Demand Shocks and New Firm Dynamics: Evidence from the Dominican Republic*

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Abstract. We study the effects of a large and randomly assigned demand shock on small firms and prospective entrepreneurs. We take advantage of a unique public procurement setting in the Dominican Republic (DR) where construction projects are assigned via lottery to guard against corruption. In 2012 the government began a large school construction initiative, assigning over 1,800 projects – with an average budget exceeding a million dollars – via lottery to engineers ranging from prospective entrepreneurs to established firms. Unlike other procurement processes, our setting stands out in several ways: (1) projects were assigned via lottery so the demand shock spans the full support of firm size and productivity; (2) lottery participants were mostly young firms or skilled, but inexperienced, prospective entrepreneurs yet to even run a firm; (3) demand shocks were large, exceeding average firm revenues prior to the lotteries; and (4) entrepreneurs rarely won multiple lotteries. Using detailed administrative data on firm and individual taxes, employer-employee matched earnings, and firm-to-firm transactions, we leverage this setting to study how randomized demand shocks affect entrepreneurs relative to established firms. We find large and persistent positive causal effects from winning the lottery on contractor revenues, labor costs, firm-to-firm transaction amounts, and profits. We also find that firm assets and firm registration increase in response to winning a lottery. These effects persist beyond the period of the government contract.

1 Introduction

1.1 Introduction

Active firm entry can be an important source of economic growth as new, more productive firms capture market share at the expense of less productive incumbents or incumbents offering lower quality products. But a number of forces potentially work against an active entry margin. Without much of a track record, new firms may find it difficult to secure credit to finance necessary capital investments or challenging to find customers. New or prospective firms may also start out as less efficient if productivity increases with output from learning-by-doing; or entrepreneurs may not know how productive they would be were they to enter and this uncertainty deters entry. Finally, new firms may have less bargaining power in labor markets or other input markets such that employees and suppliers capture a large fraction of potential profits.

These forces may be particularly strong in developing countries where firm entry and exit rates are low. With less developed credit markets, supplier networks and employment relationships often formed via word of mouth and referral, and fewer opportunities for past experience in nascent industries, entrepreneurs in developing countries may consider entry or investment less profitable.

In this paper, we study the effects of a large and randomly assigned demand shock on small firms and prospective entrepreneurs. We take advantage of a unique public procurement setting in the Dominican Republic (DR) where construction projects are assigned via lottery to guard against corruption. In 2012 the government began a large school construction initiative, assigning over 1,800 projects – with an average budget exceeding a million dollars – via five rounds of lotteries to engineers ranging from prospective entrepreneurs to established firms.

Unlike other procurement processes, our setting stands out in several ways: (1) projects were assigned via lottery so the demand shock spans the full support of firm size and productivity; (2) lottery participants were mostly young firms or skilled, but inexperi-

enced, prospective entrepreneurs yet to even run a firm; (3) demand shocks were large, exceeding average firm revenues prior to the lotteries; and (4) entrepreneurs rarely won multiple lotteries. This last feature allows us to create clean treatment and comparison groups, which is often a challenge in public procurement settings where a single firm is subject to many lotteries.

To study the causal effects of winning a project on firm outcomes, we bring together a variety of detailed administrative data sets. We have data on the details of the lotteries, including project characteristics, lottery winners, and lottery losers. We link the lottery applicants to tax data on firms and individuals, which includes profits, earnings, wage bill, and assets. Completing many of the projects requires significant capital and labor expenses; we therefore link the lottery applicants to employer-employee matched earnings data and firm-to-firm transactions. This match allows us to study the spillover effects of the demand shock onto the individual or firm's employee and supplier networks. Finally, we collect data on government payments to the firms and how quickly the construction project was completed.

With this data, we run an event study analysis that examines how individual and firm outcomes change upon winning a construction project. As the randomization occurs at level of the province-lottery round, our first specification controls for the full set of 2013 lotteries that each contractor enters and identifies causal effects using only variation within risk sets of contractors that entered the exact same lotteries. Because the number of applicants greatly exceeded the number of projects, the probability of winning a project in any lottery was not very high such that we have large samples of contractors in both treatment and control groups. We also propose a specification that controls for contractor heterogeneity with firm fixed effects and examines how within-contractor variation over time relates to whether the contractor won a lottery.

Our estimates show large and persistent causal impacts on a variety of outcomes. We find the lottery winners see a large increase in revenues, starting at 5 log points in the first year post-lottery and remaining above 2 log points five years after the lottery assignment. The revenue increase indicates that the school construction projects are positive

net demand shocks relative to the contractors' alternate activities if not assigned a school. This revenue increase coincides with causal increases in costs. The wage bill and input purchases also increase following the project assignment. But revenues rise by more than costs, as we estimate causal effects on profits of over 2.5 log points initially and over 1 log point five years after the assignment.

We also see positive causal effects on outcomes related to post-procurement project business. Firms that win a lottery see asset increases of over 1 log point. Most interestingly, we see that lottery winners register 0.08 more construction firms following project assignment. This is a very large increase over the pre-treatment mean of 0.20, especially because firm registration is optional and does not entail any tax benefits. We see that the registrations increase over time even though the revenue increase is immediate. This staggered timing may indicate that individuals learn from their first year of experience whether they are productive enough to stay in construction after the procurement project is complete.

The data on employer-employee linkages and supplier networks allows us to test how the profits from the demand shock are split within and across firm boundaries. This division of profits is important in understanding the incentives of the firm to finance investments aimed at growth. Future drafts will include these results.

Finally, we leverage our data on government transfers to assess whether these effects persist beyond the length of the school construction project. The construction initiative has largely been halted such that some projects (exogenously) have not been completed. We compare treatment effects for contractors still receiving payments as of 2019 with those whose government transfers ended prior to 2019. We find that the causal effects are driven entirely by the set of contractors whose projects finished. They continue to earn high revenues from business beyond the public procurement project. The other contractors, on the other hand, may be suffering from having to be available for projects that are dragged out for reasons beyond their control.

This paper relates closely to other recent work studying the effect of winning procurement lotteries on firm outcomes. Ferraz, Finan, & Szerman (2016) study public procure-

ment in Brazil and find that winning a contract increases firm growth by 2.2 percentage points. They find that effects are persistent beyond the length of the specific contract. Lee (2017) also finds persistent increases in firm growth for small firms in Korea. Relative to these papers, our context has fewer, but larger, projects per firm such that the winners and losers of a specific lottery have large differences in total number of projects won.[1]

2 Background and Setting

2.1 Background

The Dominican Republic has seen the fastest economic growth of any Latin American country over the last two decades, at an average rate of 5.3 percent per year (World Bank 2018). However, welfare indicators have not improved in line with this growth.[2] Education access has improved, with gross enrollment rates of 102 percent at the primary level – reflecting the high prevalence of over-age enrollment – and 77 percent at the secondary level (World Bank 2018). However, education quality falls far behind, as reflected by the Dominican Republic claiming last place in student skills among all participating countries in the international PISA test in 2015 (OECD 2016). President Danilo Medina's administration won the 2012 election using a campaign focused on turning this around by allocating 4 percent of GDP to education from 2013. This allocation has been used primarily to finance school construction and renovation for two flagship education programs: *Jornada Escolar Extendida* (JEE) and *Quizqueya Empieza Contigo* (QEC). JEE is a program to transition the country from a half-day schooling model to one of full-time schooling, intended to broaden educational offerings and improve performance on pedagogical management indicators. QEC is an early childhood development (ECD) program tasked with increasing the coverage and quality of services provided to children between 0 and 5 years of

[1]Donaldson, Carrillo, Pomeranz, & Singhal (2018) studies similar questions in Ecuador. We have only seen an abstract of the paper.

[2]The poverty headcount ratio at $3.20 a day (2011 PPP) fell at a much lower average rate of 2.4 percent per year, and inequality remains high, with the Gini index decreased only slightly, from 47.4 in 1996 to 45.3 in 2016 (World Bank 2018).

age, based on the notion that the nature of learning is cumulative (Phillips & Shonkoff 2000) and that environments that do not stimulate young children place them at an early disadvantage (Heckman, 2006).

2.2 Setting

In November 2012, the government issued Decree Number 625-12, which created the National School Construction Program (Programa Nacional de Edificaciones Escolares, PNEE hereafter). The PNEE mandated the construction of 28,000 classrooms across primary and secondary schools over a four-year period, which would be needed to meet the demands of full-time schooling under the JEE. Prior to the reform, school buildings functioned in two or three shifts to accommodate overly large numbers of students. The expansion required to move away from the multiple shift model, without overcrowding, corresponds to a 78 percent increase in the number of classrooms available in 2013. To achieve this goal, 425 schools were refurbished or expanded, and over 1,300 new schools were built. An additional 100 new ECD centers built to satisfy the needs of QEC. This represents an increase of 87% relative to the 114 ECD centers that existed in 2013.

The years leading up to the PNEE saw several corruption claims related to the procurement of school construction contracts. Cases were brought to court in which the government paid selected firms 20 percent of the value of awarded contracts in advance and, subsequently, the construction of many schools was severely delayed and that of others never begun. To promote procurement transparency in the aftermath of these corruption cases, the government decided to allocate new school construction contracts for the PNEE and QEC through open lotteries carried out by the Office of Procurement Services and the Ministry of Education. Civil engineers, architects, and construction companies fulfilling certain minimum requirements were invited to participate in the lotteries, either as firms or as individuals. Successful applicants were required to: (i) have complied with their tax and social security obligations, (ii) be legally domiciled and established in the country, and (iii) be registered with the national registry of public suppliers (Registro Nacional de Proveedores).

School construction, expansion, and renovation projects were grouped into lots to be drawn together and allocated to a single firm or individual through the lottery process. Lots had different budgets determined by the number of classrooms they included. Each lot could only involve construction work related to one school. Overall, 1,833 lots of construction contracts for the PNEE and QEC were allocated through lotteries between 2012 and 2014. These lots were then drawn through four different lotteries for the PNEE and one lottery for QEC, for a total of five lotteries. Each lottery was divided into the 32 provinces that make up the country. Provinces had different numbers of construction lots depending on their size and existing school infrastructure. For example, in the first lottery round, Santo Domingo (the province home to the country's capital city of the same name) included 43 lots while Dajabón included just three. In any given lottery round, applicants were only allowed to participate in a single province of their choosing.

For every lottery round, each of the 32 provinces held simultaneous lotteries. Applicants were required to attend the lottery in the province in which they participated.[3] The lottery process worked as follows. Each applicant who fulfilled the minimum requirements received a lottery number that was posted online the day before the draw. The day of the lottery, all numbers were then placed in an urn and, for every lot, three applicants were randomly drawn. The applicant holding the first drawn number was assigned as the winner of that lot and their number was removed from the urn. In case the winner proved unable to complete the contract, the applicants holding the numbers drawn second and third were assigned as possible replacements. The backups' numbers were then put back inside the urn. As a result, lottery winners could obtain a contract for at most one school, while those in second and third places could still compete for another contract.

Table 1 provides a summary of each lottery round, including its budget, the number of lots it included, and the date on which it was held. The first lottery took place in November 2012, and the last one in December 2014. Each lottery round included between 100 lots – for the QEC round – and 548 lots and had average contract values ranging

[3]Interested firms or individuals who were unable to be present on the relevant lottery days were allowed to send a representative with a notarized power of attorney to participate in their place, and any individual was able to represent themselves and another participant.

between 26 and 58 million Dominican pesos (or 0.602 and 1.347 million USD). The number of lots included in each lottery increased in later rounds as did the size of the contracts, reflecting the fact that that later lotteries included more contracts for the construction – as opposed to renovation – of classrooms. Construction contracts are comparatively large in magnitude; for comparison, an average firm in the Dominican construction sector declared a total of 5,038 thousand RD$ (or 0.116 million USD) in earnings in 2011.[4]

Table 2 presents the number of participants and winners per lottery round. Naturally, the number of winners in each lottery round is the same as the number of lots, while the number of second and third places is smaller as any given participant could be drawn in second or third place for multiple lots. Across all lottery rounds, the majority of applicants were individuals, although the share of applicants that were firms increased from 13 percent in the first round to 20 percent in the last round.

Given the random nature of the assignment, we observe a similar distribution of firms and individuals among winners. Although winners were excluded from draws for subsequent lots, they were still able to participate in future lottery rounds as long as they had delivered the contracted classrooms and terminated their previous contract beforehand. The probability of participating in another lottery round conditional on having participated at all varies between 70 and 75 percent. Hence the participants used as controls are very similar across lotteries (see Table 3 for the cross-participation matrix) .

This context distinguishes it from other public procurement settings in several ways. First, these assigned construction projects are very large relative to typical construction projects. The size of this demand shock means that we might pick up effects on outcomes like firm entry that are a nonlinear function of the demand shock. Not only are the projects large, the considerable variation in size within our sample lets us potentially trace out such nonlinearities. Second, the number of contractors applying for projects greatly exceeds the number of assigned projects such that contractors getting multiple projects is rare. As we describe in Section 4, this allows us to translate the assignment variation to exogenous shocks at the contractor level. Other settings where firms enter, and win,

[4]Conditional on reporting earnings over 1,000 RD$.

multiple procurement lotteries often suffer from little sampling variation at the firm level. Third, this construction initiative is so large that most of the country's eligible contractors applied for a project. Our estimates are thus representative of the full industry. Finally, because the application process does not require a firm to exist yet, many of our lottery winners are young individuals. This offers the opportunity to study entrepreneurship and whether demand shocks have differential effects depending on firm age.

3 Data and Descriptive Statistics

3.1 Data

School construction under the PNEE and QEC programs was an extensive initiative requiring the collaboration and coordination of multiple government agencies. As a result, our final dataset is a compilation of administrative data on the lotteries, lottery participant performance, suppliers, government payments, and construction status from a number of different sources. Details on each of these component datasets and their sources are provided below.

3.1.1 Lotteries

For each of the five lottery rounds, we gather data on lots, participants, and winners. For lots, we collect data on the number of lots that were randomized within each of the 32 provinces, as well as the school name and location, the number of classrooms to be constructed, and the total budget associated with each lot. For participants, we have access to the list of participant names in every lottery round, as well as the province in which they chose to participate. For winners, we collect the lists of winners and replacements (i.e., those drawn in second and third place) for every school lot. The lists of participants and winners include their firm/individual status and their national identification numbers.[5]

[5]These identifiers are national identification numbers for individuals and employer tax identification numbers for firms.

3.1.2 Participant Performance

To measure the performance of the lottery winners and losers, we combine data on participants and winners with data from their annual tax reports from the Dominican Internal Tax Agency (Dirección General de Impuestos Internos, DGII hereafter). Using participants' tax identification numbers, we are able track their performance since 2007 on several measures including their earnings, assets, number of permanent and temporary employees, wage bill for permanent and temporary employees, wage bill for employees without national identification numbers, total number of suppliers used, total value of local purchases, and total value of imports.[6].

3.1.3 Suppliers and Employees

In addition to participant (buyer) performance, we collect data on buyer-supplier linkages, where suppliers are the firms/individuals contracted by participants to provide the inputs or labor needed for construction. For each of the participants, we collect annual data on firm-to-firm transactions. Finally, we augment these data with firm and individual characteristics from the tax registry which gives us the sector, size, and the first date of registration. For each of the participants, we collect matched employer-employee data from the social security agency allowing us to observe the monthly wage of every employee. This dataset allows us to see how supplier wages change before and after the lotteries, although unfortunately the data are only available for full-time workers.

3.1.4 Government Payments

We collect data on all the payments that were officially disbursed from the government to winning firms and individuals, as well as the dates of these payments, using administrative records from the National Treasury. By combining this with data on the earnings of winners from tax reports (described in Participant Performance) we are able to deter-

[6]It is common practice in the Dominican construction sector to hire undocumented Haitians workers. The DGII created a special to entry to report expenses related to such workers in 2012.

mine the degree to which the demand shock generated by winning a lottery persists after government payments for construction associated with the lottery are complete.

3.1.5 Construction Status

Finally, we collect data on the status of classroom construction, expansion, and repairs from the Ministry of Public Works, the agency in charge of supervising the entire construction process. We use this information to determine the start and end dates of construction for each lot.

3.2 Descriptive Statistics and Balance

This section presents descriptive statistics on the number of participant and winners of the lotteries that were part of the National Plan of School Buildings (Plan Nacional de Edificaciones Escolares, PNEE hereafter).

Table 4 presents a balance table that compares characteristics of winners and losers across lotteries. We see that winners and losers are very similar in terms of firm (or individual) characteristics before the lotteries, as would be expected given the transparent randomization process.

4 Empirical Specification

This section presents our empirical specification and how we use the lottery-specific randomization to identify causal effects on contractor outcomes. A challenge in the procurement literature is that while the project assignment process may involve randomization, firms' outcomes depend on their full portfolio of potential projects, each subject to random assignment. Thus, the randomization does not neatly sort firms into treatment and control groups – indeed, a single firm may be a winner in one lottery but a loser in another. Furthermore, lottery entry is likely endogenous such that lottery-specific randomization does not necessarily generate purely exogenous variation in number of total projects as-

signed. We face this problem as well, as contractors may enter up to five lotteries. But because the number of lotteries is small and the each contractor can win at most one project per lottery, we can properly control for contractors' lottery entry and still have enough identifying variation left over to estimate precise causal effects.

We focus our attention on the three lotteries that occurred in 2013 (PNEE #2, QEC #1, PNEE #3). Let i index a contractor and t index year. Let $m = m(i)$ denote the set of province-specific lotteries that contractor i entered in 2013. With 32 provinces and 3 lotteries, plus the option of not entering, there are 35,936 ($33^3 - 1$) possible risk sets. But because most applicants stay within the same province for all lotteries, applicants cover 1,366 unique risk sets, for an average of 8 applicants per risk set. We specify the following event study reduced form framework for contractor-year outcome, y_{jt}:

$$y_{it} = \sum_{\tau=-5}^{5} \beta_\tau Treat_{i\tau} + \mu_{mt} + \epsilon_{it} \tag{1}$$

where $Treat_{i\tau}$ is a dummy for winning at least one lottery τ years ago. We include risk set-year fixed effects to control for any unobserved differences in the types of contractors that entered each lottery. We thus identify our causal effects by comparing contractors that entered the exact same set of lotteries but had different (random) outcomes.

We call this a reduced form because the actual number of projects assigned depends on contractors' participation in the other lotteries. However, the 2013 lottery losers rarely win a project in subsequent lotteries. Thus, the first stage coefficient on number of 2013 wins predicted number of total wins is nearly 1.

Controlling for each risk set offers the cleanest summary of the lotteries' randomization of demand shocks to contractors. But if contractor entry into multiple lotteries is uncorrelated with *time-varying* contractor shocks, then a more parsimonious set of controls will likely lead to more precise estimates. We thus also implement a complementary empirical specification that controls for contractor fixed effects:

$$y_{it} = \sum_{\tau=-5}^{5} \gamma_\tau Treat_{i\tau} + \lambda_i + \lambda_t + \eta_{it} \quad (2)$$

5 Estimates

In this section we present the estimated event study plots for contractor outcomes. We plot them separately for contractors who were registered with firms ("firms") or not ("individuals") at the time of the lottery as we might expect very different effects.

We start by estimating the effect on revenues. In the left panel of Figure 4 we plot event study coefficients (with 95% confidence intervals) from our specification with risk set-year fixed effects. We plot estimates separately by firms and individuals and as well as pooled estimates. We see a large increase in revenues for lottery winners in the year of the lotteries (2013) that lasts for several years before declining somewhat in 2017. In the right panel, we present results from our specification that includes contractor and year fixed effects. We see a very similar pattern of estimates for the two specifications. This holds as well for log(revenues+1) (Figure 5).[7] The panels again differ by the fixed effects specification. We estimate that revenues increase for winners by over 4 log points in 2013 and remain over 1 log point higher than losers' revenues through 2018. These large positive effects on individual and firm revenues indicate that winning a school construction project did not crowd out business of equal revenues. This is unsurprising given the high application rates for the lotteries; it thus motivates our labeling of winning a lottery as receiving a large positive demand shock.

We next turn to causal effects of winning a lottery on measures of inputs and input costs. Because the two empirical specification produce such similar results, we proceed with presenting results from the specification that includes contractor and year fixed effects as this specification yields somewhat higher precision. In Figure 6 we present esti-

[7] Going forward, we will refer to outcome $log(x+1)$ as "log x" but because of the frequent zeroes, all logged outcomes will add 1 before taking the log. Results are similar if we do not add 1 or if we use inverse hyperbolic sine.

mates of the effects of winning a lottery on log employment and the log wage bill. We estimate large effects – an employment increase that peaks at 0.7 log points in 2014 before falling to just above 0.3 log points. The wage bill similarly peaks in 2014, at over 2 log points before decreasing down to about 0.5 log points. The peak in 2014 indicates that contractors ramped up their hiring during the course of the project. The employment effects come both from full-time Dominican workers as well as Haitian workers (Figure 7). Haitians make up a large fraction of the unskilled temporary workforce in the DR, though interestingly the Haitian employment effects persist through 2018.

In addition to labor costs, lottery winners spend more on other inputs and purchase from additional suppliers. In Figure 8 we see that purchases increase by over 4 log points and the number of suppliers increases by more than 2 log points. Increases are slightly larger for individuals than firms. The revenue effects outpace the cost effects such that profits increase by over 2 log points (Figure 9).

The outcomes so far are not necessarily related to future business. We now turn to other measures of firm or individual outcomes that describe a contractor's plans or positioning for continued business. In Figure 10 we plot the effects of winning a lottery on firm assets.[8] We see an effect of over 1 log point that persists through at least 2017. This likely understates the total effect on asset accumulation because we do not include contractors that registered firms post-lottery and may have accumulated assets. In Figure 11 we look at firm creation directly. We find that winning the lottery leads to a 0.08 increase in the number of registered construction firms an individual has. Recall that most (80%) winners are individuals. This causal effect is thus very large relative to the pre-lottery mean, and we see large increases well into the procurement contract. Unlike in other settings, there is no tax advantage to registering as a firm, and the government does not explicitly encourage such registration for the sake of completing procurement contracts. This large effect may then signal that many of these entrepreneurs used the demand shock to enter the industry on a more permanent basis.

[8]Individuals do not have assets reported to the tax agency.

5.1 Heterogeneous Effects

So far we have just compared lottery winners to losers. But the size of the project is also randomly assigned. We now estimate separate causal effects for firm assets and firm creation based on whether the randomly assigned project is large (above median budget) or small (below median budget). In Figure 12 we present the event study plots. In the left panel we see that large projects generate a much larger causal effect on log assets while the right panel shows only a slight and statistically insignificant difference in terms of firm creation.

While many of the causal estimates extend into 2018, well beyond the length of many of the procurement contracts, not all schools were built by the end of the sample. To dig deeper on whether these effects are truly persistent beyond the length of the contract – and also to rule out persistent effects directly tied to the initial contract, such as continued maintenance on the new or renovated school – we split the winners sample by whether the government is still transferring funds to the contractor (Figure 13). While speed at completing a contract is possibly endogenous, we believe that whether the projects were completed by 2019 is largely related to exogenous factors. All projects were initially expected to be completed by 2018, but after the 2016 Presidential election, the school construction initiative become a much lower priority and the government slowed progress on remaining projects.

We see the positive causal effects are driven exclusively by the projects that were finished before 2019. We see no effect on log assets or firm creation for unfinished projects. The long delay for these unfinished projects could tie up contractor resources and thus limit firm growth. The result on firm creation is particularly interesting as it indicates that firm creation is really a forward-looking action taken with respect to future business rather than an action that affects the process of completing the current contract. Even if whether a project being finished is endogenous, these results would be consistent with entrepreneurs using the large demand shock as an opportunity to learn about their own type. Productive contractors, who finish earlier, are more likely to take the next step and

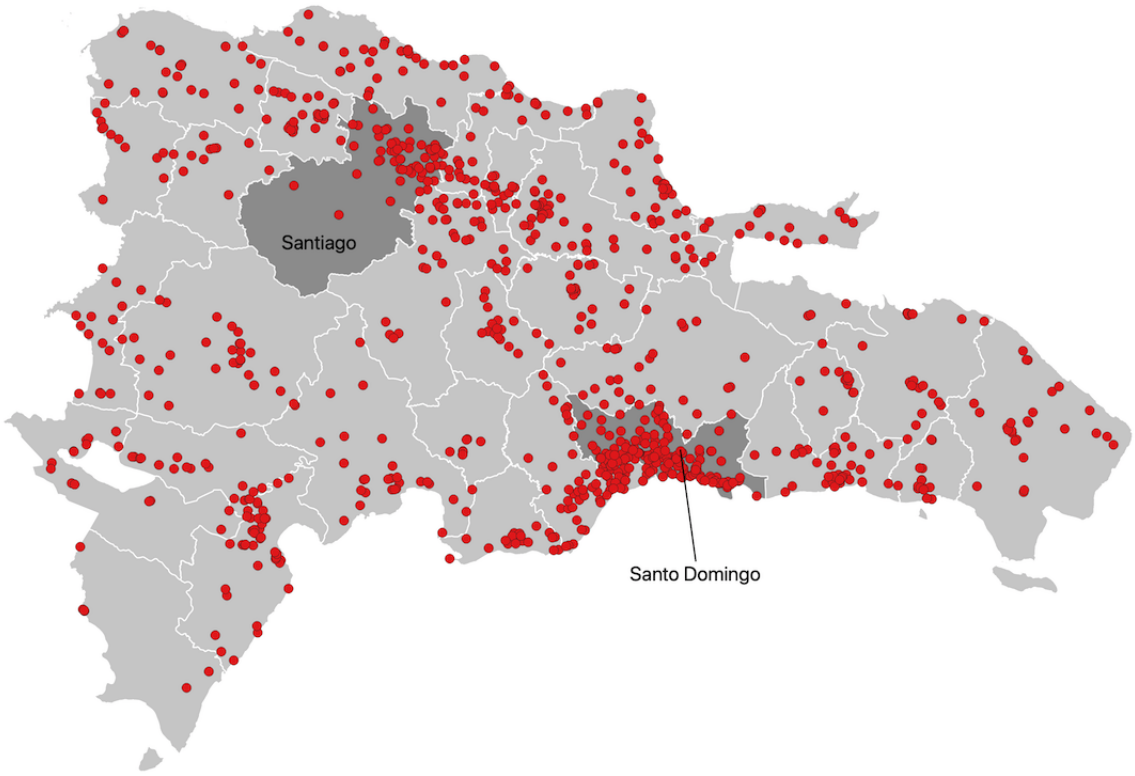
create a firm for conducting future business.

6 Conclusion

Future drafts will estimate the effect of a contractor winning a procurement lottery on the contractor's employees and suppliers to assess how the returns to the demand shock are split within the supply chain and within the firm. This will allow us to assess whether holdup could explain low rates of investment in the DR that may be inhibiting growth.

Tables and Figures

Figure 1: Schools' Location

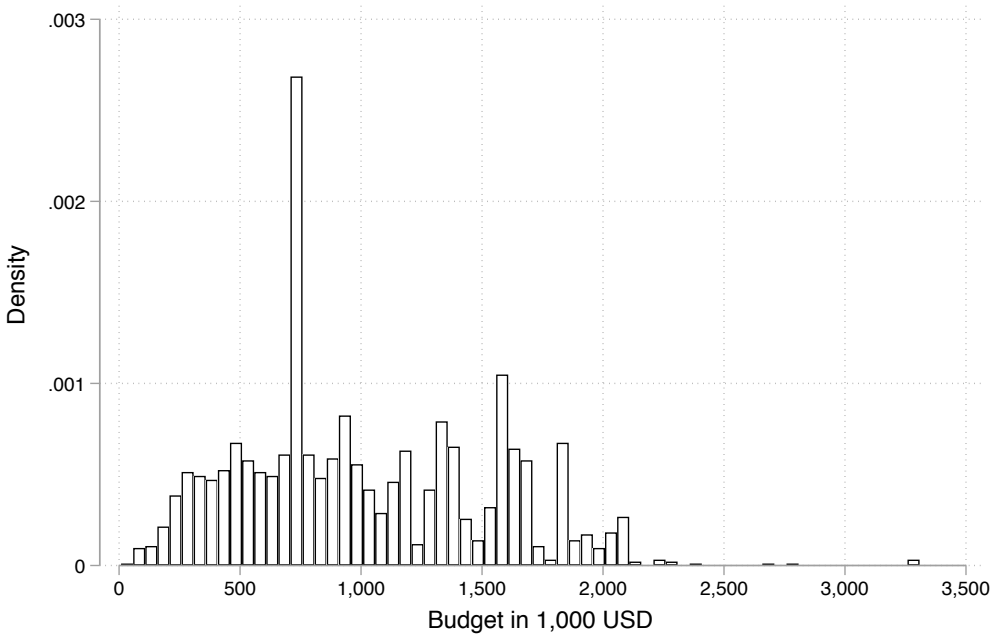


Notes: This map shows the location of the government projects. The shaded provinces contain the two large urban centers – Santo Domingo and Santiago.

Note: These photos show the lottery events, including how numbers were chosen.

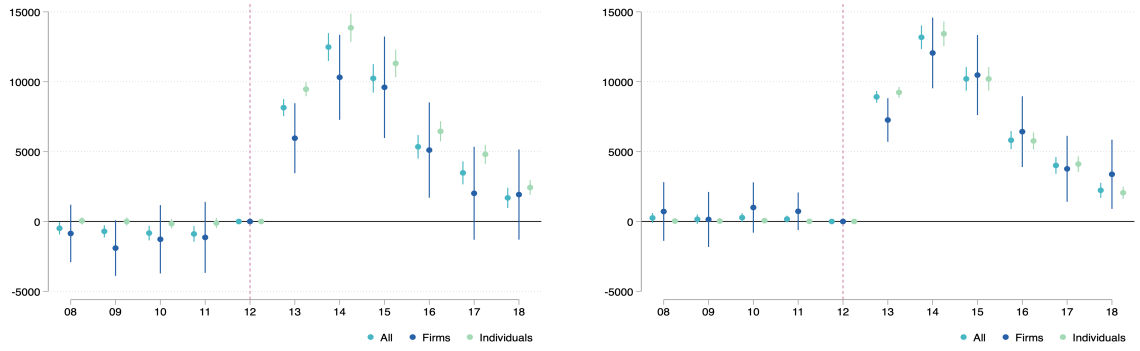
Figure 2: Lottery Examples

Figure 3: Size of Contracts, Histogram



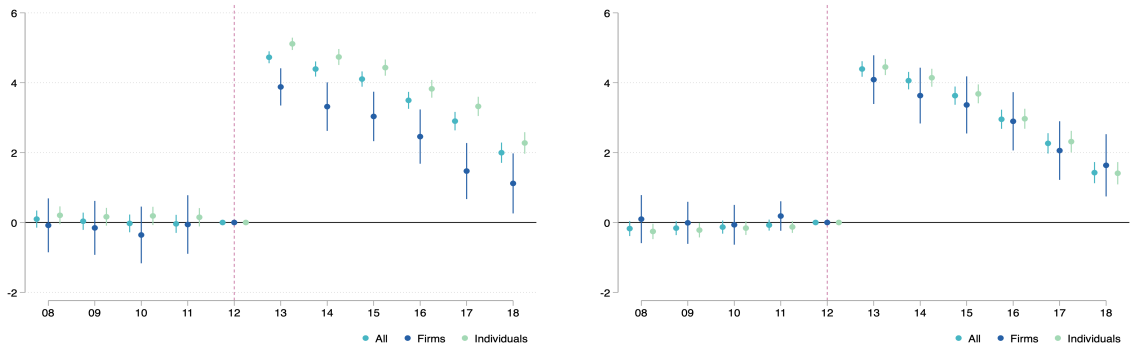
Notes: The histogram shows the distribution of project sizes.

Figure 4: Effects on Revenues



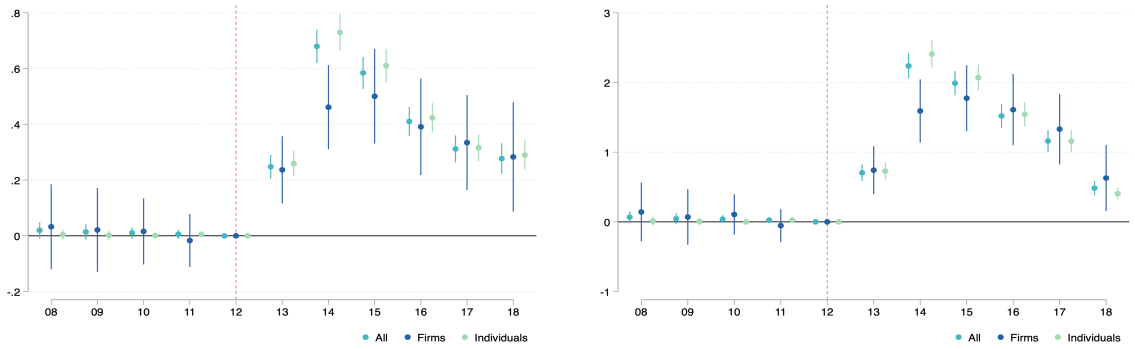
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual revenues. The left panel uses risk set-year fixed effects while the right panel uses contractor and year fixed effects.

Figure 5: Effects on Log Revenues



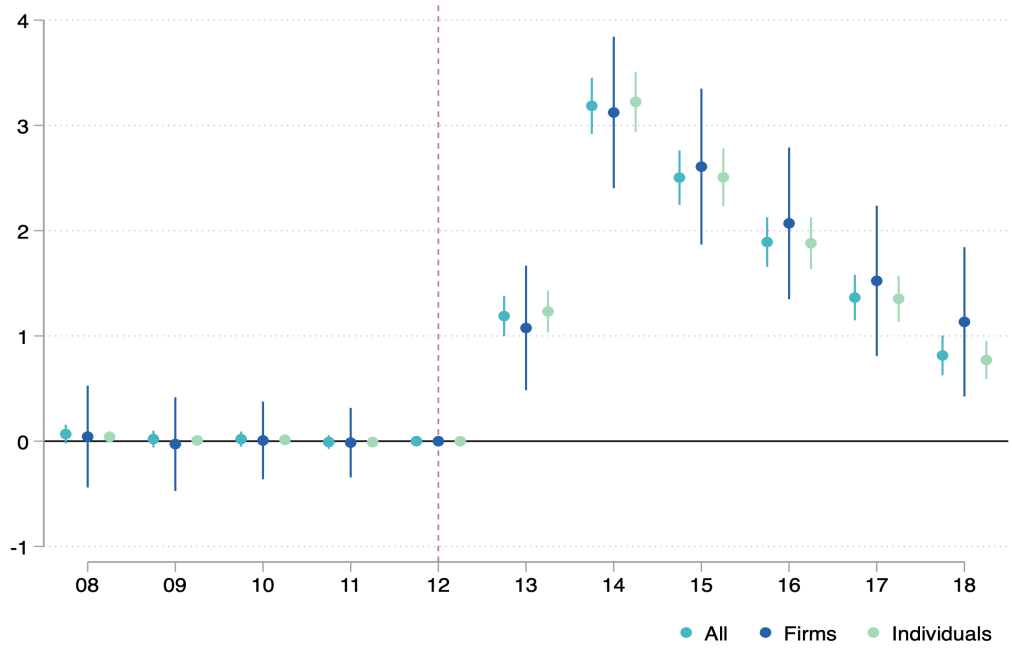
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual log(revenues+1). The left panel uses risk set-year fixed effects while the right panel uses contractor and year fixed effects.

Figure 6: Effects on Log Employment and Log Wage Bill



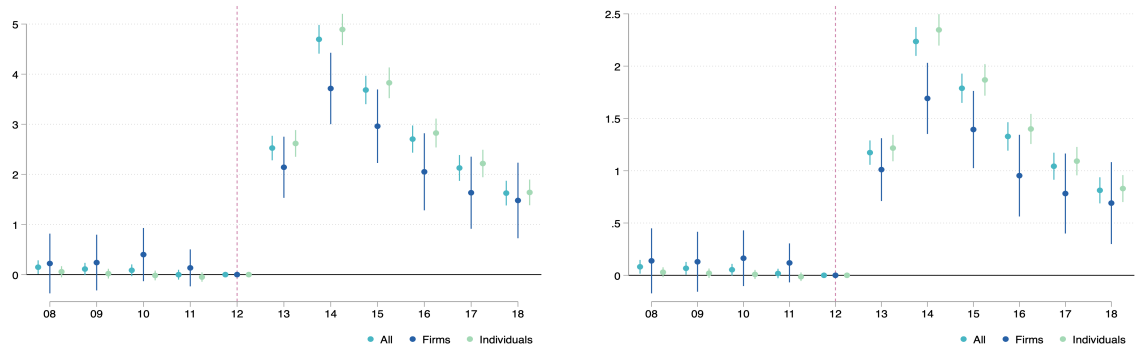
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual log(employment+1) (left panel) and log(wage bill+1) (right panel).

Figure 7: Effects on Log Haitian Employment



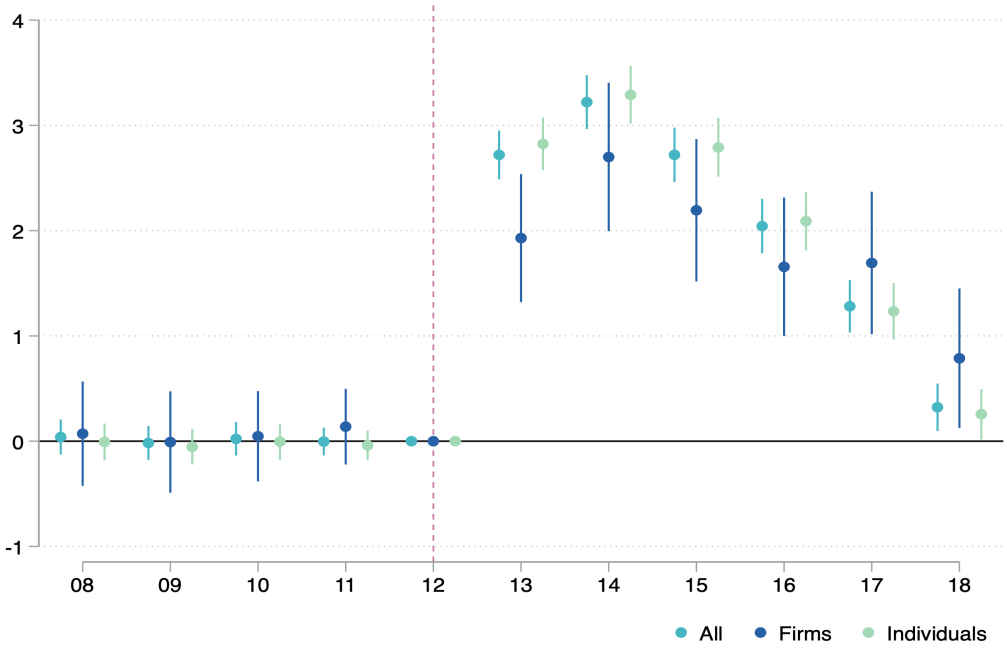
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual log(Haitian employment+1).

Figure 8: Effects on Log Purchases and Log Number of Suppliers



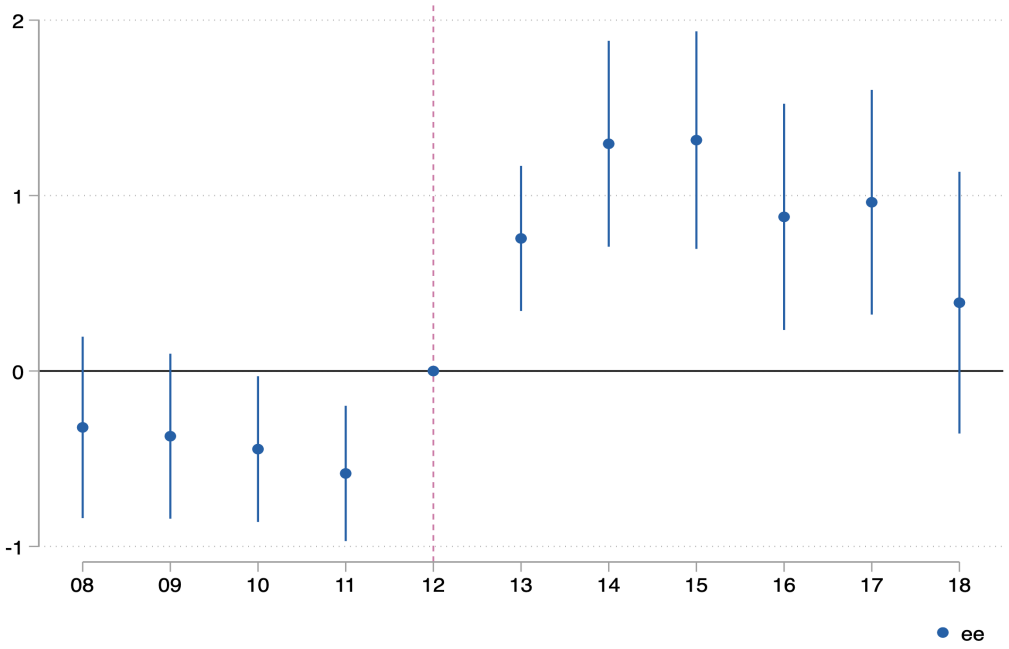
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual log(purchases+1) (left panel) and log(number of suppliers+1) (right panel).

Figure 9: Effects on Log Profits



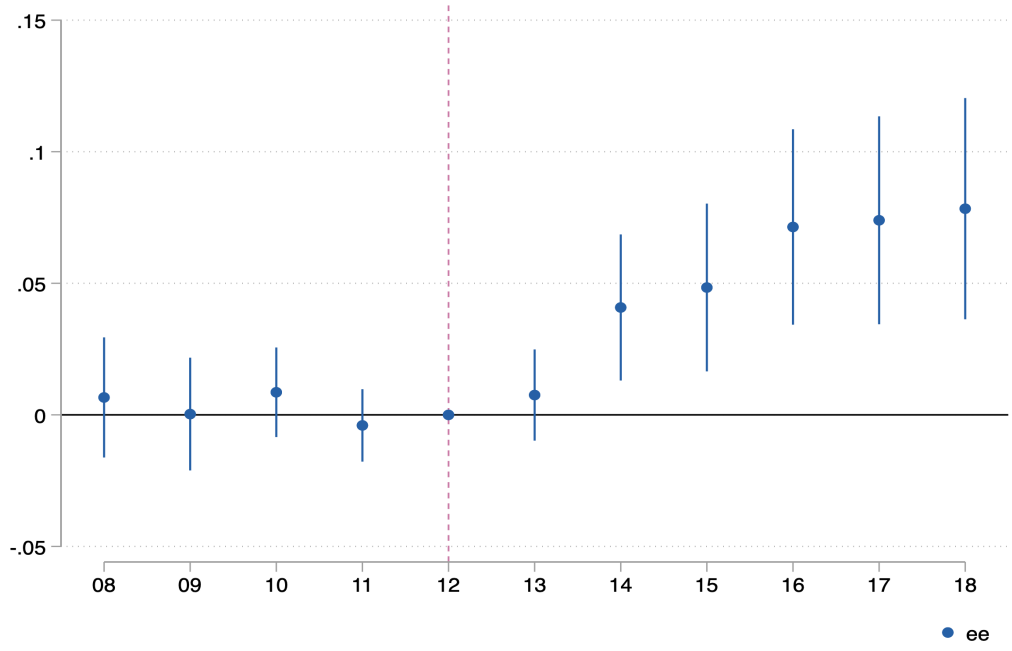
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm or individual log(profits+1).

Figure 10: Effects on Log Assets



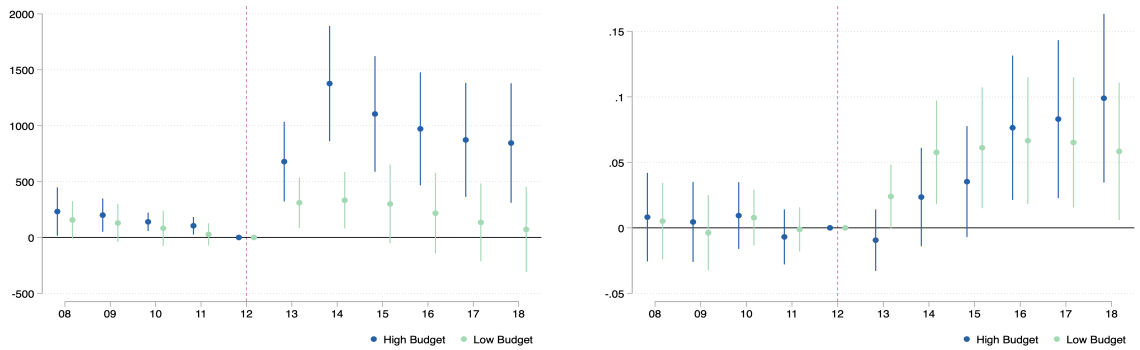
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm log(assets+1).

Figure 11: Effects on Construction Firm Creation



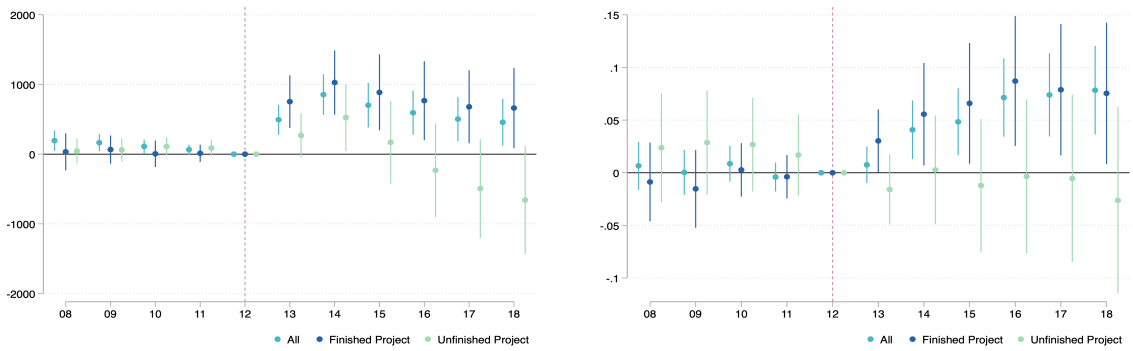
Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on the number of registered construction firms.

Figure 12: Effects on Log Assets and Firm Creation, by Project Size



Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm log(assets+1) (left panel) and number of registered construction firms (right panel). We present separate estimates for projects with above and below median budgets.

Figure 13: Effects on Assets and Firm Creation, by Whether Project Finished



Notes: The figure shows the event study estimates (with 95% confidence intervals) of the causal effect of winning a lottery on firm assets (left panel) and number of registered construction firms (right panel). We present separate estimates for projects that have finished by 2019 versus those that have not.

Table 1: Lotteries Description

Lottery Process	Date	Lots	Budget (in 1,000s RD$ ≈ 23 USD in 2013)					
			total	mean	min	p25	p75	max
PNEE #1	11-30-2012	372	15,166,190	40,770	3,689	30,704	56,634	70,335
PNEE #2	01-31-2013	548	14,349,634	26,185	359	22,521	30,748	73,883
QEC #1	09-13-2013	100	32,826,944	32,826	32,826	32,826	32,826	32,826
PNEE #3	11-19-2013	401	23,494,580	58,590	23,349	44,769	68,364	74,177
PNEE #4	12-17-2014	462	26,324,082	56,979	20,100	32,826	79,910	141,946

Notes: Add Notes

Table 2: Lotteries Participants and Winners

Lottery	All				Individuals				Firms			
	All	1st	2nd	3rd	All	1st	2nd	3rd	All	1st	2nd	3rd
PNEE #1	3427	371	353	268	3029	310	305	233	398	61	48	35
PNEE #2	8423	548	521	527	7130	474	442	443	1293	74	79	84
QEC #1	6053	100	100	100	-	79	89	86	5241	21	11	14
PNEE #3	9737	401	394	390	8111	329	315	324	1626	72	79	66
PNEE #4	13354	462	453	453	11157	368	362	384	2197	94	91	69

Notes: Add Notes

Table 3: Lotteries cross-participation

	P($i \in$ Lottery $x \mid i \in$ Lottery y)			
x	1	2	3	4
y =1	1.00	0.76	0.68	0.73
y =2	0.31	1.00	0.75	0.76
y =3	0.24	0.65	1.00	0.82
y =4	0.19	0.48	0.60	1.00

Notes: Add Notes

Table 4: Balance and Summary Statistics

	Lottery 1			Lottery 2			Lottery 3			Lottery 4		
	Winners	Losers	Beta	Winners	Losers	Beta	Winners	Losers	Beta	Winners	Losers	Beta
Year of Start	2,005.04	2,005.65	-0.53	2,006.13	2,006.27	-0.33	2,007.14	2,006.95	0.14	2,008.16	2,007.71	0.43
	(5.98)	(5.73)	(0.38)	(5.96)	(5.95)	(0.27)	(5.39)	(5.95)	(0.30)	(5.54)	(5.94)	(0.28)
ID is Active	0.73	0.62	0.09***	0.54	0.53	0.02	0.51	0.46	0.05*	0.38	0.39	-0.01
	(0.44)	(0.49)	(0.03)	(0.50)	(0.50)	(0.02)	(0.50)	(0.50)	(0.03)	(0.49)	(0.49)	(0.02)
ID is individual	0.84	0.89	-0.03	0.86	0.85	0.01	0.82	0.83	-0.01	0.80	0.84	-0.04**
	(0.37)	(0.31)	(0.02)	(0.34)	(0.36)	(0.02)	(0.38)	(0.37)	(0.02)	(0.40)	(0.37)	(0.02)
Firm is SME	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Earnings	3,382	2,639	-976	2,357	2,010	586	1,718	1,697	131	1,311	1,431	-80
	(19,786)	(26,035)	(1,686)	(31,783)	(13,460)	(687)	(8,512)	(13,969)	(705)	(9,029)	(13,228)	(622)
Regular Employees	0.99	0.79	-0.79	0.56	0.90	-0.29	0.55	0.76	-0.18	0.43	0.54	-0.11
	(5.45)	(9.74)	(0.62)	(3.18)	(8.65)	(0.38)	(3.14)	(9.17)	(0.46)	(2.99)	(5.58)	(0.26)
Payroll, Regular Employees	1,671	1,128	-768	914	1,340	-252	669	1,148	-370	503	879	-348
	(10,327)	(13,707)	(883)	(10,637)	(13,690)	(606)	(4,053)	(15,891)	(797)	(3,454)	(10,489)	(490)
Non-Regular Employees	0.08	0.08	-0.02	0.00	0.08	-0.06	0.09	0.07	0.03	0.00	0.04	-0.04
	(1.01)	(1.58)	(0.10)	(0.04)	(1.83)	(0.08)	(1.23)	(1.72)	(0.09)	(0.00)	(0.98)	(0.05)
Payroll, Non-regular Employees	21.91	15.01	4.98	0.05	11.45	-10.92	27.14	8.36	19.05	0.00	8.75	-8.33
	(274.36)	(379.40)	(24.79)	(1.23)	(299.48)	(12.99)	(537.66)	(217.11)	(12.21)	(0.00)	(272.65)	(12.71)
Payroll, Hatian Employees	539	594	-750	679	262	497***	44	218	-147	299	213	102
	(3,946)	(12,501)	(784)	(12,920)	(2,136)	(174)	(340)	(2,034)	(102)	(2,767)	(3,566)	(168)
Local Purchases	2,365	1,330	243	1,274	1,222	234	1,132	972	244	793	864	-45
	(16,996)	(11,004)	(786)	(17,351)	(8,611)	(422)	(7,170)	(7,619)	(388)	(6,334)	(8,456)	(398)
Assets	2.53	1.87	-1.08	1.81	1.71	0.55	0.47	1.31	-0.62	0.52	1.19	-0.60
	(16.58)	(22.22)	(1.44)	(33.97)	(18.14)	(0.88)	(3.09)	(16.44)	(0.82)	(5.71)	(16.56)	(0.77)
Imports	16.23	28.62	-26.18	6.24	47.10	-31.13	25.00	42.21	-10.57	3.78	42.86	-37.04
	(139.82)	(484.69)	(30.62)	(49.24)	(1,023.64)	(44.41)	(444.50)	(1,036.54)	(52.12)	(44.42)	(1,122.03)	(52.28)

Notes: Add Notes