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# FOREIGN INVESTMENT REGULATION AND FIRM PRODUCTIVITY: GRANULAR EVIDENCE FROM INDONESIA

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# Foreign investment regulation and firm productivity: Granular evidence from Indonesia*

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**Abstract**

Countries that control foreign direct investment (FDI) often face the trade-off between following national policy interests and suffering efficiency losses arising from FDI restrictions. We demonstrate the presence of this trade-off in the case of a protectionist FDI policy in Indonesia that restricts FDI at the product level. Using a yearly census of Indonesian manufacturing firms for 2000 to 2015, we link product-level changes in FDI regulation to changes in firm-level productivity. Controlling for an extensive set of fixed effects as well as potential political-economy drivers of regulation, we find that newly introduced limitations on FDI were successful at reducing foreign capital use within the regulated firms. Although the drop in foreign capital has been more than compensated by increases in domestic capital, regulated firms have experienced a substantial loss in productivity that was concentrated in the sectors most dependent on external finance and technological innovation.

*JEL Classification:* F23, L51, D24, F21, L6

*Keywords:* FDI regulation, Indonesia, productivity

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# 1 Introduction

In the course of the last two decades, developing and emerging economies liberalized their markets substantially, dismantling trade barriers and welcoming larger inflows of foreign direct investment (FDI). This global liberalization process was subject to numerous regulatory shifts and reversals that affected FDI flows (Harding and Javorcik 2011, Bourlès et al. 2013). While a substantial literature has documented links between foreign participation and firm productivity (Aitken and Harrison 1999, Arnold and Javorcik 2009, Javorcik and Poelhekke 2017),[1] the direct effects of FDI regulation on firm outcomes have been much less explored (Bourlès et al. 2013, Duggan et al. 2013, Eppinger and Ma 2017). Our empirical analysis addresses five-digit product-specific regulatory reforms in Indonesia at an unusually high level of granularity in order to understand how did changes in FDI regulation affect the productivity of domestic firms.[2]

Foreign capital is expected to affect firm productivity through several channels. It can substitute for domestic capital and relieve liquidity constraints if access to domestic capital is limited. Foreign investors have been shown to introduce nontangible productive assets such as technological, managerial and marketing skills, trading contacts and reputation (Aitken and Harrison 1999, Arnold and Javorcik 2009, Javorcik and Poelhekke 2017). As a result, firms with foreign participation are typically more productive, more capital intensive and pay higher wages (Harrison and Rodríguez-Clare 2010).

Since precise data on FDI regulation is frequently unavailable, most studies rely on FDI flows to proxy for reforms in FDI regulation. But as investment flows themselves are influenced by a large number of different factors, this raises the fundamental problem of unobserved heterogeneity (Harrison and Rodríguez-Clare 2010). Alternatively, newer studies rely on aggregated indices of FDI openness (Topalova and Khandelwal 2011, Duggan et al. 2013), which by construction cannot be used to capture differential effects of regulation across more disaggregated sectors. The use of disaggregated regulation data should help us to trace the effects of FDI regulation at a finer grained product scale.

Indonesia offers a great case not only to study the effects of FDI on firms (e.g., Blalock and Gertler 2008) but also to investigate the productivity effects of FDI regulation itself. As one of the largest economies in the world, with a wide variety of industries that rely on an abundance of both human and natural resources, Indonesia has emerged as an attractive FDI recipient. At the same time, the Indonesian government has been sending mixed signals to foreign investors, among others by setting up a blacklist of sectors to be closed or only conditionally open to FDI (Lindblad 2015). The first negative investment

[1] See Görg and Strobl (2001) and Görg and Greenaway (2004) for surveys of the earlier literature.

[2] The most closely related study to ours is Eppinger and Ma (2017) who look at FDI regulation at the firm level around China's WTO accession and show that changing ownership structures have lead to a boost in output and labor productivity.

list (NIL) was released in 2000 and was generally seen as contributing to a more clearly defined regulatory environment (WTO 2013). The FDI regime has been tightened in 2007 with a substantial extension of the sectoral coverage of the NIL, followed by minor adjustments in 2010 and a partial deregulation in 2014.

The stated reason for the regulatory tightening in 2007 was to protect national industries from international competition and takeovers. Our regressions investigating the political economy of these reforms find the sectoral exposure to privatization at the beginning of the decade to be among the strongest predictors of increasing regulatory penetration at the product level, suggesting that protection of current and formerly state-owned enterprises may have played a central role in decisions about the NIL. Descriptively, regulatory penetration increased by more in sectors that are generally less dependent on external finance (Rajan and Zingales 1998) but was not targeting firms operating in high-tech sectors only.

The effects of this policy instrument have been hitherto unexplored and offer a particularly interesting opportunity to investigate the effects of FDI regulation on firm performance at a highly disaggregated level. The excellent quality of Indonesian firm data, especially as compared to that from other developing countries (Blalock and Gertler 2008), enables us to investigate the effects of FDI policies on a large sample of middle and large manufacturing enterprises in an emerging economy. This paper exploits policy variation due to three revisions of the NIL that regulates sectors at the five-digit KBLI product code level, listing each product that will be fully or partially closed to FDI in the future and also specifying whether all firms or only certain types of firms are to be affected.[3] We link the regulatory changes in the NIL to a firm panel of 16 years (2000 to 2015), derived from the Indonesian yearly census of manufacturing plants. This census includes the full universe of manufacturing firms with at least 20 employees and reports a wide range of plant-level outcomes.[4] Our main outcome variables are the share of foreign ownership of each firm and two measures of firm productivity, estimated total factor productivity (TFP) and value added per worker. Our regulation indicators are firm-specific and vary by year, linking information from the NIL to the firm's main product (at five-digit level) while also utilizing individual firm characteristics (firm size, legal status and prior foreign investment) to identify direct exposure to regulation. To get a better understanding of what drives our main results, we further look at changes in capital, employment, intermediate input use and trading behavior. We also consider a host of heterogeneous effects, contrasting firms in different productivity classes as well as firms operating in sectors with lower or

[3]The KBLI (*Klasifikasi Baku Lapangan Usaha*) sector classification is published by BPS (Indonesian Statistical Office, *Badan Pusat Statistik*). It is equivalent to the United Nation's International Standard Industrial Classification of All Economic Activities (ISIC) at the four-digit level, but it is adjusted to five-digit level in order to distinguish between additional Indonesian sectors of local importance.

[4]In what follows, we use the concepts of firm and plant interchangeably as we have no further information on the structure of multi-plant firms.

higher dependence on external finance (following Rajan and Zingales 1998) and advanced technologies.

All our results are conditional on firm fixed effects and hence only consider within-firm variation in the main economic outcomes over time. Additionally, our specifications include island-year and two-digit sector-year effects that capture all average time variation due to global and national industry-specific shocks as well as variation in average input prices or regional economic conditions. The panel structure of 16 yearly waves allows us to investigate the time profile of regulation in a more flexible way by also including lags and leads of regulatory change.

The identification of causal linkages between FDI regulation and firm-level changes in foreign capital shares and productivity requires two main conditions to be fulfilled: no further interventions should be spuriously correlated with the FDI regulation and regulation should be exogenous to all characteristics that drive changes in firm productivity. As to the first condition, by the mid-2000s the tariff liberalization of the Indonesian economy was already mostly over, and although there were some further adjustments in non-tariff barriers to trade over the decade, their sectoral range was much more limited than the sectoral coverage of the NIL. By that, we are fairly confident that two-digit sector-year effects can sufficiently deal with average effects of additional broad regulatory trends as well as industry-level shocks to global demand.

The second requirement poses a larger challenge, especially as the government may have faced incentives to restrict foreign entry especially in the least productive industries. Such a lobbying process (in the spirit of Grossman and Helpman 1994) would yield a spurious negative correlation between regulation and productivity. Indeed, by testing a wide range of product market characteristics, we demonstrate that several political economy factors serve as good predictors of changes in regulation at the product level. The government was more likely to include products in the list where firms have faced recent privatization and where the remaining share of state-owned enterprises was higher or where such enterprises were less productive on average. Moreover, regulated products were produced in larger firms and more concentrated industries and have shown larger capital accumulation before becoming regulated. We address such reasons for endogenous product-specific regulation by controlling for product-level characteristics in two different ways. First, we control for three central product-level factors that are predicted to drive regulatory exposure from a theoretical perspective and allow firm-level outcomes to flexibly vary with pre-reform product characteristics over time. Second, we select the twelve most relevant time-variant predictors of product-level regulation and include these characteristics as controls in our preferred regressions.

Finally, as the NIL does not treat all firms within the same five-digit product market alike (regulation of some products being conditional on firm size, legal status or foreign

ownership share), we also have to make sure that the coefficients on regulation do not simply reflect different trajectories of firm growth across selected traits. Therefore, in our preferred specifications we also allow for differential initial firm-trait-specific trends (or their interactions with year effects). Conditional on sector-year and firm fixed effects (or also product-specific controls and firm-trait-specific trends), we see no evidence of pre-reform trends in productivity differences across regulated and non-regulated firms, which supports a causal interpretation of our results.

The results document a robust negative relationship between regulation and foreign capital shares as well as firm productivity. Foreign capital dropped in regulated firms already one year before the regulation came into force, reflecting the importance of anticipation effects. As a next step, reductions in firm productivity in regulated firms followed. Productivity declines were concentrated in the middle of the firm productivity distribution, among firms of medium size and relying on global trade linkages. Moreover, firms operating in sectors that are most reliant on external financing and that are more technology intensive experienced larger productivity declines. As the declines in foreign capital within regulated firms were more than compensated by increases in domestic capital, this suggests either less efficient allocation or a lower technological content of domestic capital. Regulated firms also tended to increase their total wage bill, while cutting back on imports at the same time, which again may have contributed to the negative technology effects. From the different types of regulation, sector-wide investment bans and licensing requirements have led to similarly large productivity reductions, whereas bans that were linked to firm-specific conditions did not change firm productivity significantly. These latter forms of regulation may have been more prone to avoidance behavior but potentially also to measurement errors.

This paper proceeds as follows. Section 2 describes the regulatory framework of the NIL in Indonesia and discusses its political economy determinants. Section 3 describes the data sources and presents descriptive trends. Section 4 introduces the estimation strategy and the identification approach. Section 5 presents our results on the direct effects of the investment reform on foreign capital share and firm productivity and investigates the main channels behind this change. Section 6 concludes.

# 2 Regulatory background

## 2.1 Foreign investment regulation in Indonesia

Indonesia started to remove the first barriers to FDI already under the "New Order" regime of President Suharto. The investment coordination board (BKPM, *Badan Koordinasi Penanaman Modal*) was installed in 1973 in order to deal with foreign investment

approvals (Gammeltoft and Tarmidi 2013). However, due to its strong dependence on natural resources, the Indonesian manufacturing sector was only poorly developed until the early 1980s (Lindblad 2015). Starting in 1983, successful efforts towards industrialization increased the importance of the manufacturing sector and made it the driving force behind Indonesia's accelerating growth (Blalock and Gertler 2008). During the 1990s, the Indonesian government has changed its previously investment-hostile regime by opening up the economy to investments from abroad. It quickly became "one of the most promising host countries [for investment], combining liberal legislation with a massive endowment of natural resources and a huge and rapidly growing domestic market for manufactured goods" (Lindblad 2015, p. 225).

The Asian financial crisis of 1997 marks a break in Indonesia's economic development. Despite immediate intervention by the International Monetary Fund, the consequences of the rapidly depreciating Rupiah spread to the real economy. This was accompanied by social and political instability that destroyed much of the confidence in Indonesia as a host for investment (WTO 1998). In order to regain the confidence of foreign investors, steps towards democratization, administrative reform, privatization and further trade liberalization were taken (Duggan et al. 2013). However, Indonesia did not immediately return to economic growth and foreign investors remained cautious since the business and legal environment remained rather precarious. Major reforms after 2004 introduced fiscal incentives to foreign investors, streamlined bureaucratic procedures and prescribed non-discriminatory treatment of foreign and domestic investors (WTO 2013). In the aftermath of these reforms, FDI inflows have massively increased again and economic growth has recovered strongly. Nonetheless, despite the ongoing liberalization, trade and investment policy in Indonesia remains "blurred by contradictory signals" (Lindblad 2015, p. 229).

In the close aftermath of the Asian financial crisis in 2000, the president released the Presidential Decree 96/2000, at the core of which lies the so-called negative investment list (NIL 2000), naming sectors that are closed or only conditionally open to FDI. Conditions included the need to form joint ventures between domestic and foreign entities, authorization in certain regions and licensing requirements. Before 2000, no explicitly formulated version of the NIL was available. There was a blacklist of sectors closed to foreign investment, but approval procedures lacked transparency and were completely in the hands of the BKPM. The NIL 2000 was the first to publish regulatory information in a transparent way.

The NIL has been revised for the first time in 2007 and the new list was released with the Presidential Decree 77/2007. The new version replaced the old rather vague descriptions from 2000 (Article 7) and listed product codes at five-digit level for the first time. In its trade policy review, the World Trade Organization highlights that a detailed NIL brings greater transparency with respect to investment and therefore may be beneficial (WTO

2013). However, closing or conditionally opening certain sectors to foreign investment is likely to be associated with wasted gains from FDI. In this sense, the revised version can be considered as a protectionist measure as it adds substantially more sectors and involves more conditions compared to the NIL 2000. The NIL 2007 comprises manufacturing as well as agriculture and services and introduces standardized categories of conditions for the first time. According to these conditions, some sectors were fully closed to foreign investment, in others, FDI was only allowed in small and medium-sized firms, in form of partnerships, up to a certain limit of foreign capital ownership, in certain locations, or required licensing by the ministry in charge. The list has been revised by further Presidential Decrees (36/2010, 39/2014 and 44/2016), removing some sectors and adding other sectors to the NIL, converting bans into licensing requirements, and slowly decreasing the overall extent of regulation. A comprehensive overview of all revisions of the NIL is provided in table A1 in the appendix, including its representation in the sample and the shares of regulated firms in total manufacturing output.[5]

## 2.2 The political economy of the NIL

Although the Indonesian government did not announce explicitly the reasons behind the choice of products to enter the NIL, a whole range of political economy factors could stand behind such decisions (Gawande and Krishna 2003). The government may have chosen to protect especially the relatively less competitive state-owned enterprises (Chari and Gupta 2008) or those industries that rely more on unskilled/more vulnerable workers (Topalova and Khandelwal 2011). Moreover, from a theoretical perspective, market concentration should have eased co-ordination problems across firms and improved their ability to pursue their interests through lobbying the government for or against certain regulatory instruments (Grossman and Helpman 1994, Chari and Gupta 2008). We control for these three dimensions in our empirical specifications explicitly by including the initial conditions on five-digit product level (concentration of sales, share of blue-collar workers, share of public enterprises) interacted with a complete set of year dummies.

In order to better understand the driving factors of FDI regulation, we additionally systematically tested a large set of further explanatory factors behind the product-specific regulatory penetration. We applied the procedure by Sala-i-Martin (1997) to search for robust predictors of the changes in the regulatory environment at the product level across a wide range of model specifications. We investigated five groups of potential political economy factors at the product market level, capturing (1) state ownership and prior

[5] An important characteristic of all versions of the NIL is that regulation is forward looking and does not apply to previously approved investments. Thus, the regulation refers to new investment plans and interferes with possible future FDI inflows. See Article 8, Presidential Decree 36/2010, article 5 of Presidential Decree 77/2007 and article 9 of Presidential Decree 39/2014.

privatization, (2) productivity dynamics, (3) firm size and concentration, (4) internationalization and (5) labor market characteristics, resulting in a total of 36 variables (measuring lagged levels as well as long differences over the previous five years).[6]

The Indonesian fiscal and administrative decentralization of 2001 (see e.g., Kis-Katos and Sjahrir 2017) was accompanied by a major wave of privatization, shifting a large share of firm assets formerly owned by local governments into the hands of private owners. Among the firms in our sample, the share of capital stock owned by the government declined rapidly, from about 67% in 2000 to about 15% in 2004 and stabilized at this lower level (see figure 1).[7] This privatization wave turns out to be the most important predictor of the subsequent regulation through the NIL. Table 1 lists the twelve product-level characteristics with the largest explanatory power for regulatory penetration across firms producing the given product, together with their average estimated coefficients. Among the top five strongest predictors of product-level regulation three refer to state ownership and the recent privatization experience of Indonesian firms. Products are more likely to have been subject to new FDI regulation if firms operated in product markets that have been privatized to a larger extent over the past five years, but also if the remaining share of state-owned enterprises was relatively higher and their productivity was relatively lower in the previous year.

Additionally, scale and productivity dynamics seem to have mattered for including new products in the list as regulated product categories were experiencing capital accumulation (a larger growth in the capital-labor ratio) and larger sales growth prior to regulation. By contrast, the share of medium-sized firms within the industry is almost mechanically (negatively) linked to regulation as several rules and limitations targeted large firms only. This is also why sales concentration or past average sales show a positive correlation with regulation.[8] From the large number of labor market characteristics that we tested, only average wage growth is (negatively) linked to regulation. In terms of internationalization, regulatory penetration is negatively linked to past export growth whereas past import growth turns insignificant in more extensive regressions.

Taken together, these results support the notion that one of the motivations behind the NIL must have been to keep recently privatized firms in domestic ownership and shield them from direct foreign competitors as well as to cushion the remaining state-owned enterprises from competitive pressures. Moreover, they suggest that regulation

[6] We tested these variables against each other in triplets, by running 6,545 regressions in total. See A.1 for more details on the estimation procedure and the full list of tested variables.

[7] At the beginning of the period, about 51% of firm capital in the sample was owned by the local governments, 16% by the central government. In 2004, the local governments' share declined to 3%, the central government's share to 13%.

[8] Conditional on a longer list of controls, the correlation between firm size and regulation tends to turn negative. While size is mechanically linked to regulation, larger firms or more concentrated industries seem to have been able to lobby against regulation, once holding all other product market characteristics constant.

was focusing on product groups with larger market potential as measured by sales growth whereas the protection of domestic employment does not seem to have played a crucial role. Throughout our empirical analyses, we will include the twelve most important product-level drivers of regulation from table 1 as controls.

# 3 Data

## 3.1 Firm data

The source of firm data is the annual manufacturing census of Indonesia (*Survei Industri*, SI) that surveys the universe of all registered Indonesian manufacturing firms with at least 20 employees. The census has been conducted by BPS yearly since 1975 and contains a rich set of information at the level of manufacturing plants, including the values of inputs and output, foreign ownership, the value of imports and exports as well as employment and capital stocks. We follow the literature by using the share of foreign capital as a proxy of FDI (see e.g., Amiti and Konings 2007, Blalock and Gertler 2008, Arnold and Javorcik 2009, all based on the same SI data).

The data is cleaned for missing values and extreme outliers. As common in the literature, data points are interpolated between the previous and the next year to avoid the loss of too many observations, while further missing observations are dropped from the sample (Amiti and Konings 2007).[9] Our final dataset consists of an unbalanced panel of 25,736 firms with a total of 196,818 observations. The sample size decreases further in some regressions because of missing values for some of the control variables as well as due to the choice of lag structure. The main regressions estimating the effects of regulation on firm productivity rely on 180,794 observations. We investigate the robustness of our results to the choice of lag structure and to using other proxies of productivity for a larger sample of firms in section 5.4. We transform all input and output variables to their natural logarithms, using a Box-Cox-transformation to deal with zeros. We deflate all monetary values to the base year 2008 by using the yearly wholesale price index from BPS.

There are some concerns regarding data quality in the SI. First, doubts arise with respect to its completeness since it claims to include all medium-sized and large manufacturing firms in Indonesia. Due to the large number of firms, it is at least possible that SI misses firms in some years or cannot investigate cases of non-respondents, leading to non-random selection and undercounting of smaller firms. The presence of financial incentives for the field agents to register new firms and verify firms that do not reply immediately reduces this problem as budgets are linked to the number of reported establishments (Blalock and Gertler 2008, Arnold and Javorcik 2009). However, this may also create wrong incentives

[9] Appendix A.2 provides more detailed information on data cleaning procedures.

by tempting field agents to fill in values of non-reporting firms themselves. A second issue arises because of potential misreporting by firms. Government law guarantees the exclusive and anonymized use of information for statistical purposes. Firms may still be concerned, however, that reported information is leaked to tax authorities or competitors and may intentionally report wrong data (Blalock and Gertler 2008). Furthermore, if firms do not put much effort into the correct completion of the questionnaires, numbers may be falsely reported by accident. Hence, noise within the data is likely to be a considerable issue. However, as long as firm selection and response behavior is not directly linked to FDI regulation, firm and two-digit sector-year fixed effects are likely to lead to unbiased within-estimates. We investigate one specific potential channel of misreporting more explicitly in section 5.4 by assessing whether regulation makes firms to switch their reported main product and whether switching firms show different productivity responses to regulation.

## 3.2 Combined dataset and descriptive trends

We combine the firm data with self-collected information from five revisions of the NIL on five-digit product level. While total closure to any investment within an industry unambiguously affects all firms, other rules depend on firm characteristics such as firm size, legal status or location. We thus use information from the firm census on previous sales, net assets, legal status and location to determine firm-specific exposure to regulation. Moreover, since the preambles of the Presidential Decrees exclude already existing FDI stocks from any new regulation, we offset regulation for those firms that exceed the later legal limits on the share of foreign capital already before the revision of the NIL.[10] Although some of the NIL stipulations further narrow regulation to selected product features, we always assign regulation to the whole five-digit product. For a detailed description of the coding and merging procedures, see appendix A.3.

We combine the detailed conditions of the NIL with firm-level information to generate a single measure of exposure to regulation. The indicator variable *Regulated* takes one if a firm is subject to any kind of regulation in a certain year, taking firm characteristics relevant for the applicability of the regulation into account. For example, *Regulated* takes zero if a medium-sized firm operates in a product market that allows FDI in small and medium-sized firms but requires licensing from large firms. For a large firm operating in the same product market, however, *Regulated* takes one since FDI is conditional on a successful licensing procedure.[11] We further investigate which types of rules affect foreign

[10] As the foreign capital share in most of the adjusted cases is 100% or close, forward looking regulation does not limit the direct scope of FDI in such firms, at least in the short run. The effect of regulation on firm productivity does not crucially depend on this adjustment.

[11] We define firm size according to the Presidential Decree No. 36/2010 that refers to law 20/2008 on small and medium-sized enterprises. A firm is defined as large by this law if its annual sales are higher than 50 billion IDR or its net assets (excluding land and buildings) surpass 10 billion IDR. The Presidential

share and productivity by explicitly differentiating between different types of regulation (licensing requirements as well as sector-wide or firm-specific bans and limitations).

Table 2 presents summary statistics for the main variables in the years 2000, 2007 and 2015.[12] The average share of foreign capital increases over time, although most domestic firms receive zero FDI throughout the whole time period. At the same time, regulatory penetration peaks in 2007. The same pattern is also reflected in figure 2 where the dashed lines show a marked increase in the share of regulated output and in the share of regulated firms in 2007 as well as some smaller adjustments in regulatory exposure afterwards. Table 2 also shows a more recent shift in the mix of the regulatory instruments from firm-specific bans towards licensing requirements.

While non-regulated firms experienced a steady increase in FDI shares over time (denoted by the grey solid line in the left panel of figure 2), FDI shares in regulated firms dropped sharply in 2007 and did only reach their previous trend by the end of our observed time period. Figures A2 and A3 in the appendix additionally show trends in labor and capital stocks, distinguishing between blue- and white-collar workers and state-owned versus private capital. The number of both types of workers decreases in 2007 in regulated firms, while staying constant in non-regulated firms. Average capital stays relatively constant throughout time, with a drop in private capital among regulated firms. The structural shifts in FDI shares, labor and capital arise from a combination of within-firm shifts in these outcomes and a composition effect as regulation was extended in 2007 to smaller and less internationalized firms.

The trends in total factor productivity (TFP) in figure 2 show that regulated firms were somewhat more productive than other firms before the reform. In 2007, both regulated and non-regulated firms faced a negative productivity shock on average, but the drop in productivity was substantially larger among regulated firms. In the aftermath, productivity in both groups recovered slowly and by 2015, average TFP was again close to equal in regulated and non-regulated firms. These trends are clearly descriptive and are potentially also driven by composition effects but they already foreshadow our regression results. The observed negative productivity shock precedes any potential effects of the global financial crisis, the macro-economic effects of which did not reach the emerging markets for other two years. It was only in 2009 that Indonesian GDP experienced a short stagnating period with a subsequent quick recovery. Hence, the 2007 productivity drop is less likely to be driven by this common global market shock. Moreover, common market shocks that affected whole industries will be factored out in our empirical analysis by the use of two-digit sector-year effects.

Decree No. 77/2007 refers to an earlier law 9/1995 on small enterprises with very similar definitions once the thresholds are adjusted for inflation. We apply this rule yearly, adjusting for inflation.

[12] Summary statistics for the full sample can be found in table A3 in the appendix. Table A4 shows the yearly number of observations in the two largest estimation samples.

Table 3 displays the share of regulated firms, the average foreign capital share and TFP by two-digit sector and year. Regulation across sectors shows a very heterogeneous picture. Some industries are not affected by the NIL at all whereas other sectors like wood and wood products were already strictly regulated in 2000. Our analysis will only rely on within-sector variation in regulation and productivity of the two-digit sectors over time, while controlling for sector-year effects. Thus, we do not explain changes in FDI penetration or sector-wide changes in productivity, but only focus at the within-firm and within-sector-year differential relationship between FDI regulation and firm outcomes.

# 4 Estimation strategy

We investigate the effect of the foreign investment regulation on firm outcomes by estimating the equation

$$\begin{aligned} y_{ijsrt} = \quad & \alpha REG_{ijsr\tau} + \boldsymbol{X}'_{ijsrt}\,\beta + \lambda_i + \gamma_{rt} + \psi_{st} \\ & + \boldsymbol{Z}'_{1j,2005} \times \phi_t + \boldsymbol{Z}'_{2jt}\,\varphi + \boldsymbol{W}'_{i0} \times t + \varepsilon_{ijsrt} \quad \tau = t-1, t, \end{aligned} \tag{1}$$

where $y_{ijsrt}$ measures the relevant outcomes of firm $i$ operating in the five-digit product market $j$ within the two-digit sector $s$ in macro-region $r$ and year $t$.[13] Our main outcomes measure the percentage of foreign equity in total firm equity (FDI share) and two productivity proxies: the estimated log of TFP and the log of value added per worker in each firm. $REG_{ijsr\tau}$ is the investment restriction in product market $j$ in year $\tau$, conditional on the characteristics of firm $i$ and firm location $r$. We test for contemporaneous as well as lagged effects of regulation, $\tau = t, t-1$, and in further tests also include up to three lags and leads of regulation at the same time. All regressions include a vector of controls $\boldsymbol{X}_{ijsrt}$ to capture time-variant firm characteristics, such as a set of indicators of firm age categories and a public enterprise indicator (if more than half of a firm's capital is owned by the state). We condition our results on firm fixed effects $\lambda_i$, a set of year effects that vary by macro-region $\gamma_{rt}$, and two-digit sector-year fixed effects $\psi_{st}$. The residuals $\varepsilon_{ijsrt}$ are robustly estimated and clustered at the firm level.

Our extensive fixed effects mitigate issues with unobserved heterogeneity and endogenous regulation. Firm fixed effects absorb all time invariant unobservable firm characteristics, including the firms' average propensity to enjoy protection or be subject to regulation (Goldberg and Pavcnik 2005). Island-year fixed effects flexibly control for all regional factors that may correlate with both regional exposure to regulation and shifts in foreign capital shares. The sector-year fixed effects control for time-variant incentives to lobby for protection at the two-digit sector level (Blalock and Gertler 2008). They are considered

[13] We distinguish between five island groups as macro-regions: Sumatra, Java, Kalimantan, Sulawesi and the rest of smaller islands.

to be crucial controls especially for productivity estimates (Goldberg and Pavcnik 2005) as they also reflect industry-specific variation in the price of intermediates, which will affect TFP estimates substantially. Moreover, they also implicitly cancel out common time trends and common macroeconomic or regulatory shocks to FDI and productivity. Adding further lags and leads of regulation helps us to better understand the timing patterns of regulatory effects and to look for anticipation effects or pre-trends.

In our preferred specifications, we capture three further sets of determinants of the propensity to be subject to regulation both at the detailed five-digit product and at the firm level. First, we interact $\boldsymbol{Z}_{1j,2005}$, average characteristics of product $j$ measured two years before the major regulatory reform (in year 2005), with a full set of year effects $\phi_t$. These characteristics include the share of state-owned firms, a Herfindahl index of sales concentration and the share of blue-collar (production) workers within the five-digit industry, all of which have been hypothesized to explain the success of firm lobbying for or against regulation (Grossman and Helpman 1994, Chari and Gupta 2008, Topalova and Khandelwal 2011). Interactions with a full set of time effects control flexibly for all further (as well as previous) product-specific dynamics that may be related to these product market characteristics. As a second approach, we control for $\boldsymbol{Z}_{2jt}$, a vector of twelve time-variant product market traits that turned out as the most robust predictors of product level regulatory penetration. These traits are listed in table 1 and include past privatization and productivity dynamics, measures of firm size and concentration, growth in wages and exports as well as import penetration (also see section 2.2 and A.1 in the appendix). The third set of factors, $\boldsymbol{W}_{i0}$, allows for differential time dynamics by a set of firm-specific characteristics. Certain firm traits make exposure to regulation less likely as medium-sized firms or firms with a very high share of previous FDI were exempt from certain forms of regulation. Further firm characteristics like legal status or state ownership may also put firms on different growth trajectories. We control for these differences in firm growth by interacting the first observation of these variables for each firm with a time trend. Alternatively, we also interact all relevant firm characteristics in 2005 with a full set of year effects instead, allowing for even more flexible time dynamics.[14] These three sets of controls help us to isolate the causal effect of regulation on productivity.

In terms of our dependent variables, we contrast results using two productivity proxies. First, we estimate TFP for each firm, while simultaneously accounting for the correlation of the firm's input choices with the error term (cf. Javorcik 2004, Amiti and Konings 2007, Newman et al. 2015, Fons-Rosen et al. 2018).[15] We apply the approach suggested by

[14] Although being more flexible, this last approach limits our sample to firms that existed in 2005 and had full information on all firm characteristics, decreasing the effective sample size by more than a third. For this reason, we report results including interactions between 2005 firm traits and years only as robustness checks.

[15] If a firm adjusts its choice of inputs to unobserved productivity shocks, disregarding this adjustment will induce a severe simultaneity problem and, thus, lead to biased coefficients. See van Beveren (2012) for a

Wooldridge (2009), estimating the log of TFP for each two-digit sector $s$ separately, taking into account the varying importance of input factors across industries (see appendix A.4 for a detailed description). A more disaggregated estimation, yielding separate input coefficients on three-digit industry level, is also feasible. However, as this results in somewhat less stable input coefficients, we prefer to rely on two-digit input coefficient estimates for the baseline results. We comment on the role of aggregation in section 5.4.[16] Estimating TFP over time may also be sensitive to the choice of price deflators. As detailed sector-specific price deflators are not available for the whole time period, our main results rely on a common wholesale price deflator. Section 5.4 reports further results that use more detailed sectoral input and output deflators measured at the five-digit product level. Moreover, in order to check the robustness of our results to the way productivity is estimated, we always contrast the TFP results with a substantially simpler but frequently used proxy of productivity (see e.g., Amiti and Konings 2007), the log of value added per worker.

# 5 Results

## 5.1 Pre-trends and anticipation effects

Time patterns of FDI and productivity around the regulatory change indicate some anticipation effects for FDI but no pre-trends in productivity. This latter finding supports a causal interpretation of the effects of regulation on productivity. Figure 3 plots estimated differential and cumulative coefficients from fully specified firm-level regressions in panels A and B. The regressions include time-variant controls, initial product market traits in 2005 interacted with a full set of year effects, time-variant product market traits, firm-trait-specific trends, firm fixed effects as well as island-year and two-digit sector-year fixed effects, as described in equation (1). Moreover, they redefine the regulation indicator to include three further lags and leads:

$$\alpha REG_{ijsrt} = \sum_{\tau=t-3}^{t+3} \alpha_\tau REG_{ijsr\tau}, \tag{2}$$

the estimated coefficients $\widehat{\alpha}_\tau$ from which then are plotted in figure 3 (see also table A5 for all differential coefficients and value added per worker as alternative dependent variable).[17] Foreign capital shares and productivity follow different time patterns around the regula-

detailed discussion of TFP estimation in the literature.

[16] To account for potential imprecision in TFP estimates, we weight all regressions that use TFP as a dependent variable by the inverse of the estimated standard error of the residual.

[17] The inclusion of several lags and leads of regulation reduces the sample size substantially, especially as we omit the years 2000 to 2002 from the regression (see also table A4). We include leading observations of regulation by relying on information from the NIL 2016 revision.

tory intervention (figure 3, yearly coefficients in panel A and cumulative effects in panel B). FDI shares decline in regulated firms in comparison to their non-regulated counterparts already one year before the regulatory tightening, followed by a further decrease in the year of regulation. FDI stabilizes in the aftermath of regulation and we even see a rebound effect in the year $t+1$. The cumulative effect shows the same dynamics, levelling off at about $-0.01$ in the medium run. By contrast, the differential time effects on TFP show no pre-trends in the three years before regulation. Regulated and non-regulated firms are comparable in the run-up to regulatory change in terms of their productivity, after conditioning on our main controls. Starting with the year of regulation, productivity shows a marked decline in the group of regulated firms and the differential negative effects persist for two further periods. The cumulative effect of regulation becomes only significant in period $t+2$, but the shift starts already in $t$. Substituting value added per worker instead of TFP results in highly comparable productivity dynamics (see table A5).

These time patterns conform with the original intent of the NIL, which had the primary goal to shift the sectoral presence of FDI, whereas potential further adjustments must have arisen as a reaction to changes in FDI. In our baseline models, we follow the literature by linking productivity to regulatory intervention within the past year, setting $\tau = t-1$ (see equation 1), but at the same time we consider a shorter term response of FDI to contemporary regulation with $\tau = t$. Section 5.4 tests the robustness of our results under different assumptions about the timing of effects. The missing pre-trends in productivity suggest that policy makers were not implementing protectionist measures in product markets with declining productivity and thus reverse causality is unlikely to drive our results. Nonetheless, the significant FDI reaction in the year before regulation highlights the potential importance of anticipation effects.

Anecdotal evidence indeed suggests that firms already may have anticipated changes in the regulatory framework before the introduction of the new Presidential Decrees. For instance, the largest Indonesian newspaper, Kompas, has already started to cover the topic in 2005 (June 30), two years before the actual NIL 2007 revision, reporting that the wheat industry will not enter the new list. Coverage got more pronounced at the beginning of 2007. On February 8, Kompas announced that the Ministry of Industry wants sugar refineries to enter the list. When the revision finally took place, Kompas reported some concerns from business actors who criticized the list because "existing investment is difficult to develop even though the NIL is not retroactive" (July 16, 2007, p. 18). Similarly, Kompas already started to report on plans to revise the NIL at the beginning of 2013 while the Presidential Decree was only released in April 2014. In February 2013, Kompas quoted the head of the investment coordination board, M. Chatib Basri, saying that "the main goal is to improve national competitiveness and to be more investor friendly" while "there are still sectors that must be protected" (February 18, 2013,

p. 20). Another article reported on plans for relaxation of investment in the alcoholic beverage industry on July 12, 2013. By the end of 2013, news coverage of the topic increased substantially. For example, Reuters reported on the "ease of regulation to allow foreign companies [...] to manage and operate airports" (November 20, 2013). Around the same time, Kompas published a letter to the editor in which a concerned reader named further sectors where access to foreigners is planned, among others also pharmaceuticals (November 28, 2013).

Even though this evidence is only anecdotal, the fact that newspapers openly discussed the revisions of the NIL more than one year ahead shows its relevance for the Indonesian economy. We further believe that industries and firms have been aware of more detailed plans of the revisions even before they entered public media, which can explain the observed anticipation effects and changing foreign investment shares in selected sectors.

## 5.2 Baseline results

Results in table 4 show a significant decline both in FDI and productivity within regulated firms. They report the average effects of regulation on FDI shares (panel A) and two measures of productivity (panel B and C) using equation (1). All regressions identify within firm variation by including firm fixed effects plus basic time-variant firm characteristics (categories of firm age and an indicator for any state ownership). Island-year and two-digit sector-year effects factor out all macroeconomic and policy shocks that are common to a macroregion or broad sector.

Further columns extend this basic specification, flexibly controlling for a range of potential determinants of endogenous FDI policies. Column 2 includes interactions of selected product characteristics in a pre-reform year (2005) with a full set of year effects in order to capture the firms' ability to lobby regulators (proxied by the share of state-owned firms, sales concentration and the share of blue-collar workers). Column 3 further includes twelve time-variant product-level characteristics that were found to be the most important drivers of product-level regulation (see table 1) as controls. Column 4 also adds firm-trait-specific time trends, allowing for differential growth trajectories by initial firm characteristics that were related to regulatory exposure (using FDI shares and dummies for state ownership, legal status, and firm size in the initial period). Finally, column 5 includes pre-reform firm-level traits from 2005, interacted with a full set of year dummies in order to allow for more complex dynamics over time. This reduces the number of observations considerably as not all firms existed or reported in 2005. Overall, these additional variables control for a rich list of political economy factors that could have potentially explained product-level regulation. The coefficients stay remarkably stable when further time dynamics by product and firm characteristics are controlled for, indicating that endogenous regulation

is unlikely to drive these results.

Throughout all specifications, the estimated contemporaneous impact of the regulation indicator on foreign capital share is highly significant and implies that regulation is associated with a 0.6 to 0.9 percentage points reduction in the foreign equity ownership share on average (see table 4, panel A). This effect may not seem very substantial but it still amounts to about 10% of the mean foreign ownership within the sample (which is about 7%). At the same time, regulation is also linked to a statistically significant decline in TFP and value added per worker (see table 4, panel B and C).[18] The point estimate on the regulation coefficient in our preferred specification in column 4 implies that a firm that has become regulated in the previous year experiences a 3.1% reduction in its TFP, or a 2.9% reduction in the value added per worker.[19]

Our baseline TFP regressions measure the full regulatory effect, without controlling for changes in FDI shares directly. Alternative specifications that include the foreign capital share as additional control result in virtually the same regulatory coefficient (see table A8 in the appendix). While we also find that TFP is positively related to foreign ownership shares (though mostly not reaching conventional levels of statistical significance), the regulatory effects do not seem to be driven by immediate drops in the firms' FDI shares and may rather reflect changing patterns of technological upgrading or changing expectations with respect to competitive pressure that lead to adjustments in factor use.

In our main specifications, the regulation indicator turns to zero upon de-regulation, which implicitly assumes symmetric effects of regulation and de-regulation. However, it is ex-ante not clear why the effect should be equal in both directions. For instance, Davies et al. (2016) show that employment and capital growth within Jordanian firms react asymmetrically depending on whether foreign investors increase or decrease their shares. Table A9 in the appendix therefore simultaneously tests both the impact of being regulated and de-regulated after a period of protection in order to contrast it with our previous baseline results.[20] We do not find evidence for an immediate positive impact of de-regulation. Regulation still affects foreign capital and productivity negatively whereas all coefficients on the de-regulation dummy stay insignificant, but also negative. It seems that the effects of de-regulation, if any, may need an even longer time to materialize.

Our general regulation indicator combines a range of different provisions, not all of them equally restrictive. As an alternative approach, table 5 differentiates between the effects of major types of regulatory instruments by contrasting licensing requirements with the

[18] We use the first lag of the regulatory indicator in our main specifications as productivity is usually expected to adjust more slowly upon regulation (and figure 3 has shown no anticipation effects). Table A6 in the appendix shows that our results are robust to substituting contemporaneous for lagged regulation. See also section 5.4.

[19] Alternative measures of productivity, such as total value added, or value added per capital yield overall comparable results (see table A7 in the appendix).

[20] 3,478 firms experience de-regulation in our sample whereas 6,526 firms shift into being newly regulated.

more direct bans and limitations. Licensing requirements leave the affected sectors open to FDI but increase the burden of compliance by introducing costly and time-consuming procedures. In comparison, the various direct bans and limitations on FDI aim at restricting FDI flows more generally, either by closing off full product categories to FDI or limiting FDI conditional on further firm-specific characteristics (like firm size or legal status, or prior FDI shares).[21] The results show that while licensing requirements do not curb foreign investment, all other types of bans and limitations do reduce FDI (column 1 of table 5). Both outcomes seem plausible. While bans and limitations were used from the beginning, some limitations have been substituted by licensing requirements in only later years. As licenses played a part in the partial de-regulation process, they may have also been seen as partially restoring openness to these sectors. However, this does not imply that licensing is costless in productivity terms. Estimates of the productivity effects of these different regulatory instruments show similar productivity losses both due to the introduction of licensing requirements and general bans (of about 5 to 7%, in columns 2 and 3 of table 5). By contrast, firms that were subject to regulation conditional on firm-specific characteristics show substantially smaller and insignificant reductions in productivity. This may reflect a larger flexibility in the enforcement of firm-specific regulations but the effects could also be attenuated due to measurement error in the firm-specific characteristics (firm size, legal status and previous ownership shares) that we use to define exposure to regulation.

## 5.3 Potential reasons for productivity losses

In order to shed more light on the adjustment dynamics behind the observed productivity losses, table 6 tests the responses of input use and output to FDI regulation. The first three lines repeat regulation coefficients on FDI and productivity from the fully specified baseline model (table 4, column 4), whereas further results focus on capital use and composition, labor use and remuneration, output, exports and intermediate inputs, including imports. Although we may have expected that limiting the access to foreign capital would translate into an overall shortage of capital, this does not seem to be the case. While the value of foreign assets within a firm falls as a consequence of regulation substantially (by 19 log-points), this is over-compensated by a similar relative increase in domestic capital, resulting in a statistically significant increase in the value of the overall capital stock of about 4%. The increase of private and public domestic investment within regulated firms is similar in relative terms but domestic private investment dominates by far whereas public investment plays a negligible role in absolute terms (cf. figure A3). We do not see average changes in the employment of blue-collar (production) or white-collar (non-

[21] See appendix A.3 for a detailed overview of the types of regulation and how categories are coded and aggregated.

production) workers although wages of both worker types improve in regulated firms. Restricting foreign capital use has been thus successful in expanding domestic investment and increasing wages in the short run. At the same time, we see no average changes in intermediate input use, exports or total outputs, although regulation seems to be interfering with firms ability to rely on intermediate import products.

These average results mask differential adjustment dynamics across firms of different types. We first test for differences by productivity class, splitting firms into three groups according to their position in their within-industry productivity distribution and interacting FDI regulation with indicators for the low-/mid- and high-productivity group in table 7.[22] Each line in Table 7 presents estimates from a separate empirical model, showing three group-specific interaction coefficients with regulation plus statistical tests on differences between the coefficients. Regulation reduces FDI shares in firms of all three productivity classes significantly, but the subsequent productivity losses are entirely concentrated in the middle of the productivity distribution and for these firms amount to an up to 7% loss in the years after regulation. Mid-productivity firms experience an overall increase in their capital stock of about the same magnitude as increases in domestic capital tend to over-compensate the decline in foreign capital. They employ fewer white-collar workers for a higher average wage, and reduce both their output and intermediate input use, resulting in lower TFP and value added per worker. By contrast, neither the least, nor the most productive firms suffer productivity losses when facing FDI restrictions. Among the least productive firms, foreign capital gets substituted by government capital only as domestic private investors even decrease their investment into such firms. Conversely, high-productivity firms experience a substantial boost in domestic private capital, showing that the NIL has been successful in channelling more private investment towards the most successful regulated firms. Low-productivity firms additionally tend to raise wages and reduce import use whereas high-productivity firms increase blue-collar employment.

In a next step, we test for two further channels that have been widely recognized in the literature to influence firm productivity: the importance of access to financing (Rajan and Zingales 1998) and technology intensity (OECD 2003). Descriptively, FDI constitutes a more important source of external funding in finance dependent sectors (with an average FDI share of 11% as opposed to 5% otherwise). At the same time, the NIL targeted firms in finance dependent sectors to a somewhat lesser extent (see figure A4 in the appendix). Nonetheless, any policy that restricts foreign capital inflows will obviously also complicate external financing of domestic enterprises. The resulting mis-allocation

[22]The low-(high-)productivity group includes firms that have been in the lowest (highest) decile of the two-digit sectoral TFP distribution in at least one year. The group of medium productivity comprises firms that have never been in the lowest or highest decile of the sectoral productivity distributions, or, in some cases, appeared in both the upper and lower decile, mostly due to sector switches across two-digit sectors. According to this definition, there are 7,081/12,446/6,209 firms in the low/mid/high-productivity categories.

of capital could lead to inefficiencies and productivity losses. Second, a huge literature advocates the importance of FDI for technology transfer to domestic enterprises (e.g., Blalock and Gertler 2008). High-tech sectors do not seem to have been specifically targeted by the NIL (see figure A5 in the appendix). Nonetheless, worsening access to technology could also be behind the observed productivity declines.

In table 8, we split industries into two groups, using the definition of sectoral dependency on external finance and thresholds provided by Rajan and Zingales (1998).[23] In both groups, we see capital reallocation from foreign towards domestic sources, leading to FDI declines of similar relative magnitude. Firms in both types of sectors react to regulation in their input use or output as well, albeit relying on partially different margins of adjustment. Upon regulation, firms with high external finance dependency increase white-collar employment, reduce their output and domestic intermediate input use. Firms in less finance dependent sectors reduce white-collar employment and adjust their trading behaviour by increasing their exports and reducing their imports. However, regulation is only statistically linked to negative productivity effects within the sectors with a high dependence on external finance. Table A10 in the appendix shows that this differential productivity effect is also retained when varying the cut-off for high external finance dependency.

To test for potential heterogeneities due to technology access, we group firms according to the overall technology intensity of their sector, based on global research and development activity (OECD 2003).[24] Table 9 shows regulatory effects interacted with high and low sectoral technology intensity. Firms in high-tech sectors experience substantially larger reductions in FDI upon regulation and generally more negative productivity effects (especially when measured by value added per worker). These main results persist if we define technology intensity relying on within-sample information on R&D activities in 2006 instead (the share of R&D in total expenditures, the number of R&D units operating at the firm and the share of employees with a graduate degree, see table A11 in the appendix). The adjustment dynamics differ in the two sub-groups. Whereas government capital substitutes for FDI in both parts of the sample, the newly added domestic private investment is focusing almost exclusively on high-tech sectors. In terms of further reallocation, firms in high-tech sectors reduce both output and input use, whereas low-tech firms reduce their use of inputs and increase wages.

[23] In table 8, which uses a cut-off value of sectoral share of external funding of 0.2 (Rajan and Zingales 1998), 15,885 firms fall in the low dependency category at any point in time (with an average foreign capital share of 4.3%), whereas 12,165 firms are listed in the high financial dependency category (with an average foreign capital share of 9.3%).

[24] We merge the upper two categories by the OECD (2003) to denote high-technology industries. The low technology group (e.g., food, textiles and metal products) includes 24,005 firms (with an average foreign capital share of 5.2%), and the high technology group (e.g., machinery, chemicals and pharmaceuticals) includes 2,665 firms (with an average foreign capital share of 19.5%).

Tables A12 and A13 in the appendix investigate regulation effects by firms' size and foreign market linkages. Although being more intensely targeted by the NIL and experiencing the most substantial reallocation from foreign to domestic capital, large firms managed to avoid productivity losses (table A12). By contrast, medium-sized firms, which constitute the bulk of our firm universe, show significant average productivity declines. Further adjustment dynamics do not differ substantially by firm size. Finally, regulation-induced productivity declines are concentrated among firms that rely on global trade linkages (having ever engaged in importing or exporting, table A13). They experience stronger capital reallocation and are targeted more by domestic private investment, and reduce their intermediate input use, especially from imports. Non-trading firms are the ones to increase wages and reduce white-collar employment upon regulation.

Overall the results show larger productivity declines in firms of medium size and productivity, which constitute the majority of manufacturing firms. The negatively affected firms are more likely engaged in international trade and operate in sectors that are more dependent on external finance and high technology. Conversely, the least successful firms seem to have managed to avoid productivity losses: they started off from low productivity levels altogether, did not engage in trade and were operating in sectors less dependent on external funding and technology. Although we cannot disentangle the relative importance of each of the above factors, some common patterns emerge. Productivity declines always go together with substantial declines in foreign capital among the affected groups of firms but total capital availability never seems to drop (and in some sub-groups it increases significantly). Hence, productivity losses cannot be attributed to a general lack of capital among the regulated firms. The results also document that the NIL was successful in channeling more domestic private capital towards large, higher productivity firms with global market linkages, operating in high-tech sectors. Nonetheless, this capital reallocation is in most sub-groups also linked to productivity losses, suggesting that a potential inferiority of domestic capital use and missing technology inflow may have been behind the productivity declines.

Concerning the other potential margins of adjustment, regulation does not affect firm employment on average, but is linked to increasing blue-collar employment in trading firms and firms at the upper end of productivity distribution. White-collar employment increases in firms operating in sectors with a strong finance dependency, but decreases in medium productive and non-trading firms, operating in weak-finance dependency sectors. Such differential patterns could arise from differences in the complementarities between differently skilled workers and domestic and foreign capital across sectors. Wage increases for white-collar work are the strongest among the least productive, non-trading firms, operating in the low finance dependency and low-technology sectors, whereas wages for blue-collar workers only increase in low-tech sectors and only among the least produc-

tive and non-trading firms. The value of output declines among mid-productivity firms, operating in sectors with high finance dependency and high technology, whereas input use shrinks among medium productivity firms, trading firms, in sectors with high finance dependency and high technology. Finally, as the most productive (and hence potentially exporting, Melitz (2003)) firms do not lose productivity due to the NIL, regulation does not lead to general export losses, but it tends to interfere with importing. Thus, part of the productivity decline may also be explained by a reduction of intermediate imports into the Indonesian economy.

## 5.4 Further robustness issues

The baseline models fixed the time structure of the regulatory response by considering contemporaneous regulation for FDI and lagged regulation for productivity. Relying on a shorter time-frame, figure 3 and table A5 depict a more complex time structure for the regulatory effects, showing that the strongest reductions in TFP arise two years after regulation. As an alternative test of time patterns around the regulatory intervention, table A6 repeats the baseline regressions for FDI and TFP by shifting the time lag of the regulatory treatment by one year in each direction and reporting results pairwise. Unlike the results based on three lags and leads, these shifts in the lag-structure reduce the sample by one year only. For FDI, there is hardly any difference between the coefficient of regulation in $t$ and $t+1$, with both of them being significant, whereas regulation in $t-1$ does not reach conventional levels of significance. By contrast, while there is no evidence in favor of any anticipation effects on TFP, the lagged coefficient comes out somewhat larger in magnitude and more significant than the contemporaneous effect.

Although our results are identified within the same firms and hence are less likely to be driven by shifts of firm composition, it is still useful to understand whether firm composition endogenously adjusts in response to the revision of the NIL. Protection of a sector may increase the incentives for new firms to enter the market or reduce the exit rate of firms by allowing non-competitive firms to stay in the market. Conversely, regulation may also impact firms negatively, forcing them to leave the market or keeping out new entrants. It is not clear in which direction the effect will go ex-ante, but the resulting shifts in firm composition may affect average firm productivity. Column 1 of table 10 documents that regulation within a particular sector indeed reduces the probability of market entry by new firms in the same period. Furthermore, regulation also increases the likelihood of market exit in the next period. Since the exact year of entry or exit may be mis-measured due to firm (non-)response behavior, we cannot provide a more detailed analysis of market entry and exit dynamics. Instead, we test for a differential response to regulation among those firms that either enter or exit the market over the sample period. Column 3 shows that new entrants do not differentially respond to regulation in terms

of their FDI, but exiting firms experience smaller adjustments in FDI upon regulation. With respect to productivity, we see no differential changes upon regulation when looking at TFP (columns 5 and 6), but declines in value added per worker are smaller among firms that enter or exit the market. As firm exit and entry is endogenous, this may reflect selection effects. Taken together, these results show that entering and exiting firms do not react more negatively (and potentially experience less short-term adjustments) upon regulation. This makes it unlikely that the average results would be driven by entry or exit dynamics.

A different, and potentially more serious, concern is that firms will endogenously decide on whether they want to operate in a regulated sector or switch to a non-regulated product. Such sector switching could bias our estimates, but the direction of the bias is not clear ex-ante. It is both possible that firms select into newly protected sectors or choose to operate in non-regulated sectors. Moreover, as SI firms (more accurately, plants) may produce multiple products but only report their main product, regulation may also simply lead to firms reporting to belong to a non-regulated sector as a form of avoidance behavior. This second channel is unlikely to play a central role though as the firm census is not used by the authorities to explicitly monitor firms (Blalock and Gertler 2008). Table 11 addresses the product switching behavior by firms. Our dependent variable in the first two columns is an indicator for a sector switch that takes one if a firm changes its reported five-digit product code in year $t$ as compared to its previously observed sector. Column 1 shows no evidence for a sector switch occurring in year $t$ as a response to contemporaneous regulation (in year $t$), hence firms do not switch *into* protected sectors. Column 2 looks at the response to regulation in year $t-1$ instead, testing for whether firms actively select *out of* regulated sectors, yielding again an insignificant coefficient. As a next step, we test the differential effects of regulation on FDI and productivity among switching firms. We therefore distinguish between four different transition types: firms switching from non-regulated to regulated, from regulated to non-regulated and within the regulated or non-regulated sectors. Columns 3 and 4 of table 11 show that, beyond the robust negative effect of regulation on FDI, no form of sector switching is significantly associated with a decline in FDI. Columns 5 and 7 show more pronounced differences for TFP and value added per worker: firms that have recently switched sectors experience a drop in productivity by 2.4–2.5% in the next period. This seems plausible as switches may require changes in the production process that come at the cost of initial productivity losses. As before, the direction of the switch matters (see columns 6 and 8). While the average regulatory effect increases slightly, firms switching into or out of regulated sectors do not experience changes in productivity. Only firms switching within non-regulated sectors see significant reductions in productivity. This makes it clear that it is very unlikely that switching behavior across sectors would drive our findings.

Due to a large number of missing observations on capital, our sample size shrinks substantially during the data cleaning process (see appendix A.2 for more detail). Table A14 performs an important robustness check showing that our findings also hold when using the full sample size, which includes firms with missing capital observations as well. Naturally, we cannot use TFP as a measure for productivity in this fuller sample as capital is a key ingredient into the productivity estimates, but we can still use value added per worker. Regulation coefficients stay robust and of comparable magnitude both for FDI shares and value added per worker and fully confirm our baseline results.

As a last robustness check, table A15 assesses the sensitivity of baseline results to our TFP estimation procedures. The first two columns of the table repeat the baseline TFP estimates, calculated at the two-digit level with and without further time-variant controls. As a comparison, the further columns report results that are based on a more disaggregated TFP estimation. Here the TFP regressions are separately estimated for each three-digit industry, even though a few sectors have to be combined because of insufficient observations. Columns 3 to 4 of table A15 fully replicate our main results. Columns 5 to 6 of table A15 add further detail to the three-digit TFP estimates by exchanging the common wholesale price deflators used for the baseline results with five-digit product-specific price deflators. These include a five-digit wholesale price index used to deflate firm sales, a five-digit input price index used to deflate intermediate inputs, and a machinery price index, used to deflate the capital stock and net assets (for identifying large firms). The results show that our preferred specification yields almost the same regulatory effects on TFP irrespective of the sectoral aggregation for TFP estimation and sectoral detail in price deflators. All in all, we prefer to use the two-digit TFP estimates (together with the aggregated wholesale price deflator) in our main models as the higher level of detail in TFP sectors and price deflators comes at the cost of a loss in precision. Due to the relatively lower number of firms operating in some three-digit industries, input coefficients estimated at the three-digit level tend to be more unstable and some of them even turn negative, which does not happen at the two-digit level (cf. table A2). Moreover, five-digit sector-specific output and input price indices as well as the machinery price index are only available to us until 2012 and have to be imputed for the following years by assuming proportionate sectoral price variation. As our fully specified results do not change when using more detailed TFP estimates or more detailed price deflators, we interpret this as a support of our more aggregated TFP estimation approach.

# 6 Conclusion

This paper contributes to the literature on the effects of product-specific regulation of foreign investment. Despite its relatively open FDI regime, the Indonesian government

uses the instrument of a negative investment list to restrict future foreign investment in particular industries. As a clear instance of regulatory tightening, it has increased the number of regulated products very substantially in 2007. Empirical results show that the government has been especially targeting products that were previously more exposed to privatization, but also products with a larger share of state-owned firms that were less productive on average, and products where firms have been expanding their capital-labor-ratio more strongly in the past.

We measure the effects of this product-level regulation, exploiting the revisions of the NIL in 2007, 2010 and 2014. Our identification strategy is based on an extensive set of fixed effects at the firm, region-year and two-digit sector-year level. Moreover, we allow for yearly productivity changes being proportionate to an extensive set of five-digit product as well as firm characteristics in order to control for classical political economy factors that could drive industry-level variation in regulatory action. An examination of the time pattern of productivity changes helps to exclude that the effects of regulation merely reflect differences in pre-trends.

We find robust evidence that shows a substantial effect of FDI restrictions on foreign ownership shares within the affected firms. Analyzing the relationship between regulation by the NIL and firm-level productivity, we find evidence in favor of a negative influence of investment regulation on TFP and value added per worker. FDI restrictions are associated with productivity decreases of about 3% that start in the year following the regulatory change. The productivity declines cannot be mechanically explained by a drop in foreign capital shares. Instead, we see productivity declines to be concentrated both within industries that rely more strongly on external financing and are more technology intensive. As the drop in foreign capital is more than compensated by the increase in the value of firm assets in domestic ownership, the average results are unlikely to be driven by a simple shortage of capital. Instead, the domestically supplied capital may be an imperfect substitute for foreign capital and may contribute less to firm productivity. Average productivity declines go along with wage increases and reductions in intermediate import use, potentially also contributing to productivity losses.

Our results show that the Indonesian NIL has been very successful in shifting domestic investment towards the regulated sectors and has also contributed to increases in wages of both production and non-production workers within the regulated firms. These factors may well explain the general domestic popularity of the policy. However, our empirical results also emphasize that restricting foreign ownership in sectors that are deemed to be domestically important is likely to come at the cost of efficiency losses in form of productivity declines.

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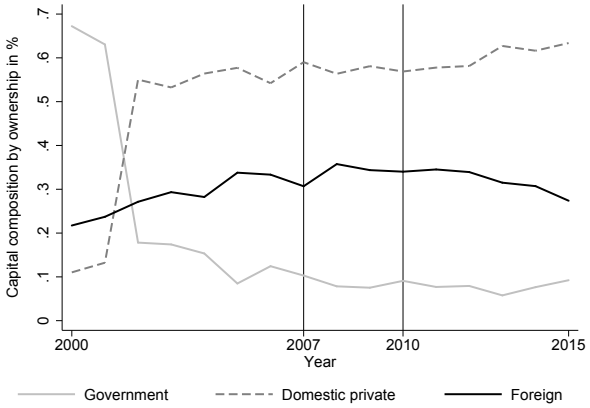
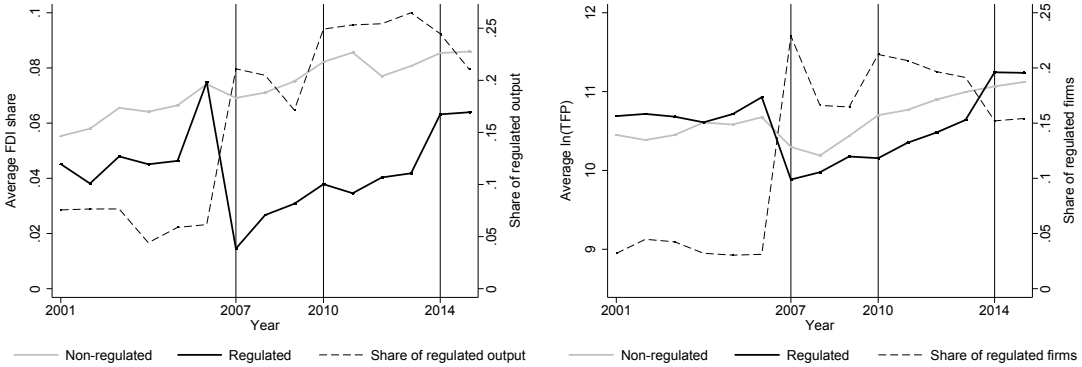
# Figures

Figure 1: Trends in capital ownership structure over time



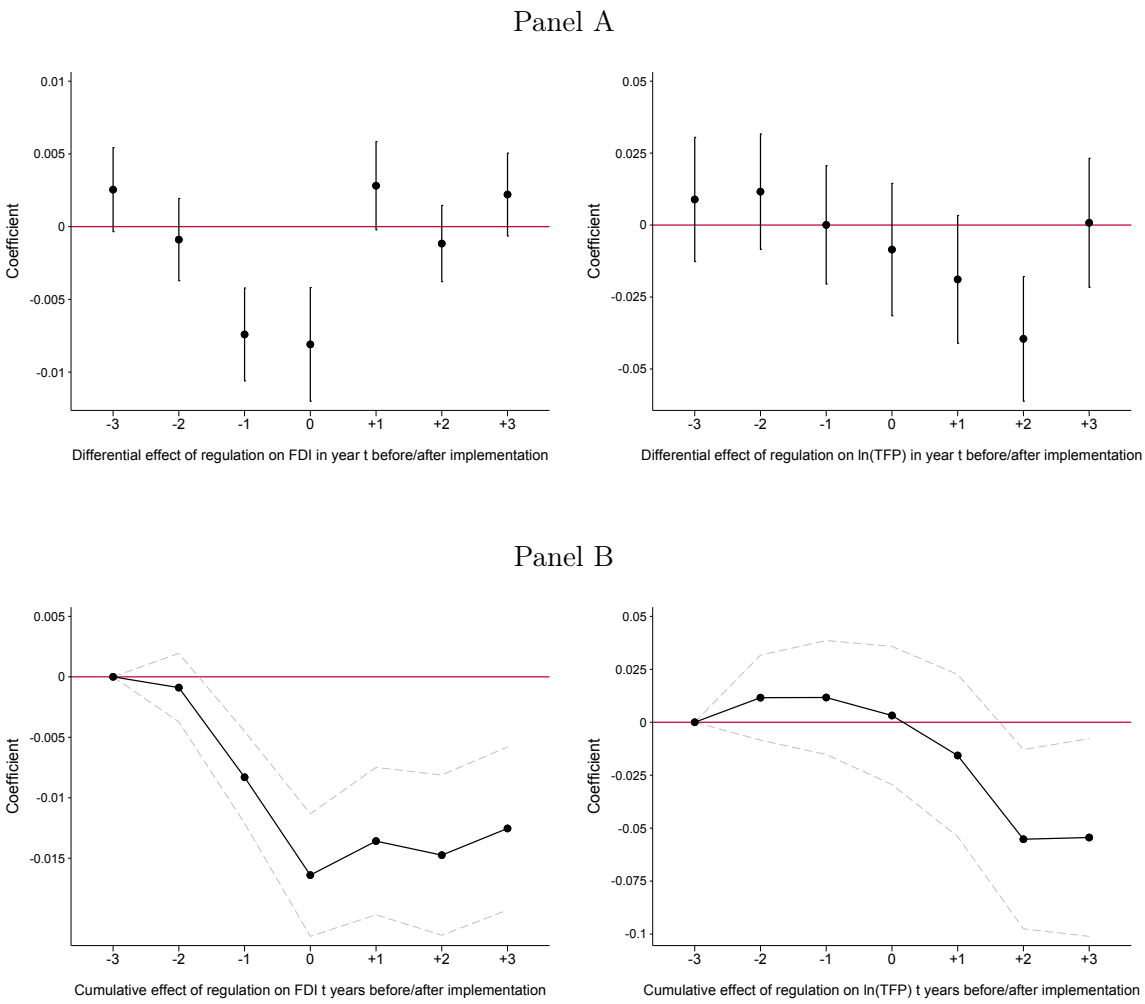

Note: The graph plots the share of total assets in government, domestic private and foreign ownership across all firms included in our sample in each year.

Figure 2: FDI and productivity in regulated vs. non-regulated firms




Note: The graph plots the share of regulated output or regulated firms over the sample period (right scale) together with the average FDI share or the average log of TFP among regulated and non-regulated firms in the respective year (left scale).

Figure 3: Timing effect on FDI and ln(TFP)




Note: Plotted coefficients are estimated controlling for categories of firm age, a public enterprise indicator, interactions of five-digit product traits with year dummies, time-variant political economy factors and firm trait specific trends as well as firm, island-year and sector-year FEs. Panel A shows differential effects of leading and lagged regulation on FDI or ln(TFP). Bars around the point estimates denote 90% confidence intervals. Panel B shows cumulative effects where the effect of regulation three periods ahead is normalized to zero. Dashed lines indicate 90% confidence bands.

# Tables

Table 1: Predictors of product-level regulatory penetration

| Variable | Change in share of regulated firms ($t-1$ to $t$, sales weighted) | | |
|---|---|---|---|
| | Coefficient | CDF (non-normal distribution) | Cluster |
| Change in share of state-owned firms ($t-6$ to $t-1$) | −0.046 | 0.96 | State ownership/privatization |
| Growth rate of capital-labor ratio ($t-6$ to $t-1$) | 0.003 | 0.96 | Productivity dynamics |
| Share of medium-sized firms ($t-1$) | −0.020 | 0.94 | Firm size/concentration |
| Share of state-owned firms ($t-1$) | 0.019 | 0.88 | State ownership/privatization |
| Average productivity of state-owned firms ($t-1$) | −0.003 | 0.87 | State ownership/privatization |
| Log of average firm sales ($t-1$) | 0.001 | 0.84 | Firm size/concentration |
| Change in share of exports in total sales($t-6$ to $t-1$) | −0.012 | 0.83 | Internationalization |
| Growth rate of average firm sales ($t-6$ to $t-1$) | 0.002 | 0.82 | Productivity dynamics |
| Growth rate of capital intensity ($t-6$ to $t-1$) | 0.004 | 0.82 | Productivity dynamics |
| Herfindahl concentration index of sales ($t-1$) | 0.006 | 0.79 | Firm size/concentration |
| Growth rate of average wage per worker ($t-6$ to $t-1$) | −0.004 | 0.79 | Labor markets |
| Change in import penetration ($t-6$ to $t-1$) | 0.006 | 0.78 | Internationalization |

Note: The table includes the 12 product-level characteristics with the highest predictive power of regulation, together with their estimated coefficient, the value of the CDF under the non-normality assumption (see Sala-i-Martin, 1997) and their respective thematic cluster. Factors are selected based on 5-digit product-level regressions of the change in the average regulation share on triplets of explanatory variables.

Table 2: Summary statistics in 2000, 2007 and 2015

| | 2000 | | 2007 | | 2015 | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Regulated | 0.03 | 0.18 | 0.23 | 0.42 | 0.18 | 0.39 |
| Licensing requirements | 0.01 | 0.10 | 0.03 | 0.16 | 0.06 | 0.25 |
| Specific bans and FDI limitations | 0.00 | 0.05 | 0.22 | 0.41 | 0.14 | 0.35 |
| Sector-wide bans | 0.02 | 0.14 | 0.01 | 0.11 | 0.01 | 0.11 |
| Reg. horizontal | 0.04 | 0.15 | 0.19 | 0.29 | 0.18 | 0.25 |
| Reg. backward | 0.01 | 0.03 | 0.06 | 0.17 | 0.07 | 0.15 |
| Reg. forward | 0.04 | 0.08 | 0.04 | 0.06 | 0.06 | 0.07 |
| FDI share | 0.05 | 0.20 | 0.05 | 0.21 | 0.07 | 0.25 |
| MNE | 0.06 | 0.24 | 0.06 | 0.24 | 0.08 | 0.28 |
| ln(TFP) | 10.17 | 1.51 | 10.18 | 1.50 | 11.13 | 1.47 |
| ln(VAD/L) | 9.87 | 1.24 | 9.88 | 1.23 | 10.79 | 1.19 |
| ln(K) | 14.23 | 2.04 | 13.79 | 2.07 | 14.30 | 2.12 |
| ln(L) | 4.18 | 1.13 | 4.03 | 1.05 | 4.17 | 1.15 |
| Firm age below 5 years | 0.16 | 0.36 | 0.13 | 0.33 | 0.00 | 0.00 |
| Firm age between 5-15 years | 0.45 | 0.50 | 0.40 | 0.49 | 0.21 | 0.41 |
| Firm age between 15-25 years | 0.24 | 0.43 | 0.28 | 0.45 | 0.39 | 0.49 |
| Firm age above 25 years | 0.15 | 0.36 | 0.20 | 0.40 | 0.40 | 0.49 |
| Switch in t | 0.15 | 0.36 | 0.20 | 0.40 | 0.11 | 0.31 |
| Switch into regulated | 0.01 | 0.07 | 0.03 | 0.17 | 0.01 | 0.12 |
| Switch into nonregulated | 0.00 | 0.00 | 0.01 | 0.09 | 0.01 | 0.11 |
| Switch within regulated | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 | 0.08 |
| Switch within nonregulated | 0.14 | 0.35 | 0.16 | 0.37 | 0.08 | 0.27 |
| Exit in t | 0.00 | 0.00 | 0.03 | 0.16 | 0.00 | 0.00 |
| Entry in t | 0.06 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |

Note: Number of observations in 2000: 11,725; 2007: 13,459; 2015: 9,823.

Table 3: Summary statistics by sectors in 2000, 2007 and 2015

| | Regulated | | | FDI share | | | ln(*TFP*) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2007 | 2015 | 2000 | 2007 | 2015 | 2000 | 2007 | 2015 |
| Food products and beverages | 0.01 | 0.28 | 0.16 | 0.02 | 0.03 | 0.04 | 9.57 | 9.64 | 10.35 |
| Tobacco products | 0.00 | 0.27 | 0.76 | 0.00 | 0.00 | 0.01 | 8.66 | 8.66 | 10.76 |
| Textiles | 0.00 | 0.11 | 0.10 | 0.06 | 0.04 | 0.06 | 10.85 | 10.65 | 11.34 |
| Wearing apparel | 0.00 | 0.00 | 0.03 | 0.05 | 0.05 | 0.09 | 9.53 | 9.44 | 10.27 |
| Leather and leather products | 0.00 | 0.00 | 0.00 | 0.06 | 0.07 | 0.10 | 11.08 | 10.89 | 11.94 |
| Wood and wood products, except furniture | 0.33 | 0.31 | 0.32 | 0.04 | 0.04 | 0.06 | 10.24 | 9.95 | 10.66 |
| Pulp, paper and paper products | 0.01 | 0.03 | 0.01 | 0.05 | 0.07 | 0.11 | 10.81 | 10.77 | 11.54 |
| Publishing, printing and recorded media | 0.00 | 0.18 | 0.02 | 0.01 | 0.01 | 0.02 | 10.80 | 11.16 | 11.53 |
| Coke, refined petroleum products and nuclear fuel | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.07 | 10.50 | 10.74 | 11.17 |
| Chemicals and chemical products | 0.09 | 0.36 | 0.29 | 0.14 | 0.16 | 0.18 | 12.51 | 12.62 | 13.40 |
| Rubber and plastics products | 0.00 | 0.00 | 0.09 | 0.07 | 0.10 | 0.12 | 11.49 | 11.64 | 12.44 |
| Other non-metallic mineral products | 0.00 | 0.71 | 0.11 | 0.02 | 0.01 | 0.03 | 9.79 | 9.72 | 10.66 |
| Basic metals | 0.00 | 0.15 | 0.26 | 0.22 | 0.18 | 0.20 | 11.61 | 11.62 | 11.87 |
| Fabricated metal products | 0.00 | 0.06 | 0.04 | 0.09 | 0.13 | 0.13 | 10.71 | 10.96 | 11.88 |
| Machinery and equipment | 0.02 | 0.19 | 0.16 | 0.12 | 0.20 | 0.22 | 10.46 | 10.83 | 11.54 |
| Electrical equipment, office machinery, computers | 0.00 | 0.00 | 0.00 | 0.27 | 0.32 | 0.24 | 12.57 | 12.52 | 13.38 |
| Radio, television and communication equipment | 0.00 | 0.00 | 0.00 | 0.55 | 0.61 | 0.58 | 12.95 | 12.54 | 13.30 |
| Medical, precision and optical instruments | 0.00 | 0.00 | 0.00 | 0.20 | 0.27 | 0.26 | 11.82 | 11.45 | 11.97 |
| Motor vehicles | 0.00 | 0.00 | 0.00 | 0.13 | 0.20 | 0.25 | 12.05 | 12.14 | 13.35 |
| Other transport equipment | 0.00 | 0.64 | 0.47 | 0.07 | 0.12 | 0.20 | 10.63 | 11.38 | 11.85 |
| Furniture and n.e.c. | 0.00 | 0.14 | 0.10 | 0.05 | 0.06 | 0.11 | 10.11 | 10.11 | 11.12 |
| Total | 0.03 | 0.22 | 0.15 | 0.05 | 0.06 | 0.08 | 10.25 | 10.19 | 11.13 |

Note: Average share of regulated firms, average foreign capital share and average log productivity within sectors. Number of observations in 2000: 11,725; 2007: 13,459; 2015: 9,823.

Table 4: Baseline results: Regulation, FDI and productivity

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| *Panel A:* Dependent: FDI | | | | | |
| Regulated | −0.006*** | −0.007*** | −0.007*** | −0.009*** | −0.011*** |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) |
| Treatment in year | $t$ | $t$ | $t$ | $t$ | $t$ |
| Observations | 196,818 | 196,818 | 196,818 | 196,818 | 124,471 |
| Firms | 25,736 | 25,736 | 25,736 | 25,736 | 14,521 |
| R-squared | 0.867 | 0.867 | 0.867 | 0.868 | 0.864 |
| *Panel B:* Dependent: ln*(TFP)* | | | | | |
| Regulated | −0.033*** | −0.029** | −0.032*** | −0.031** | −0.029* |
| | (0.012) | (0.012) | (0.012) | (0.012) | (0.016) |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 | 113,268 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 | 14,202 |
| R-squared | 0.814 | 0.814 | 0.815 | 0.815 | 0.824 |
| *Panel C:* Dependent: ln*(VAD/L)* | | | | | |
| Regulated | −0.031** | −0.028** | −0.031** | −0.029** | −0.028* |
| | (0.012) | (0.012) | (0.012) | (0.012) | (0.016) |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 | 113,268 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 | 14,202 |
| R-squared | 0.734 | 0.734 | 0.735 | 0.735 | 0.741 |
| Basic controls | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | | Yes | Yes | Yes | Yes |
| Time-variant product traits | | | Yes | Yes | Yes |
| Firm traits specific trend | | | | Yes | |
| Firm traits in 2005 × Year | | | | | Yes |

Note: The dependent variable is the share of foreign capital (panel A), log of total factor productivity (panel B) or log of value added per worker (panel C) within each firm. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. The same set of firm traits is fixed to 2005 and then interacted with a full set of year effects. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 5: Distinguishing between types of regulation

| Dependent variable: | FDI share | ln(TFP) | ln(VAD/$L$) |
|---|---|---|---|
| | (1) | (2) | (3) |
| Licensing requirements | 0.003 | −0.053** | −0.068** |
| | (0.003) | (0.026) | (0.027) |
| Specific bans and FDI limitations | −0.011*** | −0.012 | −0.002 |
| | (0.002) | (0.014) | (0.015) |
| Sector-wide bans | −0.013*** | −0.061** | −0.063** |
| | (0.004) | (0.030) | (0.031) |
| Basic controls | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes |
| Treatment in year | $t$ | $t-1$ | $t-1$ |
| Observations | 196,818 | 180,794 | 180,794 |
| Firms | 25,736 | 24,726 | 24,726 |
| R-squared | 0.868 | 0.810 | 0.735 |

Note: The dependent variable is the foreign capital share within each firm, log TFP or log value added per worker. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 6: Transmission channels

| | Regulated | | Treatment | Observations | Firms | R-squared |
|---|---|---|---|---|---|---|
| | Coeff | SE | in year | | | |
| FDI share | −0.009*** | (0.002) | $t$ | 196,818 | 25,736 | 0.868 |
| ln($TFP$) | −0.031** | (0.012) | $t-1$ | 180,794 | 24,726 | 0.815 |
| ln(VAD/$L$) | −0.029** | (0.012) | $t-1$ | 180,794 | 24,726 | 0.735 |
| ln($K$) | 0.041** | (0.016) | $t$ | 196,818 | 25,736 | 0.882 |
| ln(Foreign $K$) | −0.191*** | (0.038) | $t$ | 196,818 | 25,736 | 0.872 |
| ln(Domestic $K$) | 0.160*** | (0.034) | $t$ | 196,818 | 25,736 | 0.809 |
| ln(Private $K$) | 0.083** | (0.035) | $t$ | 196,818 | 25,736 | 0.911 |
| ln(Gov.t $K$) | 0.101*** | (0.017) | $t$ | 196,818 | 25,736 | 0.956 |
| ln(Blue $L$) | 0.008 | (0.008) | $t-1$ | 180,794 | 24,726 | 0.913 |
| ln(White $L$) | −0.014 | (0.013) | $t-1$ | 180,794 | 24,726 | 0.818 |
| ln(Blue $w/L$) | 0.033*** | (0.011) | $t-1$ | 159,640 | 23,592 | 0.610 |
| ln(White $w/L$) | 0.118*** | (0.027) | $t-1$ | 159,640 | 23,592 | 0.650 |
| ln($Y$) | −0.016 | (0.013) | $t-1$ | 180,794 | 24,726 | 0.902 |
| ln(Exports) | 0.066 | (0.059) | $t-1$ | 142,343 | 21,858 | 0.821 |
| ln($M$) | −0.023 | (0.015) | $t-1$ | 180,794 | 24,726 | 0.878 |
| ln(Domestic $M$) | −0.045 | (0.034) | $t-1$ | 180,794 | 24,726 | 0.764 |
| ln(Imports) | −0.106** | (0.050) | $t-1$ | 180,794 | 24,726 | 0.823 |

Note: The dependent variables are listed in the first column. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 7: Effect heterogeneity by productivity level

| Regulated × | Low productivity | | Mid productivity | | High productivity | | $p$-value: | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coeff | SE | Coeff | SE | Coeff | SE | 1=2 | 1=3 | 2=3 |
| FDI share | −0.004*** | (0.001) | −0.005*** | (0.002) | −0.021*** | (0.005) | [0.321] | [0.001] | [0.003] |
| ln($TFP$) | 0.001 | (0.019) | −0.069*** | (0.015) | −0.010 | (0.027) | [0.002] | [0.738] | [0.058] |
| ln(VAD/$L$) | 0.013 | (0.020) | −0.068*** | (0.016) | −0.018 | (0.029) | [0.001] | [0.377] | [0.134] |
| ln($K$) | 0.021 | (0.024) | 0.068*** | (0.022) | 0.023 | (0.035) | [0.118] | [0.961] | [0.257] |
| ln(Foreign $K$) | −0.076*** | (0.026) | −0.111*** | (0.039) | −0.456*** | (0.102) | [0.338] | [0.000] | [0.001] |
| ln(Domestic $K$) | 0.053* | (0.030) | 0.147*** | (0.036) | 0.310*** | (0.090) | [0.019] | [0.005] | [0.073] |
| ln(Private $K$) | −0.061* | (0.032) | 0.100** | (0.039) | 0.233** | (0.092) | [0.000] | [0.001] | [0.157] |
| ln(Gov.t $K$) | 0.135*** | (0.017) | 0.082*** | (0.025) | 0.090** | (0.037) | [0.052] | [0.243] | [0.851] |
| ln(Blue $L$) | −0.011 | (0.011) | 0.004 | (0.010) | 0.039** | (0.018) | [0.263] | [0.017] | [0.095] |
| ln(White $L$) | 0.013 | (0.018) | −0.042** | (0.017) | −0.000 | (0.032) | [0.014] | [0.719] | [0.243] |
| ln(Blue $w/L$) | 0.100*** | (0.021) | 0.016 | (0.015) | −0.011 | (0.022) | [0.000] | [0.000] | [0.319] |
| ln(White $w/L$) | 0.342*** | (0.060) | 0.102** | (0.042) | −0.076** | (0.036) | [0.001] | [0.000] | [0.001] |
| ln($Y$) | 0.002 | (0.022) | −0.059*** | (0.018) | 0.033 | (0.029) | [0.020] | [0.389] | [0.007] |
| ln(Exports) | 0.099 | (0.076) | 0.085 | (0.072) | −0.008 | (0.142) | [0.878] | [0.501] | [0.551] |
| ln($M$) | −0.016 | (0.025) | −0.063*** | (0.021) | 0.031 | (0.031) | [0.112] | [0.234] | [0.012] |
| ln(Domestic $M$) | −0.055 | (0.044) | −0.089** | (0.044) | 0.035 | (0.077) | [0.523] | [0.301] | [0.153] |
| ln(Imports) | −0.332*** | (0.065) | −0.010 | (0.057) | 0.014 | (0.122) | [0.000] | [0.010] | [0.854] |

Note: The dependent variables are listed in the first column. Columns 7 to 9 test whether the respective interaction terms are statistically different from each other. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 8: Effect heterogeneity by dependency on external financing

| Regulated × | Weak dep. on ext. finance | | Strong dep. on ext. finance | | $p$-value: |
|---|---|---|---|---|---|
| | Coeff | SE | Coeff | SE | 1=2 |
| FDI share | −0.008*** | (0.002) | −0.010*** | (0.003) | [0.589] |
| ln($TFP$) | 0.006 | (0.016) | −0.077*** | (0.018) | [0.001] |
| ln(VAD/$L$) | 0.017 | (0.016) | −0.084*** | (0.018) | [0.000] |
| ln($K$) | 0.066*** | (0.021) | 0.010 | (0.026) | [0.101] |
| ln(Foreign $K$) | −0.153*** | (0.043) | −0.238*** | (0.065) | [0.270] |
| ln(Domestic $K$) | 0.160*** | (0.036) | 0.159** | (0.062) | [0.985] |
| ln(Private $K$) | 0.073** | (0.036) | 0.097 | (0.066) | [0.745] |
| ln(Gov.t $K$) | 0.101*** | (0.021) | 0.102*** | (0.029) | [0.956] |
| ln(Blue $L$) | 0.005 | (0.010) | 0.012 | (0.011) | [0.643] |
| ln(White $L$) | −0.056*** | (0.018) | 0.038** | (0.019) | [0.000] |
| ln(Blue $w/L$) | 0.036** | (0.016) | 0.028* | (0.015) | [0.727] |
| ln(White $w/L$) | 0.200*** | (0.045) | 0.034 | (0.031) | [0.002] |
| ln($Y$) | 0.018 | (0.018) | −0.056*** | (0.020) | [0.005] |
| ln(Exports) | 0.179*** | (0.063) | −0.085 | (0.107) | [0.032] |
| ln($M$) | 0.019 | (0.020) | −0.074*** | (0.023) | [0.002] |
| ln(Domestic $M$) | 0.005 | (0.037) | −0.107* | (0.060) | [0.110] |
| ln(Imports) | −0.262*** | (0.060) | 0.082 | (0.082) | [0.001] |

Note: The dependent variables are listed in the first column. Column 5 tests whether both interaction terms are statistically different from each other. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 9: Effect heterogeneity by technology

| Regulated × | Low technology | | High technology | | $p$-value: |
|---|---|---|---|---|---|
| | Coeff | SE | Coeff | SE | 1=2 |
| FDI share | −0.007*** | (0.002) | −0.023*** | (0.008) | [0.070] |
| ln($TFP$) | −0.025** | (0.013) | −0.088** | (0.043) | [0.156] |
| ln(VAD/$L$) | −0.018 | (0.013) | −0.114*** | (0.042) | [0.028] |
| ln($K$) | 0.043*** | (0.017) | 0.022 | (0.060) | [0.734] |
| ln(Foreign $K$) | −0.129*** | (0.035) | −0.688*** | (0.166) | [0.001] |
| ln(Domestic $K$) | 0.130*** | (0.031) | 0.401*** | (0.152) | [0.075] |
| ln(Private $K$) | 0.050 | (0.032) | 0.351** | (0.169) | [0.077] |
| ln(Gov.t $K$) | 0.093*** | (0.017) | 0.167** | (0.074) | [0.326] |
| ln(Blue $L$) | 0.005 | (0.008) | 0.037 | (0.024) | [0.200] |
| ln(White $L$) | −0.018 | (0.014) | 0.023 | (0.040) | [0.327] |
| ln(Blue $w/L$) | 0.042*** | (0.012) | −0.036 | (0.033) | [0.024] |
| ln(White $w/L$) | 0.145*** | (0.030) | −0.068 | (0.052) | [0.000] |
| ln($Y$) | −0.006 | (0.014) | −0.086* | (0.044) | [0.084] |
| ln(Exports) | 0.066 | (0.060) | 0.062 | (0.218) | [0.984] |
| ln($M$) | −0.010 | (0.016) | −0.120** | (0.049) | [0.032] |
| ln(Domestic $M$) | −0.019 | (0.032) | −0.248 | (0.153) | [0.138] |
| ln(Imports) | −0.125** | (0.049) | 0.035 | (0.204) | [0.443] |

Note: The dependent variables are listed in the first column. Column 5 tests whether both interaction terms are statistically different from each other. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 10: Robustness: Exit and entry of firms

| Dependent variable: | Entry | Exit | FDI share | | ln($TFP$) | | ln(VAD/$L$) | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Regulated | −0.004*** | 0.006** | −0.010*** | −0.010*** | −0.037** | −0.035*** | −0.045*** | −0.042*** |
| | (0.001) | (0.003) | (0.002) | (0.002) | (0.016) | (0.013) | (0.016) | (0.014) |
| Entry firm × regulated | | | 0.004 | | 0.017 | | 0.039* | |
| | | | (0.003) | | (0.021) | | (0.022) | |
| Exit firm × regulated | | | | 0.006** | | 0.021 | | 0.072*** |
| | | | | (0.003) | | (0.024) | | (0.026) |
| Basic controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Treatment in year | $t$ | $t-1$ | $t$ | $t$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 184,327 | 180,792 | 184,327 | 184,327 | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,970 | 24,726 | 24,970 | 24,970 | 24,726 | 24,726 | 24,726 | 24,726 |
| R-squared | 0.262 | 0.372 | 0.870 | 0.870 | 0.810 | 0.810 | 0.735 | 0.735 |

Note: The dependent variable is an entry (exit) indicator turning 1 if a firm enters (leaves) the sample in $t$, the foreign capital share within each firm, log TFP or log value added per worker. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table 11: Robustness: Sector switching behavior

| Dependent variable: | Switch | | FDI share | | ln($TFP$) | | ln(VAD/$L$) | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Regulated | −0.002 | 0.005 | −0.009*** | −0.009*** | −0.031** | −0.035** | −0.029*** | −0.033** |
| | (0.005) | (0.005) | (0.002) | (0.002) | (0.012) | (0.014) | (0.009) | (0.014) |
| Sector switch | | | −0.000 | | −0.024*** | | −0.025*** | |
| | | | (0.001) | | (0.006) | | (0.006) | |
| Switch into regulated sector | | | | 0.003 | | −0.004 | | −0.009 |
| | | | | (0.002) | | (0.019) | | (0.020) |
| Switch into nonregulated sector | | | | −0.004 | | −0.015 | | −0.017 |
| | | | | (0.002) | | (0.021) | | (0.021) |
| Switch within regulated sectors | | | | −0.004 | | 0.015 | | −0.006 |
| | | | | (0.005) | | (0.041) | | (0.041) |
| Switch within nonregulated sectors | | | | −0.000 | | −0.028*** | | −0.028*** |
| | | | | (0.001) | | (0.007) | | (0.007) |
| Basic controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Treatment in year | $t$ | $t-1$ | $t$ | $t$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 184,327 | 180,794 | 184,327 | 184,327 | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,970 | 24,726 | 24,970 | 24,970 | 24,726 | 24,726 | | 24,726 |
| R-squared | 0.364 | 0.368 | 0.870 | 0.870 | 0.810 | 0.810 | 0.735 | 0.735 |

Note: The dependent variable is a sector switch indicator turning 1 if a firm switches its operating sector in $t$, the foreign capital share within each firm, log TFP or log value added per worker. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

# A Appendix

## A.1 Product-level determinants of regulation

We study the drivers of product-level regulation by testing the predictive power of an extensive set of product-level characteristics to identify factors that robustly explain changes in the regulatory environment across a wide range of model specifications (Sala-i-Martin 1997).

Therefore, we run regressions on five-digit product level of the form:

$$\Delta REG_{jt} = \alpha + \beta_z z_{jt} + \beta_1 x_{1,jt} + \beta_2 x_{2,jt} + \beta_3 x_{3,jt} + \delta_t + \psi_s + \varepsilon_{jt} \tag{A1}$$

Our dependent variable is the change in the share of regulated firms in product market $j$ in year $t$, weighted by sales. $z_{jt}$ denotes the political economy factor to be tested, while $x_{1,jt}$ and $x_{2,jt}$ are two additional controls taken from the pool $\chi$ of all available variables, and $x_{3,jt}$ denotes a permanent control. Our permanent control is the share of state-owned firms since we expect the presence of public enterprises to be a major determinant of regulation. The regressions additionally include year fixed effects $\delta_t$ and two-digit sector fixed effects $\psi_s$, which alleviate the most obvious problems of misspecification.[25] We then run regressions with all possible combinations of $z_{jt}$, $x_{1,jt}$, $x_{2,jt}$ and $x_{3,jt}$ and compute the cumulative distribution function [CDF(0)] under the assumption of non-normality (see Sala-i-Martin (1997) for details).

The 36 investigated product level factors include the lag $(t-1)$ and the long difference $(t-1$ to $t-6)$ of the following variables:

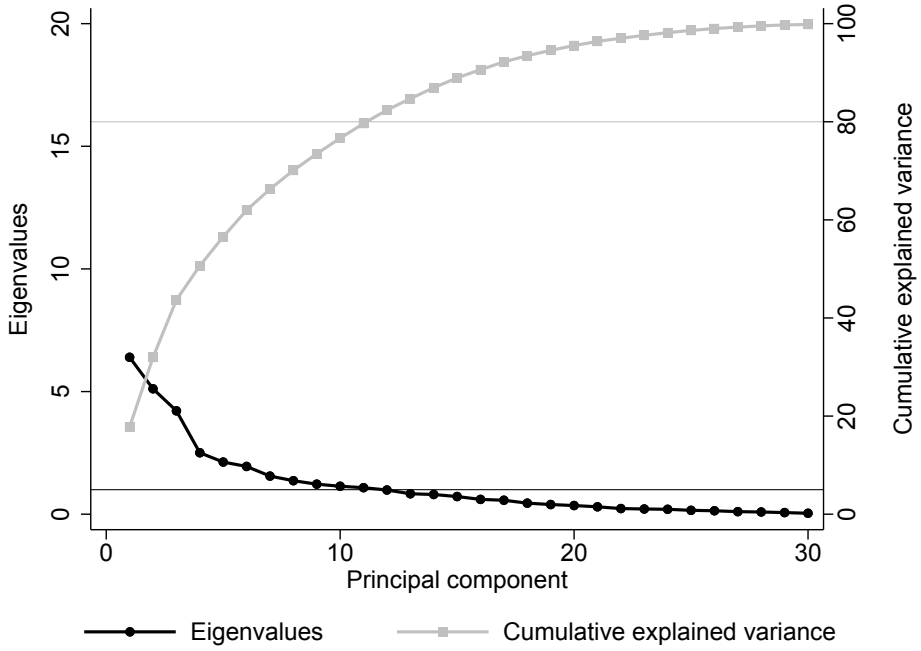
- *State ownership and privatization:* share of state-owned firms, average TFP of state-owned firms
- *Firm size and concentration:* share of medium-sized firms, Herfindahl index of sales, Herfindahl index of employment concentration
- *Productivity dynamics:* log capital-labor ratio, log capital intensity log average firm sales, log total sales,
- *Internationalization:* share of exports in total sales, average foreign capital share, import penetration
- *Labor market factors:* log average wage per worker, log total wage bill, log blue-collar worker wage bill, log white-collar worker wage bill, share of blue-collar workers, log total employment

[25] Adding a further random control from the pool alters our results only marginally.

In total, we estimate 6,545 regressions. We then select the 12 political economy factors with the highest significance in terms of the non-normal cumulative density function (CDF) and include them as time-variant controls in all our main specifications.

Finally, we perform a principal component analysis (PCA) of all available variables. Figure A1 shows eigenvalues and cumulative explained variance of the first 30 PCs. According to two selection criteria (eigenvalue of subsequent PC below one and cumulative explained variance at least at 80%), we choose 12 PCs to be included as further controls in table A16.

Figure A1: Scree plot of PCA




Note: The graph shows the eigenvalues of 30 principal components (left scale) and their cumulative explained variance (right scale), based on a PCA of 36 potential political economy factors. Horizontal lines denote rules of thumb for selecting the number of principal components (eigenvalue equals 1 and explained variance equals 80%).

## A.2 Cleaning the firm data

Matching the yearly firm panel and the NIL regulatory data relies on five-digit product. If product codes are incomplete (e.g., '151' instead of '15111') or missing, we impute, whenever plausible and unambiguously possible, the same code as in the year before or in the next year. We exclude all observations for which product codes are still missing or incomplete after this adjustment. We convert all codes to the common standard of KBLI (*Klasifikasi Baku Lapangan Usaha*) 2000 based on conversion tables provided by BPS. We drop all observations with ambiguous conversion results. We start with 378,856 observations over the 16 years, of which 1,213 have to be removed due to missing or incomplete coding. 725 additional observations are lost because of ambiguous conversion results between the years, arising from a split or unification of sector codes across different versions.

In order to estimate TFP, we rely on information on the capital stock, employment, the value of intermediate inputs, and value added. Out of these four core variables, capital stock is the one missing most frequently. As common in the literature (e.g., Amiti and Konings 2007), we interpolate the capital stock if values are missing in one year only. This is especially relevant in the year 2006, where information on the capital stock is missing for a large part of the firm sample. We are able to interpolate 21,656 observations within 17,169 firms. Even after interpolation, we have to drop 130,385 observations within 30,412 firms due to missing information on the capital stock. Thereby we lose 15,381 firms completely. We investigate the sensitivity of our results to these missing observations by also repeating our estimates for a larger sample using value added per worker as a proxy for productivity, the results for which stay comparable.

In a next step, we exclude extreme outliers by dropping all observations for which inputs or output are not within the threefold of the inter-quartile range above and below the 25 and 75 percentiles. We deal with extraordinary spikes in the data by also dropping all observations with plant-level input growth (labor, intermediate inputs and capital) as well as output growth that is outside the first and ninety-ninth percentile range of each variable's distribution. These steps reduce our sample size by further 14,217 observations within 8,652 different firms.

We also drop all firms with only one observation within the sample period, which reduces our dataset to 222,633 observations pertaining to 31,184 firms. Finally, we completely exclude all firms which do not report their legal status in any year. Though we make the rather conservative assumption of no regulation if legal status is only missing in one year, we lose all firms that never report their legal status when controlling for trends in initial firm-specific traits. We further lose some observations due to lag and long difference structure within our time-variant product trait measures. As a result, we end up with a final dataset of 196,818 observations within 25,736 firms.

## A.3 Merging the NIL conditions to product codes

Both the Negative Investment List (NIL) and the main products of the firm (KBLI) are encoded at the same five-digit level that we use to determine a product-level match between firms and regulated product groups.

Unlike in later years, NIL 2000 does not yet provide KBLI codes, but only states the names of the included sectors. Thus, in this one year we match the verbally stated sector names to the corresponding KBLI sector codes. Furthermore, as the NIL 2007 slightly changes in 2008 by an amendment to the existing regulation, we use the content of the first draft of NIL for 2007 and the amendment for the years starting with 2008. We convert the changing KBLI sector codes between the years and adjust the coding of the NIL 2010, NIL 2014 and NIL 2016 to the KBLI 2000 standard. The regulatory and firm data are merged according to the five-digit KBLI 2000 sector codes and the relevant year.

As several of the regulatory instruments are conditional on firm characteristics (see table A1 for a more detailed representation), we encode them conditional on firm attributes:

- *Closed* [closed to new investment in general] applies to all kinds of investment, both domestic and foreign. We set this regulatory measure to zero for firms that have already existing foreign involvement as the regulation is forward looking and cannot restrict foreign participation anymore.[26] The average FDI share among these firms is 85% with the majority of firms reporting full foreign ownership of 100%. Thus, these firms are not limited by forward looking regulation since a further increase is not feasible for them anyway.

- *Condition a* [opened to small and medium-sized firms] is conditional on firm size as regulated in law 20/2008 on micro, small and medium enterprises (see Presidential Decree 36/2010). According to Law 20/2008, firms should be considered as large if they have annual revenues from sales above 50 billion Rupiah and assets (excluding land and buildings) equal or above 10 billion Rupiah. The earlier Presidential Decree 77/2007 refers to the law 9/1995 on small enterprises, which establishes similar thresholds in real terms. When applying the firm size thresholds over time, we adjust for inflation. Accordingly, we generate an indicator variable that encodes large firms based on their annual sales and assets, thereby deviating from the most commonly used definition in literature which relies on the number of workers. Due to high volatility in the data, we use the median sales and median net assets of each firm in order to circumvent wrong coding in cases of outliers. Hence, we consider the classification into large and small enterprises to be time invariant. Regulation turns to one if a firm is operating in a product market regulated by *condition a* and

[26] We use offsets in this and other categories for a total of 799 firms: 755 firms in closed sectors (defined by conditions closed, a, b, d, f, i) and further 44 firms that fall under FDI limitations (c, h).

(only if) this firm is a large firm.

- *Condition b* [opened to partnerships] depends on the legal status of a firm. We exploit information on the firm's legal status given by the SI as regulation in *condition b* only applies to firms that do not have the legal status of a partnership. Unfortunately, the SI does not give any useful extra information on neither the exact structure of the partnership nor the partner's identity. Additionally, the variable on legal status suffers from plenty of missing values. In these cases, we assume no regulation as the default. Therefore, we suspect that we may undercount firms subject to *condition b*. We checked the robustness of our results to setting *condition b* to apply sector-wide instead: TFP results stay practically the same also if we consider this condition to apply to all firms within a five-digit product, while the results for FDI reduce in size and significance.

- *Condition c* [upper limit to foreign capital] sets a maximum share of capital that can be owned by foreign investors. In nine out of ten cases the upper limit to foreign capital is set to be 95% of total capital. We set this regulatory measure to zero for firms that have already reached a foreign capital share above the threshold as the regulation is forward looking and cannot restrict their foreign capital shares anymore.

- *Condition d* [limited to certain locations] and *condition g* [upper limits of foreign capital ownership in a certain location] are easily implemented by matching the regulation with plant location. Regulation is applied if a firm is located outside the authorized province.

- *Condition e* [licensing requirement] and *condition h* [upper limit to foreign capital ownership and license] allow for (limited) FDI under the prerequisite of a valid license issued by the appropriate authorities.

- *Condition f* [investment open to domestic capital] and *condition i* [investment open to domestic capital and license] ban FDI in the affected sectors entirely.

To investigate the impact of these conditions on our outcome variables, we introduce two major categories of regulation. First, we collect all conditions that are related to *Licensing requirements* since they should impose costs to investment but are different from full FDI bans. This includes *conditions e, h and i.*

Second, we generate categories of FDI limitations and bans. We collect all remaining conditions as well as *conditions h and i*, since they also impose hard limitations on FDI. To account for heterogeneity within the different types of limits and bans, we subdivide the category into two groups according to whether conditions are firm-specific or apply

to whole sectors. *Specific bans and FDI limitations* take into account any kind of firm-specific FDI ban, such as size, legal status or location, and all upper limits to foreign capital shares (including *conditions a, b, c, d, g, h*). In contrast, *Sector-wide bans* collect all conditions that affect entire sectors irrespectively of firm characteristics (including *conditions closed, f, i*).

Table A1: Conditions of the NIL over time: affected sectors and regulated firms in the sample

| Industry division | closed | a | b | c | d | e | f | h | i | Regulated firms in sample | % share of regulated firms within industry | % share of regulated firms in total output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: NIL 2000 | | | | | | | | | | | | |
| Food and beverages | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 26 | 0.79 | 0.85 |
| Wood products | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 406 | 34.73 | 2.93 |
| Pulp and paper | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0.78 | 0.57 |
| Publishing and printing media | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chemicals | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 55 | 9.34 | 0.65 |
| Machinery and equipment | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.66 | 0.00 |
| **Regulated firms in sample** | 41 | 0 | 28 | 0 | 261 | 162 | 0 | 0 | 0 | 492 | 3.44 | 5.00 |
| Panel B: NIL 2007 | | | | | | | | | | | | |
| Food and beverages | 3 | 14 | 7 | 7 | 0 | 0 | 0 | 1 | 0 | 1118 | 28.90 | 8.44 |
| Tobacco products | 0 | 1 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 280 | 30.34 | 9.20 |
| Textiles | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 182 | 10.98 | 0.05 |
| Wood products | 0 | 7 | 5 | 0 | 0 | 4 | 0 | 0 | 0 | 288 | 30.80 | 1.24 |
| Pulp and paper | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 7 | 2.56 | 1.57 |
| Publishing and printing media | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 69 | 18.75 | 0.47 |
| Chemicals | 3 | 1 | 1 | 3 | 0 | 2 | 1 | 2 | 0 | 179 | 34.76 | 2.50 |
| Rubber and plastic | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other non-metallic mineral prod. | 0 | 1 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 923 | 70.46 | 4.75 |
| Basic metals | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 18 | 17.14 | 0.82 |
| Fabricated metal products | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 6.94 | 0.19 |
| Machinery and equipment | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 32 | 18.10 | 0.06 |
| Other transport equipment | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 63.85 | 1.37 |
| Furniture | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 245 | 14.69 | 0.64 |
| **Regulated firms in sample** | 67 | 130 | 3150 | 87 | 0 | 333 | 103 | 123 | 1 | 3453 | 22.26 | 31.30 |
| Panel C: NIL 2010 | | | | | | | | | | | | |
| Food and beverages | 3 | 16 | 9 | 0 | 0 | 0 | 0 | 11 | 0 | 1254 | 31.75 | 12.20 |
| Tobacco products | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 685 | 88.73 | 4.52 |
| Textiles | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 271 | 13.53 | 0.68 |
| Wearing apparel | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 2.17 | 0.39 |
| Wood products | 0 | 7 | 5 | 0 | 0 | 5 | 0 | 0 | 0 | 313 | 35.45 | 1.23 |
| Pulp and paper | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 1.01 | 1.77 |
| Publishing and printing media | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 7 | 2.58 | 0.00 |
| Chemicals | 3 | 1 | 1 | 2 | 0 | 3 | 1 | 3 | 0 | 201 | 31.96 | 1.50 |
| Rubber and plastic | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 39 | 3.95 | 2.22 |
| Other non-metallic mineral prod. | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 143 | 11.33 | 0.03 |
| Basic metals | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 31 | 19.75 | 0.85 |
| Fabricated metal products | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 68 | 12.76 | 0.27 |
| Machinery and equipment | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 35 | 18.32 | 0.34 |
| Other transport equipment | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 98 | 51.90 | 0.79 |
| Furniture | 0 | 1 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 194 | 13.23 | 0.27 |
| **Regulated firms in sample** | 54 | 297 | 2712 | 84 | 0 | 515 | 53 | 469 | 2 | 3368 | 21.45 | 27.06 |
| Panel D: NIL 2014 | | | | | | | | | | | | |
| Food and beverages | 3 | 16 | 7 | 4 | 0 | 0 | 0 | 11 | 0 | 702 | 17.31 | 16.08 |
| Tobacco products | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 486 | 79.41 | 3.97 |
| Textiles | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 167 | 9.77 | 0.97 |
| Wearing apparel | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 3.91 | 0.78 |
| Wood products | 0 | 7 | 3 | 0 | 0 | 5 | 0 | 0 | 0 | 216 | 29.92 | 1.48 |
| Pulp and paper | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 1.43 | 1.56 |
| Publishing and printing media | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 7 | 2.34 | 0.22 |
| Chemicals | 3 | 1 | 1 | 2 | 0 | 3 | 1 | 3 | 0 | 197 | 30.26 | 1.46 |
| Rubber and plastic | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 109 | 11.19 | 2.27 |
| Other non-metallic mineral prod. | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 127 | 10.84 | 0.05 |
| Basic metals | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 44 | 25.29 | 0.92 |
| Fabricated metal products | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 28 | 5.34 | 0.18 |
| Machinery and equipment | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 33 | 14.47 | 0.46 |
| Other transport equipment | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 98 | 47.57 | 0.68 |
| Furniture | 0 | 1 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 121 | 9.70 | 0.33 |
| **Regulated firms in sample** | 42 | 297 | 1672 | 98 | 0 | 513 | 48 | 465 | 113 | 2383 | 16.00 | 31.41 |

Note: Panels A to D outline the sectoral incidence of various forms of regulation in the NIL 2000, 2007, 2010 and 2014. In each panel, two-digit sectors are displayed in rows and the various conditions of the NIL in columns (closed and a to i). The figures display the number of five-digit products that are subject to the specific form of regulation in the respective year whereas the last columns display sectoral penetration of regulation. The specific conditions include: a - Reserved for micro, small and medium enterprises and cooperatives. b - Reserved for partnerships. c - Upper limit to foreign capital ownership. d - Limited to certain locations. e - Special license required. f - 100% local capital. g - Upper limit to foreign capital ownership and limited location. h - Special license and upper limit to foreign capital ownership. i - 100% local capital and special license.

## A.4 The Wooldridge approach for productivity estimation

The estimation of TFP is based on a Cobb-Douglas production function in value added terms on plant level:

$$VA_{it} = Y_{it} - M_{it} = A_{it} L_{it}^{\alpha_L} K_{it}^{\alpha_K}, \tag{A2}$$

where the value added of firm $i$ in year $t$, $VA_{it}$, is calculated by subtracting the value of the intermediate inputs $M_{it}$ from total firm output $Y_{it}$. Value added is a function of productivity $A_{it}$, the variable input factor labor $L_{it}$ and quasi-fixed capital $K_{it}$. Taking natural logs results in:

$$va_{it} = \alpha_0 + \alpha_L l_{it} + \alpha_K k_{it} + \omega_{it} + e_{it}, \tag{A3}$$

where small letters denote logs. The error term can be decomposed into two components, an unobserved productivity component $\omega_{it}$ and the independently identically distributed error term $e_{it}$. Simultaneity bias is introduced because a part of the productivity shocks is also correlated with the choice of the variable inputs, namely labor and intermediate goods.

Wooldridge (2009) suggests an alternative and more efficient way of estimating TFP compared to the well-known procedures by Olley and Pakes (1996) or Levinsohn and Petrin (2003). Hereby, estimation of TFP needs to account for potential simultaneity bias due to correlation of input choices with the error term.[27]

The Wooldridge approach decomposes total output as:

$$va_{it} = y_{it} - m_{it} = \alpha_0 + \alpha_l l_{it} + \alpha_k k_{it} + \omega_{it} + e_{it}. \tag{A4}$$

The error term combines an unobserved productivity shock component, $\omega_{it}$, which is correlated with the input choices, and the independently identically distributed error term component, $e_{it}$. For the i.i.d. component it must hold that

$$E(e_{it}|l_{it}, k_{it}, m_{it}, l_{it-1}, k_{it-1}, m_{it-1}, ..., l_{i1}, k_{i1}, m_{i1}) = 0. \tag{A5}$$

At the same time, assume that the dynamics of productivity shocks are restricted to

$$\begin{aligned} E(\omega_{it}|k_{it}, l_{it-1}, k_{it-1}, m_{it-1}, ..., l_{i1}, k_{i1}, m_{i1}) &= E(\omega_{it}|\omega_{it-1}) \\ &= j(\omega_{it-1}), \end{aligned} \tag{A6}$$

where $\omega_{it-1} = g(k_{it-1}, m_{it-1})$.

[27] See CompNet Task Force (2014) for a more detailed description of the approach. Our notation follows that of CompNet Task Force (2014).

By introducing productivity innovations $a_{it}$, the error component turns to

$$\omega_{it} = j(\omega_{it-1} + a_{it}), \tag{A7}$$

under the assumption that

$$E(a_{it}|k_{it}, l_{it-1}, k_{it-1}, m_{it-1}, ..., l_{i1}, k_{i1}, m_{i1}) = 0. \tag{A8}$$

Consequently, only the contemporaneous choice variables $l_{it}$ and $m_{it}$ are correlated with innovations $a_{it}$, while $k_{it}$ and all past values of inputs are uncorrelated with $a_{it}$. The production function becomes:

$$va_t = \alpha_0 + \alpha_l l_{it} + \alpha_k k_{it} + j(g(k_{it-1}, m_{it-1})) + u_{it}, \tag{A9}$$

where $u_{it} = a_{it} + e_{it}$ and $E(u_{it}|k_{it}, l_{it-1}, k_{it-1}, m_{it-1}, ..., l_{i1}, k_{i1}, m_{i1}) = 0$.

Assuming that the productivity process is a random walk with drift $\omega_{it} = \tau + \omega_{it-1} + a_{it}$ (cf. CompNet Task Force 2014) and the function $g(.)$ takes the polynomial form of order three, we can identify the coefficients of input factors $\alpha_K$ and $\alpha_L$. Then, equation (A9) becomes:

$$va_{it} = (\alpha_0 + \tau) + \alpha_l l_{it} + \alpha_k k_{it} + g(k_{it-1}, m_{it-1}) + u_{it}. \tag{A10}$$

We estimate equation (A10) using a pooled instrumental variable approach, instrumenting labor by the one period lag of labor input. The estimation relies on a two-step efficient generalized method of moments (GMM) approach. The log of TFP is derived for each two-digit sector $s$ separately, taking into account the varying importance of input factors across industries:

$$\ln(TFP)^s_{it} = va^s_{it} - \hat{\alpha_0}^s - \hat{\alpha_l}^s \; l^s_{it} - \hat{\alpha_k}^s \; k^s_{it}, \tag{A11}$$

where $\alpha^s_l$ and $\alpha^s_k$ are the sector-specific input coefficients (see also table A2).

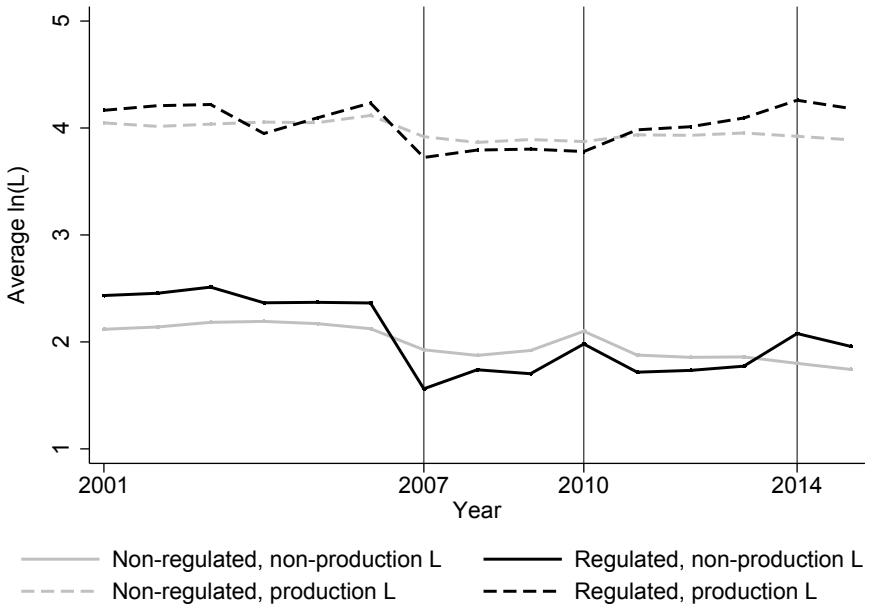
Table A2: Production function coefficients by two-digit sector

| | | ln($TFP$) | | |
|---|---|---|---|---|
| | Sector | Labor | Capital | Observations |
| Food products and beverages | 15 | 0.561 | 0.139 | 50,190 |
| Tobacco products | 16 | 0.610 | 0.105 | 9,029 |
| Textiles | 17 | 0.535 | 0.072 | 20,932 |
| Wearing apparel | 18 | 0.778 | 0.078 | 17,112 |
| Leather and leather products | 19 | 0.716 | 0.017 | 4,923 |
| Wood and wood products, except furniture | 20 | 0.594 | 0.108 | 12,201 |
| Pulp, paper and paper products | 21 | 0.546 | 0.109 | 3,574 |
| Publishing, printing and recorded media | 22 | 0.666 | 0.042 | 4,710 |
| Coke, refined petroleum products and nuclear fuel | 23 | 0.464 | 0.173 | 407 |
| Chemicals and chemical products | 24 | 0.438 | 0.058 | 8,279 |
| Rubber and plastics products | 25 | 0.500 | 0.073 | 12,293 |
| Other non-metallic mineral products | 26 | 0.438 | 0.127 | 17,872 |
| Basic metals | 27 | 0.554 | 0.125 | 1,880 |
| Fabricated metal products | 28 | 0.642 | 0.071 | 7,243 |
| Machinery and equipment | 29 | 0.629 | 0.103 | 2,987 |
| Electrical equipment, office machinery, computers | 31 | 0.642 | 0.015 | 1,743 |
| Radio, television and communication equipment | 32 | 0.586 | 0.039 | 1,284 |
| Medical, precision and optical instruments | 33 | 0.497 | 0.089 | 480 |
| Motor vehicles | 34 | 0.571 | 0.049 | 2,188 |
| Other transport equipment | 35 | 0.511 | 0.120 | 2,371 |
| Furniture and n.e.c. | 36 | 0.714 | 0.062 | 19,340 |

Note: The production function is estimated by GMM according to Wooldridge (2009).

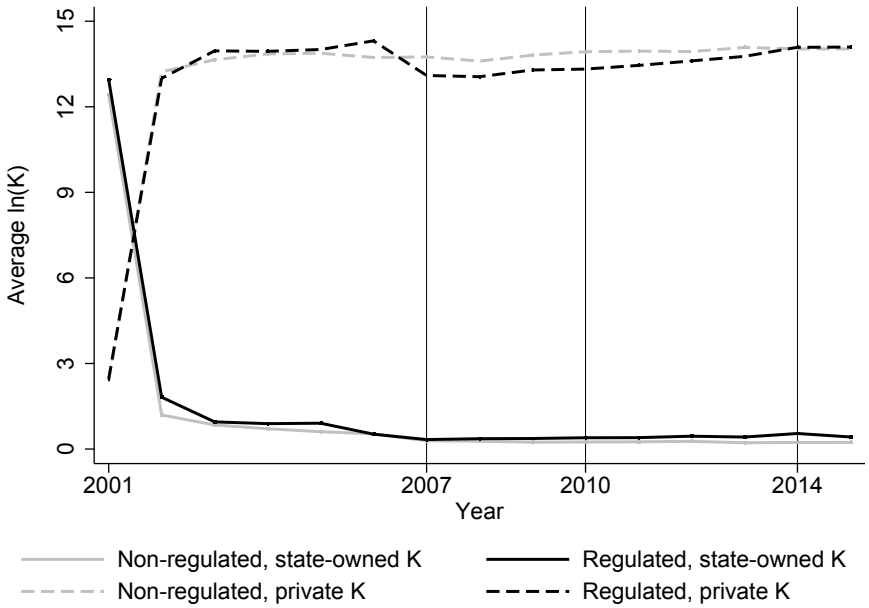
## A.5 Additional figures

Figure A2: Average blue- and white-collar labor over time



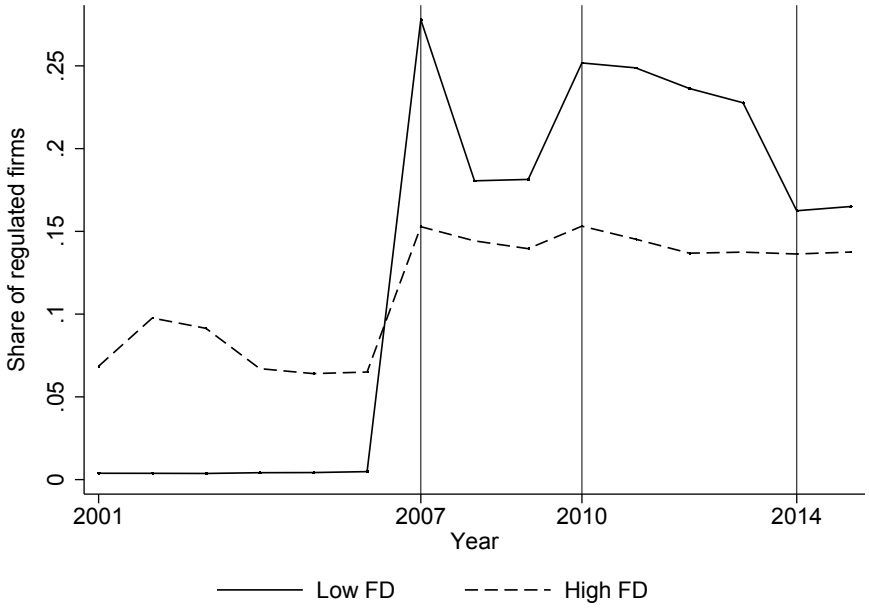

Note: The graph plots the average of log total blue-collar (white-collar) workers among regulated and non-regulated firms in the respective year.

Figure A3: Average state-owned and private capital over time



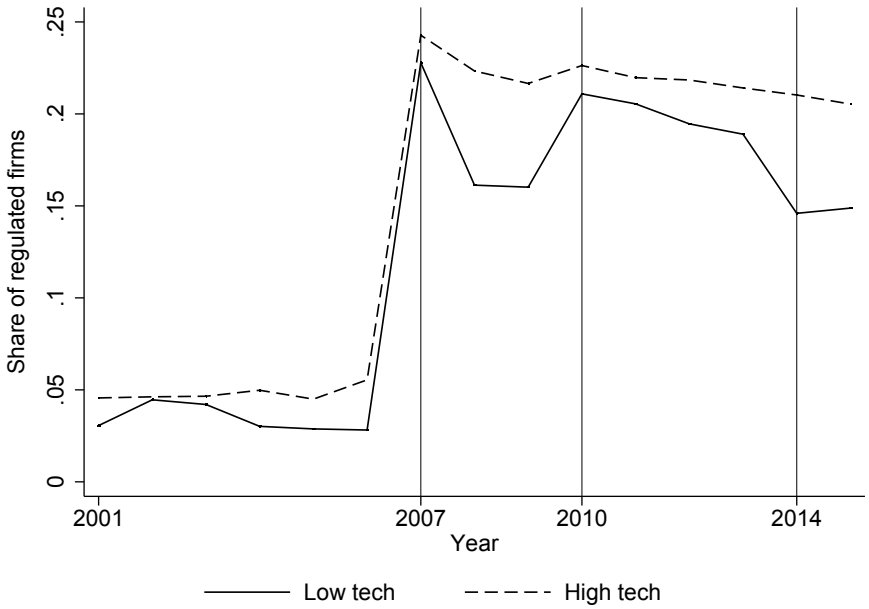

Note: The graph plots the average of the state-owned (private) log capital among regulated and non-regulated firms in the respective year.

Figure A4: Share of regulated firms by external finance dependency




Note: The graph plots the share of the regulated firms within sectors with low and high dependency on external finance.

Figure A5: Share of regulated firms by reliance on high technology




Note: The graph plots the share of the regulated firms within sectors defined as low-tech and high-tech.

## A.6 Additional tables

Table A3: Summary statistics of the main variables

| | Mean | SD | Minimum | Maximum | Observations |
|---|---|---|---|---|---|
| Regulated | 0.13 | 0.33 | 0.00 | 1.00 | 196,818 |
| Licensing requirements | 0.03 | 0.17 | 0.00 | 1.00 | 196,818 |
| Specific bans and FDI limitations | 0.10 | 0.30 | 0.00 | 1.00 | 196,818 |
| Sector-wide bans | 0.02 | 0.12 | 0.00 | 1.00 | 196,818 |
| FDI share | 0.06 | 0.23 | 0.00 | 1.00 | 196,818 |
| MNE | 0.07 | 0.26 | 0.00 | 1.00 | 196,818 |
| ln(TFP) | 10.55 | 1.59 | 0.71 | 19.43 | 196,818 |
| ln(VAD/L) | 10.20 | 1.30 | 1.06 | 18.71 | 196,818 |
| ln(K) | 14.16 | 2.09 | 4.58 | 23.52 | 196,818 |
| ln(L) | 4.17 | 1.14 | 3.04 | 9.26 | 196,818 |
| Firm age below 5 years | 0.07 | 0.26 | 0.00 | 1.00 | 196,818 |
| Firm age between 5-15 years | 0.39 | 0.49 | 0.00 | 1.00 | 196,818 |
| Firm age between 15-25 years | 0.31 | 0.46 | 0.00 | 1.00 | 196,818 |
| Firm age above 25 years | 0.24 | 0.43 | 0.00 | 1.00 | 196,818 |
| Switch in t | 0.15 | 0.35 | 0.00 | 1.00 | 196,818 |
| Switch into regulated | 0.01 | 0.11 | 0.00 | 1.00 | 196,818 |
| Switch into nonregulated | 0.01 | 0.10 | 0.00 | 1.00 | 196,818 |
| Switch within regulated | 0.00 | 0.06 | 0.00 | 1.00 | 196,818 |
| Switch within nonregulated | 0.12 | 0.32 | 0.00 | 1.00 | 196,818 |
| Exit in t | 0.04 | 0.20 | 0.00 | 1.00 | 196,818 |
| Entry in t | 0.02 | 0.12 | 0.00 | 1.00 | 196,818 |

Table A4: Number of observations in the full sample by year

| Year | FDI regressions | TFP regressions |
|---|---|---|
| 2000 | 11,725 | |
| 2001 | 13,159 | 11,968 |
| 2002 | 13,174 | 12,764 |
| 2003 | 13,097 | 12,597 |
| 2004 | 13,233 | 12,434 |
| 2005 | 13,206 | 12,463 |
| 2006 | 11,361 | 11,289 |
| 2007 | 13,459 | 13,347 |
| 2008 | 13,758 | 13,657 |
| 2009 | 13,618 | 13,512 |
| 2010 | 12,285 | 12,212 |
| 2011 | 12,071 | 12,062 |
| 2012 | 11,434 | 11,316 |
| 2013 | 11,030 | 11,000 |
| 2014 | 10,385 | 10,382 |
| 2015 | 9,823 | 9,791 |
| Total | 196,818 | 180,794 |

Table A5: The time pattern of regulation

| Dependent variable: | FDI share | ln($TFP$) | ln(VAD/$L$) |
|---|---|---|---|
| | (1) | (2) | (3) |
| Regulated in $t+3$ | 0.003 | 0.009 | 0.017 |
| | (0.002) | (0.013) | (0.013) |
| Regulated in $t+2$ | −0.001 | 0.012 | 0.004 |
| | (0.002) | (0.012) | (0.012) |
| Regulated in $t+1$ | −0.007*** | 0.000 | 0.008 |
| | (0.002) | (0.012) | (0.013) |
| Regulated in $t$ | −0.008*** | −0.009 | −0.007 |
| | (0.002) | (0.014) | (0.014) |
| Regulated in $t-1$ | 0.003 | −0.019 | −0.025* |
| | (0.002) | (0.013) | (0.014) |
| Regulated in $t-2$ | −0.001 | −0.040*** | −0.035*** |
| | (0.002) | (0.013) | (0.013) |
| Regulated in $t-3$ | 0.002 | 0.001 | −0.002 |
| | (0.002) | (0.014) | (0.014) |
| Basic controls | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes |
| Observations | 109,930 | 109,930 | 109,930 |
| Firms | 16,651 | 16,651 | 16,651 |
| R-squared | 0.881 | 0.824 | 0.746 |

Note: The dependent variable is the share of foreign capital within each firm, log of total factor productivity or log value added per worker. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A6: Shifting the time window of regulation

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Panel A:* Dependent: FDI share | | | | |
| Regulated | −0.009*** | −0.008*** | −0.009*** | −0.003** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| *Panel B:* Dependent: ln(TFP) | | | | |
| Regulated | −0.022* | −0.005 | −0.024* | −0.031** |
| | (0.013) | (0.012) | (0.013) | (0.012) |
| *Panel C:* Dependent: ln(VAD/$L$) | | | | |
| Regulated | −0.017 | 0.001 | −0.020 | −0.029** |
| | (0.013) | (0.012) | (0.013) | (0.012) |
| Basic controls | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes |
| Treatment in year | $t$ | $t+1$ | $t$ | $t-1$ |
| Observations | 186,690 | 186,690 | 180,794 | 180,794 |
| Firms | 24,407 | 24,407 | 24,726 | 24,726 |

Note: The dependent variable is the foreign capital share, the log total factor productivity or log value added per worker. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A7: Alternative TFP measures

| Dependent variable: | ln(TFP) | ln(VAD) | ln(VAD/$L$) | | ln(VAD/$K$) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Panel A:* | | | | | | |
| Regulated in $t-1$ | −0.031** | −0.026* | −0.029** | −0.033** | −0.039*** | −0.045*** |
| | (0.012) | (0.014) | (0.012) | (0.013) | (0.012) | (0.013) |
| Control for ln($K/L$) | | | | Yes | | Yes |
| *Panel B:* | | | | | | |
| Regulated in $t$ | −0.023* | −0.018 | −0.019 | −0.021 | −0.044*** | −0.022** |
| | (0.013) | (0.014) | (0.013) | (0.013) | (0.013) | (0.009) |
| Control for ln($K/L$) | | | | Yes | | Yes |

Note: All entries report separate estimation results of regulation in $t-1$ or $t$. The dependent variable is log total factor productivity, log value added or log value added per worker (or per capital). All regressions include basic controls (categories of firm age, a public enterprise indicator), interactions of five-digit product traits in 2005 (sector concentration of sales, share of blue-collar workers, share of public enterprises) with year dummies, time-variant product traits (see table 1) and firm trait specific trends (firm size, legal status and public enterprise dummies, foreign capital share) as well as firm, island-year and sector-year FE. The number of observations is 196,818 when using regulation in $t$ and 180,794 for regulation in $t-1$. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A8: Impact on productivity while controlling for FDI

| Dependent variable: | ln(TFP) | | ln(VAD/$L$) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Regulated | −0.030** | −0.028* | −0.029** | −0.028* |
| | (0.012) | (0.016) | (0.012) | (0.016) |
| FDI share | 0.035 | 0.055* | 0.024 | 0.050 |
| | (0.026) | (0.030) | (0.027) | (0.031) |
| Basic controls | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | | Yes | |
| Firm traits in 2005 × Year | | Yes | | Yes |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 180,794 | 113,268 | 180,794 | 113,268 |
| Firms | 24,726 | 14,202 | 24,726 | 14,202 |
| R-squared | 0.810 | 0.819 | 0.735 | 0.741 |

Note: The dependent variable is log total factor productivity or log value added per worker. Basic controls include categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. The same set of firm traits is fixed to 2005 and then interacted with a full set of year effects. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A9: The impact of de-regulation

| Dependent variable: | FDI share | | ln(TFP) | | ln(VAD/$L$) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Regulated | −0.011*** | −0.013*** | −0.037** | −0.033* | −0.037** | −0.032* |
| | (0.002) | (0.003) | (0.015) | (0.019) | (0.015) | (0.019) |
| De-regulated | −0.004 | −0.005 | −0.017 | −0.011 | −0.022 | −0.012 |
| | (0.003) | (0.004) | (0.020) | (0.026) | (0.020) | (0.025) |
| Basic controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | | Yes | | Yes | |
| Firm traits in 2005 × Year | | Yes | | Yes | | Yes |
| Treatment in year | $t$ | $t$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 196,818 | 124,471 | 180,794 | 113,268 | 180,794 | 113,268 |
| Firms | 25,736 | 14,521 | 24,726 | 14,202 | 24,726 | 14,202 |
| R-squared | 0.868 | 0.864 | 0.810 | 0.819 | 0.735 | 0.741 |

Note: The dependent variable is the foreign capital share within each firm, log total factor productivity or log of value added per worker. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. The same set of firm traits is fixed to 2005 and then interacted with a full set of year effects. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A10: Dependency on external finance: Varying the cut-off value

| Cut-off values (Rajan and Zingales, 1998) | 0.1 | 0.2 | 0.3 | 0.4 |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *Panel A: Dependent: FDI* | | | | |
| Weak external finance dependence × regulated | −0.010*** | −0.008*** | −0.007*** | −0.007*** |
| | (0.004) | (0.002) | (0.002) | (0.002) |
| Strong external finance dependence × regulated | −0.009*** | −0.010*** | −0.024*** | −0.020*** |
| | (0.002) | (0.003) | (0.007) | (0.007) |
| $p$-value: 1=2 | [0.688] | [0.589] | [0.016] | [0.078] |
| Observations | 196,818 | 196,818 | 196,818 | 196,818 |
| Firms | 25,736 | 25,736 | 25,736 | 25,736 |
| Treatment in year | $t$ | $t$ | $t$ | $t$ |
| *Panel B:* Dependent: ln(TFP) | | | | |
| Weak external finance dependence × regulated | 0.064*** | 0.008 | −0.024* | −0.023* |
| | (0.025) | (0.016) | (0.013) | (0.013) |
| Strong external finance dependence × regulated | −0.059*** | −0.076*** | −0.071** | −0.081** |
| | (0.014) | (0.018) | (0.036) | (0.038) |
| $p$-value: 1=2 | [0.000] | [0.000] | [0.213] | [0.149] |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| *Panel C:* Dependent: ln(VAD/$L$) | | | | |
| Weak external finance dependence × regulated | 0.083*** | 0.017 | −0.018 | −0.018 |
| | (0.026) | (0.016) | (0.013) | (0.013) |
| Strong external finance dependence × regulated | −0.059*** | −0.084*** | −0.093*** | −0.104*** |
| | (0.014) | (0.018) | (0.036) | (0.039) |
| $p$-value: 1=2 | [0.000] | [0.000] | [0.049] | [0.034] |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Basic controls | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes |

Note: The dependent variable is the share of foreign capital, log of TFP or log value added per worker within each firm. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A11: Technology: Varying the definition of high-tech sectors

| Technology categories based on: | OECD | R&D expenses | R&D units | Graduate share |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *Panel A:* Dependent: FDI | | | | |
| Low technology × regulated | −0.007*** | −0.006*** | −0.007*** | −0.008*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| High technology × regulated | −0.023*** | −0.024*** | −0.026*** | −0.015** |
| | (0.008) | (0.007) | (0.008) | (0.007) |
| $p$-value: 1=2 | [0.070] | [0.008] | [0.019] | [0.329] |
| Observations | 196,818 | 196,818 | 196,818 | 196,818 |
| Firms | 25,736 | 25,736 | 25,736 | 25,736 |
| Treatment in year | $t$ | $t$ | $t$ | $t$ |
| *Panel B:* Dependent: ln(TFP) | | | | |
| Low technology × regulated | −0.026** | −0.024* | −0.029** | −0.025** |
| | (0.013) | (0.013) | (0.012) | (0.013) |
| High technology × regulated | −0.082* | −0.066* | −0.042 | −0.076* |
| | (0.042) | (0.034) | (0.043) | (0.042) |
| $p$-value: 1=2 | [0.197] | [0.235] | [0.770] | [0.244] |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| *Panel C:* Dependent: ln(VAD/$L$) | | | | |
| Low technology × regulated | −0.018 | −0.014 | −0.021* | −0.017 |
| | (0.013) | (0.013) | (0.013) | (0.013) |
| High technology × regulated | −0.114*** | −0.101*** | −0.083* | −0.112*** |
| | (0.042) | (0.034) | (0.043) | (0.042) |
| $p$-value: 1=2 | [0.028] | [0.015] | [0.161] | [0.028] |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Basic controls | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | Yes | Yes | Yes | Yes |
| Time-variant product traits | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes |

Note: The dependent variable is the share of foreign capital, log of TFP or log value added per worker within each firm. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A12: Effect heterogeneity by firm size

| Regulated × | Medium-sized firm | | Large firm | | $p$-value: |
|---|---|---|---|---|---|
| | Coeff | SE | Coeff | SE | 1=2 |
| FDI share | −0.005*** | (0.002) | −0.044*** | (0.010) | [0.000] |
| ln($TFP$) | −0.038*** | (0.012) | 0.032 | (0.045) | [0.133] |
| ln(VAD/$L$) | −0.036*** | (0.013) | 0.024 | (0.047) | [0.217] |
| ln($K$) | 0.039** | (0.017) | 0.058 | (0.055) | [0.730] |
| ln(Foreign $K$) | −0.090*** | (0.029) | −0.986*** | (0.218) | [0.000] |
| ln(Domestic $K$) | 0.086*** | (0.030) | 0.739*** | (0.165) | [0.000] |
| ln(Private $K$) | 0.043 | (0.031) | 0.402** | (0.183) | [0.051] |
| ln(Gov.t $K$) | 0.062*** | (0.015) | 0.412*** | (0.093) | [0.000] |
| ln(Blue $L$) | 0.004 | (0.008) | 0.042 | (0.029) | [0.216] |
| ln(White $L$) | −0.006 | (0.012) | −0.074 | (0.063) | [0.285] |
| ln(Blue $w/L$) | 0.029** | (0.011) | 0.051 | (0.038) | [0.593] |
| ln(White $w/L$) | 0.115*** | (0.030) | 0.136*** | (0.050) | [0.708] |
| ln($Y$) | −0.022 | (0.014) | 0.040 | (0.043) | [0.164] |
| ln(Exports) | 0.097* | (0.057) | −0.194 | (0.270) | [0.293] |
| ln($M$) | −0.031* | (0.016) | 0.039 | (0.048) | [0.169] |
| ln(Domestic $M$) | −0.042 | (0.033) | −0.072 | (0.149) | [0.845] |
| ln(Imports) | −0.109** | (0.047) | −0.082 | (0.243) | [0.912] |

Note: The dependent variables are listed in the first column. Column 5 tests whether both interaction terms are statistically different from each other. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A13: Effect heterogeneity by trading behavior

| Regulated × | Trading firm | | Non-trading firm | | $p$-value: |
|---|---|---|---|---|---|
| | Coeff | SE | Coeff | SE | 1=2 |
| FDI share | −0.012*** | (0.003) | −0.006*** | (0.001) | [0.087] |
| ln($TFP$) | −0.051*** | (0.017) | −0.011 | (0.016) | [0.070] |
| ln(VAD/$L$) | −0.055*** | (0.018) | −0.004 | (0.016) | [0.034] |
| ln($K$) | 0.059** | (0.023) | 0.023 | (0.022) | [0.237] |
| ln(Foreign $K$) | −0.260*** | (0.063) | −0.121*** | (0.027) | [0.022] |
| ln(Domestic $K$) | 0.224*** | (0.054) | 0.096*** | (0.031) | [0.025] |
| ln(Private $K$) | 0.146** | (0.057) | 0.021 | (0.031) | [0.033] |
| ln(Gov.t $K$) | 0.101*** | (0.026) | 0.102*** | (0.020) | [0.972] |
| ln(Blue $L$) | 0.020* | (0.012) | −0.003 | (0.009) | [0.117] |
| ln(White $L$) | 0.031 | (0.020) | −0.057*** | (0.016) | [0.000] |
| ln(Blue $w/L$) | 0.008 | (0.016) | 0.057*** | (0.016) | [0.037] |
| ln(White $w/L$) | 0.064* | (0.033) | 0.173*** | (0.043) | [0.037] |
| ln($Y$) | −0.030 | (0.019) | −0.001 | (0.017) | [0.247] |
| ln(Exports) | 0.084 | (0.112) | 0.049 | (0.038) | [0.763] |
| ln($M$) | −0.045** | (0.022) | −0.002 | (0.020) | [0.128] |
| ln(Domestic $M$) | −0.072 | (0.054) | −0.020 | (0.034) | [0.374] |
| ln(Imports) | −0.247*** | (0.092) | 0.031 | (0.029) | [0.003] |

Note: The dependent variables are listed in the first column. Column 5 tests whether both interaction terms are statistically different from each other. All regressions are specified according to column 4 of table 4 and thus include firm, island-year and sector-year fixed effects, categories of firm age and a public enterprise indicator. They further control for five-digit product traits in 2005 (including sector concentration of sales, the share of blue-collar workers and the share of public enterprises), time-variant product traits (see table 1 for a full list) and firm trait specific trends (including foreign capital share, firm size, legal status and public enterprise dummies). Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A14: Full sample including observations with missing capital

| Dependent variable: | FDI share | | ln(VAD/$L$) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Regulated | −0.010*** | −0.012*** | −0.030*** | −0.026** |
| | (0.002) | (0.002) | (0.010) | (0.010) |
| Basic controls | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | | Yes | | Yes |
| Time-variant product traits | | Yes | | Yes |
| Firm traits specific trend | | Yes | | Yes |
| Full sample (incl. missing capital) | Yes | Yes | Yes | Yes |
| Treatment in year | $t$ | $t$ | $t-1$ | $t-1$ |
| Observations | 287,282 | 287,282 | 264,724 | 264,724 |
| Firms | 31,909 | 31,909 | 30,772 | 30,772 |
| R-squared | 0.857 | 0.857 | 0.720 | 0.723 |

Note: The dependent variable is the foreign capital share within each firm or log value added per worker. Basic controls include firm and island-year fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. The sample is larger compared to the baseline sample size due to non-omission of missing or zero capital values. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A15: Robustness: Levels of TFP estimation and sector-specific deflators

| Dependent variable: | ln(TFP) | | ln(TFP), 3-digit | | ln(TFP), 3-digit | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Regulated | −0.033*** | −0.031** | −0.031*** | −0.031** | −0.035*** | −0.035*** |
| | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) |
| Basic controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes | Yes |
| Product traits in 2005 × Year | | Yes | | Yes | | Yes |
| Time-variant product traits | | Yes | | Yes | | Yes |
| Firm traits specific trend | | Yes | | Yes | | Yes |
| 5-digit sector-specific deflators | | | | | Yes | Yes |
| Treatment in year | $t-1$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 180,794 | 180,794 | 180,794 | 180,794 | 180,545 | 180,545 |
| Firms | 24,726 | 24,726 | 24,726 | 24,726 | 24,715 | 24,715 |
| R-squared | 0.809 | 0.810 | 0.816 | 0.817 | 0.821 | 0.822 |

Note: The dependent variable is log total factor productivity as estimated on the two digit (columns 1 and 2) and three digit sector level (columns 3 to 6). Columns 5 and 6 additionally use five-digit product-specific input and wholesale price deflators. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. Five-digit product traits in 2005 include sector concentration of sales, the share of blue-collar workers and the share of public enterprises. For full list of time-variant product traits see table 1. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).

Table A16: Robustness: Testing a set of political economy factors

| Dependent variable: | FDI share | | ln($TFP$) | | ln(VAD/$L$) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Regulated | −0.010*** | −0.009*** | −0.027** | −0.023* | −0.027** | −0.022* |
| | (0.002) | (0.002) | (0.012) | (0.012) | (0.012) | (0.012) |
| `State-owned firms:` | | | | | | |
| Change in share of state-owned firms | −0.007 | | 0.004 | | −0.017 | |
| | (0.007) | | (0.056) | | (0.054) | |
| Share of state-owned firms | −0.003 | | 0.076 | | 0.103 | |
| | (0.011) | | (0.082) | | (0.082) | |
| Average productivity of state-owned firms | −0.000 | | 0.016*** | | 0.016*** | |
| | (0.000) | | (0.005) | | (0.005) | |
| `Internationalization:` | | | | | | |
| Change in share of exports in total output | −0.002 | | 0.050 | | 0.070* | |
| | (0.006) | | (0.040) | | (0.040) | |
| Change in import penetration | −0.001 | | −0.011 | | −0.022 | |
| | (0.002) | | (0.016) | | (0.016) | |
| `Labor markets:` | | | | | | |
| Growth rate of average wage per worker | −0.000 | | 0.029*** | | 0.030*** | |
| | (0.001) | | (0.009) | | (0.009) | |
| `Firm size/sector concentration:` | | | | | | |
| Share of medium-sized firms | −0.009 | | 0.091 | | 0.129** | |
| | (0.009) | | (0.061) | | (0.060) | |
| Herfindahl concentration index of sales | −0.005 | | −0.058** | | −0.071*** | |
| | (0.003) | | (0.024) | | (0.024) | |
| `Productivity dynamics:` | | | | | | |
| Growth rate of capital-labor ratio | 0.001 | | −0.003 | | 0.008 | |
| | (0.001) | | (0.007) | | (0.007) | |
| ln(Average firm sales) | −0.001 | | 0.060*** | | 0.059*** | |
| | (0.001) | | (0.006) | | (0.006) | |
| Growth rate of average firm sales | 0.001* | | 0.002 | | −0.004 | |
| | (0.001) | | (0.006) | | (0.006) | |
| Growth rate of capital intensity | −0.001 | | −0.008 | | −0.025 | |
| | (0.002) | | (0.016) | | (0.016) | |
| $p$-value of 12 principal components | | [0.353] | | [0.000] | | [0.000] |
| Basic controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector-year interactions | Yes | Yes | Yes | Yes | Yes | Yes |
| Extended set of product traits in 2005 × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm traits specific trend | Yes | Yes | Yes | Yes | Yes | Yes |
| Treatment in year | $t$ | $t$ | $t-1$ | $t-1$ | $t-1$ | $t-1$ |
| Observations | 196,030 | 192,797 | 180,000 | 176,935 | 180,000 | 176,935 |
| Firms | 25,705 | 25,549 | 24,679 | 24,540 | 24,679 | 24,540 |
| R-squared | 0.868 | 0.867 | 0.811 | 0.810 | 0.736 | 0.736 |

Note: The dependent variable is the foreign capital share within each firm, log total factor productivity or log value added per worker. Basic controls include firm fixed effects, categories of firm age and a public enterprise indicator. The extended set of five-digit product traits in 2005 includes sector concentration of sales, share of blue-collar workers, share of public enterprises, growth rate of sector employment, FDI share, import penetration, export share and capital intensity. Initial firm-level traits include foreign capital share as well as firm size, legal status and public enterprise dummies and allow for trait-specific linear trends. Time-variant product traits are included based on the selection in table 1 (see appendix A.1 for information on the selection procedure). Choice of the number of principal components is based on figure A1. Robust standard errors are clustered on firm level and reported in parentheses. Significance at or below 1% (***), 5% (**) and 10% (*).