

# Enforcing Competition and Firm Productivity

Evidence from 1,800 Peruvian Municipalities

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## Abstract

This paper uses a unique data set that captures the elimination of subnational regulatory barriers to firm entry and competition across 1,800 municipalities and matches it with establishment census panel data to estimate the impact on establishment productivity and markups. The elimination of local barriers that were inconsistent with national legislation was the result of legal reforms that strengthened the mandate of Peru's competition authority. Legislative changes in 2013/14 empowered the competition authority to enforce the elimination of illegal, sector-specific subnational regulatory barriers to firm entry and competition, conditional on the existence of a precedence. The changes provide a unique quasi-experimental setting to identify the

impact of enforcing competition within the controlled institutional environment of a single country. The paper finds that the elimination of subnational barriers to entry boosted the (revenue) productivity of establishments operating in reform municipalities and sectors relative to establishments in nonreform municipalities/sectors. But it did not raise the establishments' markups, which, if anything, declined, suggesting that physical productivity improved. The paper provides a wide range of evidence supporting a causal interpretation of this finding. The results suggest that strengthening the mandate of institutions enforcing competition is critical to raise productivity.

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# **Enforcing Competition and Firm Productivity: Evidence from 1,800 Peruvian Municipalities**

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## 1. Introduction

We use a unique data set for Peru that captures the elimination of subnational regulatory barriers to firm entry and competition across 1,800 municipalities. These were caused by legal reforms in 2013 and 2014 that strengthened the mandate of Peru's competition authority over the implementation of business regulation by subnational government bodies. We match these data with establishment census panel data from 2008-15 to estimate the impact on changes in establishments' productivity and markups. We find that the reforms have raised firm productivity. To the best of our knowledge, it is the first time that a positive impact of strengthening a country's institutions to enforce the elimination of barriers to market entry and competition on firm productivity in that country has been established.

According to conventional wisdom, product market competition improves the allocative efficiency among firms and makes market structures more conducive to innovation and growth. Specifically, declining market entry costs are expected to level the playing field and encourage firms to increase their cost effectiveness to outperform their competitors.

But the empirical evidence linking competition to productivity growth has been relatively scant, except for reforms related to international trade liberalization, due to the lack of adequate data. Cross-country data do not seem adequate given the difficulty to identify exogenous regulatory changes across countries with unobservable institutional characteristics and given the limited low-frequency sample sizes relative to the seemingly open-ended list of growth correlates. Microeconomic data, on the other hand, often lack sufficient disaggregated variation needed to identify an appropriate control group (of firms) not affected by regulatory changes.

We argue that recent reforms expanding the legal mandate of Peru's competition authority to enforce the elimination of subnational regulatory barriers to market entry and competition provide a unique quasi-experimental setting to identify the impact of strengthening the enforcement of competition, that is the elimination of regulatory barriers to market entry, within the controlled institutional environment of a single country. Specifically, Peru provides a unique setting for at least two reasons.

First, Peru has one of the most liberal international trade regimes in the world and has a best-practice national legal framework for competition. But its large number of municipalities have far-reaching authority to regulate critical aspects of local market access—each municipality

defines its own regulatory code to grant operating licenses, issue permits, define sector-specific technical standards, and define regulatory fees and charges.

Second, Peru recently implemented a worldwide unique ex post control mechanism governed by the competition authority to enforce the elimination of subnational barriers to market entry that are inconsistent with national law. Before 2013, the competition authority's legal mandate to contest regulatory barriers imposed by subnational governments that are inconsistent with national law had been very limited. But in 2013, it became much easier to eliminate similar regulatory barriers to market entry across the country once they had been confirmed as inconsistent with national law in one municipality. Therefore, the complaint of a single firm in a random municipality, once confirmed, triggered the elimination of similar regulatory barriers across the country. The dependence on such precedents led to a 'roll-out' of eliminated, often sector-specific regulatory barriers across municipalities which can be regarded as exogenous to other contemporaneous municipal policy changes.

The legislative changes produced a database of eliminated regulatory barriers to market entry and competition across municipalities in 2013 and 2014 which we match with establishment census data from 2008-15. We follow the integrated approach of De Loecker and Warzynski (2012) to derive establishments' (revenue) productivity and markups and estimate how they are impacted by the subnational regulatory changes in a difference-in-differences specification. The integrated approach is critical for our purpose as it allows to control for unobserved establishment-level productivity shocks, permits technologies to differ across establishments within the same industry, and is valid under imperfect competition.

Moreover, estimating the reform impact on establishments' productivity and markups makes it possible to infer their impact on physical productivity. That is, physical capital can increase because of increases in revenue productivity or increases in establishment-specific prices from higher markups.<sup>1</sup> Markups thus drive a wedge between the observed revenue and unobserved physical productivity, potentially biasing the measured reform impact. Specifically, the elimination of regulatory barriers to access domestic markets may increase establishments' markups since it raises the demand for their products and their ability to differentiate products across markets. On the other hand, the reforms may also reduce markups by reducing local rents from the regulatory protection from (price) competition.

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<sup>1</sup> De Loecker and Goldberg (2014).

We find that establishments located in municipalities that eliminated regulatory barriers to entry experienced a significant increase in subsequent total factor productivity (TFP) growth but not in markups, relative to establishments not located in reform-municipalities. Taken together, this suggests that physical productivity improved. In fact, if anything, we find that markups tended to decline, biasing the results against our finding of higher productivity.

We provide a wide range of evidence supporting a causal interpretation of the findings. First, the reform impact cannot be explained by contemporaneous common trends. Second, the probability that municipalities eliminated regulatory barriers to entry is independent of municipalities' initial average productivity (capturing the effect of other municipal productivity determinants). Third, the reform impact is robust across different types of regulatory barriers; and it is strongest if barriers to issue operating licenses were eliminated while the reduction of small administrative fees without removing the underlying regulatory procedure has weak or no effects. Fourth, the results are robust when estimating the impact of the subnational regulatory reforms separately for 2013 and 2014 and when restricting the comparison to establishments located in different district-municipalities within the same province (by including province-year fixed effects). Fifth, the results are robust when we account for the intensity of reform efforts, measured by the number of eliminated regulatory barriers per municipality, and when analyzing the effect of the reforms separately in Lima and the rest of the country. Finally, they are robust when we restrict the empirical identification only to the reforms that are sector-specific by including (district) municipality-year fixed effects. We thus use only the joint sector-municipality-year changes to identify the reform impact, addressing any remaining endogeneity concerns.

The next section reviews the literature on competition and productivity growth. Section 3 describes Peru's competition policy framework and the changes in legislation expanding the competition authority's mandate. Section 4 describes the underlying data. Section 5 presents the empirical strategy and section 6 summarizes the results. The final section concludes.

## **2. Literature Review**

The theoretical literature on endogenous growth offers contrasting views on competition and productivity. The standard model of endogenous technological change predicts that an increase in product market competition between intermediate producers will reduce expected future profits

from innovations and hence the rate of technical change (“rent dissipation effect”).<sup>2</sup> Likewise, more intense competition will lower the expected durability of new innovations (i.e., creative destruction) and hence the incentive to innovate.

Aghion et al. (2001) show that a straightforward extension of the basic framework predicts a positive relationship between market competition and growth. They consider an oligopolistic intermediate sector where innovation enables a firm to break away from competition for a certain period of time. The authors predict that firms operating in sectors with neck-on-neck competition are forced to constantly enhance their cost-effectiveness and innovate to make (temporary) profits. In contrast, firms operating in sectors where some firms have an exogenous cost advantage, for example due to regulatory barriers shielding them from competition, have less incentives to innovate. Higher cost firms are discouraged to innovate since the introduction of a new, cost-effective technology might not be sufficient to overcome the regulatory privileges of the low-cost firms.<sup>3</sup> Low-cost firms also have little incentives to innovate since they are already making healthy profits from the policies protecting them from competition.<sup>4</sup> Similarly, Hellwig and Irmen (2001) show that the prospects to achieve profits from inframarginal rents, rather than monopoly or oligopoly rents, are sufficient for more intense competition to promote technical change. Moreover, Parente and Prescott (1999) and Gancia and Zilibotti (2009), among others, predict that barriers to market entry lead to slower technological change and productivity growth.

Empirical research on the link between competition-enhancing reforms and productivity (growth) has been relatively scant, except for reforms related to trade liberalization.<sup>5</sup> One reason appears to be the lack of adequate data. The existing empirical evidence typically examines the effects of changes in product-market regulation on growth at the aggregate level. Several cross-country studies look at the effect of regulation on growth through channels such as changes in mark-ups, entry, exit, or turnover rates.<sup>6</sup> Cross-country growth regressions are, however, a limited tool to draw inference on the impact of competition on growth due to the difficulty to measure differences in competition across countries with different unobservable institutional environments. Moreover, the small low-frequency sample sizes relative to the seemingly open-ended list of

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<sup>2</sup> See, for example, Aghion and Howitt (1991).

<sup>3</sup> That is, low-productivity firms simply adopt low-cost vintage technologies and serve local (informal) market niches.

<sup>4</sup> Aghion et al. (2009) extend this framework to an “escape entry effect”, whereby the threat of potential entrants augments the incumbents’ incentives to innovate.

<sup>5</sup> See, among others, Syverson (2011), de Loecker and van Biesebroeck (2016), de Loecker et al. (2016), and Atkin et al. (2017).

<sup>6</sup> Loayza et al. (2002), Barseghyan (2008), Griffith and Harrison (2004), Cincera and Galgau (2005), Cole et al. (2005).

growth correlates makes it quasi impossible to address the problem of endogeneity.<sup>7</sup> Consequently, the results typically depend on the specific set of included control variables, countries, economic activities, or time periods.

At the microeconomic level, the empirical relation between competition and productivity is, however, also difficult to identify either due to the lack of appropriate disaggregated measures of product-market regulation or competition or due to the lack of a valid control group (of firms) not affected by the reforms. Several contributions thus focus on case studies for a single homogenous good for which detailed information on prices or specific market characteristics that provide an exogenous variation in competition are available. Syverson (2004) studies the market for ready-mix concrete where competition is highly localized due to high transportation costs so that regions with different densities generate an exogenous variation in the number of competitors. Schmitz (2005) analyzes the impact of large-scale Brazilian producers entering the world steel market in the 1980s. Collard-Wexler and De Loecker (2015) exploit changes in market structures due to the introduction of a new technology for producing steel to analyze the impact on firm productivity. Bloom et al. (2015) use variations in government interventions in the health sector to study the impact of competition on hospital management quality. These studies find that more competition encourages firms to adopt more efficient technologies (management practices) or to lower operating costs.

Beyond the industry-specific case studies, several recent contributions use micro data to analyze the impact of regional- or industry-specific<sup>8</sup> regulatory changes on firm productivity.<sup>9</sup> Several contributions exploit, for instance, the entry of China in the WTO and the subsequent rise of import competition from China. Bloom et al. (2011) and Iacovone et al. (2015) estimate that manufacturing firms in EU countries and Mexico are more likely to adopt new technologies and use them more productively when they sell products that are directly competing with imports from China. The former estimate that competition from China explains 15 percent of the technology investment of OECD countries from 2000-07. Finally, several studies show that political

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<sup>7</sup> See Hauk and Wacziarg (2009) or Durlauf et al. (2009).

<sup>8</sup> Industry-level measures of product market regulations should be regarded with caution, however, since these regulatory changes can be endogenous with respect to the (expected future) performance of a given industry. For example, policy makers might aim to promote entry into sectors with prospects of high productivity growth.

<sup>9</sup> Nickell (1996), Nicoletti and Scarpetta (2003), Aghion et al. (2008), Aghion et al. (2009), Ospina and Schiffbauer (2010), Buccirossi et al. (2013), Bartelsman et al. (2014).

connections of few firms lead to political privileges, such as subsidies or regulatory protection, shielding these firms from competition and potentially reducing long-term growth.<sup>10</sup>

We contribute to this literature by focusing on the impact of enforcing the elimination of regulatory barriers to market entry and competition that are inconsistent with national legislation on establishment productivity and markups within the controlled institutional environment of a single country. For this, we construct a unique data set of eliminated barriers to entry across 1,800 municipalities in Peru merged with establishment census panel data from 2008-15. The unique reform of Peru's competition agency's legal mandate further warrants that the roll-out of eliminated barriers can be considered as exogenous since the case against a specific municipality could only be made for a specific regulation that had already been confirmed as illegal based on the complaint of an individual firm elsewhere.

Importantly, a growing literature discussing shortcomings in the measurement of firm productivity is relevant for this study. Foster, Haltiwanger, and Syverson (2008) use U.S. data with information on producer-level quantities and prices to distinguish physical productivity from revenue productivity which is derived by deflating firms' revenues with industry-level prices. They show that revenue productivity is positively correlated with firms' markups which undermines the identification of the impact of regulatory reforms on firms' technical efficiency. In fact, both measures are only proportional under perfect competition. But market power due to product differentiation or rents results in markups, driving a wedge between physical and revenue productivity. And it has been well documented that market power due to product differentiation is ubiquitous (Katayama, Lu, and Tybout, 2009; De Loecker and Goldberg, 2014). The elimination of subnational regulatory barriers to market entry may thus result in higher (lower) markups as firms face more demand and may be better able to differentiate their products (face more price competition reducing local rents).

Against this background, De Loecker and Warzynski (2012) apply the control function approach of Akerberg (2015) to develop an integrated framework to estimate firm (revenue) TFP and markups. We follow this integrated approach to derive establishments' (revenue) productivity and markups and estimate how they are impacted by the subnational regulatory changes, making it possible to infer the impact on physical productivity.

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<sup>10</sup> See Fisman (2001), Faccio (2007), Diwan et al. (2018), and Schiffbauer et al. (2015).

### 3. Chronology of legal reforms and the empirical identification strategy

Peru implemented a comprehensive competition policy framework promoting product market competition at the national level in the past 20 years.<sup>11</sup> As a result, Peru has one of the most liberal trade regimes in world—the average tariff rates have been reduced to only 1.9 percent by 2013 and only a few products are subject to nontariff technical barriers to trade (NTMs). The presence of state-owned companies has been minimized and key sectors such as telecommunications or energy have been deregulated. Peru also introduced a best-practice national legal framework for competition with an independent competition authority, INDECOPI, responsible for its implementation.<sup>12</sup> But despite these comprehensive pro-competition national reforms providing a basis for competitive, contested domestic markets, many instances of regulatory barriers to free market entry and competition have emerged at the subnational level and firm productivity growth has been slow (World Bank, 2017).

The legal framework in Peru gives subnational governments the authority to regulate local market entry and investments without imposing the appropriate checks and balances in the current decentralized system, effectively allowing local public officials to limit market access and thus competition. Peru decentralized the enforcement and regulation of critical areas of business regulations such as issuing operating licenses, permits, defining local technical standards, and conducting inspections (see Figures 1-3). As a result, each of the 25 regional governments and of the more than 1,800 (province and district) municipalities issues its own specific code of business regulations, the Texto Unico de Procedimientos Administrativos (TUPA). In principle, all regulations in the TUPAs should be consistent with national legal frameworks but in practice this has been proven to be the exception rather than the rule (Figure 3).

These shortcomings are reflected in existing regulatory indicators. In contrast to most other countries, for example, more than half of the time and costs to open a business in Lima measured by the Doing Business indicators is consumed by regulatory barriers such as licensing requirements and technical requirements imposed by municipalities (Figure 1). And almost two-thirds of the eliminated regulatory barriers to market entry and competition declared illegal by the competition authority INDECOPI were imposed by province or district municipalities. Goodwin,

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<sup>11</sup> See Goodwin et al. (2015) for a comprehensive summary of pro-competition reforms in Peru in the last 20 years.

<sup>12</sup> INDECOPI INDECOPI is the Spanish acronym for Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual.

Licetti, de Rosa and Villaran (2015) estimate that almost one-third of all municipalities in 2014 did not comply with the national legal framework for issuing operating licenses for establishments. Among these, several municipalities outright refused to issue operating licenses or construction permits to new establishments, protecting local incumbents. The district municipality of Chilca, for example, refused to receive the applications of selected firms for the construction permit of a new building without providing a reason. This practice was declared illegal by INDECOPI and was removed in 2014.

Against this background, Peru put in place a worldwide unique ex-post control mechanism governed by the competition authority, INDECOPI, to eliminate regulatory barriers to free market access and competition imposed by different levels of government. The institutional changes started 20 years ago, but, only recently, INDECOPI's legal mandate has been expanded to facilitate the enforcement of national legislation to eliminate illegal subnational regulatory barriers (see Figure 5).

Specifically, INDECOPI created the market access commission (CAM) to investigate regulations that prevent the access to markets in 1996. The CAM was able to initiate a legal procedure by itself or based on an individual firm complaint, but it was not allowed to act upon decrees or resolutions by different government bodies, including states and municipalities.<sup>13</sup> In 2007, CAM was replaced by the Commission for the Elimination of Bureaucratic Barriers (CEB) which was allowed to investigate Decrees and Resolutions.<sup>14</sup> The CEB, however, had to investigate each specific (subnational) regulatory barrier for each firm separately, on a case by case basis; once a barrier was declared illegal or irrational since it was inconsistent with national law,<sup>15</sup> the CEB could not apply the ruling to other firms that were affected by the same regulatory barrier in the same municipality, let alone for firms in other municipalities affected by a similar barrier. Moreover, firms could not refer to previous rulings and had to submit their own, new complaint to the CEB to enforce national law and eliminate subnational regulatory barriers that had already been declared illegal or irrational based on a previous complaint.

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<sup>13</sup> CAM faced severe restrictions to act upon Regional or Municipality Decrees for which it was only able to provide non-binding recommendations to Municipal or Regional Councils.

<sup>14</sup> INDECOPI (2013).

<sup>15</sup> INDECOPI can declare an administrative procedure as illegal or irrational based on the principles of procedural formalities, the rule-making entity's legal mandates, public interest, and proportionality and cost-effectiveness of regulatory alternatives. See INDECOPI (2013) and Goodwin et al. (2015) for more details.

In 2013, Peru enacted a new legal framework boosting the mandate of INDECOPI to contest regulatory barriers to free market access and competition imposed by subnational governments and to enforce their elimination when inconsistent with national legislation. First, the new law authorizes INDECOPI to enforce the elimination of a regulatory barrier inconsistent with national legislation for all firms dealing with the municipality that imposed it. Second, INDECOPI is empowered to roll-out the elimination of specific types of regulatory barriers across all municipalities in the country once they have been declared illegal or irrational in one municipality; these include the regulatory barriers considered in this study—business licenses and permits, illegal technical requirements, and irregular fees and charges. Third, it allows INDECOPI to directly sanction public officials applying illegal or irrational regulations in fast-track procedures at any government level and to enforce the reimbursement of any resulting administrative expenses to firms. INDECOPI’s power was further strengthened in 2014 by expanding the set regulatory barriers that can be sanctioned in fast-track procedures to include irrational fees and charges and by quadrupling the maximum sanction it can impose. These reforms were an important step to reduce the discretion of (local) public officials to establish regulatory local barriers to market entry in the TUPA and to discriminate between firms in the implementation of rules and regulations.

As a result, the number of initiated investigations on regulatory barriers to market entry and competition surged by more than 3-fold from 2011/12 to 2013/14. Figure 3 highlights that the majority of the eliminated barriers in 2013 and 2014 emerged at the subnational level. Almost two-thirds of eliminated regulatory barriers had been imposed by subnational governments, of which 97 percent have been imposed by province or district municipalities. Moreover, the majority of the regulatory reforms in 2013 eliminated licenses requirements inconsistent with national legislation which accounted for 77 percent of all eliminated barriers (Figure 4). In 2014, illegal licenses requirements accounted for 37 percent whereby another 38 percent were illegal technical requirements for market entry. Consistent with the change in legislation in 2014, the removal of excessive administrative fees increased that year, accounting for 25 percent of the eliminated barriers.

Our empirical identification strategy exploits the exogenous roll-out of regulatory changes across municipalities. An important characteristic of the 2013 reform of INDECOPI’s legal mandate was that it became much easier to eliminate similar regulatory barriers to market entry across the country once they had been confirmed as inconsistent with national law in one

municipality. In addition, the opening investigation of a specific regulatory barrier in the initial municipality was often prompted by the complaint of a single firm. In other words, the complaint of a single firm in a random municipality, once confirmed, triggered the elimination of similar regulatory barriers across different municipalities across the country. The dependence on such precedents thus led to a ‘roll-out’ of eliminated regulatory barriers across municipalities which can be regarded as exogenous to other contemporaneous changes in municipalities’ local business environment (such as infrastructure investments) that may have promoted higher productivity growth of establishments operating in these municipalities. Moreover, the eliminated barriers were often sector-specific, providing additional exogenous variation in the data.<sup>16</sup>

For example, the initial complaint by a second mobile phone operator that had been denied a municipal permit to install antennas in one of Lima’s 42 municipalities enabled INDECOPI to enforce the issuance of permits to install antennas in 3 other Lima municipalities in 2013 and 9 other municipalities in other parts of the country in 2014. Similarly, the refusal of granting an operating license for a passenger transport firm that did not possess the required minimum number of fleet vehicles in one municipality in 2013, led to the elimination of the de facto market entry barrier of minimum fleet size requirements across numerous municipalities in Peru. The province municipality of Chanchamayo, for instance, had to eliminate the requirement to possess at least 10 vehicles to be eligible to obtain an operating license while the district municipality of Puente Piedra had to eliminate the minimum requirement of 30 vehicles.

## **4. Data**

### **4.1 Establishment census data**

The analysis is based on establishment-level data from the Annual Economic Survey (EEA) collected by Peru’s National Institute of Statistics (INEI) for the 2008-15 period. The survey is representative of formal establishments in agriculture, manufacture, commerce, construction, transport & communication and services sectors in all regions. The sample frame comes from SUNAT, the tax administration database. Each year, some establishments are selected with certainty to form the “forzosa” stratum. The forzosa stratum is defined based on net sales, which

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<sup>16</sup> INDECOPI had a limited number of staff available in the Commission of Elimination of Bureaucratic Barriers that was responsible to oversee the business regulations defined in the detailed TUPA’s of over 1,800 subnational jurisdictions. It thus focused its efforts on illegal practices for specific economic activities determined by the initial firm complaints in a given year.

means that establishments with net sales larger than a certain threshold are always selected.<sup>17</sup> Therefore, the forzosa stratum allows to construct a data panel specification, where the starting year is reported but exit is not reported in the data. Exits could reflect establishments' output falling below the threshold as well as real exit.

The survey includes information related to establishment location, industry classification (following ISIC revision 4), sales, value added, intermediate input costs, number of employees, wages and book values of assets. Our main variables of interest are establishment TFP and markups, which require information on the value added, the capital stock (tangible fixed assets), intermediate inputs, the number of employees, the total wage bill, and establishments' age. All monetary variables are deflated using constant industry price indices (constant 2007) at the most disaggregated level available.

#### **4.2 Subnational regulatory reform data**

We use a unique data set for Peru that captures the elimination of all regulatory barriers across more than 1,800 municipalities as a response to legislative changes in 2013 and 2014, strengthening the power of the national competition authority (INDECOPI) to enforce the elimination of regulatory barriers to market entry and competition that are inconsistent with national legislation. The initial list published by INDECOPI includes 613 and 1,577 different eliminated regulatory barriers in 2013 and 2014, respectively, the majority of which were eliminated by subnational governments. The list includes regulatory changes that apply only to consumers but not to firms. We thus restrict the analysis to eliminated regulatory barriers that impact firms by easing licensing requirements to operate in a specific location or economic activity, removing technical requirements to enter local markets or sectors (such as specifications for buildings or transport vehicles), and reducing charges and fees for regulatory procedures.

This leaves us with 594 (149) regulatory changes eliminating barriers by subnational governments in 2014 (2013), of which 473 (80) were implemented at the district-municipality level, 110 (60) at the province-municipality level, and 11 (9) at the state-level. Among these reforms, we are able to distinguish between different types of reforms which we will use

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<sup>17</sup> Firms with net sales greater than 1,700 Tax Units (*Unidad Impositiva Tributaria*, UIT) are selected. The UIT values vary each year.

empirically—the removal of licenses requirements, the removal of technical requirements, and the reduction of fees and charges for administrative procedures.

Overall, 70 (35) of 1,874 districts, 22 (18) of 196 provinces, and 3 (2) of 25 states in Peru eliminated at least one regulatory barrier in 2014 (2013). Among these, eliminating operating license requirements was the most common regulatory change (Table 2). The extent to which different municipalities eliminated regulatory barriers to competition in 2013 and 2014 is illustrated in the map of Peru in Figure 2. It shows substantial variety in the reform municipalities. Notably, the map reveals significant differences between both years with several municipalities eliminating regulatory barriers to market entry and competition only in one of the two years.

Several establishments benefitted from more than one eliminated regulatory barrier within a year because the responsible district and the higher tier province municipality both eliminated barriers that are inconsistent with national law. On average, establishments located in reform district or province municipalities benefitted from 4.5 eliminated barriers in 2013 and 5.4 in 2014. In 2013, illegal licenses requirements were the most common type— establishments in license-reform municipalities benefitted on average from 4.1 eliminated illegal license requirements; establishments in technical- and fee-reform municipalities benefitted on average from the elimination of 1.9 and 1.02 such barriers, respectively. In 2014, the removal of regulatory barriers was more evenly distributed among these types. Establishments in license-, technical- and fee-reform municipalities benefitted on average from the elimination of 2.5, 4.1, and 1.6 such barriers, respectively. The fact that many establishments benefitted from more than one eliminated barrier allows us to also estimate the impact of the intensity of municipal reforms.

### **4.3 Matched census-reform data set**

We match the data on regulatory changes across the 1,800 municipalities in Peru in 2013 and 2014 with establishment census panel data from 2008-15, using the 6-digit location codes providing the exact location of establishments at the district-municipality level. Since we observe subnational reforms at three different levels of aggregation (departments, province municipalities, and district municipalities), we then aggregate the number of reforms (by the different types of regulatory changes) for each establishment. Thus, establishments can be impacted by 0, 1 or multiple (up to 20) different reforms by different subnational government tiers in our matched data.

We use different empirical specifications to define the treatment and control groups in the matched reform-establishment census data. First, we define a dummy variable which is equal to 1 in 2013 (2014) and the years after if an establishment has been impacted by at least 1 pro-competition regulatory reform (treatment group) and zero otherwise (control group). We further exploit the different intensity of regulatory changes that impacted establishments by estimating the impact of the number of regulatory reforms per municipality. The availability of different reform indicator variables due to multiple reform years, levels of subnational aggregation, and types of regulatory changes allows us to conduct a series of empirical checks to test for the robustness of our findings.

## 5. Empirical Specification

### 5.1 Deriving establishments' TFP and markups

We follow the integrated control function approach of De Loecker and Warzynski (2012) to estimate the unbiased measures for the output elasticities of inputs, allowing to compute (revenue) productivity and markups. The approach is critical for our purpose since it allows to control for unobserved establishment-level productivity shocks, permits technologies to differ across establishments within the same industry, and is valid under imperfect competition.

We restrict the analysis to production functions with a scalar Hicks-neutral productivity term and with common technology parameters ( $\beta_s$ ) across the set of producers ( $I$ ). We emphasize that the latter does not imply constant output elasticities of inputs across establishments within an industry, except for the special case of Cobb-Douglas. The main advantage of production technologies of this form is that we can rely on proxy methods such as Akerberg (2015) to obtain consistent estimates of the technology parameters  $\beta_s$ . We can thus define an establishment's production function as follows:

$$Q_{ist} = F(X_{ist}^1, \dots, X_{ist}^V, K_{ist}; \beta_s) \exp(\omega_{ist}) \quad (1)$$

where  $\beta_s$  and  $\omega_{ist}$  govern the transformation of inputs ( $X$ ) to units of output ( $Q$ ) for each establishment  $i$  in industry  $s$  at time  $t$ . For our baseline empirical specifications, we use a value

added translog production function, implying that  $F$  is approximated by a second order polynomial:<sup>18</sup>

$$y_{ist} = \beta_{ls}l_{ist} + \beta_{ks}k_{ist} + \beta_{lls}l_{ist}^2 + \beta_{kks}k_{ist}^2 + \beta_{lks}l_{ist}k_{ist} + \omega_{ist} + \epsilon_{ist} \quad (2)$$

The translog production function specification allows technologies to differ across firms within the same industry in that the output elasticities of inputs are firm-specific—they vary depending on their technologies. More specifically, the elasticity depends on the estimated coefficients and the individual firm’s stock of labor and capital. Any two firms that differ in their number of employees or capital stocks will thus have different estimated output elasticities of inputs. This contrasts to the much more restrictive standard Cobb-Douglas production function where all firms within an industry are assumed to have the same output elasticities of inputs (which are scalars). Specification (2) thus accounts for variations in technology across firms and, in contrast to a Cobb-Douglas specification, does not attribute these to variation in firm TFP and markups which would potentially bias our results.

To obtain consistent estimates of the production function in (1), we need to control for unobserved contemporaneous productivity shocks that may influence establishments’ input choices. We deal with this standard simultaneity problem by following the control-function approach proposed by Akerberg, Caves, and Frazer (2015). That is, we stipulate that an establishment’s demand for intermediate inputs depends on its capital stock, other observable attributes (establishment age), and an unobservable contemporaneous firm productivity shock; we can then proxy for the latter by estimating the inverted material inputs demand function (using polynomials to approximate the function);<sup>19</sup> in a second step, all production function parameters are identified by using a generalized method of moments (GMM) approach that relies on the assumption that the proxied productivity shock is uncorrelated with lagged intermediate inputs and employment and the current capital stock (which firms decide on a period ahead). This approach by Akerberg, Caves, and Frazer (2015) addresses the functional dependence problem that the earlier control-function methods by Olley and Pakes (1996) and Levinsohn and Petrin (2003)

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<sup>18</sup> We also report the findings for the Cobb-Douglas production function, which is obtained by removing the logged inputs squared and all interaction terms between the logged inputs from (1).

<sup>19</sup> The method assumes that the demand for material inputs is monotonically increasing in the technology shock for a given value of establishment age which holds under a large class of imperfect competition models (De Loecker and Warzynski 2012).

suffer from. We estimate the production function separately for sectors and years with establishments' real output as the output measure.<sup>20</sup>

This approach allows us to extract the unbiased estimates of the establishment-level output elasticities required to determine an unbiased measure of establishments' productivity (TFP) and markups that accounts for unobserved productivity shocks across establishments facing heterogeneous technologies and potentially imperfect competition. More specifically, the estimated output elasticities are computed using the estimated coefficients of the production function and the establishment-level information on labor, capital, and age—the output elasticity for labor under the translog production function, for instance, is given by

$$\hat{\theta}_{ist}^L = \hat{\beta}_{ls} + \hat{\beta}_{lls}l_{ist} + \hat{\beta}_{lks}k_{ist} \quad (3)$$

Note that the use of the standard Cobb-Douglas production function implies that the output elasticity of labor is simply given by  $\hat{\beta}_{ls}$ . We use the estimated unbiased output elasticities in (3) to compute establishments' TFP and markups, whereby we compute the latter by multiplying the output elasticity to labor with the ratio of establishments' sales over total labor costs.

## 5.2 Subnational regulatory reform impact

The matched subnational regulatory reform and establishment census panel data allow us to estimate the effects of eliminating subnational barriers to market entry on establishments' productivity in a difference-in-differences setting. The census data are available from 2008-15 so that we can track productivity and markups of establishments impacted by one of the subnational reforms for up to 5 years before and 2 years after the changes in the national legislation expanding the enforcement power of Peru's competition authority over subnational jurisdictions. We thus consider the following generalized difference-in-differences specification:

$$Y_{idmt} = \beta_0 + \beta_1 R_{dmt} + F_i + F_d * F_t + \varepsilon_{idmt} \quad (4)$$

where  $i$  stands for an establishment,  $d$  for an establishment's state (*departamento*) or province municipality,  $m$  for an establishment's municipality (district or province), and  $t$  for the year.  $Y_{idmt}$  measures TFP or markups as defined earlier.  $R_{dmt}$  is the regulatory reform indicator; it is a dummy variable which is equal to 1 in the years of and after a reform for establishments located in the

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<sup>20</sup> We distinguish between manufacturing, commercial, and other services to have at least 1,000 establishments per year, needed to ensure a robust TFP estimation based on the Akerberg approach.

subnational reform jurisdiction (district, province, or state) and 0 otherwise. Alternatively, we use the absolute number of reforms for  $R_{irt}$  in each jurisdiction to measure the intensity of reforms in each municipality.<sup>21</sup>  $F_i$ ,  $F_d$ , and  $F_t$  are vectors controlling for establishment, state/province, and year fixed effects and  $\varepsilon$  is an independent and identically distributed error (i.i.d).

The establishment fixed effects control for unobserved differences across establishments that influence their performance.<sup>22</sup> The state/province-year fixed effects ( $F_d * F_t$ ) control for all fixed and time-varying country and state/province-specific factors affecting all establishments in these locations, including any country and state/province level policy changes, infrastructure investments, and macroeconomic trends. Specification (4) thus controls for any regulatory or other policy changes in Peru's 25 states / 196 province-municipalities.<sup>23</sup> The state/province-year fixed effects also address the concern that the results may be driven by reforms in Lima municipalities relative to municipalities in other states or provinces. Nevertheless, we also separately estimate the reform impact for establishments located in the agglomeration of Lima and Callao and for establishments in the rest of the country in Table 8.

$\beta_1$  thus measures if establishments located in municipalities that eliminated regulatory barriers to entry experienced higher subsequent growth in productivity or markups relative to establishments located in municipalities within the same state that did not change their business regulations (or eliminated fewer barriers). The coefficient measures a causal reform impact, assuming that the 'roll-out' of eliminated regulatory barriers across municipalities can be considered as exogenous to other municipal-level changes within the same state.

Specifically, a potential reverse causality concern could still arise if establishments increased their productivity or markups in municipalities that eliminated regulatory barriers to entry in the same period for reasons unrelated to these reforms. This would require that municipalities that eliminated barriers to competition after a ruling of Peru's competition authority were also more likely to have improved other areas of the business environment in the same year. We argue, however, that the way in which INDECOPI had to investigate a specific illegal or

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<sup>21</sup> We also used a qualitative indicator for  $R_{irt}$  which is equal to 0 for all establishments and years in municipalities with no reforms, 1 in with 1-4 reforms, 2 with 5-9 reforms, and 3 for more than 10 reforms. The results are qualitatively equivalent to using the number of reforms and are available from the authors upon request.

<sup>22</sup> The establishment fixed effects also account for other fixed municipality or industry attributes (since each establishment is in a single location and industry).

<sup>23</sup> This includes the elimination of two subnational regulatory barriers to entry in two of these states (see Table 2). The results are qualitatively equivalent and the TFP effects even stronger if we do not control for state fixed effects and thus control only for changes in national policies instead of additional state-specific policies. They are available from the authors upon request.

irrational regulatory barrier across municipalities, conditional on a precedent based on a confirmed initial complaint of a single firm about another municipality’s regulation, makes this scenario unlikely (see Section 3).

We address any remaining endogeneity concerns by making use of the fact that the majority of the eliminated regulatory barriers were applied to specific economic activities—about three-quarters were sector-specific. Specifically, these barriers were often concentrated in few economic activities—the activities pursued by the firms that made the initial complaints about a sector-specific regulation in a specific municipality which, once confirmed, INDECOPI then also declared as illegal in other municipalities. In other words, the sectoral allocation of the eliminated sector-specific barriers depends on the specific economic activities of the initial complainants and can thus be considered as exogenous to other sector-specific municipal policy changes.

In 2013, for instance, INDECOPI declared illegal that municipalities declined to grant additional operating licenses for specific transport routes within or between cities. This practice had been applied by a large number of municipalities so that more than half of the 199 sector-specific regulatory barriers to entry in 2013 we eliminated in the transport sector. In 2014, 70 percent of the 782 eliminated regulatory barriers were concentrated in 4 sectors: manufacture of fabricated metal products (20 percent), transport services (19 percent), construction (17 percent), and telecommunication services (14 percent).

We use this sector-specific allocation to apply the following more restrictive difference-in-differences specification as a robustness check:

$$Y_{imst} = \beta_0 + \beta_1 R_{mst} + F_i + F_m * F_t + \varepsilon_{imst} \quad (5)$$

where, in addition to the notation in (4),  $s$  stands for a 2-digit sector (ISIC Rev. 4 classification). Specification (5) controls for (municipal) district-year fixed effects taking out all municipality-year variation in the data<sup>24</sup> The empirical identification of the impact of the eliminated regulatory barriers on productivity and markups is thus restricted to joint sector-municipality-year changes in the exogenous reform variables;  $\beta_1$  now measures if establishments operating in one of the 2-digit sectors for which sector-specific regulatory barriers have been eliminated experienced higher subsequent productivity growth relative to establishments operating in the same municipalities but in sectors in which no (fewer) sector-specific barriers have been eliminated.

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<sup>24</sup> The sector fixed effects are absorbed by the establishment fixed effects.

## 6. Results

### 6.1 Impact of eliminating subnational barriers to entry on productivity and markups

Table 3 summarizes the baseline results, following the difference-in-difference specification in equation (4). The first column in the upper panel shows that establishments located in province or district municipalities that eliminated any regulatory barrier experienced a significant increase in revenue TFP in the years after the reform relative to establishments not located in reform municipalities. The subsequent TFP effect is strongest if municipalities eliminated licenses requirements (column 2) which directly prevented the (threat of) new market entry of potential rivals. The impact is economically significant. Eliminating an illegal license requirement beyond the ones specified in national law has raised establishments' TFP by .45 percentage points relative to establishments in municipalities that did not change their licensing requirements. The positive reform impact is somewhat smaller but also statistically significant for establishments operating in municipalities that removed technical requirements and specifications which are also often used to limit local market entry (column 3).

In contrast, the removal or reduction of administrative fees did not have a significant impact on establishments' TFP growth (column 4). The reduction in administrative fees in excess to the fees defined in national law was in almost all cases very small (often not more than a few hundred dollars). Their size was quasi negligible compared to the total operating costs of the affected establishments. These fees were thus not real barriers to market entry so that their impact on establishment productivity can be interpreted as a placebo test. Hence, as one would have expected, we only find significant TFP effects for regulatory barriers that symbolized actual barriers to market entry and competition.

Columns 5-8 show the analog results for the Cobb-Douglas specification when estimating the production function in (1). The elimination of regulatory barriers to entry in province or district municipalities has a significant and large impact on revenue TFP derived from the standard Cobb-Douglas specification. The magnitude of the impact is larger for the elimination of technical requirements, suggesting that ignoring differences in technologies and thus output elasticities across establishments within a sector may lead to an upward bias in the coefficients.

Columns 9-16 of Table 3 present the impact of the regulatory reforms on establishments' markups. Importantly, we do not find any significant effects on markups. Since revenue TFP is a

positive function of markups and physical TFP, we can infer that the significant and large impact of the subnational regulatory reforms on revenue TFP stem from a surge in establishments' physical TFP rather than a rise in their markups.

We highlight that the absence of markup effects does not necessarily imply that the reforms did not reduce firms' rent-seeking opportunities. While these would reduce markups, the elimination of barriers to market access increases also the demand for firms' products and allows them to better differentiate their products across markets, both of which have been shown to raise firms' markups (Katayama, Lu, and Tybout, 2009; De Loecker and Goldberg, 2014). The absence of changes in markups may thus be explained by the contrasting potential effects of the elimination of local barriers to market access which cancel each other out—the negative impact of lower rents on markups has been compensated for by demand and product differentiation effects.

The lower panel presents the analog results when we control for (municipal) province-year fixed effects which restricts the empirical identification exclusively to district-level reforms. In this specification, we take out the impact of the province municipality reforms which account for almost one-third of the total reform municipalities (see Table 2). We thus estimate the impact of the elimination of regulatory barriers to entry on establishments' productivity and markup growth relative to establishments located in the same province but in a district without a regulatory reform. The results are qualitatively equivalent when we only measure the impact of district level reforms, apart from the impact of all and operating license reforms under the more general translog production function specification. In the latter case, the coefficients are positive but drop by half and are not significant any more at conventional levels. The elimination of entry barriers at the province level has thus been an important part of the overall productivity growth effects.

In Table 4, we estimate the separate impact of regulatory reforms in 2013 and 2014. Regulatory reforms among municipalities were less common in 2013 but among these, the elimination of licenses requirements was much more prevalent, whereas the types of reforms in 2014 were more diverse and included more often reductions in administrative fees. Moreover, we observe one additional year after the 2013 reforms. We thus expect the impact to be larger for 2013 reforms which is confirmed in the data. For the translog and the Cobb-Douglas specifications, the elimination of the different regulatory barriers to entry (excluding fees) lead to a significant and large increase in TFP but do not raise markups. The corresponding coefficients are all larger for 2013 reforms than for 2014 reforms. For the preferred translog specification, regulatory changes

among municipalities in 2014 have a significant and large TFP impact for all types of reforms taken together and for the elimination of technical requirements.

In the following, we test if the elimination of regulatory barriers among municipalities was indeed exogenous and has not been anticipated by establishments or driven by contemporaneous common trends. If the reforms were exogenous, we should not see any impact in the data in the years before their implementation. That is, we should not see any changes in TFP and markups in the years before 2013. Figure 6 highlights that this was indeed not the case. It shows that there is a slight decline in TFP among establishments in reform municipalities (treatment) from 2010-12. In 2013, TFP among establishments in reform municipalities surges and remains on a significantly higher level for the remaining sample period until 2015. The middle panel of Figure 6 illustrates that the rise in TFP is especially large relative to pre-trends for the elimination of licenses requirements. Finally, the lower panel of Figure 6 shows that markups remain quasi flat during the whole sample period. If anything, they tend to decline slightly after the implementation of the pro-competition reforms in 2013/14.

We check formally for the significance of common pre-trends in TFP and markups in Table 5 where we test if the lead effects of the treatments in our sample period are jointly significant. That is, we test if TFP and markups increased for establishments in reform municipalities relative to establishments in non-reform municipalities for the different estimation specifications before the actual reform years 2013/14. In most specifications, we do not find a significant difference in TFP or markups growth between establishments in reform municipalities (treatment) and other establishments (control) in the years before the actual reforms in 2013/14. Specifically, for the preferred translog specification, the lead effects from 2009-12 are jointly insignificant for the overall reforms impact and all the different types of reforms other than the elimination of technical requirements. For the latter, they are only insignificant for the 2014 reforms. The results for the Cobb-Douglas specifications and when controlling for the more restrictive province-year fixed effects are similar. For markups, we do not find evidence of significant pre-trends between reform and non-reform municipalities for the different types of reforms and specifications.

Taken together, Tables 3-5 suggest that the elimination of subnational regulatory barriers to entry, especially through the elimination of licenses requirements, had a strong positive impact on subsequent productivity growth among establishments located in reform municipalities. The results support the theoretical prediction of models linking barriers to market entry to lower

average firm productivities as in Parente and Prescott (1999) and Aghion et al. (2001). In the following, we conduct a series of additional robustness tests.

## **6.2 Intensive margin of eliminating subnational barriers to entry**

The intensity of reforms removing eliminating barriers to market entry and competition also matters. In Table 6, we estimate to which extent the number of eliminated barriers for the different types of regulations matter for establishment productivity and markup growth. We find significant and large effects for TFP growth. Establishments located in (province or district) municipalities that eliminated more barriers to entry had larger subsequent TFP growth relative to establishments located in municipalities with fewer reforms. For the preferred translog specification, 1 additional reform of any type in the municipal province or district jurisdiction of an establishment augments its revenue TFP on average by 0.11 percentage points (column 1, upper panel); 1 additional removal of illegal license requirements augments TFP by 0.09 percentage points (column 2, upper panel).

We also find that more intensive regulatory reform efforts tend to reduce markups. The negative impact is statistically significant for the overall reform intensity and for all three regulatory reform types in the case of the Cobb-Douglas specification (columns 13-16 of Table 6, upper panel). The results suggest that the intensive margin of subnational regulatory reform efforts enhances establishments' physical productivity growth. The physical productivity impact may be even larger than the measured revenue productivity impact since the reform efforts tend to reduce markups, biasing the results against our finding of higher revenue productivity (recall that revenue TFP can be decomposed into physical TFP and markups).

The lower panel of Table 6 presents the analog results when we control for (municipal) province-year fixed effects which suppresses the impact of the province municipality reforms. The qualitative results do not change for the intensive margin of regulatory reform efforts for this more restrictive specification. Establishments located in district municipalities that eliminated more barriers to entry had larger subsequent TFP growth and tended to have lower markups relative to establishments located in district municipalities with fewer reforms. The magnitude of the coefficients for the number of reforms increases in this specification since the average number of regulatory reforms is much lower if we restrict the analysis to district-level barriers.

## **6.3 Sector-specific identification**

Table 7 reports the results when we restrict the empirical identification to joint sector-municipality-year changes in the reform variables, following the difference-in-difference specification in equation (5). That is, we control for all municipality-year variation in the data and instead identify the impact of eliminated regulatory entry barriers through the sector-specific nature of the municipal reforms. Recall that about three-quarters of eliminated entry barriers were specific to the establishments' economic activities (measured at the 2-digit sector level).

We find significant and large effects for TFP growth. An establishment operating in one of the 2-digit sectors for which sector-specific regulatory barriers have been eliminated experienced higher subsequent productivity growth than an establishment operating in the same municipality but in a sector not affected by the reforms (columns 1-8 of Table 7). Moreover, the intensity of the regulatory sector-specific reform efforts also matters for productivity growth. Establishments operating in sectors and municipalities that eliminated more regulatory barriers to entry had larger subsequent TFP growth than establishments operating in the same municipalities but in sectors with fewer reforms.

#### **6.4 Additional robustness**

In the following, we conduct several additional checks to test for the exogeneity of the timing of subnational regulatory reforms and assess the robustness of the main findings.

First, we estimate the impact of the elimination of entry barriers separately for the departments of Lima and Callao and the rest of the country to test if our results are primarily driven by the reform effort of Lima municipalities which account for about half of Peru's total GDP. The results for the preferred translog specification are presented in Table 8. They show that establishments experienced higher subsequent TFP growth if they operated in municipalities that eliminated (more) regulatory entry barriers independent of their location in Lima or in any of the other states in the rest of the country. The results demonstrate that the positive regulatory reform impact on establishments' TFP growth is not primarily driven by the potentially more frequent reform efforts in Lima relative to municipalities in the rest of the country. The results are significant and large across subnational jurisdictions throughout the country.

Second, we test if the probability that municipalities eliminated regulatory barriers is independent of municipalities' initial average establishment productivity. Specifically, if other time-varying factors at the municipal level (e.g., policy changes or infrastructure investments)

explain the subsequent productivity growth in reform-municipalities, we should expect a positive correlation between the probability that a municipality (is forced to) eliminate a regulatory barrier and that municipality's initial productivity (capturing the effect of other municipal productivity determinants). Table 9 shows that this is not the case. The probability that a municipality eliminated any regulatory barrier or any different type of barrier is not correlated with municipalities' initial average establishment productivity for the preferred translog specification. The results corroborate our identification assumption that the 'roll-out' of the elimination of regulatory barriers to entry across municipalities is exogenous; i.e., independent of other contemporaneous policy changes at the municipal level.

Finally, we provide some additional analysis to better understand the markup results. Recall that the elimination of barriers to market access is not only expected to reduce establishments' rents but also to increase the demand for their products and their ability to differentiate their products across markets, both of which raise firms' markups. Our finding that the reforms did not change establishments' markups in most specifications (in the others they declined) is thus not surprising. To further analyze which of the two opposing effects on establishments' markups dominates, we estimate the impact of the reforms on establishments' market shares (based on their share of sales in their corresponding 4-digit ISIC Rev. 4 sector). That is, we expect establishments' market shares to increase if the product demand and differentiations effects dominate and to decline if the reduced rent-seeking effect dominates. The results are provided in Table 10 and show that the elimination of regulatory entry barriers tend, if anything, to have reduced establishments' market shares. Especially, we find that market shares declined among establishments located in municipalities that eliminated technical requirements to operate in their jurisdiction. Moreover, a larger number of any type of reforms or licenses reforms reduced market shares of establishments operating in these municipalities. The results support our conjecture that the elimination of regulatory barriers reduced firms' rent-seeking opportunities.

## **7. Conclusion**

We use a unique data set for Peru that captures the elimination of subnational regulatory barriers to competition across about 1,800 municipalities and departments in 2013 and 2014 to estimate the impact of pro-competition reforms on establishment productivity growth. We argue that the specific legislative changes expanding Peru's competition authority's mandate in 2013/14

over subnational jurisdictions, provides a unique opportunity to identify the impact of pro-competition reforms on establishments' productivity and markups in a quasi-experimental setting within the controlled institutional environment of a single country.

We match the information on eliminated subnational regulatory barriers to competition across municipalities in 2013 and 2014 with establishment census data to estimate the impact of the enforcement of the elimination of regulatory barriers to market entry and competition on establishment productivity. We find that establishments located in municipalities that eliminated regulatory barriers to entry experienced a significant increase in subsequent (revenue) TFP growth relative to establishments not located in reform-municipalities. The effect is largest if municipalities eliminated operating licenses requirements not complying with national law which constitute local barriers to market entry. At the same time, these regulatory reforms did not impact establishments' markups, or, if anything, tended to reduce them, suggesting that establishments' physical productivity has indeed improved. We provide a wide range of evidence supporting a causal interpretation of these findings.

The results highlight the importance of subnational regulatory barriers in attenuating competition and reducing firm productivity. Such barriers can undermine the impact of seemingly best practice national regulatory frameworks and trade liberalization at the macroeconomic level. Our findings further suggest that strengthening the mandate of institutions enforcing competition is critical to raise productivity. In Peru, they help explain why (firm) productivity growth has been lagging for a long time despite the relatively competitive business regulations at the national level and the introduction of one of the world's most liberal trade regimes. The reforms strengthening Peru's competition authority in 2013/14 partly correct this shortcoming. Legal reforms in 2016/17 further empowered Peru's competition authority by strengthening its judicial mandate and establishing that its ruling on regulatory barriers declared illegal is universally binding for all government bodies throughout the country. Similar analysis based on subnational microeconomic data might shed light on explaining the laggard productivity growth also in other countries with relatively liberal trade regimes and macro-regulatory environments, such as Mexico.

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**Table 1. Summary Statistics of the firm-level data**

**Panel A. Number of Firms per Year**

	2008	2009	2010	2011	2012	2013	2014	2015
Number of firms	7,017	7,487	7,725	4,812	4,246	4,690	5,241	4,975

**Panel B. Summary Statistics on Firm-Level Outcome Variables across 2011-2015**

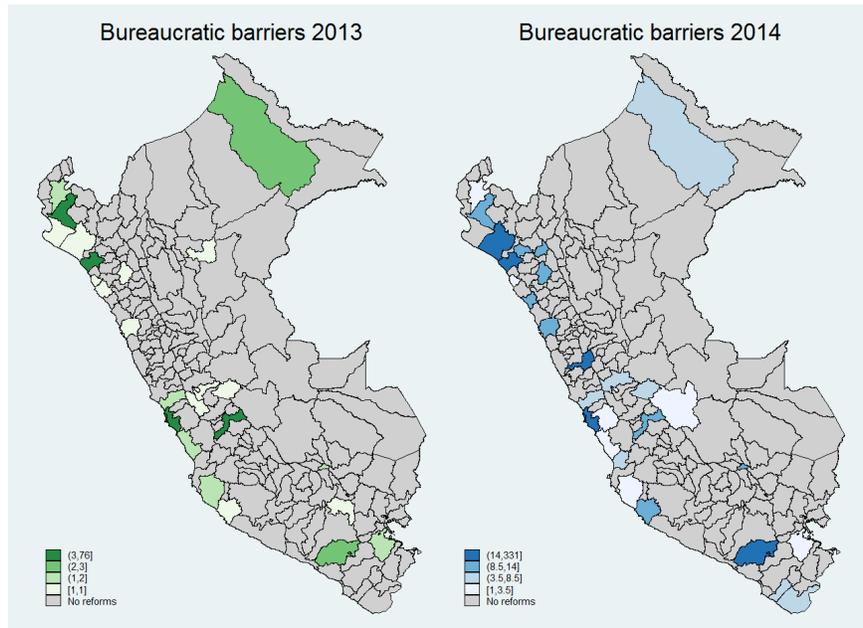
	Number of observations	Average	Standard Deviation	Minimum	Maximum
Log Total Factor Productivity Translog	38,845	15.0	3.75	-57.71351	63.6
Log Total Factor Productivity Cobb-Douglas	38,845	8.96	2.92	-3.52	24.6
Log Markups Translog	43,505	.751	.900	-8.83	9.03
Log Markups Cobb-Douglas	44,625	1.73	.957	2.25	14.9
Market shares within 4-digit sectors	46,193	.011	.043	8.95e-07	1
Log Real Value Added	45,865	11.1	1.10	-2.04	19.7
Log Employees	45,865	3.80	1.58	0	20.6
Log Real Stock of Capital	46,193	14.5	2.28	5.01	21.6
Log Real Intermediate Input Cost	46,193	14.6	2.20	6.30	21.1
Age	46,189	16.5	13.8	0	183

**Table 2. Frequency of different types of eliminated regulatory barriers at the subnational level**

	2013			2014		
	States	Provinces	Districts	States	Provinces	Districts
Total number of districts, etc. in Peru	25	196	1,874	25	196	1,874
<i>Type of reforms:</i>						
Reforms of any type	2	18	35	3	22	70
License requirement	2	16	32	3	17	45
Lower fees and charges	1	4	10	0	10	20
Technical requirements	1	9	12	0	17	48

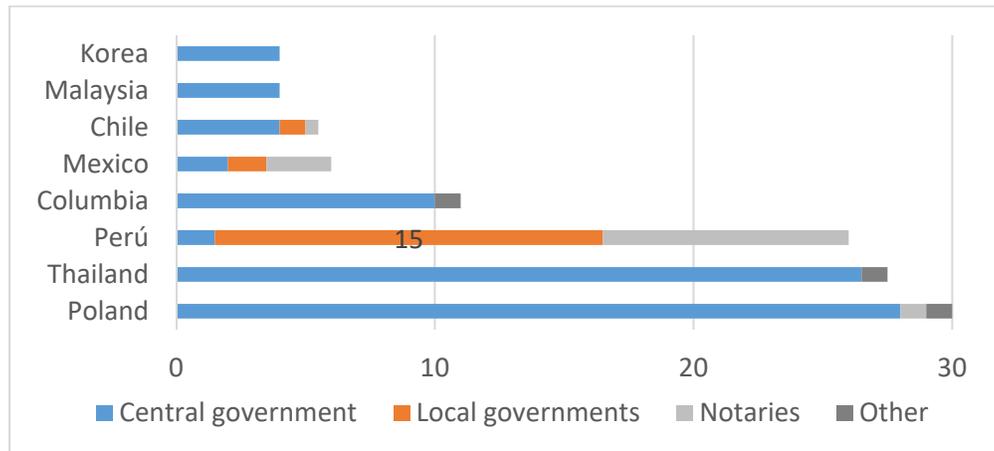
Note. The table shows the number of districts, provinces and departments where at least one regulatory barrier for businesses has been eliminated.

**Figure 1. The elimination of regulatory barriers across municipalities (province level)**



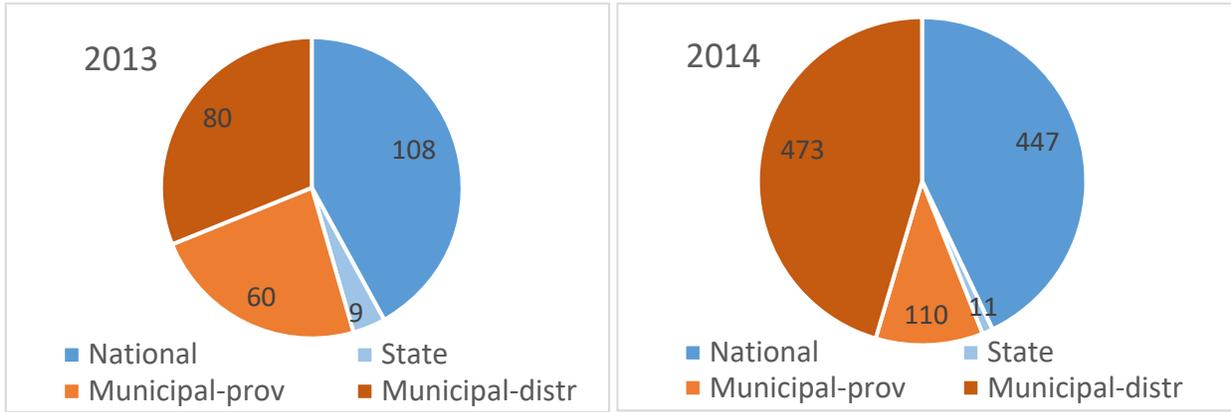
Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. The map shows the number of eliminated regulatory barriers at the province level and includes eliminated barriers at the more granular district level (which have been aggregated and added to the province level).

**Figure 2. Days to start a business by source of legal procedure**



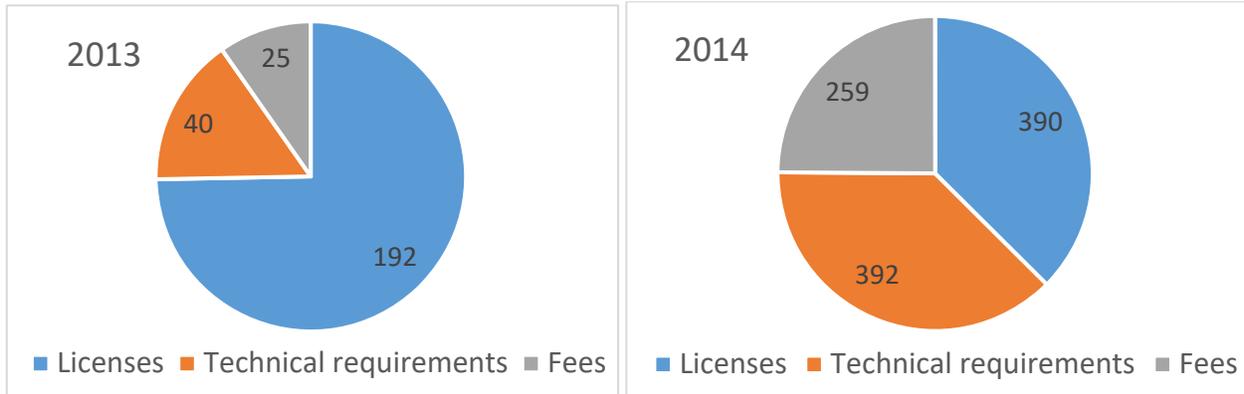
Note: Number of days required by official procedures to open a business in Lima; categorized into procedures imposed by national government, subnational (local) governments, notaries, and other (usually banks); Doing Business (2016).

**Figure 3. Regulatory barriers to firm competition by source**



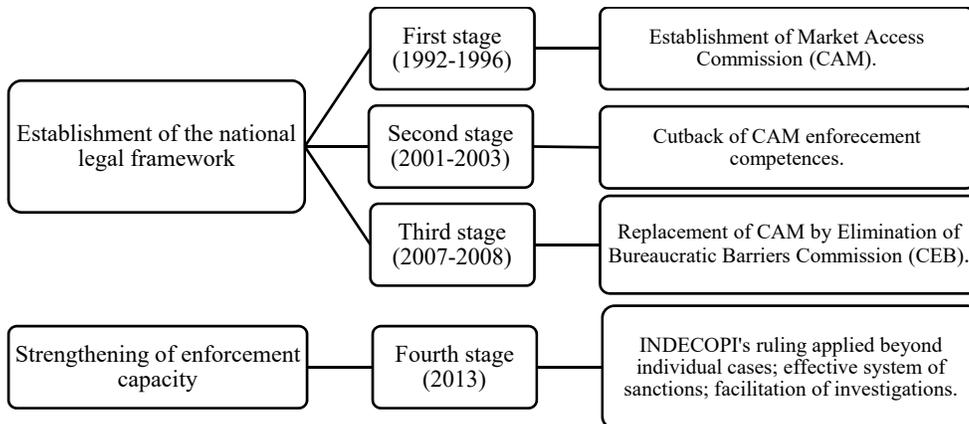
Note: The number of eliminated regulatory barriers for businesses by different government tiers based on INDECOPI (2013, 2014).

**Figure 4. Regulatory barriers to firm competition by type**



Note: The number of eliminated regulatory barriers for businesses by different government tiers based on INDECOPI (2013, 2014).

**Figure 5. Chronology of INDECOPI' legal mandate to eliminate regulatory barriers to market entry and competition**



Source: INDECOPI (2013).

**Table 3. Impact of eliminating subnational barriers to competition on firm productivity and markups**

	<b>ln(TFP-translog)</b>				<b>ln(TFP-cd)</b>				<b>ln(Markups-translog)</b>				<b>ln(Markups-cd)</b>			
	Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality			
Reform-any	.455** (3.52)				.425** (2.65)				.056 (1.27)				.046 (1.06)			
Reform-license	.451** (3.01)				.463** (2.73)				.034 (0.74)				.025 (0.56)			
Reform-technic	.230** (4.41)				.368** (5.04)				-.026 (-0.80)				-.014 (-0.46)			
Reform-fees	-.147* (-1.81)				-.117* (-1.81)				-.012 (-0.57)				-.028 (-1.35)			
Firm FE	Yes	Yes	Yes	Yes												
State*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024

	<b>ln(TFP-translog)</b>				<b>ln(TFP-cd)</b>				<b>ln(Markups-translog)</b>				<b>ln(Markups-cd)</b>			
	Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality			
Reform-any	.192 (0.90)				.491** (2.42)				.042 (0.63)				.009 (0.13)			
Reform-license	.238 (0.82)				.506** (2.07)				-.052 (-0.84)				-.087 (-1.34)			
Reform-technic	.209** (2.80)				.399** (5.11)				-.024 (-0.61)				-.003 (-0.09)			
Reform-fees	-.180** (-2.10)				-.128* (-1.89)				-.022 (-1.01)				-.039* (-1.85)			
Firm FE	Yes	Yes	Yes	Yes												
Province*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024

Note: Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. reform-dummy is 1 in reform-years and after for establishments located in reform municipality, 0 otherwise. Heteroscedasticity robust s.e. clustered at firm-level, t-statistics in parenthesis; \*,\*\* significance at 10,5 percent level.

**Table 4. Impact of eliminating subnational barriers to competition separately for reforms in 2013 and 2014**

	ln(TFP-translog)				ln(TFP-cd)				ln(Markups-translog)				ln(Markups-cd)			
<b>Reforms 2013</b>	Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality			
Reform-any	.477** (3.11)				.501** (2.85)				.021 (0.43)				.007 (0.14)			
Reform-license	.571** (3.57)				.584** (3.10)				-.002 (-0.10)				.009 (0.52)			
Reform-technic	.601** (7.88)				.378** (5.46)				.003 (0.06)				-.023 (-0.55)			
Reform-fees	.261** (2.04)				.129 (1.23)				.024 (1.04)				.012 (0.49)			
Firm FE	Yes	Yes	Yes	Yes												
State*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	12,585	12,480	2,685	913	12,585	12,480	2,685	913	12,585	12,480	2,685	913	12,585	12,480	2,685	913

	ln(TFP-translog)				ln(TFP-cd)				ln(Markups-translog)				ln(Markups-cd)			
<b>Reforms 2014</b>	Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality				Dummy if reform in municipality			
Reform-any	.443** (3.32)				.013 (0.08)				-.001 (-0.02)				-.021 (-0.48)			
Reform-license	-.020 (-0.31)				.103** (2.10)				.015 (0.36)				-.012 (-0.28)			
Reform-technic	.515** (12.8)				.250 (1.60)				-.026 (-1.17)				-.007 (-0.30)			
Reform-fees	-.183** (-2.10)				-.289** (-4.07)				-.055 (-1.61)				-.086** (-2.69)			
Firm FE	Yes	Yes	Yes	Yes												
State*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	8,901	4,030	8,716	1,251	8,901	4,030	8,716	1,251	8,901	4,030	8,716	1,251	8,901	4,030	8,716	1,251

Note: Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. reform-dummy is 1 in reform-years and after for establishments located in reform municipality, 0 otherwise. Heteroscedasticity robust s.e. clustered at firm-level, t-statistics in parenthesis; \*,\*\* significance at 10,5 percent level.

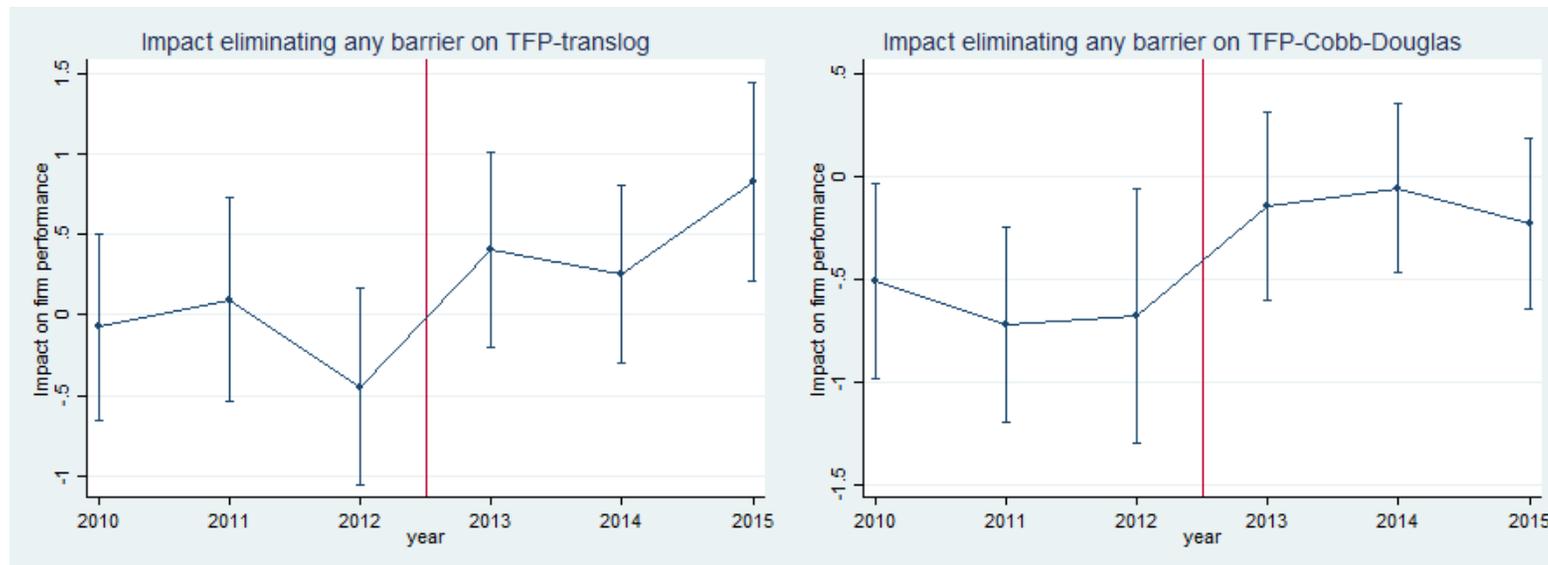
**Table 5. Test of common trend assumption:**

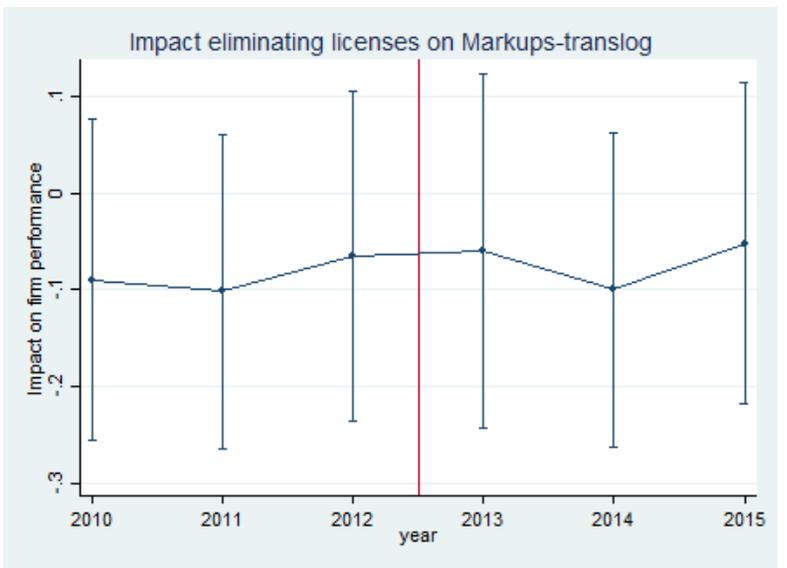
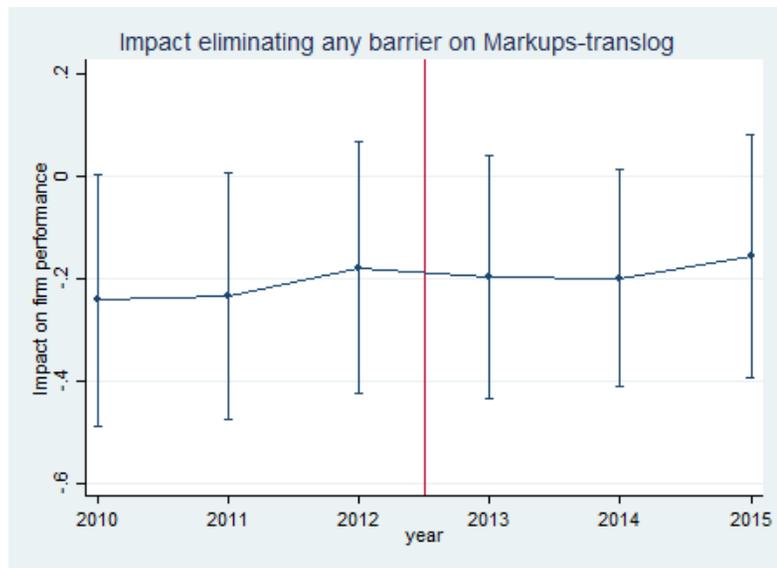
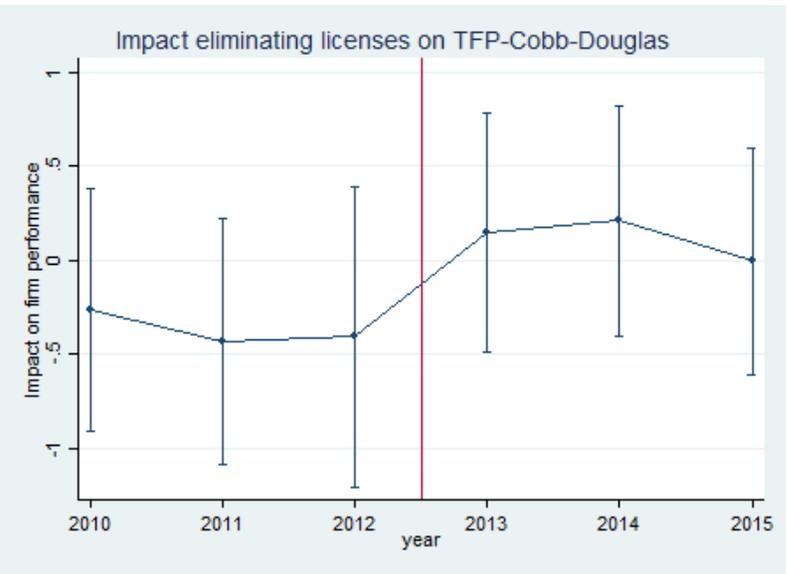
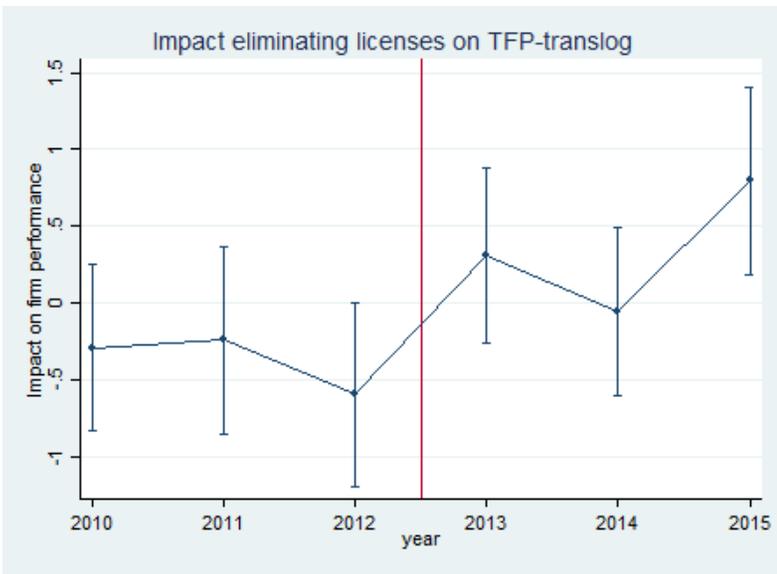
**Null hypothesis: reform and non-reform municipalities have the same productivity and markups in years before the reforms**

	ln(TFP-translog)				ln(TFP-cd)				ln(Markups-translog)				ln(Markups-cd)			
	all	license	technic	fees	all	license	technic	Fees	all	license	technic	fees	all	license	technic	fees
<i>State*year FE:</i>																
<i>2013/14: Prob&gt;F (F2.-F4.=0)</i>	0.674	0.002	0.507	0.076	0.554	0.029	0.229	0.000	0.425	0.291	0.738	0.480	0.329	0.292	0.812	0.760
<i>2013: Prob&gt;F (F2.-F4.=0)</i>	0.384	0.529	0.000	0.209	0.036	0.025	0.005	0.633	0.435	0.489	0.458	0.966	0.422	0.280	0.241	0.640
<i>2014: Prob&gt;F (F1.-F3.=0)</i>	0.674	0.002	0.507	0.076	0.554	0.029	0.229	0.000	0.841	0.575	0.254	0.061	0.746	0.875	0.238	0.319
<i>Province*year FE:</i>																
<i>2013/14: Prob&gt;F (F1.-F3.=0)</i>	0.636	0.001	0.357	0.104	0.689	0.012	0.972	0.000	0.101	0.020	0.672	0.485	0.063	0.010	0.760	0.728
<i>2013: Prob&gt;F (F1.-F4.=0)</i>	0.392	0.445	0.000	0.196	0.320	0.262	0.005	0.693	0.971	0.890	0.374	0.962	0.919	0.799	0.501	0.605
<i>2014: Prob&gt;F (F1.-F4.=0)</i>	0.636	0.001	0.357	0.104	0.689	0.012	0.972	0.000	0.535	0.643	0.132	0.064	0.496	0.882	0.102	0.341

Note: Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. F-test if impact of leads of reform dummies in Tables 3 and 4 is jointly equal to zero in each of the regressions in Tables 3 and 4. For each regression specification, it is thus tested if reform-municipalities have the same productivity and markups as non-reform municipalities in the years before the reforms.

**Figure 6. Impact of eliminating subnational barriers to competition on firm productivity and markups**





**Table 6. Impact of the number of eliminated subnational barriers to competition (intensive margin of reforms)**

	ln(TFP-translog)				ln(TFP-cd)				ln(Markups-translog)				ln(Markups-cd)			
	Number of reforms in municipality				Number of reforms in municipality				Number of reforms in municipality				Number of reforms in municipality			
Reform-any	.109** (21.1)				.039** (9.38)				-.001 (-0.09)				-.004** (-3.09)			
Reform-license	.087** (13.5)				.029** (5.94)				.000 (0.20)				-.004** (-2.45)			
Reform-technic	.144** (14.4)				.059** (9.40)				-.003 (-1.00)				-.004* (-1.77)			
Reform-fees	.145** (3.76)				-.046* (-1.79)				-.003 (-0.25)				-.024** (-2.01)			
Firm FE	Yes	Yes	Yes	Yes												
State*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024

	ln(TFP-translog)				ln(TFP-cd)				ln(Markups-translog)				ln(Markups-cd)			
	Number of reforms in municipality				Number of reforms in municipality				Number of reforms in municipality				Number of reforms in municipality			
Reform-any	.491** (2.42)				.041** (9.60)				-.001 (-0.62)				-.005** (-3.17)			
Reform-license	.506** (2.07)				.029** (5.95)				.000 (0.06)				-.004** (-2.50)			
Reform-technic	.399** (5.11)				.061** (9.60)				-.003 (-1.02)				-.004* (-1.76)			
Reform-fees	-.128* (-1.89)				-.043 (-1.63)				-.006 (-0.54)				-.029** (-2.37)			
Firm FE	Yes	Yes	Yes	Yes												
Province*Year FE	Yes	Yes	Yes	Yes												
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	43,505	43,505	43,505	43,505	43,505	43,505	43,505	43,505
Obs reform	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024

Note: Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. Number of eliminated regulatory barriers in a municipality in which an establishment operates. Heteroscedasticity robust s.e. clustered at firm-level, t-statistics in parenthesis; \*,\*\* significance at 10,5 percent level.

**Table 7. Impact elimination of sector-specific subnational barriers to competition**

	ln(TFP-translog)				ln(TFP-cd)				ln(TFP-translog)				ln(TFP-cd)			
	Dummy sector-specific municipal reforms								Number of sector-specific municipal reforms							
Reform-any	.728** (9.75)				.821** (12.2)				.114** (13.6)				.019** (3.77)			
Reform-license	.634** (7.81)				1.02** (14.4)				.113** (12.4)				.025** (4.49)			
Reform-technic	.801** (7.57)				-0.008 (-0.09)				.209** (4.66)				-0.022 (-0.83)			
Reform-fees	1.29** (9.17)				-0.342** (-3.38)				.297** (6.73)				-0.086** (-2.87)			
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs total	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845	38,845
Obs reform	2,056	1,717	680	414	2,056	1,717	680	414	2,056	1,717	680	414	2,056	1,717	680	414

Note: Based on firm census data from INEI and eliminated regulatory barriers from INDECOPI. Dummy and number of eliminated 2-digit sector-specific regulatory barriers in a municipality. Heteroscedasticity robust s.e. clustered at firm-level, t-statistics in parenthesis; \*,\*\* significance at 10,5 percent level.

**Table 8. Impact of the eliminated subnational barriers to competition in Lima versus the rest of Peru**

	ln(TFP-translog)															
	Lima								Rest of Peru							
	Dummy if reform in municipality				Number of reforms in municipality				Dummy if reform in municipality				Number of reforms in municipality			
Reform-any	1.33** (4.51)				.109** (19.7)				.398** (4.43)				.085** (6.19)			
Reform-license	1.33** (4.51)				.083** (12.0)				.321** (2.50)				.131** (6.78)			
Reform-technic	.286** (3.77)				.144** (16.5)				.211** (2.28)				.083** (3.56)			
Reform-fees	-.222** (-2.54)				.103** (2.46)				.346** (2.20)				.308** (4.07)			
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs total	25,667	25,667	25,667	25,667	25,667	25,667	25,667	25,667	13,178	13,178	13,178	13,178	13,178	13,178	13,178	13,178
Obs reform	10,363	10,363	7,734	1,712	10,363	10,363	7,734	1,712	2,778	2,317	1,887	312	2,778	2,317	1,887	312

**Table 9. Higher initial productivity did not impact probability that municipality eliminated regulatory barriers**

	Dummy if reform in municipality				Dummy if reform in municipality			
	all	license	technic	fees	all	license	technic	fees
tfp2009-TL	-.003 (-0.38)	.008 (1.08)	.020 (1.36)	-.006 (-0.51)				
tfp2009-CB					.083 (1.51)	.133** (2.40)	-.001 (-0.01)	-.052** (-2.32)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs total	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512

**Table 10. Impact of the eliminated subnational barriers to competition on firms' market shares within their 4-digit sectors**

	<b>ln(Market shares within 4-digit sectors)</b>															
	Dummy if reform in municipality				Number of reforms in municipality				Dummy if reform in municipality				Number of reforms in municipality			
Reform-any	.102 (1.27)				-.006** (-2.55)				.162 (1.24)				-.007** (-2.83)			
Reform-license	.033 (0.39)				-.009** (-3.08)				-.035 (-0.28)				-.010** (-3.30)			
Reform-technic	-.076* (-1.93)				-.018 (-0.45)				-.107** (-2.50)				-.002 (-0.58)			
Reform-fees	-.007 (-0.21)				-.008 (-0.48)				-.016 (-0.46)				-.013 (-0.75)			
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Province*Year FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs total	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193	46,193
Obs reform	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024	13,141	12,680	9,621	2,024