Two-Tier Tax Systems and Firms: Evidence from Brazil *

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1 Motivation and Summary

Across the world, modern systems of firm taxation often co-exist with exemptions or presumptive tax regimes (Bird *et al.* 2003). As a result, only a subset of firms in the economy are subject to the "regular" tax system, which usually features a combination of valued-added, payroll, and corporate income taxes. Other firms are exempt from these taxes, or instead subject to special tax regimes that rely on a presumptive tax base, which is typically turnover. The usual rationale for such a *two-tier tax system* is that modern taxes have desirable properties, but may come at high compliance costs for taxpayers and administrative costs for tax authorities (Slemrod & Gillitzer 2013). Hence, exemptions or presumptive taxes are often targeted at small and medium enterprises where such costs may be particularly important, and firms can often choose whether to be part of the regular or the presumptive tax regime. Of course, the details of tax schemes and the partition of taxpayers vary across countries (Kanbur & Keen 2014), including turnover thresholds for VAT (e.g. Keen & Mintz 2004) or payroll tax exemptions (e.g. Hsieh & Olken 2014). In developing countries in particular, presumptive taxation tends to be more common, which is likely due to a larger extent of information problems and enforcement constraints.

This paper investigates the key effects of a two-tier tax system on firms, using novel administrative data on firm-to-firm trade linked to labor inputs from Sao Paulo, Brazil. As it is common to a number of developing countries (Shome 2004), the Brazilian setting features a turnover threshold, below which firms are eligible to opt into a simplified regime (SIMPLES) where a single turnover tax is applied replacing

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valued-added, payroll, and corporate income taxes.[1] Our results so far show that the presence of a two-tier tax system (i) affects firms' input choice, creating (partial) segmentation in firm-to-firm trade along the supply chain, (ii) slows down firm growth around the eligibility threshold, and (iii) affects competition due to the differential tax burden on firms in the same sector.

The empirical setting of Brazil provides two key advantages. First, we obtained access to high-quality administrative data, including data on firm-to-firm trade flows based on electronic invoices. All firms must use electronic invoicing irrespective of the tax regime they choose.[2] As a result, the data allow us to map the trade network of regular firms *and* SIMPLES firms in our sample, including when firms switch between tax regimes. Figure 1 illustrates the structure of the data. The core sample is composed by wholesale firms. They are "core" because we observe all firm-to-firm trade to/from wholesale firms. For other firms that trade with wholesale firms we still observe rich firm-level data including total sales and total inputs by tax regime of the supplier. Moreover, the data is linked to administrative records on the total number of employees and payroll. Table 1 provides summary statistics of our core sample with around 2.4m firm-years. The second advantage is that there are various sources of variation in firms' tax regimes that we can exploit, including a reform that changes the location of the revenue-based SIMPLES eligibility threshold.

We aim to contribute to the literature by shedding new light on the key effects of a two-tier tax system for firms. Although some studies emphasize the potential relevance of tax systems for firm-to-firm trade (De Paula & Scheinkman 2010, Pomeranz 2015, Liu *et al.* 2019), there is little empirical evidence of such effects due to a lack of micro data on firm-to-firm trade flows.[3] This paper also contributes to a growing literature documenting firm size responses to VAT thresholds (e.g. Harju *et al.* 2019, Onji 2009, Asatryan & Peichl 2017). Finally, the paper relates to a broader literature on size-based regulation and taxation (e.g. Best *et al.* 2015, Garicano *et al.* 2016, Boonzaaier *et al.* 2019).

The next section of this extended abstract summarizes our preliminary results.

2 Preliminary Findings

Our results so far indicate that that the presence of a two-tier tax system has three key effects.[4]

[1] **Segmentation in firm-to-firm trade**. The main novel result is that we find evidence of segmentation in firm-to-firm trade across the supply chain due to VAT incentives. Firms in the regular system are more likely to trade with firms in the regular system, whereas firms in the presumptive SIMPLES system (henceforth "presumptive") are more likely to trade with firms in the same system if compared to regular firms. The incentive to segmentation occurs because firms in the regular system can take tax credit when buying inputs from a supplier that is also in the regular system, but not from a supplier outside the system. Hence, regular firms may prefer to trade with firms in the regular system. Firms in the outside the regular system may

[1]Henceforth, we will refer to the non-presumptive system as the "regular" system. Note that given the typical shape of firm size distributions with a large mass of small firms, there are actually fewer firms in the regular system than in presumptive system. However, firms in the regular system are much more relevant economically: they account for the vast majority of total transactions as they are much larger in size on average.

[2]Usually, such data is available through VAT declarations where firms itemize inputs and outputs (e.g. India and Uganda). Therefore, only transactions for which a VAT-registered firm is either a buyer or a supplier can be observed, and transactions between non-VAT firms are not covered by the data. In addition, because firms declare their inputs and outputs, the declaration of the same transaction is subject to mistakes and misreporting by the two parties. In the case of Brazil, the electronic invoicing covers all B2B transactions and each invoice has a unique key such that the same transaction cannot be reported differently by suppliers and buyers. The data thus mitigate both concerns of data censoring and misreporting.

[3]Concurrent to this paper, there is some work in progress using data from India (Gadenne *et al.* 2018, Rios & Setharam 2018).

[4]Work on this project has been ongoing for a while, but progress has been slow due to difficulties with the highly complex and confidential data on firm-to-firm trade. However, we now have direct access to all the data that we need to complete analysis by the time of the conference.

prefer to source from firms that are also not part of the regular system if the after tax cost of buying inputs from them is lower than buying inputs from regular firms. De Paula & Scheinkman (2010) argue that this differential cost should be true such that SIMPLES and VAT firms can co-exist.

Figure 2 shows descriptive patterns of input choices across the firm size distribution consistent with (partial) segmentation of firm-to-firm trade between tax regimes. In panel (a), the share of intermediate inputs purchased from regular firms is higher among regular firms than among presumptive firms across the entire revenue distribution. This is driven both by regular firms buying a larger amount of input from other regular firms (panel b), and presumptive firms buying a larger amount of input from other presumptive firms (panel c). Panel (d) shows that presumptive firms also use a larger share of labor input (out of labor and intermediate inputs), which may reflect the tax incentives around the threshold.

Of course, this cross-sectional correlation between a firm's tax regime and their input does not necessarily imply a causal effect of the tax system on input choices. The effects may be driven by selection, where for instance the (potential) set of trade partners of a firm and its labor intensity determines which tax regime the firm chooses, or by omitted variables correlated with both tax regime choice and input choice. To address these issues and to move towards identifying the causal effect of the tax system on input choices, we exploit the panel variation in our data. First, we conduct an event study around firm switches between tax regimes. Figure 3 shows that firms who switch into the regular tax regime start purchasing a larger share of inputs from other regular firms exactly at that time, and vice versa, firms who switch into the presumptive regime increase their input share from presumptive firms. Moreover, firms switching into the presumptive regime increase their labor input share, and firms switching into the regular regime decrease their labor input share. Hence, the correlation between tax regimes and input choices does not seem to be driven by fixed firm characteristics, but there could still be endogeneity in the timing of switches.

To get closer to the causal effect of the tax system, we exploit the 2012 SIMPLES reform that increased the size-based eligibility threshold for the presumptive tax regime by 50%. The reform expands the set of firms eligible for the presumptive regime, triggering exogenous tax regime switches. We define a treatment group of firms who are in the newly designated eligibility range and would be above the median gain from switching tax regimes, and a control group above who are ineligible for the presumptive regime before and after the reform. Panel (a) of figure 4 shows the "first stage", where the share of firms in the regular tax regime decreases differentially by around 6 percentage points in the treatment group. Panel (b) shows that the treatment group decreases their input share from regular firms by almost one percentage point, a sizeable effect given the modest share of tax regime switchers.

We also study whether another relevant dimension of input choice is affected: labor. Once firms become part of the VAT system, they can deduct taxes paid in inputs from VAT firms, which could change the cost wedge of these two types of inputs all else equal. In the case of Brazil, being part of the VAT system also means being liable for regular payroll taxes, which could further affect incentives to hire labor relatively to other inputs. Our results suggest that firms select tax systems based on labor shares (Figure 2d), but we find no (preliminary) evidence that the firm's tax regime affects the labor input share (DD results in Figure 4c).

[2] Firm growth. The second set of results shed further light on the potential negative firm growth effect due to the size-based eligibility criteria. Figure 4d plots DD coefficients on revenue, which we observe already for some years before the reform. There are no differential pre-reform trends in revenue, but post-reform, there is a negative effect on revenue for treated firms.

Panel (a) of figure 5 shows the overall firm size distribution before and after the 2012 reform. In 2010, there is sharp bunching below the old threshold. After the reform, bunching builds up at the new thresh-

old, and the entire region between the thresholds "fills up" with a sizeable mass of firms. Panel (b) shows coefficients from a dif-in-dif regression of firms in the presumptive regime who are just below the threshold in 2010 vs. firms further away from the threshold. Growth of the treated firms slows down when they are close to the threshold before the reform, but they grow disproportionately fast when the threshold is increased after the reform. As a placebo test, we consider firms in the regular regime, where there are no such differences in growth. This suggests that the growth of presumptive firms is constrained, as they are unwilling to cross the threshold where they would lose eligibility for the presumptive regime.

[3] Competition effects. The third set of results speaks to the competition effects of the two-tier tax system. Again, we exploit the 2012 reform, which also lowers tax rates for firms within presumptive regime. Figure 6 shows coefficients from a difference-in-difference regression, comparing a treatment group of firms in the regular regime in sectors with high vs. low market shares of presumptive competitors. Regular firms in sectors where a large share of potential competitors that receive a tax break in the reform see a fall in their sales after the reform. Hence, the differential taxation of firms in the same sectors can alter competition.

Together, these findings suggest that this dual system can cause production inefficiencies. Firms may not choose the best supplier due to the tax distortion, they may grow slower to retain eligibility, and the co-existence of taxpayers who operate in the same market but face different tax burdens can create an unlevel playing field. Thus, the compliance and administrative must be high enough to justify this dual system.

Interestingly, these adverse effects are somewhat mitigated by the sheer size of regular firms. We observe partial segmentation: firms from both tax regime mostly source from regular firms. Also, we observe small firms voluntarily registered to be in the regular regime even if they are eligible to be in the presumptive system. These firms typically have more regular firms in their nextwork, in which case they may prefer to give and claim tax credit to their buyers and suppliers. However, if VAT exemptions are granted to larger firms or sectors, these adverse effects could, instead, be magnified.

3 Next Steps

We are working on strengthening the evidence of a causal effect of the two-tier tax system on production choices by leveraging the firm-to-firm trade network data more directly. In particular, we plan to use an additional empirical strategy exploiting tax regime switches of large suppliers of firms which are exogenous to firm itself. We focus on tax regime switches of top-ten suppliers of firms, where the client firm accounts for no more than 5% of the supplier's total sales. Hence, the supplier's tax regime switch is relevant to the firm, but the switch should not be affected by the firm itself. We analyze outcomes at the firm-pair level, including the probability that any firm-to-firm trade occurs and the volume of trade. Preliminary results from this exercise are in line with a causal effect of the tax system on firm-to-firm trade.

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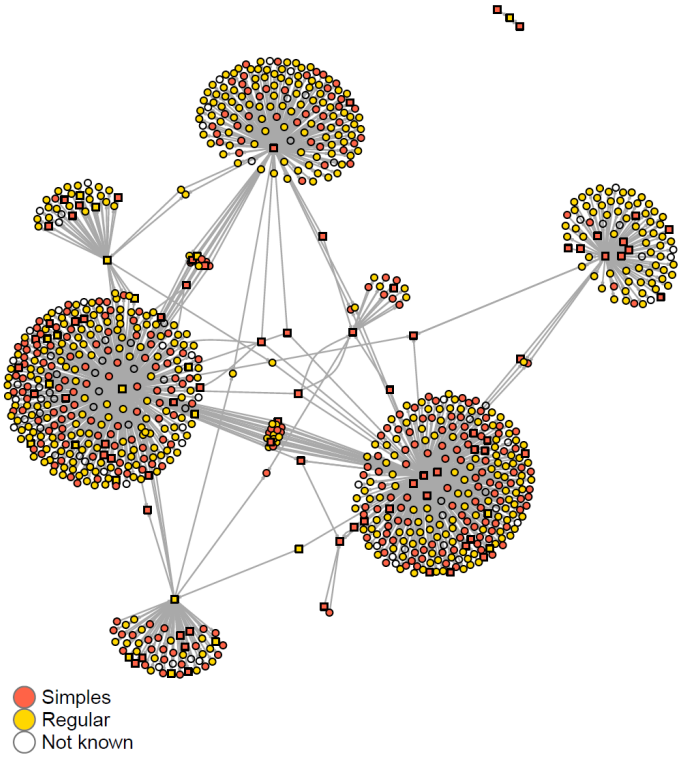
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TABLE 1: SUMMARY STATISTICS

	All Firms	Firms above SIMPLES threshold	Firms below SIMPLES threshold	
			Regular Firms	SIMPLES firms
	(1)	(2)	(3)	(4)
Group-level share of the sample	1.00	0.06	0.07	0.87
Share of firms in regular tax regime	0.13	0.97	1.00	0.00
(Log) Revenue	11.71	16.02	12.34	11.36
(Log) Material Input	11.17	15.42	11.97	10.80
(Log) Payroll	10.43	12.62	10.69	10.19
Dummy for positive labor input	0.66	0.95	0.63	0.64
(Log) Input from regular firms	10.96	15.35	11.84	10.56
(Log) Input from presumptive firms	9.01	11.30	9.08	8.81
Share of input from regular firms	0.79	0.95	0.86	0.77
Material input share	0.82	0.91	0.85	0.81
Labor input share	0.19	0.09	0.15	0.20
Share of regular firms among suppliers	0.68	0.69	0.71	0.68
Dummy for Top 1 supplier in regular regime	0.74	0.88	0.76	0.73
Share of Top 3 suppliers in regular regime	0.71	0.84	0.72	0.70
(Log) Value added	11.22	14.88	11.93	10.85
Dummy for positive value added	0.76	0.96	0.74	0.75
Value added per worker	65,200	387,176	83,490	30,807
(Log) profits	12.47	15.12	11.85	11.48
Dummy for positive profits	0.66	0.84	0.65	0.61
Age of the firm	11.63	18.80	12.70	11.05
Number of establishments	1.07	2.04	1.07	1.00
Number of firm-year observations	2,368,988	142,278	162,451	2,064,259
Number of firms	590,007	36,127	66,697	528,388

Note: Core sample

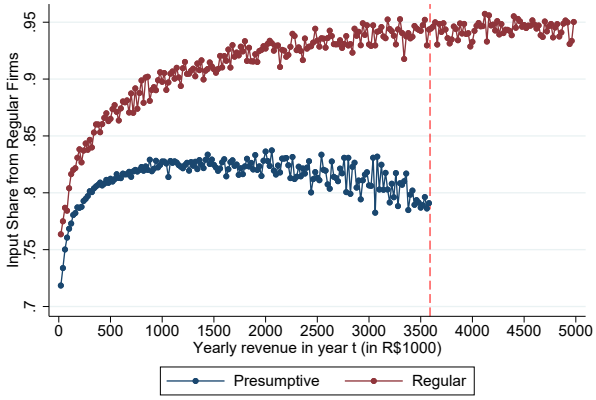
FIGURE 1: EXAMPLE OF DATA



Notes: This figure displays the firm-to-firm trade network of a 100 randomly selected firms in our sample in 2012. The squares are our *core sample*: firms in wholesale for which we have all the firm-to-firm trade (inputs and outputs). The circles are firms that trade with with at least one firm in our core sample. We have data on total revenue, total input by suppliers' tax regime, and employment for all firms (circles and squares). Orange circles/squares are firms in the presumptive SIMPLES system. Yellow circles/squares are regular firms. White circles are excluded firms from our sample: some firms are too large to be de-identified even after scrambling ids and sector of activity. But we still observe the total value that is traded with excluded firms as an aggregate.

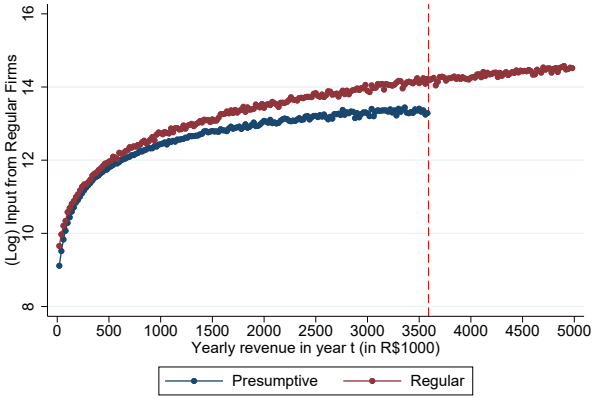
FIGURE 2: TAX REGIMES AND INPUT CHOICES

(a) Input Share from Regular Firms



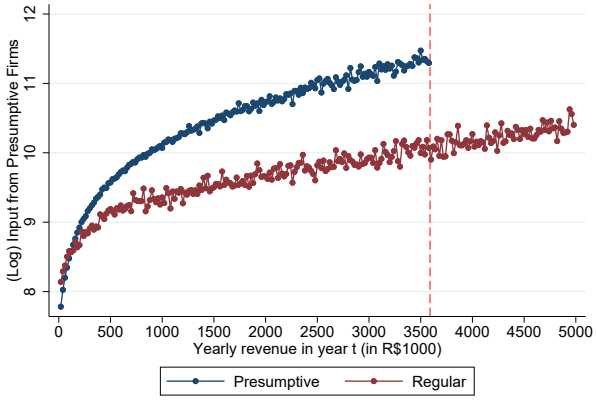
Core sample (2012-2017). Sample size: presumptive 1725678; regular 163120

(b) Log Input from Regular Firms



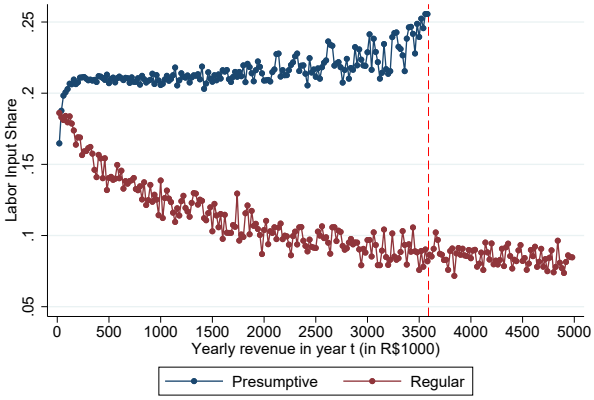
Core sample (2012-2017). Sample size: presumptive 1678730; regular 161401

(c) Log Input from Presumptive Firms Firms



Core sample (2012-2017). Sample size: presumptive 1529543; regular 142906

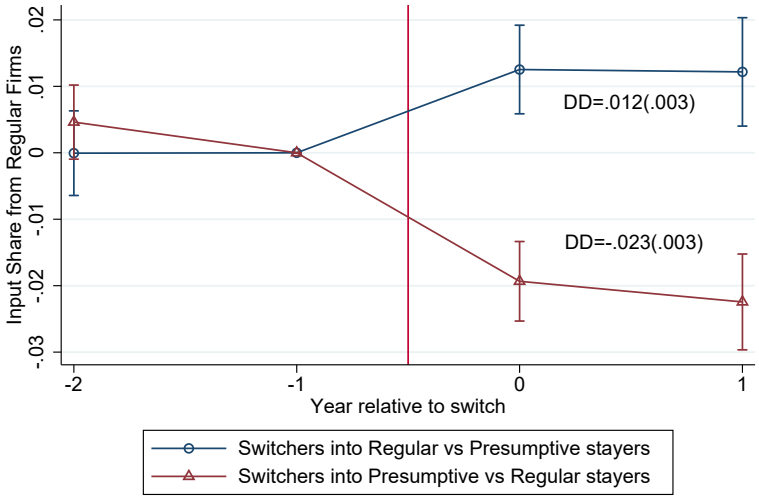
(d) Labor Input Share



Core sample (2012-2017). Sample size: presumptive 1725678; regular 163116

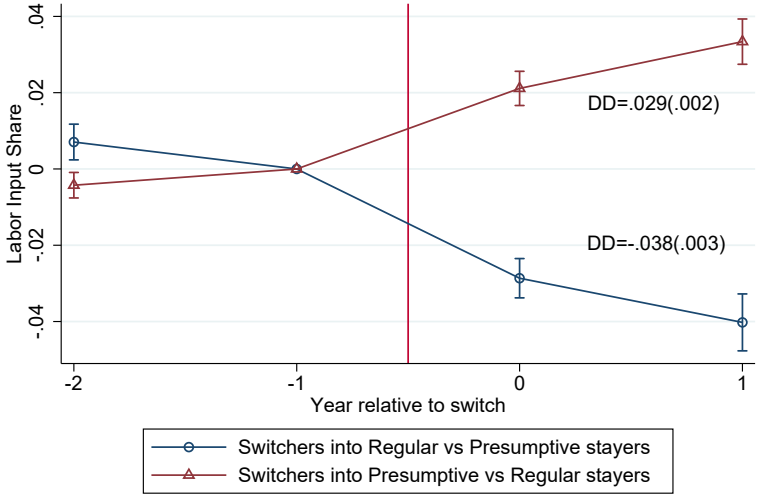
FIGURE 3: EVENT STUDY: TAX REGIME SWITCHERS

(a) Input Share from Regular Firms



N_in=14566, N_out=17356, N_always=145240, N_never=1047500.
Baseline into Regular: .84; Baseline out of Regular: .84

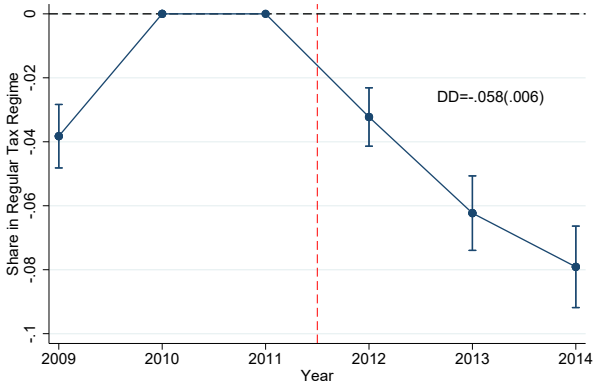
(b) Labor Input Share



N_in=14566, N_out=17356, N_always=145240, N_never=1047500.
Baseline into Regular: .18; Baseline out of Regular: .14

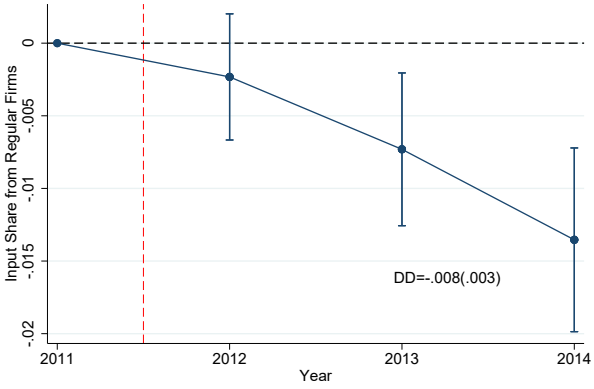
FIGURE 4: DIFFERENCE-IN-DIFFERENCES USING THE 2012 REFORM

(a) First Stage: Share of Firms in Regular Tax Regime



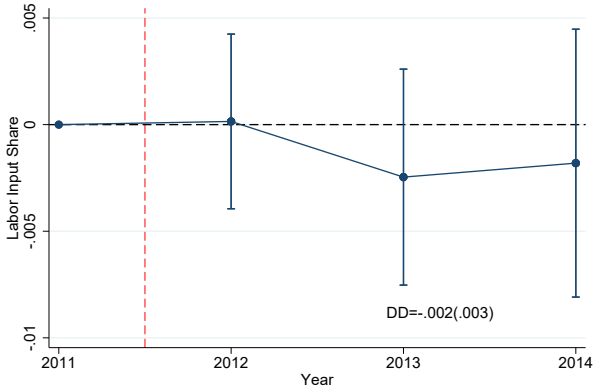
#Firms treatment = 3089. #Firms control = 5992.
DID coeff = -.058 (.005). DID coeff. with firm FE = -.058 (.006).

(b) Input Share from Regular Firms



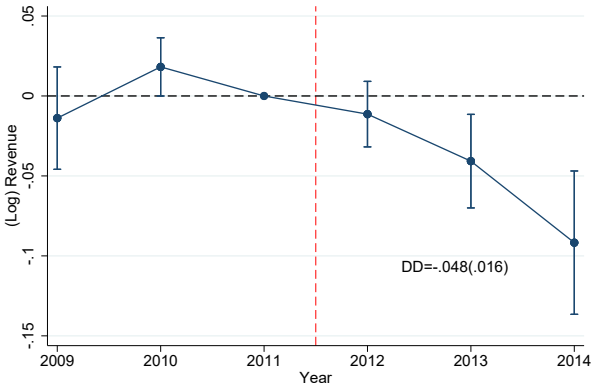
#Firms treatment = 3084. #Firms control = 5991.
DID coeff = -.008 (.002). DID coeff. with firm FE = -.008 (.003).

(c) Labor Input Share



#Firms treatment = 3086. #Firms control = 5992.
DID coeff = -.001 (.002). DID coeff. with firm FE = -.002 (.003).

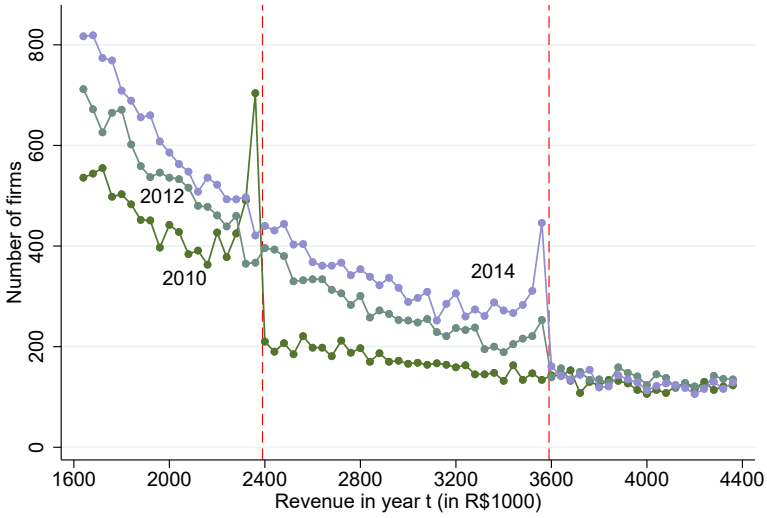
(d) Pre-Trends (Revenue)



#Firms treatment = 3089. #Firms control = 5992.
DID coeff = -.048 (.014). DID coeff. with firm FE = -.048 (.016).

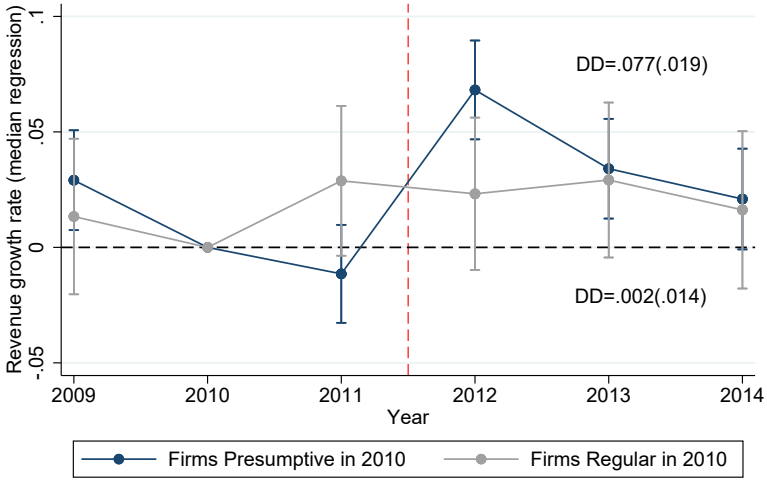
FIGURE 5: EFFECTS ON GROWTH

(a) Firm size distribution: pre- vs. post-reform



Core sample, N=203152

(b) Dif-in-dif: growth around the reform



Core sample. Regular: Baseline (treat) = .453. #Firms treat = 1551. #Firms control = 1759.
Presumptive: Baseline (treat) = .460. #Firms treat = 2724. #Firms control = 3073.
Triple-dif: DDD coeff = .075 (.016).

FIGURE 6: COMPETITION EFFECTS

