before) (WTO 1998).

Figure 1 shows the reduction in average unweighted effectively applied tariff lines across the 1990s: on average, tariff lines reduced from 17.2% in 1993 to 6.6% in 2002. The tariff reductions were not gradual but occurred more or less in two steps over the analysed time period: the first large reduction of tariff barriers came about with Indonesia's WTO obligations preceding the formation of the WTO, while a second substantial wave of tariff reductions followed in the post monetary crisis period as part of the IMF conditionality package, starting with 1999. **T**able 1 shows the detailed

[3] Goldberg and Pavcnik (2003) assess the effects of trade liberalization on the informal sector in Brazil and Colombia. Autor, Dorn and Hanson (2013) look at job displacement in the US due to imports from China, while Iacovone, Rauch and Winters (2013) find displacement effects in Mexico as a result of increased competition from China for its exports on US markets.

evolution of the tariffs for the 20 major tradable sectors, which are defined according to a concordance of tariff information and census labour market data. Figure 2 plots the average reductions in tariffs for these sectors over the entire time period. The high correlation between initial tariff levels and tariff reductions shows that tariff reductions occurred across the board and were the highest in those industries that started with the highest original tariff levels. Moreover, the pattern of tariff reductions across sectors shows that highly protected sectors were not favoured by means of delaying exposure to tariff reductions.[4] Due to the firm-specific nature of favouritism and protection in 1990s Indonesia, there were no substantial exemptions from tariff cuts across sectors (Basri and Hill 1996). In particular, some manufacturing sectors (such as wood, textiles or other manufacturing) with high initial average levels of protection saw average tariff rates reduce to below 10% by 2002.[5]

The period before the economic crisis was also characterised by high labour market flexibility and a highly elastic supply of unskilled labour (Manning 2000). The early 1990s saw a continued shift from agricultural towards urban employment, an expanding service sector and the growth of an export-oriented economy. These structural changes were accompanied by steadily decreasing poverty rates. Suryahadi, Suryadarma and Sumarto (2009) argue that the growth in urban services was a powerful driving force behind these poverty reductions. Increases in inequality during this period suggest, however, that the beneficial effects of the reforms were not concentrated on the very poor (Miranti 2010). At the same time, labour regulation started to tighten somewhat, with rising minimum wages and extensions of social security coverage.

The 1997/1998 East Asian financial crisis poses a potential challenge to our study as a confounding factor as it overlaps with our second period of analysis (1996-1999), which was also the time period of halting trade liberalization. The crisis had its roots in a monetary contagion leading to a large outflow of foreign capital, currency depreciation, as well as short-term agricultural price hikes. This also led to a sudden increase in expenditure poverty and a temporary restructuring of the labour force towards subsistence production in agriculture. The crisis' impacts were geographically clustered (Java being most strongly hit), but did not differ considerably between rural and urban regions or by the initial levels of poverty (Wetterberg, Sumarto and Pritchett 2001). The extent of expenditure poverty peaked around November of 1998 and declined sharply afterwards, with a

[4] Figure 5 in the supplemental appendix plots the per-period information presented in Table 1: it shows clearly that in both periods 1993-1996 and 1999-2002 tariff reductions were concentrated in high-tariff sectors and were highly correlated with initial tariff levels.

[5] The food sector is an exception (with an average tariff of 12.6% in 2002), partly because of tariffication and later exemption of alcoholic beverages.

quick recovery in consumption growth (Suryahadi, Sumarto and Pritchett 2003). According to our poverty data, the average regional share of those living below the poverty line decreased from 1993 to 1996 from 30 to 25%, jumped to 33% in 1999 and was again at 20% in 2002. We will investigate the importance of the crisis for our results in section 6.

2.2 Main hypotheses

The primary interest of our study lies in understanding how regional exposure to tariff reductions affected regional levels of poverty in Indonesia, a labour abundant economy. Following the insights of Amiti and Konings (2007) and Amiti and Cameron (2012), we distinguish between tariffs on output products and tariffs on the intermediate inputs used in local production.

The poverty reducing effects of international trade will be primarily transmitted through labour market mechanisms, in terms of increased wages and employment. According to the neoclassical theory of comparative advantage, under full employment and intersectoral labour mobility, reduction in trading costs can be expected to increase specialization in the production of unskilled labour intensive goods. This should lead to relative improvements in the wages of the less skilled population and by that to reductions in poverty.

However, labour market adjustments to trade liberalization are most likely to be sluggish and impose a burden on specific groups of workers (Dix-Carneiro 2014). In the short run, workers are less mobile between sectors and tariff reductions on outputs that put competitive pressures on firms will hurt the workers in the affected sectors disproportionately. In regions where labour is concentrated in those sectors that are losing most of their protection from imports this mechanism will translate to regional wage losses (Kovak 2013), or to increases in regional unemployment (Hasan et al. 2012). The poverty effects of output tariff reductions depend on the speed of labour market adjustments. In the longer run, a specialization in the unskilled intensive production should reduce poverty. In the short run however, poverty may increase with output trade liberalization if the poor work disproportionately in sectors losing protection. Thus, from a theoretical perspective, we expect output tariff liberalization to reduce regional wages and employment conditional on the speed of the sectoral adjustment of labour. The poverty effects would depend on the extent to which the employment and income of the poor is directly affected by the loss of protection but also on the adjustment of incomes in the nontradable sectors.

By contrast, reductions in tariffs and hence prices on inputs that are used in regional production should have the opposite effects on wages, employment and poverty. Lower input tariffs have a more direct productivity enhancing role by rendering inputs cheaper (Amiti and Konings 2007). Input

(but not output) tariff reductions have also been shown to go along with reductions in industrial skill premia (Amiti and Cameron 2012). As a result, we expect to see short run benefits from productivity gains due to input tariff reductions in form of wage increases and employment, especially for the workers employed in the sectors affected by input price reductions. How far these benefits translate to reductions in poverty is an empirical question.

We thus decompose the total effect of trade liberalization on poverty into an effect transmitted through a competitive pressure on output product markets and an improving productivity through input trade liberalization.

3. Data

We measure the extent of trade liberalization by reductions in the average (unweighted) tariff lines in 19 tradable goods sectors for the years 1993, 1996, 1999, and 2002.[6] The source of the tariff information is the UNCTAD-TRAINS database (retrieved through the WITS system of the World Bank). We combine this tariff data with information on the district level labour market structure before the tariff reform, based on the 1990 Indonesian Census.[7] It provides the main sector of occupation for each individual in the sample at the 2-digit level. In order to combine tariff data with the information on labour market structure, we compute average tariffs at the same level of product aggregation as the available labour market data; we are thus able to distinguish between 5 subsectors in agriculture (plants and animals; forestry; hunting; sea fishery; fresh-water fishery), 6 subsectors in mining (coal; metal ore; stones; salt; minerals and chemicals; other mining) and 9 in manufacturing (food, beverage and tobacco; textile, apparel and leather; wood and products; paper and products; chemicals; non-metallic mineral products; basic metals; metallic products; other manufacturing).

Our primary source of household information is the annual national household survey, *Susenas* (*Survei Sosial Ekonomi Nasional*). This repeated cross-section survey is representative at the level of Indonesian districts.[8] Poverty measures are derived from a comparison of monthly per capita household expenditures with province-specific urban/rural poverty lines (based on Suryahadi, Sudarno and Pritchett, 2003). Based on this, we calculate three poverty measures (Foster et al. 1984): the poverty headcount ratio (P0, the ratio of people living under the poverty line), the

[6] Since tariff data is missing for the years 1994, 1997 and 1998, we base our analysis on four equally spaced time periods.
[7] We use a 1% random sample available for public use through the IPUMS system (Minnesota Population Center, 2011).
[8] For calculating district level variables we use the population weights provided in *Susenas*.

poverty gap (P1, the aggregated income gap of the poor normalized by the total income needed to reach the poverty line), and the squared poverty gap (P2, depicting the depth of poverty, which is defined as the sum of squared individual deviations from the poverty line of those living below the poverty line, normalized by the squared value of the poverty line income).[9].

We use additional information from *Susenas* on individuals' employment status. All adults (aged 16 years or older) are considered to be working if they report having a permanent job or having worked at least one hour during the week preceding the survey. We also record the primary sector of work for each individual in the sample and distinguish between agriculture, mining, manufacturing and service sectors and use the household surveys to generate further variables used in placebo regressions and further controls (adult education rates, the share of rural population and adult literacy rates).

A second source of individual level information is the annual labour force survey, *Sakernas* (*Survei Angkatan Kerja Nasional*). This allows us to compute hourly wages, which are not available from the household surveys. *Sakernas* data are representative at the level of 23 provinces.

Information on the number of industrial workers and on total industrial wage payments in each district comes from the annual industrial survey SI (*Survei Industri*) that aims to include all Indonesian firms operating with at least 20 employees. Additionally, we use the data on SI firms to describe the regional industrial structure, which enables us to generate alternative regional tariff exposure measures for 60 tradable output sectors.

Following Amiti and Konings (2007) and Amiti and Cameron (2012), we distinguish between the reduction in tariffs on outputs and intermediate inputs, by generating a proxy of the regional sectoral input structure based on regional outputs and a national input-output-table. We use the latest national input-output table from the time period before the reforms, which distinguishes between 161 input and output sectors. The IO-table is based on the economic census (*Sensus Ekonomi*) of 1990, and has been compiled by Statistics Indonesia (BPS). We combine this information with the regional economic structure (based on either sector labour market shares or industrial production) and our tariff variables.

[9] We prefer to use these composite poverty measures to statistics on household expenditures at different parts of the income distribution. When normalized by regional poverty lines, poverty measures become directly comparable across the regions whereas we lack comparable information on regional consumption baskets at other points of the income distribution.

We use these various data sources to build a balanced pseudo-panel of Indonesian districts, which are classified as either rural districts (*kabupaten*) or municipalities (*kota*). Districts are practical units of analysis for assessing the poverty effects of trade liberalization as they are well defined geographic areas and key administrative units in Indonesia that reflect local labour markets. During the period under study, new districts emerged as a result of district splits. We deal with these splits by applying the 1993 district definition frame.[10] Some of the districts had to be dropped from the sample. After excluding peripheral regions with incomplete or missing socio-economic data (all districts in the provinces of Aceh, Maluku and Irian Jaya) as well as East Timor (which gained independence in 1999) we are left with a balanced panel of 259 districts. These 259 districts are organized into 23 provinces and are spread across 5 main island groups (Sumatra, Java, Kalimantan, Sulawesi, and the remaining smaller islands grouped together). Table 2 presents descriptive statistics on the changes in our main outcome and tariff variables over time; Table 12 and 13 in the supplementary appendix reports descriptive statistics for the all variables included in the analysis.

4. Methods

Following Topalova (2010), several recent studies identify regionally differential effects of trade liberalization by distinguishing between different levels of regional exposure to trade based on the pre-reform labour market structure of the region (Kovak 2013, McCaig 2011, Fukase 2013, Castilho et al. 2012). The advantage of this method is that it does not only focus on the manufacturing sector or formal employment but measures the effects of trade liberalization at the household level. To define tariff exposure, it uses the labour structure of local residents based on household surveys, irrespectively of the specific place and geographic location of their work, and hence focuses on tariff effects important for local residents. The main poverty measures are derived from household expenditure surveys, which capture the overall extent of regional poverty. We complement this household based information with data from firm and labour market surveys in order to investigate the labour market mechanisms that are behind these poverty effects. For firm and wage outcomes we alternatively define tariff exposure measures that are weighted by the regional firms' output and input structure.

4.1 Measuring tariff exposure at district level

[10] Districts splits followed almost entirely sub-district boundaries within the relevant district, and did not affect borders with neighboring districts. See Fitrani, Hofman and Kaiser (2005) for a more complete account of this process. Statistics Indonesia maintains a full list of district codes over time (see http://www.bps.go.id/mstkab/mfkab_03_09.pdf). Maps in Figure 3 and Figure 4 show the boundaries of 440 districts (based on PODES 2000), filled with information on 259 original districts.

Our empirical strategy applies measures of district tariff exposure that combine variation over time in nationally determined import tariffs with information on the districts' economic structure in the initial pre-reform period. Output tariffs of district *k* in year *t* are computed by weighting the actual average import tariffs of each sector *s* by the sector's relative importance in the local economy, measured in an initial, pre-reform time period:

$$Tariff_{kt} = \sum_{s=1}^{S} \left(\frac{Q_{sk,t=0}}{Q_{k,t=0}} \times Tariff_{st} \right) \quad (1)$$

For our main poverty analysis, the relative importance of a sector in a district economy is measured by its regional employment share, and hence the weights are given by the relative share of the employment of the output sector s ($Q_{sk,t=1990}$) in the total labour force of district k ($Q_{k,t=1990}$), measured before the reform, in 1990.[11] Figure 3 maps the geographic variation in reductions of the output tariff measure across the nine years of analysis for all Indonesian districts included in the analysis.

In addition to our main labour market based output tariff measure, we also compute an output tariff measure weighted by the district industrial structure, which enables us to identify the effects of tariff changes on the wage bill and employment of local firms. This alternative tariff measure is based on the output structure of formalized firms with at least 20 employees (from SI, the industrial survey). The output tariff measure weights national tariffs in sector s at year t by the industry's initial share in region *k*'s industrial output, $Q_{sk,1993}/Q_{k,1993}$, as recorded in the industrial survey in the initial year 1993.[12]

For computing the input tariffs, we rely on a national input-output table from 1990 to generate a measure of regional exposure to input tariffs based on the district sectoral structure:

$$InputTariff_{kt} = \sum_{s=1}^{S} \left(\frac{Q_{sk,t=0}}{Q_{k,t=0}} \times \sum_{j=1}^{J} \left(\frac{M_{js,1990}}{M_{s,1990}} \times Tariff_{jt} \right) \right) \quad (2)$$

For this, we weight the tariff on each input good j in year t by the initial share of the *j*-th industry among the inputs of any output sector s, $M_{js,1990}/M_{s,1990}$. We once again aggregate these input

[11] Our labour shares are calculated based on *S=20* different sectors, see section 2.

[12] After taking tariff and input-output table concordances into account, we are able to distinguish between *S=60* different tradable output industries.

tariff measures across all output producing sectors or industries of the region, which are then weighted by the output sector's initial relative regional importance. Since our input-output data does not vary across regions, we have to assume that the national structure of inputs adequately describes the regional input structures, at least on average. By using a pre-reform input-output table we can ensure that tariff induced shifts in the sectoral structure are not reflected in the measure. We capture the relative importance of specific sectors, $Q_{sk,1993}/Q_{k,1993}$, once again either through labour market shares (for household based measures) or shares in output production (for firm employment and wages).[13] Figure 4 maps the regional variation in changes in import tariffs on input goods.

The presence and size of nontradable sectors poses a challenge to the computation of weighted tariff measures. The literature on regional labour market effects of trade liberalization has applied two different approaches to deal with the nontradable sector. In the first, the share of nontradable sectors has been included in the denominator (the size of the local economy) but receives a zero tariff, which would imply no tariff reductions and hence no price changes in nontradable sectors over time (see e.g., Topalova 2010, McCaig 2011).[14] Alternatively, excluding the nontradable sectors from the weighting altogether and basing the weights on the sectoral composition of tradable industries assumes that the price adjustments are passed through to the nontradable sectors.

Kovak (2013) shows that under the assumption of sector-specific labour, no regional labour mobility and full employment, wages in nontradables fully mirror the wage developments in the tradable sectors. For consistency, nontradables should therefore be excluded from the analysis altogether. Although his theoretical analysis does not have similarly clear predictions for measures of poverty, the argument applies to poverty analysis as well as long as the main poverty effects are transmitted through wage changes.

In our analysis we follow the approach suggested by Kovak (2013). For equation (1) this implies that nontradables are excluded from the output tariff variables, since the nontradables do not appear in the variable $Tariff_s$. For the input tariff this is more complex. The nontradable sector still appears in Q_s and M_s, to take into account the effects of tariff changes on tradable inputs that are used in the non-tradable sector. That is, in equation (2) the nontradable sector is dropped from the set *J* but not from *S*: we are first weighting the sectoral tariffs by the relative weight of each input among all

[13] Due to differences in sector definitions and concordances between different sectors, we are able to distinguish between 12 (77) input sectors for the labour (manufacturing output) weighted tariffs.
[14] Topalova (2010) instruments tariffs weighted by labour market shares that include nontradables with tariffs weighted by labour market shares in tradable sectors only.

tradable inputs, but consider both tradables and nontradables among the output sectors. By contrast, the input tariff weighted by manufacturing sector output shares includes tradable goods only since all industrial products included in the weighting scheme are tradable.

4.2 Empirical specification and identification

Our main estimating equation takes the following first difference specification:

$$\Delta y_{kt} = \alpha + \beta_1 \Delta OutputTariff_{kt} + \beta_2 \Delta InputTariff_{kt} + \Delta X'_{\mathrm{kt}}\gamma + I'_k\theta + \lambda_{rt} + \Delta\varepsilon_{kt},$$

where y_{kt} denotes the district level dependent variables (poverty rates, labour force participation and formalization shares, average or total wages and employment). X_{kt} is a vector of time variant control variables (share of rural population, share of population aged 16-60, adult (20+) literacy rates, minimum wages). The vector of initial conditions, I_k, includes the 1990 labour shares in the region that are used as tariff weights, aggregated to one digit sectors, the 1990 rural population shares, and, in some specifications, the initial levels of the dependent variable. Time and island interaction terms, λ_{rt}, are included to control for regions specific time effects.[15]

The difference specification addresses the potentially endogenous nature of the components in the tariff exposure measure. First, the potential bias due to endogenous tariff setting at the national level is eliminated by controlling for national variation over time and by considering only within-district variation. Second, by taking first differences and removing district fixed effects, we purge any bias due to unobserved heterogeneity that might be introduced by the initial district sectoral structure in employment and industry output. Moreover, the district labour and industry output shares by sector are taken at 1990 and 1993 values respectively and are therefore not directly influenced by district poverty profiles and labour market developments after 1993.

The identifying variation comes from within-district differences in changes to tariff exposure across time.[16] This approach relies on the indentifying assumption that there are no unobserved time variant confounders. This assumption will be violated if poverty trends and labour market dynamics are related to the initial sectoral composition of district economies. The most relevant potential confounding trends include structural change, overall economic development and social policies. Structural change involves a gradual shift from agriculture to manufacturing and service sectors. The

[15] Although changes in the two tariff variables are highly correlated, this does not seem to affect our tariff estimates that are comparable when estimated jointly or in separate regressions. Once island-year fixed effects are controlled for, the residual correlation between input and output tariff changes amounts to around 0.5.

[16] Figure 3 and Figure 4 show the across-district variation in the reductions of output and input tariffs.

extent and speed of such structural change may vary by the initial size of the agricultural sector and the share of the population living in rural areas. Changes in poverty incidence will also be driven by overall economic development as well as targeted social policies. These may vary by initial levels of poverty (due to convergence or policy targeting) and by local economic structure.

We deal with these potential confounding trends by adding time variant controls and controls for initial conditions. The time variant controls capture regional changes in poverty due to shifts in population structure, average skill levels, urbanization and social policies. Some of these controls, for instance urbanization or minimum wages, may however also serve as transmitting factors for the effects of trade liberalization and hence we test whether our results are sensitive to the exclusion of these controls. The controls for initial conditions include initial sectoral labour shares (measured at the one-digit level) as well as the share of rural population in 1990. As an additional sensitivity check we include the 1993 value of the dependent variables (P0, P1 and P2) to proxy for convergence and poverty targeting.

The exogeneity assumption is also violated if the regional variation in trade liberalization is correlated with pre-existing trends. This could be the case if the tariff reductions are influenced by political pressure of industry or local power structures, which would involve specific sectors and regions being only affected by reduction in protection in the later periods. For the 1990s such influence is unlikely to come from the districts directly, as power in Indonesia was heavily centralized. Sector-based lobbying is also less likely as trade policy would be mainly influenced by crony capitalist's rent seeking (Basri and Hill 1996, Basri, 2010). This is also supported by the strong correlation between tariff cuts and initial tariff levels in the two sub-periods where the bulk of tariff cuts was concentrated, which suggests that highly protected sectors were not spared from tariff cuts in the early stages of the reforms.

To assess potential confounding factors from pre-existing trends we conduct placebo tests of the effects of tariff reductions on past poverty levels, using data from the 1984, 1987 and 1990 Susenas household consumption survey. These pre-1993 surveys are limited to consumption data and we can therefore only control for district fixed effects, rural shares and time-region interactions. We regress the changes in poverty rates over the three past periods on future tariff changes between 1993-1996 and 1999-2002, the two sub-periods with the most pronounced variation and strongest trends in tariff reductions.[17] In a similar vein, we also conduct placebo tests for the total wage bill, total

[17] By doing so, we eliminate kinks in the tariff schedule due to stalling tariff reductions between 1996 and 1999 (cf. Figure 1). Alternatively, regressing poverty changes on tariff changes between 1993-1996-1999 yields similar results for the placebo tests.

workers and wages per worker using three equally spaced rounds of past firm surveys (1983-1986-1989). Finally, we run placebo regressions for current socio-economic outcomes that would not likely be affected by trade liberalization in the short term. For this test we use test the effect of tariff reductions on education attainment of adults (30-60 years old), which could only be affected by substantial migration but not by schooling.

The 1997/1998 financial crisis poses a potential problem for our empirical strategy since the post-crisis recovery remains a potentially confounding effect. We deal with this concern in two ways: we include in all regressions island-year fixed effects that distinguish between five main geographic units and allow the crisis effects to vary across the regions. Given the empirical evidence on the strong geographical clustering of the poverty effects of the crisis (Wetterberg, Sumarto and Pritchett 2001), we are able to capture a part of the crisis effects already through this strategy. Robustness checks directly control for the local intensity of the crisis by measuring the differential amplitude of the explosive price increases that were observed during the economic crisis, and have subsequently been associated with the strong poverty increase in 1998 and 1999 (e.g. Hardjono et al. 2010). The crisis variable measures the amplitude of CPI across provinces at the height of the crisis (in 1998) and is interacted with the post-crisis years 1999 and 2002. Additionally, we discuss the sensitivity of our results to estimating the models for separate pre-and post-crisis periods, for the pre-and post-crisis period jointly, and for the long difference from 1993 to 2002.

5. Results

5.1 Poverty

The general effects of tariff reductions on our three poverty measures (P0, P1 and P2) for different specifications are shown in Table 3. Overall, there is a negative correlation between the three poverty measures and output tariff exposure, implying that tariff reduction for output markets is associated with an increase in poverty. The relationship persists after controlling for year-island interactions, time variant controls, and initial labour force and rural population shares. By contrast, input tariffs have a positive association with poverty, which implies that their reduction induces a reduction in poverty. For the poverty headcount this effect grows in magnitude and statistical significance when we add the control variables and initial conditions whereas coefficients are stable throughout specifications for poverty gap and the depth of poverty.

Controlling for initial levels of the dependent variable in column 4 helps to assess whether initial poverty is associated with differential parallel trends that may confound our estimates. We find no

evidence of this, as all results are robust to including these variables. Since we prefer not to include lagged levels of the dependent variable in a fixed effects specification, we omit these in the remainder of the analysis. In what follows, we refer to column 3 as our preferred specification for interpreting the economic magnitudes of the effects.[18]

The association between tariff reductions and poverty changes turns out to be of an economically significant magnitude. The point estimates suggest that a one standard deviation (or 2.06 percentage point) larger reduction in the weighted input tariff measure implies a 6.7 percentage point larger reduction in the poverty headcount (P0), which corresponds to about half of a standard deviation of the decrease in the poverty headcount over a three year period (cf. Table 2). By contrast, a one standard deviation larger decrease in output tariffs is associated with about half a standard deviation larger increase in the poverty headcount (although the absolute magnitude of the two coefficients is not statistically significantly different). The difference between the tariff coefficients increases for the poverty gap (P1) and the depth of poverty (P2).[19] Column 3 further shows that a one standard deviation reduction in the weighted input tariff measure is associated with a decrease of the poverty gap by about 92% of the standard deviation of the average decrease in the poverty gap over time (panel B), and a one standard deviation larger decrease in the depth of poverty (panel C).

Tariff reductions for intermediate inputs seem to have contributed to alleviating the depth of poverty in Indonesia and have been particularly favourable for the very poor, while reducing output tariffs has somewhat smaller offsetting effects. Based on these results, the beneficial effects of cheaper local input prices seem to be large enough to at least neutralize the poverty-increasing effects of output tariff liberalization.

Table 4 disaggregates the results from our preferred specification (column 3 in Table 3) by skill levels of the household heads. We distinguish between three educational categories: household heads with at most primary education, those with completed junior secondary education, and those with at least a completed senior secondary education. We see that tariff reductions in intermediate inputs reduce poverty across all education levels: for the low-skilled population these effects are observed mainly at the lower end of the income distribution (through their effects on the depth of poverty), while for the high skill population the effects are more prominent closer to the poverty

[18] See table 15 in the supplemental appendix for the results on additional controls in these specifications.

[19] The sum of the two negative output and positive input tariff coefficients is not statistically significantly different from zero for the poverty headcount, but it is smaller than zero for the column 3 specifications of the poverty gap and squared poverty gap (see Table 3). The direct comparison of the two tariff coefficients is meaningful since the two tariff reductions have roughly the same standard deviation (2.06 and 2.07).

line. The reductions in the depth of poverty decrease monotonically with increasing education of the household head. The effects on the poverty gap are comparable across education levels. We find a reduction in the poverty headcount only for the high skilled population, presumably because the relatively higher educated poor are likely to be concentrated closer to the poverty line than the low educated poor. As before, we see the opposite effects for the output tariffs, with the patterns almost mirroring those for input tariffs yet at smaller magnitudes. This suggests that the adjustment costs of trade liberalization are borne by both low and high skill households.

5.2 Labour market dynamics

Whereas the share of working adults (measured by working status reported in the household surveys) decreased slightly over the time period, this decrease has been mitigated by decreases in tariffs. We find that changes to output and input tariffs both induce higher market participation, although when estimated jointly, as documented in Table 5, only the decrease in tariffs on intermediate inputs remains statistically significant. A one standard deviation larger decrease in local input tariffs reduces the average drop in work participation by about 74% of its standard deviation. This effect is most pronounced for the low educated: for adults with at most primary education the effect equals 144% of its standard deviation. For the middle education category, it decreases both in size (with 62% of a standard deviation) and statistical significance, while it is not statistically significant for the highest educational category. These findings could suggest job creation especially for the low skilled due to increased competitiveness of local firms.

5.3 Firms: wages and workers

Previous firm level analyses document that trade liberalization in Indonesia has improved firm productivity (Amiti and Konings 2007) and increased the relative magnitude of the wage bill paid by manufacturing firms to production as opposed to non-production workers (Amiti and Cameron 2012). These effects were in particular due to decreases in import tariffs on intermediate production goods used by the firms. These findings suggest that direct improvements in the profitability of local firms might also help to explain the observed favourable income effects to the poor of import tariff liberalization. In order to investigate this channel more closely, we extend the analysis to the total wage bill of manufacturing firms in the region, the total employment by those firms and the wages they pay per worker. We use the same manufacturing firm data as the two studies above and also differentiate between the effects of tariffs for intermediate inputs and production outputs, but run the analysis at the level of the regional economies in order to retain comparability with our previous results.

Table 6 shows sizeable negative tariff coefficients on firm wages and employment that are imprecisely estimated. As before, the point estimates on input tariff reductions are of a consistently more sizeable magnitude, although the coefficients are statistically not significantly different from zero or each other. Nonetheless, together with the findings by Amiti and Cameron (2012), we cannot exclude that productivity improvements due to trade liberalization have led to wage increases (and potentially job creation) in the formal manufacturing sector. These developments may have reduced poverty of workers directly, but may also have increased regional wage levels for the workers outside the formal manufacturing sector and in the nontradable sectors, reducing poverty further.

Since the SI data does not provide information on the hours worked, we cannot clearly distinguish between wages and job creation. However, we can look at average wages at province level, which are collected by the national labour force survey (*Sakernas*). As the number of provinces is considerably lower than the number of districts (23 as compared to 259), this is admittedly a much cruder measure, but can be disaggregated by education level. For each district, we therefore impute the average wage at the province level and relate this to the district level tariff measures. We address the intra-province correlation due to imputing province level average wages for each district by clustering standard errors in these regressions at the province level. As robustness check we replicate these regressions with the wage variables expressed at the province level, although this reduces the number of observations to 69. In this second set of regression we only include the year-island dummies as further controls.

The estimates are shown in Panel A of Table 7 for the district level analysis (with imputed province average wages) and Panel B for the province level. Both sets of regressions confirm that average wages have increased as a result of tariff reductions for intermediate inputs, while no significant effects could be observed from changes in output tariffs. Interestingly, we detect some asymmetric effects for the different skill categories: middle and higher skilled workers seem to have especially benefited from the input tariff reductions while we find no or even reverse wage effects among the low skilled. However, these estimates are imprecise and potentially suffer from a small number of provinces.

6. Sensitivity analysis and caveats

6.1 Robustness of poverty results to confounding trends

The placebo regressions to test for confounding trends are presented in Table 8 and show no evidence of any correlation of the tariff measures with the pre-existing trends in poverty. Note that the regressions only control for district fixed effects, region-year interactions and the rural

population share, but not initial conditions. This suggests that any potential confounding effects are eliminated in our district fixed effects approach.

The placebo regressions for the total wage bill, total workers and wages per worker from three rounds of past firm surveys (1983-1986-1989) also show no statistically significant effects. Moreover, whenever the coefficients are somewhat more sizable (input tariffs for the wage bill and total number of workers) they are of the opposite sign than what we would expect if confounding trends were driving our results. Further results on the local firms' internationalization (reported in Table 16 in the supplementary appendix) show that during the 1990s the share of foreign investment flows in total firm investment and the share of imported input use increased significantly with input tariff reductions. By contrast, increases in foreign investment and imported input shares over the previous decade (1983-1986-1989) were not related to future tariff reductions. This gives us further evidence that our analysis is not affected by confounding pre-trends from previous changes in trade policies.

The tests for liberalization bias to skill intensity focus on current socio-economic outcomes that would not likely be affected by trade liberalization in the short term. For these tests we do see some statistically significant effects for junior secondary education among adults. But also for these results, the sign of the coefficient could not explain the poverty effects that we see associated with tariff reductions. For example, if input tariffs reduce the poverty headcount because low skill labour migrates away, then we would expect junior secondary education levels to be negatively correlated with input tariffs, not positively as in Table 8.

6.2 The monetary crisis and differential effects over time

The Southeast Asian monetary crisis of 1997/1998 constitutes a potentially important confounding factor during the analysed time period, especially since it induced a short-time spike in relative food prices and sharp short-term increases in poverty. Since the effects of the crisis were strongly geographically clustered, the inclusion of island-year fixed effects deals partly with this problem. However, in order to exclude that the crisis confounds our estimates, we repeat our main specifications for various sub-periods pre- and post-crisis. In an alternative approach, we include additional controls that proxy for the geographic variation of the crisis effects. Moreover, we present long-difference estimates over the total time period of 1993 to 2002.

Table 9 shows our preferred specification for the poverty measures in column 1. Column 2 re-estimates the main specification but focuses only on the two time periods of considerable tariff changes and exogenously imposed tariff reductions: 1993-1996 and 1999-2002, excluding the crisis-period 1996-1999. Although poverty reductions in the last time period could be still affected by the

post-crisis recovery, this specification eliminates the time period with little change in tariffs and concurrent poverty increases and hence serves as a useful robustness check with respect to the influence of the crisis period. Column 2 shows very stable input tariff coefficients whereas output tariff coefficients reduce somewhat in size, losing statistical significance.

Separate estimation of the tariff effects for the first and third period in columns 3 and 4 reduces precision even further. Output tariff coefficients stay relatively stable for the first time period, but no effects are identified for the third period. These results together with those in column 2 suggest that the variation in our poverty analysis comes from the differential reductions in tariffs across the two sub-periods of trade liberalization. This also explains the weak results in the long difference specification in column 5. Given the results of the placebo and robustness tests, we can only explain this by the fact that the identifying variation comes from the differential tariff changes in the sub-periods.[20] Thus, we cannot identify the effects of trade liberalization on the regional differences in poverty reduction over the whole time period, although differential reductions in poverty over time seem to be related to trade policy reform.

For the wage and employment effects, eliminating the middle sub-period increases the precision of the firm based estimates, while the labour survey based hourly wage results are not affected (column 2 of Table 10). Now both the firm wage bill and firm wages per worker show a statistically significant negative correlation with input tariffs, pointing to productivity gains leading to wage increases. The by-period and long-distance estimates are considerably more stable across sub-periods than the poverty results, although they are still not statistically significant throughout all sub-periods.

The results of Table 9 do not yet address the concern that the differences in the post-crisis poverty reductions after 1999 depend on the within-island variation of the severity of crisis effects (not controlled for by island-year effects), which may confound our trade policy estimates. We investigate this issue by including the amplitude of the hike in consumer prices at the height of the crisis in 1998, measured in 23 provincial capitals, as a further control. The crisis proxy is included into the regressions in the form of two crisis-year interaction terms in order to allow both the 1999

[20] This is supported by descriptive statistics in Table 14 of the supplemental appendix. While the changes in district tariff exposure are substantial (on average 9.96 to 13.33 percentage points, depending on the choice of tariff variable), the variation across districts is relatively small compared to changes for the full panel or the sub-districts. In other words, the within-island variation in the change from 1993 to 2002 has been fairly similar for all districts, which provides little identifying variation for the long differences analysis. However, the path to these overall changes has been different for districts, providing more identifying variation in tariff exposure changes across districts, especially in the sub-periods 1993-1996 and 1999-2002.

increase in poverty and the 2002 recovery to vary separately with the regional severity of the crisis. The results in **T**able 11 show no evidence of the poverty, wage and employment estimates being affected by differential crisis impacts.[21] The robustness of our results to the inclusion of crisis proxies strengthens the argument that we indeed capture the effects of trade policies and not that of confounding economic shocks.

7. Conclusion

We have examined the effects of trade liberalization in Indonesia from 1993 to 2002 on poverty levels in 259 Indonesian districts and the role of labour market as channel for these effects. During this period, Indonesia reduced its tariff barriers across all tradable sectors, with average import tariffs decreasing from 17.2 percent in 1993 to 6.6 percent in 2002. This period also saw overall reductions in poverty, despite a temporary setback from the 1997/1998 economic crisis.

The identification strategy relies on combining information on initial regional labour and product market structure with the exogenous tariff reduction schedule over three-year intervals. The results are robust to specification and controlling for initial conditions in labour market structure. The robustness checks and placebo regressions show no evidence of confounding trends, lending support to our identification strategy.

Our results suggest that input trade liberalization has contributed partially to poverty reduction in Indonesia by increasing incomes of the poorest segment of the population. The effects of tariff liberalization and increased competition in the regional output markets tended to increase poverty, while at the same time, tariff reductions for inputs lead to poverty reductions. This highlights the fact that for a short-run analysis of poverty effects of trade liberalization the effects propagated through input markets could also play a relevant role.

The driving mechanism behind these effects seems to be increasing firm competitiveness as a direct result of reductions in import tariffs on intermediate goods, which induced increased work participation as well as wage increases for (low- and) medium skilled labour. These experiences with trade liberalization add caution to the current policy debate in light of the recent surge in protectionist tendencies in Indonesian trade and economic policies (Nehru 2013).

[21] The detailed results show that the higher crisis amplitude was more strongly related to slower post-1999 reductions in poverty, although not so much to the variation in poverty increases from 1996 to 1999 (and hence there may be less residual variation left in the crisis effects within islands that is not picked up by our island-year effects). At the same time, crisis amplitude is related to a reduction of employment by firms and an increase of wages per worker in the second period.

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Tables

Table 1 Evolution of average effectively applied tariff rates by sector

	1993	1996	1999	2002
Agriculture				
Plants and animals	17.1	12.0	10.3	4.8
Forestry	7.7	3.9	3.5	3.8
Hunting	5.3	4.3	2.2	2.7
Sea fishery	24.9	16.6	14.0	5.2
Fresh-water fishery	10.0	0.0	0.0	0.0
Mining				
Coal mining	5.0	5.0	5.0	5.0
Metal ores mining	3.3	3.2	3.5	2.8
Stones and sand mining	7.0	5.6	3.6	3.5
Salt mining	20.0	15.0	15.0	7.4
Minerals and chemicals mining	2.9	3.0	3.0	2.7
Other mining	4.0	3.4	3.6	3.6
Manufacturing				
Food, beverages, tobacco	23.4	18.1	17.1	12.6
Textiles, apparel, leather	26.0	20.1	16.5	9.4
Wood and products	30.0	16.6	14.1	7.7
Paper and products	20.2	9.5	8.1	4.8
Chemicals and products	11.9	9.4	8.7	6.1
Non-metallic mineral products	20.4	9.5	7.0	5.6
Basic metals	10.3	8.0	7.6	6.4
Metal products	15.8	8.1	7.9	4.9
Other manufacturing	32.0	18.9	18.4	9.6

Note: Sectors are defined based on a concordance between tariff and census labour market data.
Source: UNCTAD-TRAINS database.

Table 2 Descriptive statistics on changes of dependent and tariff variables over time

	Av. change per period	SD of change per period
Dependent var.		
P0	-0.032	0.129
P1	-0.009	0.037
P2	-0.003	0.015
Share of working adults	-0.014	0.039
Share of working (max. primary)	-0.014	0.046
Share of working (jun. secondary)	-0.004	0.060
Share of working (min. sen. sec.)	-0.018	0.053
ln Total wage bill	0.029	0.675
ln Total workers	0.427	0.822
ln Wage per worker	0.398	0.544
ln Hourly wage	0.385	0.218
ln Hourly wage (max. primary)	0.514	0.222
ln Hourly wage (jun. secondary)	0.450	0.250
ln Hourly wage (min. sen. sec.)	0.340	0.261
Tariff var.		
Output tariffs (labour weighted)	-4.408	2.069
Input tariffs (labour weighted)	-3.319	2.059
Output tariffs (manuf. prod. w.)	-3.920	3.361
Output tariffs (manuf. prod. w.)	-3.206	2.174

For the total wage bill, total workers, wages per worker and manufacturing weighted tariffs N=734, for other variables N=777.

Table 3 Poverty effects of tariff liberalization, labour weighted tariffs

Source	Household surveys (Susenas panel 1993-2002)			
Model	(1)	(2)	(3)	(4)
Panel A:	*Dependent: P0*			
Output tariffs	-0.0117**	-0.0134**	-0.0122*	-0.0125*
	(0.0048)	(0.0046)	(0.0050)	(0.0049)
Input tariffs	0.0111	0.0176	0.0325*	0.0328*
	(0.0157)	(0.0157)	(0.0158)	(0.0156)
Test on OutputTariff + InputTariff=0 (p-val.)	0.959	0.756	0.149	0.143
Panel B:	*Dependent: P1*			
Output tariffs	-0.0037**	-0.0040**	-0.0034*	-0.0035*
	(0.0013)	(0.0013)	(0.0014)	(0.0014)
Input tariffs	0.0093*	0.0108*	0.0164**	0.0167**
	(0.0047)	(0.0048)	(0.0048)	(0.0047)
Test on OutputTariff + InputTariff=0 (p-val.)	0.163	0.100	0.003	0.002
Panel C:	*Dependent: P2*			
Output tariffs	-0.0014**	-0.0015**	-0.0012*	-0.0013*
	(0.0005)	(0.0005)	(0.0006)	(0.0005)
Input tariffs	0.0049**	0.0056**	0.0078**	0.0080**
	(0.0019)	(0.0020)	(0.0020)	(0.0020)
Test on OutputTariff + InputTariff=0 (p-val.)	0.026	0.016	0.000	0.000
N observations	777	777	777	777
N districts	259	259	259	259
Year-island dummies	Yes	Yes	Yes	Yes
Time variant controls	No	Yes	Yes	Yes
Initial labour force and rural shares	No	No	Yes	Yes
Dependent variable 1993	No	No	No	Yes

Note: Each block of the table reports tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Time variant controls include first differences of the share of rural population, the share of working age population (16-60), literacy rates at age 20-99 and minimum wage. Standard errors, clustered at the district level, are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 4 Poverty by education level of the head of household, labour weighted tariffs

Source:	Household surveys (Susenas 1993-2002)		
Household head education:	Max. primary	Jun. second.	Senior sec. or more
	(1)	(2)	(3)
Panel A:	Dependent: P0		
Output tariff	-0.0117*	-0.0073	-0.0153**
	(0.0059)	(0.0063)	(0.0044)
Input tariff	0.0210	0.0154	0.0532**
	(0.0201)	(0.0213)	(0.0145)
Panel A:	Dependent: P1		
Output tariff	-0.0035*	-0.0016	-0.0023**
	(0.0016)	(0.0016)	(0.0008)
Input tariff	0.0151*	0.0105*	0.0104**
	(0.0060)	(0.0051)	(0.0033)
Panel A:	Dependent: P2		
Output tariff	-0.0013	-0.0005	-0.0005†
	(0.0007)	(0.0005)	(0.0003)
Input tariff	0.0079**	0.0052**	0.0031*
	(0.0025)	(0.0019)	(0.0014)
N observations	777	777	777
Year-island dummies	Yes	Yes	Yes
Further controls	Yes	Yes	Yes

Note: Each block of the table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Standard errors, clustered at the district level, are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 5 Working status of adults, by education level, labour weighted tariffs

Source	Household surveys (Susenas 1993-2002)			
Dependent:	Share of working adults			
Sample (adults)	All	Max. primary education	Junior secondary education	Senior sec. or higher education
	(1)	(2)	(3)	(4)
Output tariff	-0.0022	0.0009	0.0008	-0.0018
	(0.0025)	(0.0027)	(0.0032)	(0.0036)
Input tariff	-0.0145†	-0.0321**	-0.0182†	0.0108
	(0.0082)	(0.0094)	(0.0106)	(0.0102)
N observations	777	777	777	777
Year-island dummies	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes

Note: The table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Standard errors, clustered at the district level, are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 6 Firm wages and employment, tariffs weighted by manufacturing output

	Source: Firm survey (SI 1993-2002)		
Dependent:	Ln total wage bill	Ln total workers	Ln wage per worker
	(2)	(3)	(4)
Output tariff	-0.0122	-0.0028	-0.0094
	(0.0158)	(0.0133)	(0.0096)
Input tariff	-0.0466	-0.0173	-0.0293
	(0.0324)	(0.0257)	(0.0230)
N observations	734	734	734
Year-island dummies	Yes	Yes	Yes
Further controls	Yes	Yes	Yes

Note: Each block of the table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs, island-year dummies and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Standard errors, clustered at the district level are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 7 Hourly wages by education level of workers, tariffs weighted by manufacturing output

Panel A:	Source: Labour market surveys (Sakernas 1993-2002, per district)			
Dependent:	Ln hourly wage (provincial averages imputed for districts)			
Sample (workers):	All	Max. primary education	Junior sec. education	Senior sec. or higher ed.
	(1)	(2)	(3)	(4)
Output tariff	0.0017	-0.0018	-0.0005	0.0026
	(0.0024)	(0.0022)	(0.0023)	(0.0032)
Input tariff	-0.0080†	0.0068	-0.0096†	-0.0063
	(0.0045)	(0.0052)	(0.0052)	(0.0056)
N observations	777	777	777	777
Year-island dummies	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes
Panel B:	Source: Labour market surveys (Sakernas 1993-2002, per province)			
Dependent:	Ln hourly wage			
Sample (workers):	All	Max. primary education	Junior sec. education	Senior sec. or higher ed.
	(1)	(2)	(3)	(4)
Output tariff	-0.0045	-0.0198	-0.0013	-0.0096
	(0.0187)	(0.0369)	(0.0166)	(0.0273)
Input tariff	-0.0666	0.0812	-0.1458*	-0.0572
	(0.0523)	(0.0499)	(0.0701)	(0.0809)
N observations	69	69	69	69
Year-island dummies	Yes	Yes	Yes	Yes
Further controls	No	No	No	No

Note: Each block of the table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and island-year dummies. Specifications in panel A are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. In panel B only year-island dummies are included. Standard errors, clustered at the province level are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 8 Placebo regressions based on household and firm surveys

Panel A	Past changes in poverty rates		
Source:	Susenas 1984-87-90		
Dependent:	P0	P1	P2
	(1)	(2)	(3)
Output tariff	0.0079	0.0033	0.0013
	(0.0101)	(0.0027)	(0.0011)
Input tariff	0.0281	-0.0026	-0.0043
	(0.0452)	(0.0159)	(0.0068)
N	294	294	294
Year-island dummies	Yes	Yes	Yes
Further controls	Yes	Yes	Yes
Panel B	Current changes in rates of adult education (30-60 yrs. old)		
Source:	Susenas 1993-96-99-02		
Dependent:	Primary ed. rate	Jun. sec. ed. rate	Tertiary ed. rate
	(1)	(2)	(3)
Output tariff	0.0005	-0.0049†	0.0011
	(0.0027)	(0.0027)	(0.0012)
Input tariff	-0.0032	0.0186*	-0.0001
	(0.0081)	(0.0093)	(0.0047)
N	777	777	777
Year-island dummies	Yes	Yes	Yes
Further controls	Yes	Yes	Yes
Panel C	Changes in past employment and wages		
Source:	SI 1983-86-89		
Dependent	Ln total wage bill	Ln total workers	Ln wage per worker
	(1)	(2)	(3)
Output tariff	-0.0103	-0.0191	0.0088
	(0.0263)	(0.0207)	(0.0113)
Input tariff	0.0501	0.0445	0.0056
	(0.0493)	(0.0464)	(0.0200)
N	394	394	394
Year-island dummies	Yes	Yes	Yes
Further controls	No	No	No

Note: The table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Panel A is based on 3 earlier rounds of household data, panel B is based on 4 rounds of contemporaneous household data, panel C on 3 earlier rounds of firm data. Panels A and C regress the outcomes on tariff changes between the years 1993-1996 and 1999-2002 and island-year effects; panel A additionally controls for changes in rural share. In panel B further controls include all controls from column 3 of Table 3, except for changes in adult literacy. Standard errors, clustered at the district level, are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 9 Poverty effects by time period, tariffs weighted by labour shares

Source:	Household surveys (Susenas)				
Time period	1993-2002 panel	1993-96, 1999-02 diff.	1993-96 diff.	1999-02 diff.	1993-02 long diff.
	(1)	(2)	(3)	(4)	(5)
Panel A:	Dependent: P0				
Output tariff	-0.0122*	-0.0081	-0.0124*	-0.0013	-0.0003
	(0.0050)	(0.0053)	(0.0061)	(0.0108)	(0.0043)
Input tariff	0.0325*	0.0312†	0.0419	0.0275	0.0111
	(0.0158)	(0.0166)	(0.0613)	(0.0680)	(0.0308)
Panel B:	Dependent: P1				
Output tariff	-0.0034*	-0.0012	-0.0026*	0.0025	0.0006
	(0.0014)	(0.0015)	(0.0017)	(0.0034)	(0.0012)
Input tariff	0.0164**	0.0159**	0.0009	0.0103	-0.0006
	(0.0048)	(0.0048)	(0.0203)	(0.0245)	(0.0124)
Panel C:	Dependent: P2				
Output tariff	-0.0012*	-0.0003	-0.0009	0.0015	0.0003
	(0.0006)	(0.0006)	(0.0007)	(0.0014)	(0.0005)
Input tariff	0.0078**	0.0075**	0.0003	0.0038	-0.0006
	(0.0020)	(0.0020)	(0.0091)	(0.0112)	(0.0056)
(Year-)island dummies	Yes	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes	Yes
N	777	518	259	259	259

Note: Each block of the table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Standard errors, clustered at the district level are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 10 Employment and wages by time period, tariffs weighted by manufacturing output

Time period	1993-2002 panel	1993-96, 1999-02 diff.	1993-96 diff.	1999-02 diff.	1993-02 long diff.
Time period	(1)	(2)	(3)	(4)	(5)
Panel A:		*Source: Firm survey (district level)*			
Dependent:		Ln firm wage bill			
Output tariff	-0.0122	-0.0035	-0.0040	0.0034	0.0034
	(0.0158)	(0.0154)	(0.0161)	(0.0269)	(0.0141)
Input tariff	-0.0466	-0.0801*	-0.0475	-0.1431*	-0.0592
	(0.0330)	(0.0349)	(0.0359)	(0.0625)	(0.0461)
N	734	487	247	240	239
Panel B:		*Source: Firm survey (district level)*			
Dependent:		Ln total workers			
Output tariff	-0.0028	-0.0006	-0.0038	0.0095	0.0064
	(0.0133)	(0.0248)	(0.0139)	(0.0244)	(0.0102)
Input tariff	-0.0173	-0.0119	-0.0229	-0.0602	-0.0089
	(0.0257)	(0.0432)	(0.0270)	(0.0601)	(0.0378)
N	734	487	247	240	239
Panel C:		*Source: Firm survey (district level)*			
Dependent:		Ln wages per worker			
Output tariff	-0.0094	-0.0049	-0.0003	-0.0062	-0.0030
	(0.0096)	(0.0101)	(0.0131)	(0.0161)	(0.0086)
Input tariff	-0.0293	-0.0440†	-0.0246	-0.0830*	-0.0503*
	(0.0230)	(0.0250)	(0.0300)	(0.0412)	(0.0248)
N	734	734	247	240	239
Panel D:		*Labour market survey (district level, province averages imputed)*			
Dependent:		Ln hourly wages			
Output tariff	0.0017	0.0025	0.0018	0.0028	0.0004
	(0.0024)	(0.0024)	(0.0036)	(0.0034)	(0.0024)
Input tariff	-0.0080†	-0.0096†	-0.0135*	-0.0051	-0.0103
	(0.0045)	(0.0050)	(0.0062)	(0.0092)	(0.0078)
N	777	777	259	259	259
(Year-)island dummies	Yes	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes	Yes

Note: Each block of the table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Standard errors, clustered at the district level (at the province level in panel D) are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Table 11 Controlling for the differential price shock during the 1997/98 crisis

Panel A:	Household surveys (Susenas 1993-2002)		
	(1)	(2)	(3)
Dependent	P0	P1	P2
Output tariff	-0.0120*	-0.0033*	-0.0012*
	(0.0050)	(0.0014)	(0.0006)
Input tariff	0.0285†	0.0145**	0.0069**
	(0.0159)	(0.0048)	(0.0019)
N	777	777	777
Panel B:	Firm surveys (SI 1993-2002)		
Dependent	Ln firm wage bill	Ln total workers	Ln wage per worker
Output tariff	-0.0123	-0.0037	-0.0087
	(0.0157)	(0.0132)	(0.0095)
Input tariff	-0.0472	-0.0133	-0.0339
	(0.0326)	(0.0260)	(0.0228)
N	734	734	734
Year-island dummies	Yes	Yes	Yes
Further controls	Yes	Yes	Yes
Interactions of 1999 and 2002 w. crisis proxy	Yes	Yes	Yes
Panel C:	Labour market surveys (Sakernas 1993-2002)			
Dependent	Ln hourly wage (provincial averages imputed for districts)			
Sample (workers)	All	Max. prim. ed.	Jun. sec. educ.	Min. senior sec.
Output tariff	0.0014	-0.0021	-0.0007	0.0025
	(0.0022)	(0.0027)	(0.0026)	(0.0027)
Input tariff	-0.0068	0.0082†	-0.0088	-0.0058
	(0.0050)	(0.0047)	(0.0058)	(0.0071)
N	777	777	777	777
Year-island dummies	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes
Interactions of 1999 and 2002 w. crisis proxy	Yes	Yes	Yes	Yes

Note: The table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Tariff measures are weighted by labour shares in panel A and by manufacturing production shares in panels B and C. The crisis variable measures the amplitude of the regional CPI at the height of the crisis (in 1998) and is interacted with a year indicator for 1999 and 2002. Standard errors, clustered at the district level (province level in column 6), are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Figures

Figure 1 Evolution of average tariff lines 1993-2002, source: Kis-Katos and Sparrow (2011)

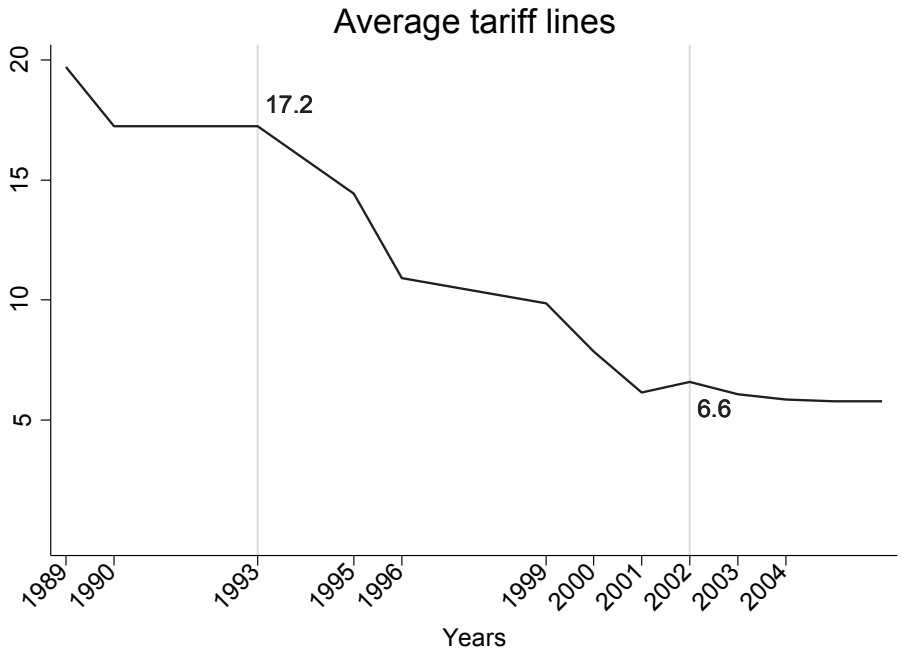


Figure 2 Tariff reductions by sector 1993-2002

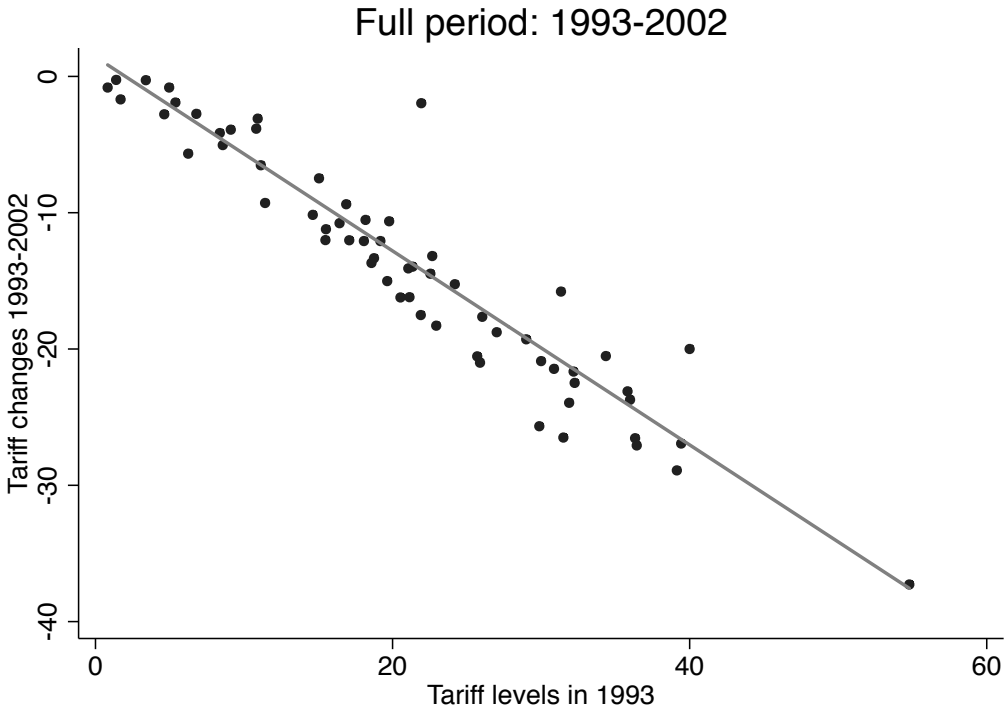
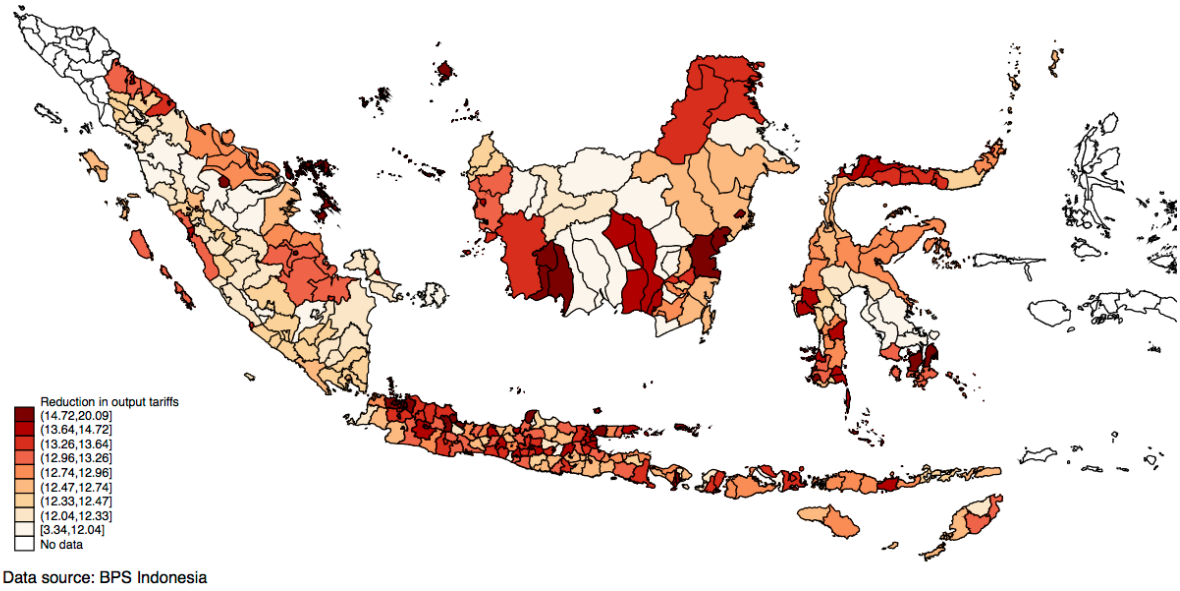
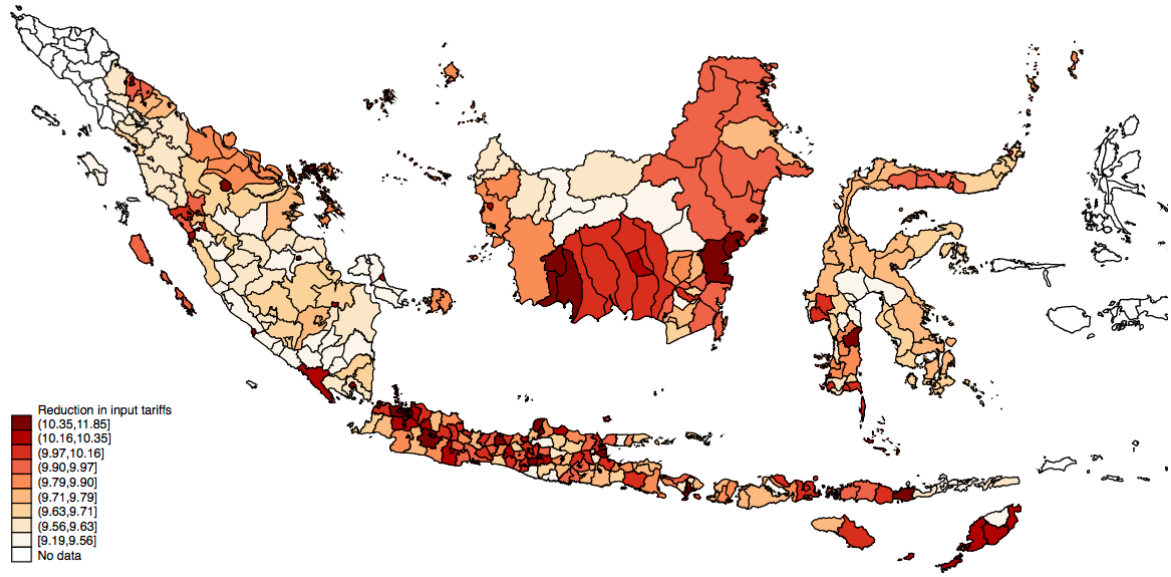


Figure 3 Reductions in labour weighted district output tariff measures (1993-2002)



Data source: BPS Indonesia

Figure 4 Reductions in labour weighted district input tariff measures (1993-2002)



Data source: BPS Indonesia

Supplemental appendix

Table 12 Descriptive statistics

Variables	Mean	SD	Min	Max	No. obs.
Dependent var.					
P0	0.2712	0.1734	0	0.8726	1036
P1	0.0565	0.0492	0	0.3403	1036
P2	0.0176	0.0193	0	0.1555	1036
ln Total wage bill	15.9102	2.4354	8.7806	22.1963	991
ln Total workers	7.9432	2.0552	2.9957	12.9947	991
ln Wage per worker	7.9670	0.8000	4.9906	10.5361	991
ln Hourly wage	7.0960	0.4872	5.5213	8.1542	1036
Share of working adults	0.6492	0.0946	0.4078	0.8962	1036
Explanatory var.					
Labour weighted output tariffs	12.2083	4.9927	3.5145	27.6609	1036
Labour weighted input tariffs	11.0025	3.5780	5.8743	18.7479	1036
Manuf. output weighted tariffs	14.5944	6.8459	0	47.1813	1036
Manuf. input weighted tariffs	9.9865	4.5403	0	33.6694	1036
Rural share	0.6421	0.3166	0	1	1036
Share of aged 16 to 60	0.6493	0.0416	0.5183	0.8137	1036
Adult literacy rate (>19)	0.8443	0.1071	0.3122	0.9988	1036
Minimum wage	0.0174	0.0112	0.0048	0.0591	1036
Initial share of mining workers	0.0251	0.0609	0	0.7080	1036
Initial share of manuf. workers	0.2348	0.2562	0	1.0000	1036
Initial share of service workers	0.4069	0.2112	0.0635	0.9141	1036
Crisis (price shock)	166.7920	6.8913	149.8500	180.7500	1036
Adult primary education rate (30-60 years old)	0.5992	0.1695	0.1090	0.9661	1036
Adult secondary education rate (30-60 years old)	0.2902	0.1647	0.0249	0.8067	1036
Adult tertiary education rate (30-60 years old)	0.0418	0.0373	0	0.2196	1036
Past poverty rates P0	0.2418	0.2078	0	0.9130	732
Past poverty rates P1	0.0559	0.0662	0	0.3670	732
Past poverty rates P2	0.0192	0.0286	0	0.1928	732
Ln Past total firm wage bill	14.0268	2.3223	4.7875	19.3398	659
Ln Past total firm workers	7.4145	1.9824	2.3026	11.9775	659
Ln Past firm wage per worker	6.6123	0.7398	1.5294	10.3090	659
Imported inputs (% of all)	0.0917	0.1623	0	0.9204	990
Foreign investment flows (% of all)	0.0251	0.1056	0	1.0000	748
Past imported inputs (% of all)	0.1268	0.2058	0	0.9414	656
Past foreign investment flows (%)	0.0081	0.0511	0	0.7499	659

Table 13 Descriptive statistics of dependent variables by education category

Variable	Max. primary education	Junior sec. education	Senior sec. or higher education
P0	0.3172 (0.1838)	0.1893 (0.1422)	0.0960 (0.0913)
P1	0.0669 (0.0546)	0.0356 (0.0371)	0.0159 (0.0198)
P2	0.0210 (0.0219)	0.0103 (0.0140)	0.0043 (0.0068)
ln Hourly wage	6.8013 (0.4415)	6.9824 (0.3867)	7.2615 (0.6345)
Share of working adults	0.6650 (0.1054)	0.5159 (0.1000)	0.6919 (0.0810)

Note: Cells of the table present means and standard deviations (in parentheses) for the various dependent variables. Education categories of poverty measures refer to household heads, on wages and work status to individuals. The number of observation is 1036 in all cells.

Table 14 Variation in weighted tariff changes over time

Changes in tariffs:	*Changes over 3 time periods (1993-96-99-02)*			*Changes over 2 time periods (1993-96, 1999-02)*		
	Mean	SD	CV	Mean	SD	CV
Output tariffs (labour w.)	-4.408	2.069	0.469	-5.751	0.987	0.172
Input tariffs (labour w.)	-3.319	2.059	0.620	-4.653	1.006	0.216
Output tariffs (manuf. w.)	-3.920	3.361	0.857	-4.920	3.543	0.720
Input tariffs (manuf. w.)	-3.206	2.172	0.678	-4.398	1.512	0.344
Changes in tariffs:	*Changes between 1993-1996*			*Changes between 1999-2002*		
	Mean	SD	CV	Mean	SD	CV
Output tariffs (labour w.)	-6.167	1.128	0.183	-5.335	0.578	0.108
Input tariffs (labour w.)	-5.619	0.351	0.062	-3.687	0.173	0.047
Output tariffs (manuf. w.)	-6.676	3.290	0.493	-3.278	2.988	0.912
Input tariffs (manuf. w.)	-4.933	1.544	0.313	-3.917	1.308	0.334
Changes in tariffs:	*Long differences from 1993 to 2002*					
	Mean	SD	CV			
Output tariffs (labour w.)	-13.325	1.563	0.118			
Input tariffs (labour w.)	-9.958	0.353	0.035			
Output tariffs (manuf. w.)	-12.232	3.361	0.479			
Input tariffs (manuf. w.)	-10.004	2.174	0.201			

Table 15 Full estimates of Table 3, specification 3, including controls

Dependent	ΔP0	ΔP1	ΔP2
	(1)	(2)	(3)
Δ Output tariff	-0.0122*	-0.0034*	-0.0012*
	(0.0050)	(0.0014)	(0.0006)
Δ Input tariff	0.0325*	0.0164**	0.0078**
	(0.0158)	(0.0048)	(0.0020)
Δ Rural share	0.1012	0.0232	0.0084
	(0.0722)	(0.0212)	(0.0083)
Δ Share of aged 16-60	-0.2302	-0.0227	0.0123
	(0.1971)	(0.0670)	(0.0299)
Δ Adult literacy rate (>20)	-0.1100	-0.0179	-0.0055
	(0.1475)	(0.0463)	(0.0193)
Δ Minimum wage	0.1237	0.0132	0.0004
	(0.9881)	(0.3117)	(0.1272)
Initial share of mining workers	0.0163	0.0043	0.0013
	(0.0296)	(0.0088)	(0.0034)
Initial share of manuf. workers	0.0107	0.0069	0.0047*
	(0.0144)	(0.0046)	(0.0021)
Initial share of services workers	0.0336	0.0097	0.0038
	(0.0217)	(0.0042)	(0.0031)
Initial rural share	-0.0029	-0.0014	-0.0007
	(0.0177)	(0.0056)	(0.0023)
Year-island dummies	*Yes*	*Yes*	*Yes*
F-test of year-island dummies (p-value)	0.000	0.000	0.000
N	777	777	777
R2	0.537	0.435	0.340

Note: The table reports the full results of column (3) of Table 3 from first difference estimates. Standard errors, clustered at the district level, are reported in parentheses. **,*,+ mark statistical significance at the 1, 5, 10% level.

Table 16 Internationalization of firms based on current and historical firm data

Dependent	Current		Placebo: previous decade	
	Imported inputs (% of all)	Foreign inv. flows (% of all)	Imported inputs (% of all)	Foreign inv. flows (% of all)
	(1)	(2)	(3)	(4)
Sample	SI 1993-2002	SI 1993-1999	SI 1983-1989	SI 1983-1989
Output tariff	0.0007	-0.0014	-0.0016	0.0008
	(0.0020)	(0.0019)	(0.0024)	(0.0008)
Input tariff	-0.0106*	-0.0130*	0.0034	0.0019
	(0.0043)	(0.0057)	(0.0061)	(0.0034)
N	732	494	391	394
Year-island dummies	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes

Note: The table reports separate tariff coefficients, generated by first difference estimates of the reported dependent variables on tariffs and further controls. Specifications are identical to model 3 of Table 3, further controls including first differences of the share of rural population, share of working age population (16-60), literacy rates at age 20-99, minimum wages, as well as 1990 labour shares and 1993 rural population shares. Placebo regressions are repeated using the same controls but are based on 3 rounds of firms' surveys, regressed on tariff changes between 1993-1996-2002. Standard errors, clustered at the district level, are reported in parentheses. **,*,† mark statistical significance at the 1, 5, 10% level.

Figures

Figure 5 Tariff reductions by sector 1993-2002

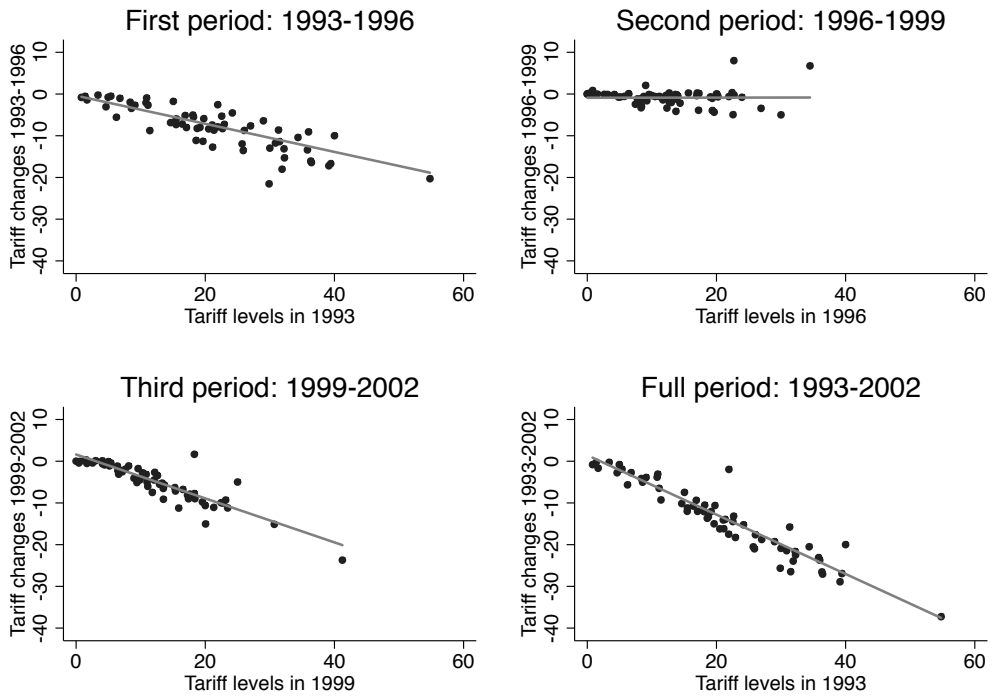


Figure 6 Changes in poverty (P0) 1993-2002

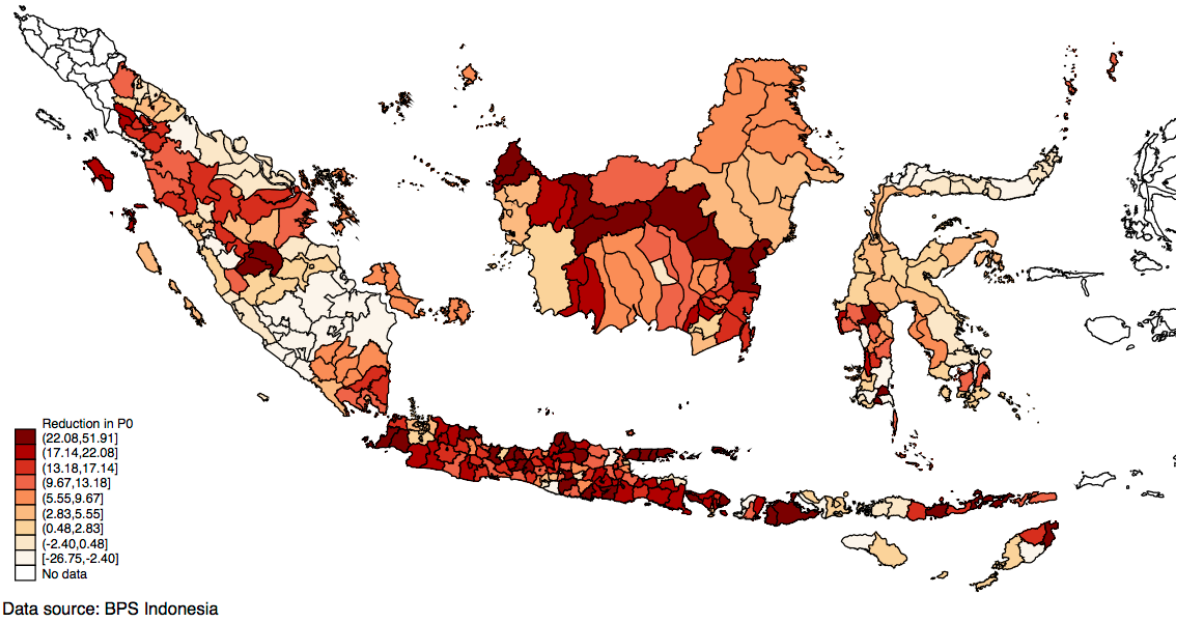
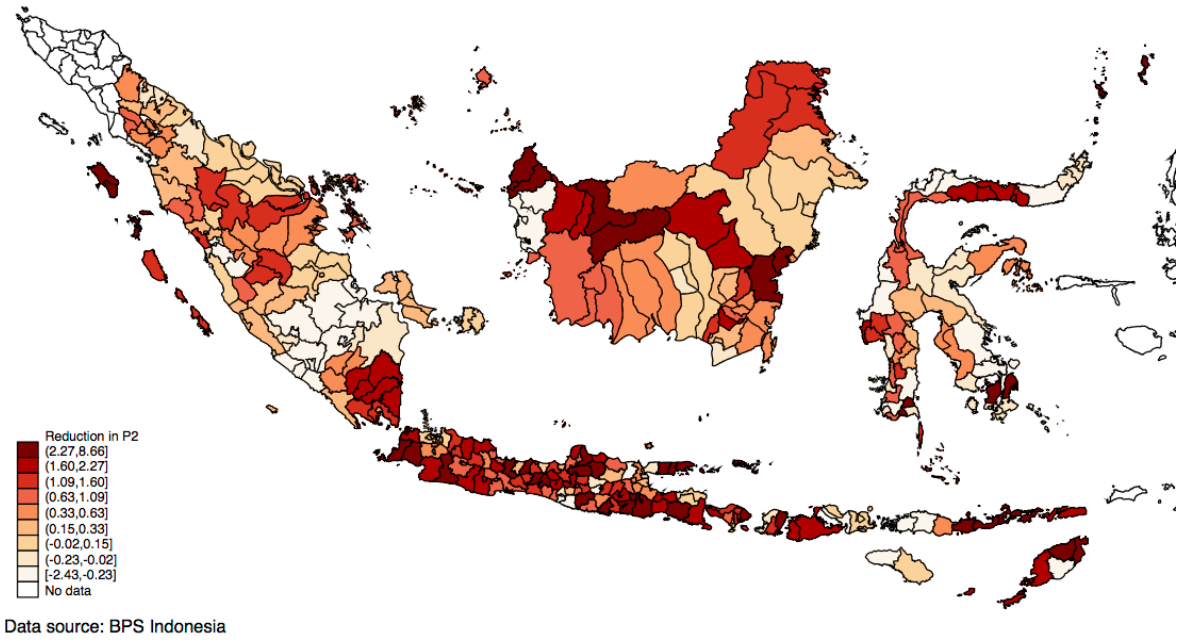


Figure 7 Changes in poverty (P2) 1993-2002



Data source: BPS Indonesia