Experimental Evidence on Shortening Supply Chains
for Fruit and Vegetable Vendors in Bogota's Slums[#]

Leonardo Iacovone, *World Bank*

David McKenzie, *Development Research Group, World Bank*

Abstract

Fruit and vegetable vendors in Bogota currently travel most days to a central market to purchase produce, incurring substantial time and monetary costs. A social enterprise attempted to shorten the supply chain between farmers and vendors by aggregating orders together from many small stores, sourcing directly from farmers, and delivering them to the stores. The introduction of this new service was randomized at the market block level. Initial interest was high, and offering the service reduced travel time for users by almost 2 hours a week, reduced travel costs, and increased work-life balance for store owners. Firms offered the service saved an average of 6 to 8 percent on purchase costs, and although some of this passed through into lower prices for consumers, there was incomplete pass-through, so that markups rose. However, stores reduced their sales of products not originally offered by this new service, and their total sales and profits appear to have fallen in the short-run, with service usage falling over time. The results highlight the potential for new technologies to solve firm coordination problems, offer a window into the nature of competition among small retailers, and point to the challenges in achieving economies of scale when disrupting centralized markets for multi-product firms.

Keywords: Retail supply chains; microenterprise competition; social entrepreneurship; randomized experiment.

JEL Classification codes: O12, C93, D43, L31

1. Introduction

Small retail stores in poor neighborhoods in developing countries face very different supply chains across the products they sell. Multinational suppliers of non-perishable products like Coca-Cola, Unilever, and Avon have famously perfected efficient supply chains that result in store-door delivery to even the most remote regions of the planet (Hammond and Prahalad, 2004). In contrast, the fresh fruit and vegetables they sell are part of what are typically less efficient supply chains, that often end in centralized wholesale markets, necessitating substantial travel time and costs for retail store vendors, and increased food costs for the urban poor (Ruel et al, 1998; FAO 2010). This is the case in Bogota, Colombia, where the typical store owner gets up at 4:30am, spends over two hours daily travelling to, around, and back from the central market of Corabastos, and spends an average of 30 percent of daily profits on transportation costs.

One potential solution would be for store owners to work together to form buyer cooperatives, allowing them to source products in bulk from the market or even directly from the farmers, and to arrange to have the products delivered to their stores. But the large number of small firms, each working long hours, and with limited connections to one another results in a coordination failure that prevents this from occurring. The social enterprise *Agruppa* was formed with the goal of using new technologies to solve this coordination issue. Their model is to use mobile phones to create virtual buyer groups, agglomerate daily orders from store owners, bulk buy from farmers, and then deliver the produce directly to stores. The aims were to reduce the amount of time and cost store owners spend travelling to the central market, improving their incomes and work-life balance as a result, lower the cost of fresh produce purchased by stores, and, in turn, reduce the prices paid by consumers.

We conducted a randomized experiment to test the extent to which this innovation was able to achieve these aims. We began with a baseline survey of 1,620 firms in 63 market blocks, in which firm owners were asked about their potential interest in using the new service, with 70 percent expressing interest. These blocks were then grouped into matched pairs, with one block in each pair randomized to treatment and the other to control. Agruppa then phased in their service at the rate of one block per week, offering their service to all interested firms in the treatment blocks. Surveys in both the treatment and matched control blocks at 2, 4, 6, 10, 14, 26, and 52 weeks after

the offer enable us to trace the trajectory of impacts on both firms offered the service, as well as spillover effects on uninterested firms in these same blocks (who were not offered the service).

We find initial interest in this solution is high, with 66 percent of interested firms (and thus 46 percent of all firms) in the treated blocks making a purchase from Agruppa. To begin with, Agruppa focused on the heaviest and highest rotation products, offering only five products to start with (potatoes, onions, plantains, tomatoes and spring onions). After four months they began adding items, eventually reaching 28 products. We find that firms taking up the Agruppa service did travel less to the central market of Corabastos, going 0.4 days fewer per week, spending less time at the market on each visit, and saving a total of 113 minutes per week in travel time. This reduced travel costs, and increased an index of work-life balance. The offer of Agruppa lowered purchase prices for these five core vegetables by 6 to 8 percent. There was incomplete pass-through of these savings into consumer prices, with mark-ups increasing, suggesting imperfect competition. Uninterested firms operating in the same blocks as firms served by Agruppa also reduced their prices for these core products. However, those offered Agruppa services also cut back on sales of other products (since they were going to the market less), and their total firm sales fell 9 percent.[1] Usage fell over time, with only 24 percent of interested firms still using Agruppa after six months, and only 16 percent after one year. The difficulty of achieving sufficient economies of scale to both serve a large enough number of firms and to offer them sufficient variety of products led Agruppa to close business in January 2018, two months after our final follow-up survey.

This work contributes to two main strands of the literature. The first is a literature on competition in agricultural supply chains. Dillon and Dambro (2017) provide a recent review, noting that most of this literature has focused on other parts of the supply chain from us, examining impacts on farmers, and the role of traders/intermediaries. Most of this literature has been non-experimental, and has examined the responses of farmers to better information about prices, and the extent to which prices in different markets co-vary. Two recent experiments have examined the responses of intermediaries to temporary price subsidies or bonuses. Casaburi and Reed (2017) find that

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[1] Note that a combination of poor record-keeping and distrust about taxes and crime means that item non-response rates for sales and profits are very high, so this sales figure should be viewed as suggestive only.

cocoa traders in Sierra Leone appear to operate in quite competitive markets, but note that price pass-through of a quality premium takes place in the form of interlinked credit transactions, rather than lower prices. In contrast, Falcao Bergquist (2017) finds that intermediaries in the Kenyan maize market appear to have substantial market power, with traders only passing through 22 percent of a subsidy to customers. To date this work has not focused on shortening supply chains, with the exception of Emran et al. (2017), who find that a ban on a particular layer of middlemen in the palm oil supply chain in Bangladesh actually ended up increasing wholesale prices and mark-ups. Busso and Galiani (2019) also find evidence of imperfect competition among grocery stores in the Dominican Republic, but that randomizing the entry of new stores did result in lower prices for consumers.

The second main strand of the literature is a growing literature on efforts to alleviate constraints to the growth of micro and small enterprises in developing countries. The vast majority of this literature has consisted of interventions intended to overcome constraints facing individual firms, such as lack of access to capital, lack of business skills, and lack of demand (see Woodruff, 2018 for a recent review). In contrast, a recent systematic review (Piza et al, 2016) found the only studies of interventions designed to help individual firms overcome coordination failures and benefit from agglomeration externalities were work on training firms in industrial clusters, and a supplier development program that aimed to link SMEs to large firms in Chile (Arráiz et al, 2013). This paper therefore supplies evidence on a type of intervention not previously considered in the literature, and points to the potential and challenges associated with overcoming coordination failures facing a very common type of small firm.

The remainder of this paper is organized as follows: Section 2 describes in detail the current supply chain facing small retailers in Bogota, and Agruppa's solution; Section 3 discusses our sample and implementation; Section 4 measures the impacts on firms; Section 5 examines what this experience tells us about the nature of competition amongst these small retailers; and Section 6 concludes. An Appendix provides more details and robustness checks.

2. The Problem Facing Small Vendors and Agruppa's Solution

2.1. Context and the Problem to be Solved

Wholesale of fruits and vegetables in Bogota is heavily centralized at *Corabastos* market, the second largest market in Latin America (after one in Mexico City). The market, located in the Southwest of the city, is owned by a combination of government and private sector shareholders, and was opened in 1972. It has an area of more than 400,000 square meters, more than 5,300 sellers, serves approximately 150,000 customers per day, and sells an average 11,500 tons of produce daily (Caracol Radio, 2018). The commercial part of the market is organized into warehouses, sorted by product (Appendix 1 provides pictures), with supply chains typically consisting of farmers selling to buyers or directly to transporters, who then bring truckloads of products in during the night to sell each day to the wholesalers. Wholesalers then negotiate with suppliers, with the price depending on the number of trucks arriving in the market that day, and the origin and quality of the produce.

This centralized market offers enormous product variety, but offers three key disadvantages in terms of *time, weight,* and *cost* for the small-scale neighborhood stores selling vegetables in Bogota, almost all of which mainly buy their fruit and vegetables from Corabastos (95% of our sample does at baseline). The most important disadvantage is in terms of time. The perishable nature of produce means that store owners travel frequently to the market, with 38 percent going seven days a week, and the median owner going 4 times a week at baseline. On the days they go to market, the median owner in our sample wakes up at 4:30am to head to Corabastos, spends 20 minutes travelling to Corabastos from their home, 120 minutes shopping for different products at the market (the vast size of the market and organization of warehouses by product means a lot of travel within the market), and then a median of 25 minutes time travelling back to their business. The consequence is a median (mean) of more than 10 hours (more than 12 hours) per week spent travelling to, in, and from the market. This is on top of long working days, with the owners typically opening their stores at 7am and keeping them open until 9pm (14 hours per day), with 97 percent of firms open every day per week.

In addition to the time taken shopping for produce, store owners must figure out how to transport a heavy weight of purchases. Potatoes are sold in *bultos* (50 kilogram bags), onions in *bultos* or *arrobas* (11.3 kg bags), tomatoes in 22 kilogram *canastillas*, plantains in 20 kilogram *bolsas,* and spring onions either in *arrobas*, in 25 kilogram units called a *pony*, or by the pound. Conditional on purchasing a product, the median amount purchased by firms in our sample is 100 kg of

potatoes, 25 kg of onions, 60 kg of plantains, 44 kg of tomatoes and 22 kg of spring onions. Not surprisingly, 68 percent pay for a *cotero* (intra-market transporter) to transport the goods within the market for them, at a median cost of 10,000 pesos ($3.24) per visit.[2] In addition to this cost, store owners must pay the cost of their own transportation to the market, sometimes pay a market exit fee[3] (averaging 7,700 pesos), and transportation back from the market with their goods. The total mean (median) cost per visit is 29,152 pesos (25,000 pesos), which is approximately 30-35 percent of median and mean daily profits for these firms.

There are thousands of these small neighborhood grocery stores scattered throughout Bogota. One solution would be for them to band together as a buyer cooperative to share travel costs, and to potentially obtain bulk discounts from agglomerating orders. However, there is a coordination failure, with the long hours of operation leaving owners little time to coordinate, which combined with competition and a lack of trust prevents this from occurring.[4]

2.2. Agruppa's Solution

Agruppa is a start-up social enterprise founded in 2014 with the goal of leveraging mobile phone technology to aggregate demand for produce from small vendors, creating daily collective orders which can then be purchased in bulk (and, by taking advantage of economies of scale, at a discount) directly from farms, and then be delivered to the business places of the small retail shops. This effectively shortens and makes more efficient the supply chain between farms and retailers. Their goals are to reduce the travel time and costs for the owners of these small stores, deliver fresh fruits and vegetables at a price discount of at least 5 percent on what store owners would pay at Corabastos, and potentially lower the costs of food to poor consumers buying from these stores.

Agruppa carried out market research and piloted a minimum viable product version of their operating model with 20 neighborhood retail stores in Bogota in 2014. In 2015 they were then selected as one of the winners of an SME innovative ideas competition run by the World Bank, and additionally attracted funding from social investors including Wayra (the accelerator of

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[2] We use an exchange rate of 1 USD = 3085.6 Colombian pesos that was prevailing at the time of the study for all currency conversions.

[3] One-third of firms paid this fee on their last purchase at baseline. The fee is charged to limit congestion, and varies with type of vehicle. Those travelling with their own vehicle would pay the fee, while the fee would be priced into the cost of paying for space on someone else's truck.

[4] Likewise, since each wholesaler at Corabastos typically sells only one product, no single wholesaler can deliver the bundle of goods a retail store typically buys at the market, and they do not typically offer delivery services.

Telefonica), Mercy Corps Social Venture Fund and Yunus Social Business. This led them to agree to work with us on an impact evaluation to evaluate the effectiveness of their model as they launched and expanded their business in 2016.

Agruppa intended to develop an app that retail store owners could use to place their daily orders, but technology problems meant that this was not developed during our implementation phase. Instead, Agruppa offered customers three ways to make their orders: (1) ordering directly from the transporters, who would take the next order while delivering the current day's order – used in 36 percent of transactions; (2) phone orders to a call center, where retail stores could call between 4 and 10pm each evening and place their order for the next day – used in 40 percent of transactions; and (3) WhatsApp orders, where customers could use their mobile phones to place orders directly – used in 24 percent of transactions. Mobile technology thus still facilitated two-thirds of the orders. These orders were then aggregated into a daily collective order per product, and Agruppa would then purchase these products as early in the supply chain as possible – either directly from farmers, or from the first middlemen. Food would then be delivered to a distribution outlet located close to the poor neighborhoods in Bogota, and delivery trucks would then take produce directly from there to the doorsteps of each customer.[5]

3. Sample, Randomization, Implementation and Take-up, and Data

3.1. Selection of the Sample and Random Assignment

All neighborhoods in Bogota are classified by the government into one of six socio-economic strata, classified from 1 (poorest) to 6 (richest). Our focus is on poor neighborhoods (strata 1 to 3) in the South-West of Bogota, not immediately adjacent to Corabastos. Agruppa went door-to-door along streets in these neighborhoods in January and February 2016 (see Appendix 2 for a study timeline) to identify stores that sell fruit and vegetables, excluding the few large supermarkets and chain stores. Their aim was to map approximately 2,400 stores. Using larger streets as natural boundaries, these neighborhoods were then divided into 69 blocks, with a median block size of 36 retail shops per block. Six of these blocks were then dropped for safety reasons, leaving 63 blocks.

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[5] Note that since orders were aggregated at night, and delivery the next morning, produce was sourced based on predicted sales.

Blocks were formed into matched pairs[6] on the basis of geographic location and number of firms in the block, and then ordered according to the sequence in which Agruppa desired to expand operations. One block within each pair was then randomly assigned to treatment, and the other to control, for a total of 32 treatment blocks and 31 control blocks (Figure 1).

Baseline surveys were then carried out by Innovations for Poverty Action (IPA) Colombia on a rolling basis between April and November 2016. Each week they would survey firms in both blocks in a pair (one treatment and one control block), checking to see whether a firm existed, whether it sold the products offered by Agruppa, and then administering a baseline survey to collect details on the owner and firm. At the end of the survey, firm owners in both blocks were given a brief factual explanation of Agruppa, and asked whether they would be interested in being a client should Agruppa decide to offer the service in their neighborhood. On this basis, firms were classified as being either *interested in Agruppa* or *uninterested in Agruppa.* Seventy-six percent of firms approached agreed to participate in the survey.

This yielded a sample of 1,620 firms, comprising 852 firms in treatment blocks and 768 firms in control blocks. On average, 69 percent of firms in treatment blocks and 70 percent of firms in control blocks expressed interest in Agruppa, giving us samples of 586 interested firms in treatment blocks, 266 uninterested firms in treatment blocks, 536 interested firms in control blocks, and 232 uninterested firms in control blocks.

3.2 Characteristics of the Sample

Table 1 summarizes key characteristics of the sample by treatment status, and by interest in Agruppa. The sample consists of small retail stores that sell fruit and vegetables, along with selected other products like grains (85 percent of stores), eggs (84%), dairy products (79%), bottled drinks (79%), household and personal cleaning products (each 79%), bread (77%), and occasionally other items such as meat (29%), and airtime (11%). Fruits and vegetables have the highest rotation rates and are purchased most regularly by customers. The average store sells 4.3 out of the 5 core products Agruppa began with (potatoes, onions, spring onions, plantains and tomatoes), and these products constituted just over half of the total value of sales for these firms.

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[6] The last three firms were grouped into a triplet, with two blocks out of three randomly assigned to treatment.

The prices of these products change very frequently, with 76 percent reporting that they change prices every day, and a further 22 percent changing prices at least weekly.

Firm owners range in age from 18 to 83, with an average age of 43, and one-third of the sample are female. They have been running their businesses for a mean (median) of 10.6 years (8 years). There is considerable variation in education levels, with 49 percent having completed no more than primary education, 43 percent having done some high school education, and only 8 percent with post-high school education. Many owners were reluctant to provide full financial information for several reasons. First, was fear of crime, with 56 percent viewing their neighborhood as unsafe or very unsafe and 10 percent being robbed in the last six months. Indeed, our enumerators were robbed several times. A second reason may be partial informality: 64 percent were registered for taxes, but those registered for taxes were less likely to report sales data. Finally, a third reason is that few owners keep financial records, with only 29 percent saying they record quantities purchased, and only 38 percent saying they record amounts sold. As a consequence, we are missing baseline household income data and profits and sales data for about half the firms in the sample. Of those who do report, mean (median) per-capita monthly household income is US$164 (US$122), and 39 percent are below the national poverty line. The mean firm is making profits of US$125 per week on US$1041 of weekly sales.

Table 1 shows that the randomized treatment and control groups look similar on most baseline observables for the full sample, and for the separate sub-samples of interested and uninterested firms. The last column then tests whether interested firms differ from uninterested firms on these owner and firm characteristics. Owners are more likely to be interested in Agruppa if they are female (which qualitative research suggested was in part due to the advantage of not having to deal with transporting heavy sacks of vegetables), and if they are younger, more educated and have higher household and business incomes (possibly reflecting a greater willingness to try new technologies). Firm owners who have a greater distance to travel to Corabastos are more interested (they have more to gain from saving on travel time), but owners who rely on the core Agruppa products for more of their sales and who travel most frequently to Corabastos are less interested (perhaps because they value the selection at Corabastos more). Column 1 of Table 2 considers these variables jointly in a probit, and confirms that women with young children are more likely

to be interested, as are owners who sell more Agruppa products and who live further from Corabastos, but those who shop at Corabastos everyday are less likely to be interested.[7]

We also did a one-time survey of 650 customers in 20 of the blocks (10 treatment and 10 control) to understand the characteristics of customers, and the extent to which our neighborhood blocks corresponded to their shopping locations.[8] This was done by randomly sampling customers shopping at stores in our sample to interview. Seventy-four percent of the customers are women, with a median age of 48, and 98 percent lived in the neighborhood they were interviewed shopping in, with a median time living in the neighborhood of 15 years. Median monthly per-capita household income is 250,000 pesos (US$81), which is approximately two-thirds of that of the median store owner. They shop for fruit and vegetables frequently, with a mean of 4.7 days per week and median of daily shopping. The median customer spends 100 percent of their fruit and vegetable expenditure at stores in the neighborhood, and only 18 percent had made any fruit and vegetable purchase outside the neighborhood in the past week. Sixty percent say they usually shop at the same businesses within the neighborhood, while 40 percent shop around to see who has the best prices that day, and the median customer makes purchases from two different stores. This suggests some competition within the neighborhood for customers, but little competition across neighborhoods.

3.3 Implementation, Take-up and Usage

Agruppa entered into a new treatment block each week, starting with our first treatment block on April 18, 2016, and entering the last treatment block at the start of December 2016. They would first visit the sample of interested firms identified in the baseline, explain their product offerings, and attempt to take orders that they would then fill in the coming days. This approach of a block a week was done to allow them to have sufficient manpower to do this first marketing visit, but it meant that to begin with, the number of firms they would be working with was small. This limited the ability to place large orders at scale, and so Agruppa began by offering only five core products (potatoes, onions, spring onions, plantains, and tomatoes).[9] These products were identified as high

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[7] Note that the last variable in Table 2, the number of products Agruppa would have available at launch, was unknown to firms at the time of assessing interest in the product, which explains the lack of correlation with interest in column 1.
[8] This survey was done between November 2017 and January 2018. There is no significant difference in the share spent in the neighborhood or likelihood of shopping outside of the neighborhood by treatment status.
[9] Note that they offered several varieties/sizes of these products.

rotation and heavy purchases, which most stores sold. Only these first five products were offered for the first 15 weeks, and then Agruppa gradually introduced additional products, starting with carrots, yuca and guava, and reaching 20 products by time the last treatment block was offered the service, and a maximum of 28 products by late 2017. The new products with the highest sales levels were peas, lemon, lulo (a citrus fruit) and rice. The initial five core products still accounted for 59 percent of total sales in December 2016, and 50 percent in the third quarter of 2017.

Figure 2 shows take-up and usage of Agruppa in the treatment blocks, while Figure 3 shows the dynamics of churn into and out of usage. Most firms decide whether or not to try the service within the first two weeks. Fifty-two percent of interested firms make at least one purchase from Agruppa within the first two weeks, while sixty-six percent make a purchase at least once in the first year (387 of the 586 interested firms). After the first eight weeks, there is little new customer acquisition, and the main dynamics consist of churn of customers back and forth between stopping using in a week, and then starting to use again in a future week. Usage in the current week averages 35 percent over the first six weeks, drops to 28 percent by week 14 and 24 percent by six months, and is only 16 percent after one year. Uninterested firms were not marketed the service, and we see very little usage by these firms.[10]

Column 2 of Table 2 uses a probit to examine the correlates of taking up Agruppa amongst those firms which expressed initial interest. The strongest predictor of not taking it up is if the firm owner was going everyday to Corabastos at baseline – 70 percent of those firm owners who did not go daily took it up, versus only 58 percent of daily travelers. This might reflect them valuing the selection at Corabastos more. Firm owners who sell more of the core Agruppa products, and who have children in the household are more likely to take it up. Since Agruppa started with only five core products, one might think that take rates would be higher when more products began to be offered. However, Figure A3 shows there is no correlation between take-up rate in a block and the number of products on offer at the time Agruppa began selling in that block. Since the ordering of which blocks to sell in first was not randomized, but was optimized for delivery routes, this might reflect other differences among firms across blocks. However, Table 2 shows that there continues to be no relationship between take-up and the number of products on offer after controlling for

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[10] Seven uninterested firms, and four control firms used the service within the first six months of launching in their block.

owner and firm characteristics. We see a weakly significant tendency for the take-up rate to fall over time, which could either reflect less Agruppa effort devoted to new customers as their base of existing customers grew, or to the blocks that Agruppa chose to work in first being better for customer acquisition.

Column 3 of Table 2 then examines the correlates of the decision to stop using Agruppa, conditional on having ever used it, while column 4 considers the correlates of an interested firm continuing to be a customer after one year. The most important determinant continues to be whether or not they were a daily shopper at Corabastos at baseline, with those who were 61.4 percent more likely to stop buying after trying it out, and 67 percent less likely to start and remain a customer after one year. Table A3 examines how these baseline daily shoppers compare to other firms, and find that they are larger and more profitable firms, that are, on average, closer to Corabastos. We do see that firms in blocks where Agruppa started with more products are in fact more likely to stop buying from Agruppa after having tried it out, and less likely to be customers after one year. This is surprising, and goes against the idea that customers will be more likely to stick around if given wider variety. While we are controlling for household socioeconomic status, owner characteristics, distance to Corabastos, and a linear time trend in time since Agruppa started in the first block, this may still reflect unobserved characteristics of the blocks phased in later rather than earlier.[11]

Our six-month follow-up survey (described below) asked current users the most important reasons for using Agruppa, and those who had stopped using the service the most important reasons for stopping. The main reasons for continued use were reducing travel time (62%), lower prices (15%), and transporting heavy items (13%). The most important reasons given for stopping use were not not enough variety (28%), not satisfied with customer service (28%), and prices not being competitive (22%). Only 11% said the reason was product quality. Qualitative work by Agruppa led them to conclude that their most loyal customers were owners of smaller shops, who had strong practical reasons for not wanting to have to travel to the market, such as safety or caring for children or elderly family members; while other clients were seen as using Agruppa mainly for sporadic needs, stocking up between visits to the market. They also noted that for many

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[11] Agruppa staff also note that despite their best efforts, service quality may not have remained stable over time, so that this increase in product variety may have been accompanied by offsetting service issues.

shopkeepers, going to Corabastos remained "central to their identity as shopkeepers, to their social life, and even to their ego, while appealing to their primordial need to have selected and negotiated (or in good Colombian "bargained") the product themselves". This suggests it may have not just been an economic consideration as to whether to use and continue using the service or not.

3.4 Data for Measuring Impacts

IPA Colombia conducted five rounds of high-frequency short-term follow-up surveys at 2, 4, 6, 10, and 14 weeks after the launch of Agruppa in a block. We would survey a treatment block and its corresponding control block in the same week, staggering the timing to match the staggered timing of the baseline surveys and introduction of Agruppa (see timeline in Appendix 2). These high-frequency surveys were short in length, and intended to capture the immediate responses in terms of the key mechanisms through which the service was designed to affect firms: travel to Corabastos, purchase and sales prices for the core Agruppa products, and sales and profits for the past week. The response rate averaged 79% for firms interested in Agruppa (81% in treatment blocks, 77% in control blocks), and 69% for not-interested firms (70% in treatment blocks, 68% in control blocks). Tables A4.1 and A4.2 break this down by survey round, showing a tendency for response rates to fall over time, reflecting some survey fatigue.[12]

We then collected two longer surveys at six-months and twelve months after the launch of Agruppa in a block. In addition to the information collected in the high-frequency surveys, these questionnaires also asked about business opening hours, sales of some other products, pricing strategies, crime, record-keeping, and work-life balance. The response rates for interested firms were 78% at six months (80% in treatment blocks, 75% in control blocks), and 76% at twelve months (77% in treatment blocks, and 74% in control blocks), and were again lower for uninterested firms (Table A4.1). We were able to collect at least sales prices in most stores interviewed (Table A4.2), but item non-response rates were very high for sales and profits (Table A4.3), so that profits and sales are only available for 35 percent of interested firms on average (similar by treatment status). In our regressions we control for block pair fixed effects (which controls for issues like overall insecurity that affect response rates) and for the baseline values of the outcome of interest (adjusting for an imbalance on initial outcomes caused by attrition).

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[12] Scratch-and-win cards with airtime incentives were offered as an incentive to get firms to respond.

4. Impacts on Firms

We analyze the impacts of this intervention by assessing the extent to which it was able to reduce travel times and travel costs to Corabastos and improve life quality for firm owners, whether it changed their input costs and sale prices, whether this resulted in changes in sales and profits, and how competing firms were then affected.

4.1.Estimation Methods

Randomization at the block level enables us to estimate the intention-to-treat (ITT) effect of offering Agruppa to interested firms by comparing outcomes for interested firms in treatment blocks to those for interested firms in control blocks. To maximize power, we use an Ancova specification which controls for the baseline level of the outcome of interest, and pool together multiple survey rounds to get the average effect over the pooled rounds (McKenzie, 2012). For outcome *y* for interested firm *i* in block *b* in time period *t*, we therefore estimate:

$$y_{i,b,t} = \beta AssignedTreatment_b + \gamma y_{i,b,0} + \delta 1(y_{i,b,0} = missing)$$

$$+ \sum_{s=1}^{T} \theta_s 1(t=s) + \sum_{p=1}^{31} \mu_p 1(b \in p) + \varepsilon_{i,t} \qquad (1)$$

Where β is the ITT effect, *AssignedTreatment* is a dummy variable taking value one if block *b* is assigned to be offered treatment and zero otherwise, $y_{i,b,0}$ is the baseline value, which is dummied out if missing, and we control for survey round fixed effects θ_s and randomization block pair fixed effects μ_p. The standard errors are then clustered at the block level. We estimate equation (1) pooling together all seven rounds, and then separately for the first three rounds (short-run effect over weeks 2, 4, and 6), for the next three rounds (medium-run effect over weeks 10, 14, and 26), and for the one-year follow-up.

As we have seen, not all firms offered Agruppa used the service, and use varied over time. We therefore also present local average treatment effect (LATE) estimates by replacing *AssignedTreatment* with *used Agruppa in the past week* in equation (1), and then instrumenting this use with block treatment assignment. This will give the effect of current use of Agruppa for firms who use it when offered. However, the LATE effects rely on the exclusion restriction that there is no effect of Agruppa on firms who do not currently use the service. This assumption will

be violated if there are competition effects, whereby non-users adjust prices or lose sales to Agruppa users. It may therefore be a more reasonable assumption for some outcomes such as travel days to Corabastos than for financial outcomes. A second issue to note is that because the usage rate for Agruppa falls over time, the set of individuals who are current Agruppa users is different in each survey round, with the number falling over time. If there are heterogeneous treatment effects, the LATE will therefore be identified for a different set of individuals in each survey round, affecting comparability of the LATE estimates over rounds.

The majority of our analysis will focus on the set of interested firms in both treatment and control blocks. But we are also interested in how uninterested firms respond to interested firms using Agruppa. We therefore also estimate equation (1) separately for the set of uninterested firms, which enables us to compare uninterested firms in blocks where interested firms are using Agruppa, to uninterested firms in blocks where no firms are using Agruppa.

4.2.Did shortening supply chains reduce travel time, travel costs, and stress?

Table 3 presents the estimated impacts on Corabastos travel. Panel A considers the extensive margin of the number of days per week that firm-owners shop at Corabastos. Over the first six weeks after introducing Agruppa, when usage is highest, those offered Agruppa shop a statistically significant 0.17 days fewer per week, while the LATE is 0.41 days fewer per week, both relative to a control mean of 4.7 days per week. This impact is smaller and not statistically significant over longer time horizons (when usage of Agruppa has fallen), and the pooled ITT impact over all seven rounds of 0.09 days per week is also not statistically significant. These effects are smaller than we ex ante anticipated, and reflects the need for firms to still go to Corabastos to obtain products that Agruppa does not sell.

Even if the firms still need to go to the market, users of Agruppa will need to go to fewer places within the market to purchase products, potentially reducing the amount of time spent shopping. Panel B of Table 3 considers this intensive margin of how many minutes the firm-owner spends shopping at Corabastos conditional on going. In both the short-term, and pooled estimation, we see statistically significant effects whereby firm owners offered Agruppa spend 6 minutes less per visit (compared to a control mean of 104-107 minutes), and those firms using Agruppa spend 14 to 16 minutes less per visit. The impacts are not significant for the medium-term, but are significant in the one year follow-up, with a particularly large LATE of 56 minutes. This suggests the smaller

subset left using Agruppa after one year are able to considerably reduce their amount of shopping time on each visit.

Panel C combines the extensive and intensive margins, along with data on the time taken to go to and from the market, to calculate the total amount of time spent each week travelling to, in, and back from Corabastos. The pooled estimate over all seven rounds shows a statistically significant 37 minute per week drop in travel time for those offered Agruppa, and 113 minute per week drop in travel time for those using Agruppa (relative to a control group mean of 729 minutes (12 hours). These effects are similar and statistically significant in the short-term period, slightly smaller and not significant in the medium-term period, but then significant at the 10 percent level with a very large LATE of 425 minutes after one-year.

Our high-frequency surveys did not ask the amount spent on transportation and exit fees per visit to Corabastos, but we did ask these in the six-month and twelve-month follow-ups. The mean control group user averages 29,659 COP per visit, and the ITT pooled treatment effect over these two rounds is 3,556 COP per visit (s.e. 1297, p=0.008), reflecting fewer heavy goods to transport. Combining this reduction in the cost per visit with the reduction in the number of days per week going to Corabastos of 0.17 in the short-run gives an estimated short-run cost savings of 20,556 COP per week (US$6.66), which is equivalent to approximately 0.5% of baseline weekly sales, or 4.9% of baseline weekly profits. Using our statistically insignificant pooled effect over the year of a 0.09 reduction in travel days would reduce this to 18,054 COP (US$5.85) per week.

Finally, panel D of Table 3 examines whether this reduction in travel time and travel costs is accompanied by a change in work-life stress. We asked a set of eight questions about general life and work satisfaction, whether they find work stressful, as well as about whether the owner feels tired, lacks time, and frequently has no time for family. These variables are coded as binary variables in the same direction so that one indicates more stress, and zero less. At baseline, ninety percent of owners say they are satisfied with their life and their work, but one quarter report feeling tired most days per week, and 40 percent say they frequently feel work forces them to spend less time with their family. We see that the offer (and use) of Agruppa results in lower work-life stress, which is significant at the six-month horizon but not at the twelve-month. Table A5 shows the impacts on each contributing item to this index, with the largest changes seen in questions about

whether they lack time to do all the things they have planned, or frequently do not have enough time for family, where there is an 18 to 20 percentage point reduction coming from using Agruppa.

4.3.Did offering Agruppa change product availability, prices and mark-ups?

Table 4 examines impacts of offering Agruppa on the extensive margin of whether a store was open, and whether it was selling specific vegetables and fruits. To allow for seasonal and time effects, our regressions include Column 1 shows that overall, and in the short and medium-term, there was a small and statistically insignificant impact on whether our enumerators found the store to be open on the day of the interview. The next five columns show that there was no significant change in whether or not firms were selling the core five Agruppa products. We see that onions and spring onions are sold by 95-97 percent of stores, plantains by 80 percent, tomatoes by 59 percent, and potatoes by 56 percent.[13] In contrast, the last five columns consider the impact of offering Agruppa on five other products that Agruppa did not offer to start with, but phased in over time.[14] We see that offering Agruppa led to a statistically significant 7 percentage point reduction in the likelihood stores were selling carrots and yuca, and a 16 to 20 percentage point reduction in the likelihood of them selling peas, lemons and bananas. The LATEs (not shown) are even larger, suggesting that using Agruppa cuts the likelihood of selling carrots and yuca by 23 and 25 percentage points respectively, and the likelihood of selling bananas, lemons and peas by 47, 54, and 60 percentage points respectively.

Agruppa knew that their potential customers would be comparing their prices to those prevailing at Corabastos, so set out to price its products at a price at least 5 percent below the Corabastos price, with a long-run goal of 10 percent. In practice, they used market informants at Corabastos to find out the current day's price, and then would use this to set their price for the following day. They would calculate 5 percent below the market price, round to nearest 1,000 pesos to make invoicing easier, and then compare to their purchase cost. If they could purchase for a lot lower, they would offer more of a discount, but they would also take a loss on items if needed to achieve the target discount. On top of this, they would adjust prices based on perceived demand elasticity

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[13] These regressions are for selling the most common variety of each of these products. 93 percent of firms sell one of the four variety/sizes of potatoes that we ask about, and there is no significant effect of treatment on the likelihood of selling at least one type of potatoes. We focus on the main variety/size (*papa pastusa gruesa*) here in order to show no change at the extensive margin selling the item we then consider the price of in our price regressions.

[14] Note that because these products were only phased in later, we only started asking about them part-way through the study. The analysis still compares treatment and control firms in the same matched pair of blocks on the same day.

(assuming that people would be more price sensitive to staples like plantains, and so offer higher discounts, than for some fruits). To test the impact on prices, we estimate equation (1), again controlling for daily fixed effects to allow for seasonal and time patterns, and report the results in Figure 4 and Table A6. This estimation is conditional on selling the product, which we have just seen the treatment had no impact on for the core products.[15] We consider both the purchase price to the firm, their sale price, and the mark-up percentage, defined as the difference between log sale price and log purchase price.

Figure 4 shows that firms offered Agruppa reduced the price of purchasing each of the five core products by a statistically significant 6 to 8 percentage points on average pooled across all survey rounds. Firms in turn pass on some of these savings to customers, reducing their sale prices by 1 to 3 percentage points, which is statistically significant for onions, plantains and potatoes, but not for tomatoes and spring onions in the pooled data. Table A7 shows that these reductions in price do not appear to be due to changes in produce quality: measuring the firmness, color, visual appearance, and shape of produce we find no significant changes in four products, and a small improvement in quality for plantains. The fact that sale prices do not fall by as much as purchase prices means that mark-ups increase, with this being a statistically significant 3 to 5 percentage points for all products except for plantains. If the exclusion restrictions hold, then this would suggest much larger savings in purchase price for those using the service than Agruppa had targeted – with the pooled and short-term estimates in the order of 13 to 20 percentage points. However, the exclusion restrictions may be violated if the option to buy from Agruppa gives firm owners more negotiating power when purchasing from vendors at Corabastos, or if firms not using Agruppa adjust their behavior in response to competitive pressure from those that do.

4.4. What was the impact on overall firm sales and profits?

As previously noted, most firms do not keep records of quantities sold, or of sales and profits. When coupled with safety concerns about crime in their neighborhood, and general mistrust, this meant that item non-response rates are high for our sales and profits measures. On average, we only have profits and sales responses for 35 percent of interested firms when pooled across all

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[15] For this reason we do not examine the impact on prices of the non-core products, since Table 4 shows offering Agruppa leads to large treatment effects in the likelihood of selling these products, so that comparing prices in control firms which sell these non-core products to treatment firms selling these non-core products is subject to selection concerns.

rounds. We control for baseline values of the sales or profits outcome, which along with the randomization pair fixed effects helps control for selective responses related to baseline levels or block characteristics. However, we still note the risk of bias is considerably higher for these estimates than for our other outcomes, and urge caution in their interpretation.

Table 5 provides the estimated treatment effects. We only show intention-to-treat effects, since the exclusion restrictions may be less likely to hold for sales and profits if there are competitive responses, and because the compliers (Agruppa users) are more likely to have reported sales and profits than the non-compliers. The first column considers sales of the five core Agruppa products in the past day, obtained by multiplying reported price per kilogram against quantities sold. We see that despite the small reduction in prices, there is no significant change in sales made, with the pooled point estimate a statistically insignificant 0.1 percent decline. Column 2 shows likewise that there is no change in mark-up profits in the last day, measured as the mark-up per kilogram multiplied by the number of kilograms sold. While the point estimate is 0, the 95 percent confidence interval runs from -8.8 percent to +8.8 percent, so is consistent with the firms making 3 to 5 percent higher mark-ups and quantity not changing much. In contrast, column 3 finds that the total sales of the firm (measured as pesos sold in the past week) fell 9 percent for those offered Agruppa, and column 4 shows this is accompanied by a fall in profits. These impacts are significant in the short-run, and also at one-year. They suggest that the savings in purchase prices and travel costs are not enough to offset a loss in sales from the firms travelling less to Corabastos and being less likely to sell other products as a result. Although we should be cautious in this interpretation given the data limitations, the results certainly do not support the idea that firm owners were able to expand and capture more sales through using Agruppa.

4.5. What was the competitive response or spillover effect on other firms?

We can examine the spillover effects of this intervention by comparing outcomes for the uninterested firms in treated blocks (where interested firms do get offered Agruppa), to those of uninterested firms in control blocks (where no firm is offered Agruppa). Table 6 reports the results, again with the caveat that overall response rates and item non-response rates on profits and sales were lower for uninterested firms (Tables A4.1, A4.2 and A4.3). The first five columns show that uninterested firms lowered their prices of the core Agruppa products by 2 to 4 percent. This provides evidence that the exclusion restriction is likely to be violated when considering the LATE

estimates on prices for interested firms, and suggests that firms are adjusting prices in response to those charged by other firms in their block. Column 6 shows positive, but statistically insignificant impacts on sales of these core products, and columns 7 and 8 show statistically insignificant impacts on total sales and profits of these uninterested firms. The smaller sample size of the uninterested firms, coupled with lower response rates, however makes the confidence intervals on sales and profits reasonably wide, encompassing a change of 15 percent in either direction.

5. What does this experiment tell us about the nature of firm competition?

Our data provide a rare look into the pricing of multi-product small retailers of perishable products in a developing country, and enable us to establish several key facts that are important for understanding how firms compete with one another in these markets, and how firms charging different prices to nearby firms are able to survive over time.

5.1 Facts about price changes in these markets

Fact 1: Prices change frequently and closely follow the Corabastos wholesale prices. As noted above, 76 percent of firms at baseline say that they change prices daily. Our six-month follow-up survey asked several questions about how they set prices. Only 9 percent of firms say they know the sale prices of fruits and vegetables at the nearest shop to theirs in the neighborhood, and only 4 percent say they aim to set a price explicitly below that of a competitor. Instead, 91 percent of firms say they just add a mark-up to their purchase price.[16] The result is that retail sale prices closely track vendor purchase prices, which in turn closely track the prices charged at Corabastos. This is seen in Figure 5.

In a simple model of perfect competition, there should be one-for-one pass-through of market prices into retail prices. In contrast, if retail store owners have market power, then they will not pass-through cost changes automatically to consumers. In Table 7, we regress the daily sale prices of our core five Agruppa products charged by retail store owners on the daily price at Corabastos and on block fixed effects. The coefficients range from 0.9 to 1.2, and are thus close to one in

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[16] However, note that firms do not use the same mark-up consistently over time (or across products): the average rank-order correlation between the mark-up used for a product today and the mark-up used 2 weeks later is only 0.29, and it is 0.13 with the mark-up used one-year later. This shows that mark-ups don't reflect persistent unobserved differences in firm quality.

magnitude, showing high pass-through of input price changes, and suggesting a high level of competition among firms.

Fact 2: Large cross-sectional variation in prices for the same good within a neighborhood market. Perfect competition also implies that undifferentiated goods should sell for the same price at different stores within close proximity to one another, or else customers will have strong incentives to shift to the cheaper store. We regress log prices charged by store owners on block-day fixed effects, and plot the residuals in Figure 6. There is large cross-sectional dispersion in prices: a firm at the 90th percentile of onion prices in its block on a given day sells onions for 57 log points (77 percent) more than a firm at the 10th percentile; a firm at the 90th percentile of potato prices in its block on a given day sells potatoes for 35 percent more than at firm at the 10th percentile; and the other three products also have price dispersion of 50 to 60 percent between the 90th and 10th percentile. This dispersion does not reflect observable differences in product quality, since controlling for the measured quality (Appendix 7) of produce reduces this dispersion by less than one percent. The cross-sectional price dispersion thus would suggest much less competition.

Fact 3: Firms are not consistently the cheapest: cheap in one product does not necessarily mean cheap in another product, and cheap today does not necessarily mean cheap two weeks from now.

We de-mean the price a store charges for a product by the block-day average, and then look to see whether a firm that offers cheaper prices for one product is also charging cheaper prices for other products. The left panel of Figure 7 shows this comparison for potatoes and onions. The rank-order correlation is only 0.20, which is also the average over all ten pairwise comparisons of core products, and shows that stores are not consistently the cheapest across products. As an example, if a customer finds a store whose onions are in the cheapest quartile of prices in their market block on a given day, the chance that the store's potatoes sell at below the mean price is still only 55 percent.

Secondly, we consider the temporal variation in price dispersion, to see if a store is consistently the cheapest for a given product. The right panel of Figure 7 provides an example for potatoes, showing that cheaper today is only weakly correlated with cheaper in two weeks (rank-order correlation of 0.22, which is similar to the 0.24 average across the five core products. As a result, if a store is selling potatoes in the bottom quarter of prices for that market block on a given day, the chance they will be selling at below the mean price two weeks later is only 60 percent.

This fact suggests that spatial variation in prices across firms is unlikely to reflect persistent unobserved characteristics of the firms, such as nicer premises, or a tendency to give credit or discounts to customers. Qualitatively, we have not found many retailers to use these, but did not measure this in our surveys.

5.2 Implications for firm competition and understanding the Agruppa impacts

Taken together, these three facts suggest that although there is close to one-for-one pass-through of wholesale market prices to retail prices, firms are not in perfect competition, and there are large differences in prices for the same product on the same day in the same market. It can pay for consumers to shop at more than one store (as the median customer does), and to look around to see which stores have the cheapest prices (as 40 percent of customers do). However, because these differences vary over products and time, there are limits to the value of search, and even within neighborhoods, firms are likely to have some market power through geographic differentiation (the nearest competitor is 50 meters away), and customer familiarity with the owner and the store layout.

This differentiation is likely what allowed firm owners to capture some of the reduction in input costs from shopping with Agruppa, and to increase mark-ups. However, it also shows why a discount of 6 to 8 percent on input costs offered by Agruppa is unlikely to be able to help firms greatly expand sales by undercutting other firms on prices – prevailing prices vary by six to seven times this amount within the same market on the same day, which would make it difficult for consumers to detect a price change arising from securing cheaper produce through Agruppa.

6. Conclusions and Lessons for Intervening to Shorten the Supply Chain

The large amount of time and money spent by retail store owners in Bogota purchasing fruit and vegetables suggests that there should be high demand for a service that can reduce this burden. Our evaluation of the initial impacts of Agruppa's attempt to shorten this supply chain do find that there was initially high interest in trying out such a service, and that store owners who used it were able to reduce the amount of time and money spent purchasing products, with an improvement in work-life balance, and cost savings that partially passed through into cheaper prices for consumers.

However, we also find that, if anything, retailers using Agruppa's service suffered a reduction in profits and sales in the short-term due to a reduction in sales of products not offered by Agruppa,

that not going to the central market as often made them less likely to sell. Usage of the service fell quickly over time, despite Agruppa expanding its product offerings. Agruppa had projected that it needed to get to a customer base of around 850 retailers buying two to three times a week to achieve the necessary scale to break-even, but was unable to expand sufficiently to reach this level, and lacking a clear pathway to financial sustainability, Agruppa closed as a business on January 20, 2018.

In drawing lessons from this experience, a number of the issues facing Agruppa were those common to many start-ups in terms of difficulties fine-tuning the logistics of product delivery, pricing strategy, paying attention to customer retention while expanding into new areas, and dealing with external shocks such as a fall in agricultural prices (which given a fixed mark-up percentage, lowered the amount earned on each transaction). But, in our view, a larger problem stems from the very market failure of a lack of coordination among buyers that this intervention aimed to fix. Starting small with a limited product offering, limited volume, and limited number of customers means that it is difficult to form contracts with farmers, hard to attract and retain customers, and difficult to cover costs while charging competitive prices. It is only by operating at scale and coordinating together the buying power of a large number of retailers that it is likely to be possible to support a broad product offering, offer an attractive partner for farmers (including closing forward contracts with them), and operate an efficient delivery network. Once the product logistics have been piloted, a much larger investment in implementation and marketing than was possible for the Agruppa team is likely to be needed to enable an enterprise to quickly reach such a scale. Nevertheless, the underlying business idea of agglomerating orders from many small purchasers still may offer promise, and at the time of writing, a new start-up had launched with the related business idea of agglomerating purchase orders from restaurants in Bogota.[17]

A final lesson is for both start-ups and researchers considering implementing randomized trials during the early stage of business launch. The advantage of working together at the launch was that the early data collected could be informative to the social enterprise in knowing more about its customer base, Agruppa was able to use the fact it was doing an impact evaluation and had short-term results in helping fundraise from social investors, and this was a stage where the planned geographic roll-out of the product easily lent itself to a randomized design. However, launching a

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[17] See https://www.frubana.com [accessed 20 March, 2019]

randomized trial at such an early stage also raised challenges for both the social enterprise and research teams. Upon reflection, the founders of Agruppa note that their delivery routes were not as efficient as they could have been without control blocks, and that they felt constrained from pivoting away from their originally planned growth rate. From the researcher side, measuring impacts while the product logistics were still getting finalized, customer retention systems were not fully in place, and the operation was not operating at scale meant that it was harder to measure what the impacts of such a service could be, given lower than anticipated usage. Ideally, in future collaborations, it would be desirable for proof-of-concept to be delivered at scale in one location, and then a design similar to that used here be used to measure impacts when expanding to a second city or part of the city.

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Figure 1: Random Assignment at the City Block Level
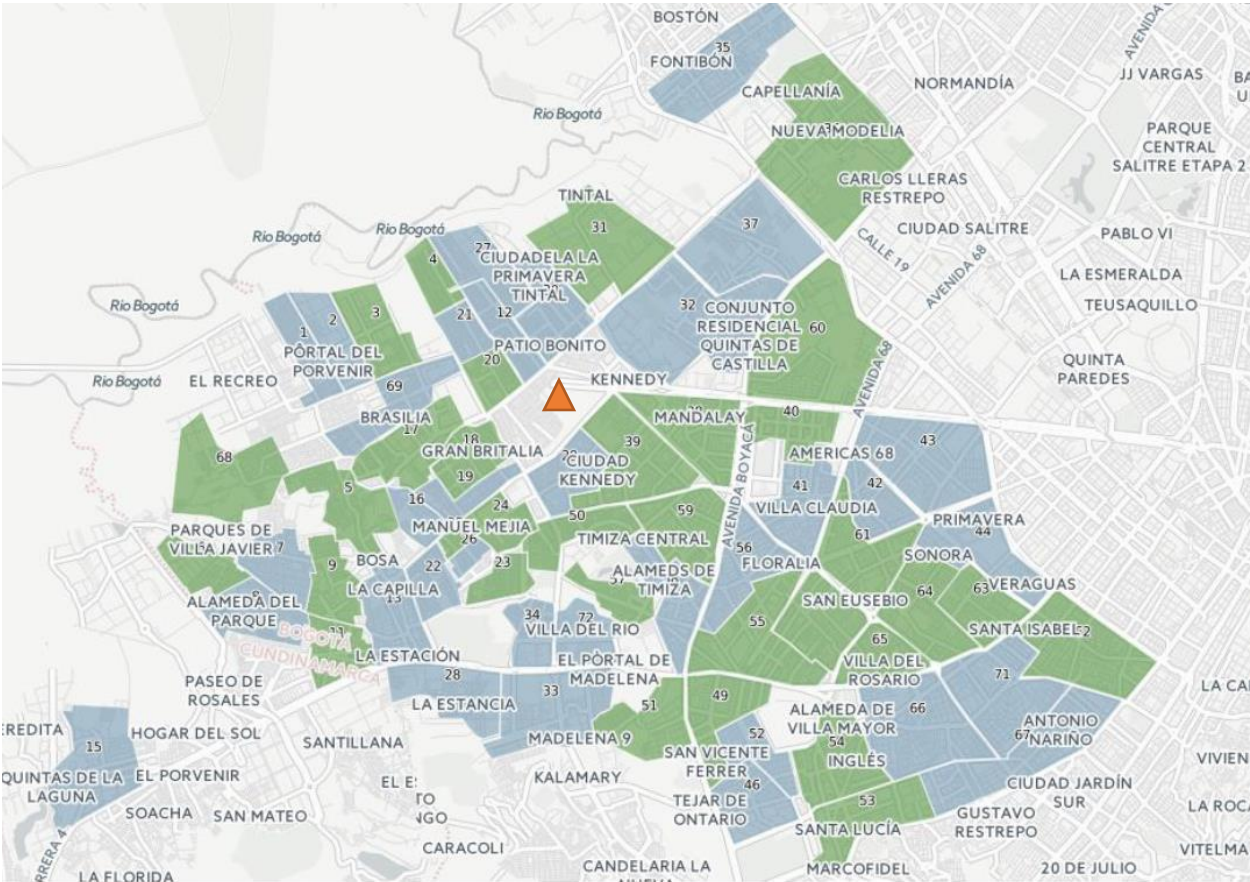
Note: treatment blocks are shown in gray, control blocks in green. Corabastos market is indicated by the orange triangle.

Figure 2: Take-up and Usage of Agruppa in Treatment Blocks
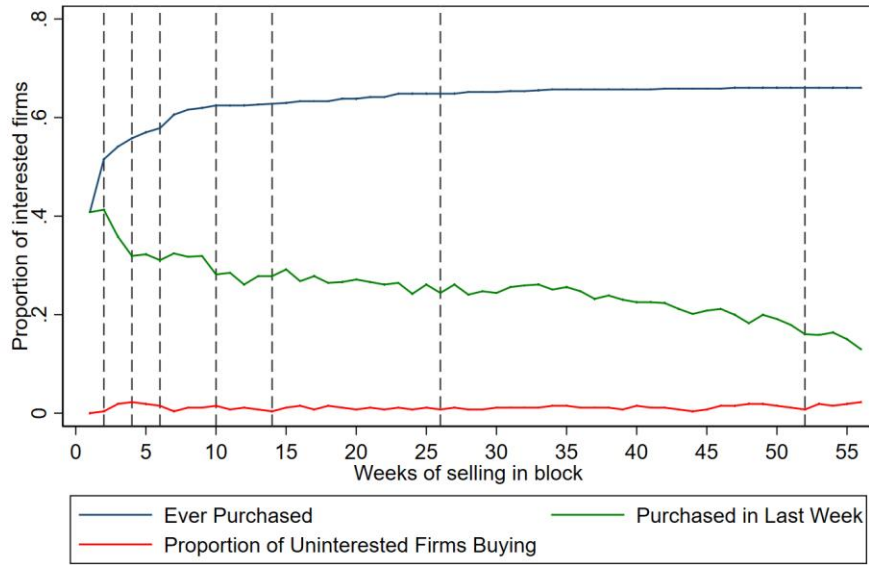
Notes: Data come from Agruppa administrative sales records. Ever purchased and purchased in last week are for the sample of firms who said they were interested in Agruppa at baseline. Agruppa only attempted to sell to these firms. Vertical lines indicate follow-up survey time periods of 2, 4, 6, 10, 14, 26 and 52 weeks after Agruppa is introduced in the block.

Figure 3: Customer Churn Dynamics
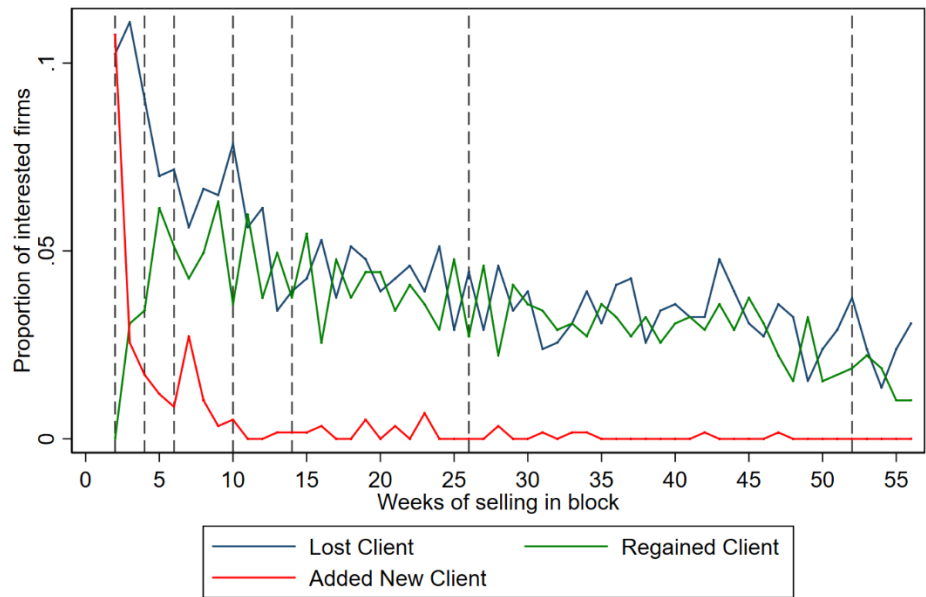
Notes: data are from Agruppa administrative sales records. Added new client indicates Agruppa started selling to a client they had not previously sold to, lost clients are those who purchased in the past week, and then not in the current week, and regained clients are those who had previously purchased from Agruppa, stopped for at least a week, and then purchased again in the current week.

Figure 4: Estimated Intention-to-Treat Impacts on Purchase and Sale Prices, and Mark-ups of Core Agruppa Products
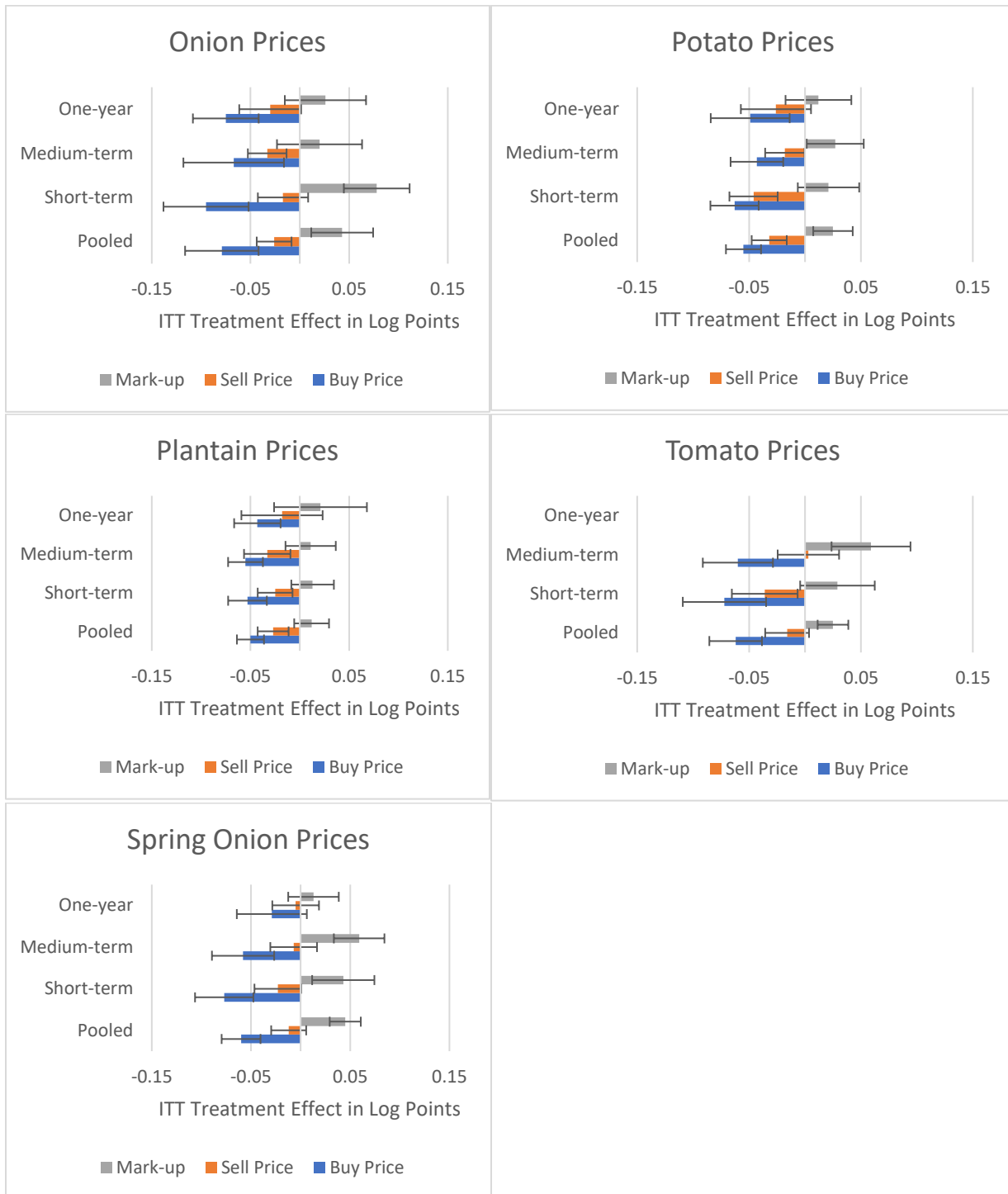
Notes: ITT estimates after controlling for baseline values, survey round, randomization pair, and daily fixed effects. 95% confidence intervals shown using robust standard errors clustered at the block level. Table A6 provides these results in numeric form and also provides LATE estimates. Tomato prices not collected in one-year survey. Short-term refers to weeks 2, 4 and 6; Medium-term to weeks 10, 14 and 26, and one-year to one-year follow-up. Pooled estimate averages over all seven rounds of follow-up surveys.

Figure 5: Firm Purchase and Sale Prices Closely Track Corabastos Prices
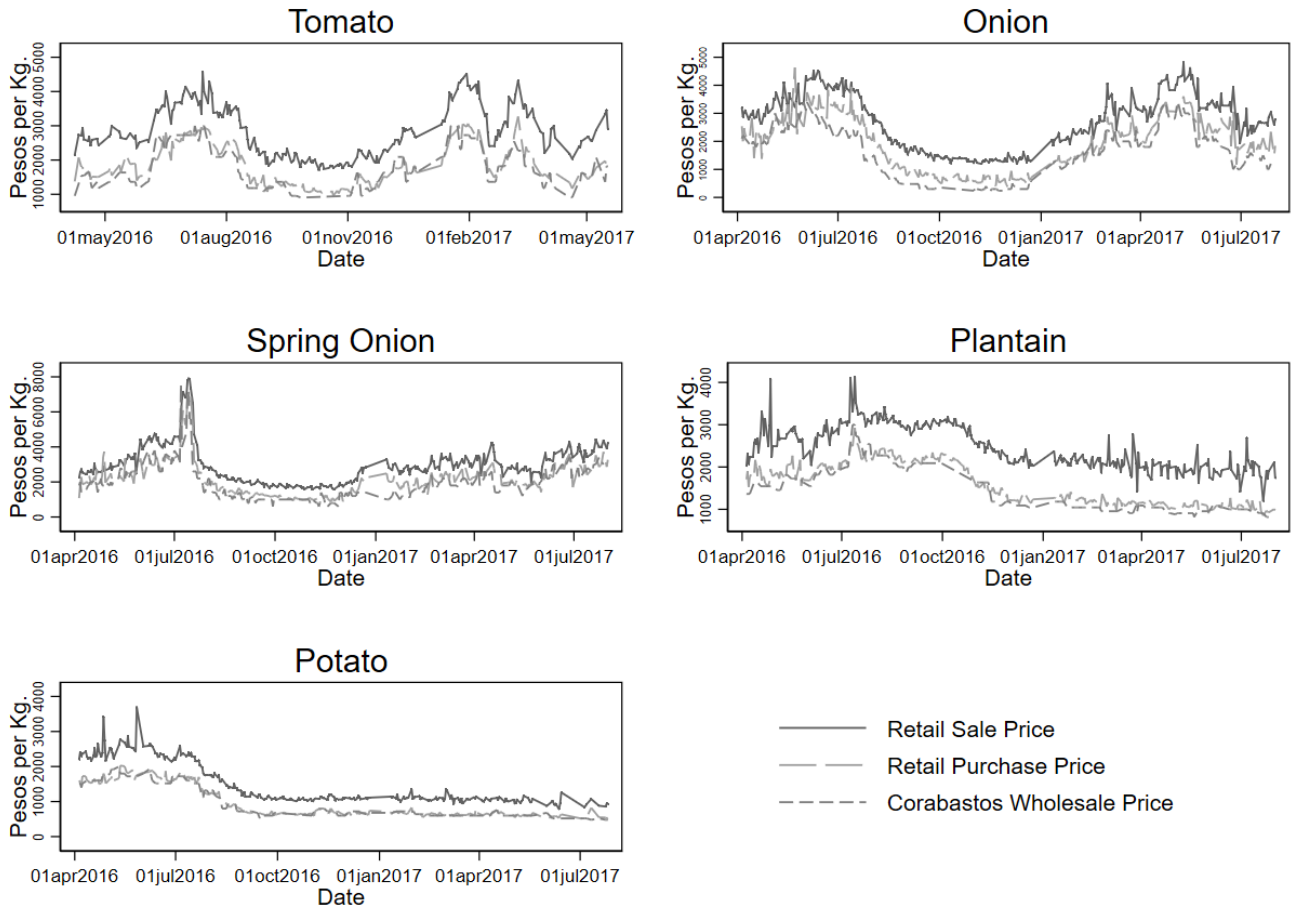
Notes: Retail sale and purchase prices are mean prices from firms in our sample interviewed on a given day, and are shown for days where at least five firms were interviewed. Corabastos prices are prices for standard quality produce reported by the Corabastos market. Tomato prices were not collected in our last few months of survey.

Figure 6: Large Cross-Sectional Dispersion in Prices Within a Neighborhood Market
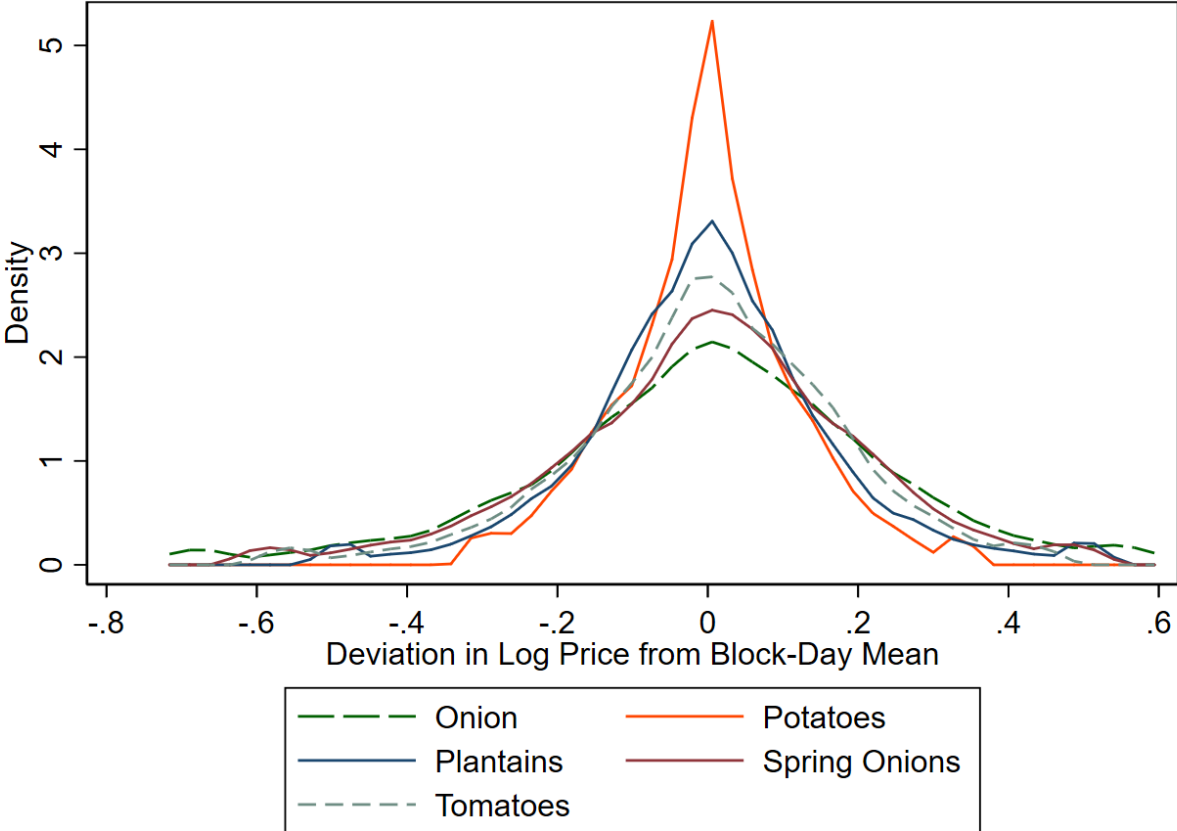
Notes: Kernel density of distribution of differences in retail sale prices within the same block on the same day for a given product.

Figure 7: The Cheapest Store in one Product is Not Much More Likely to be Cheaper for Another Product, or Cheaper in the Future
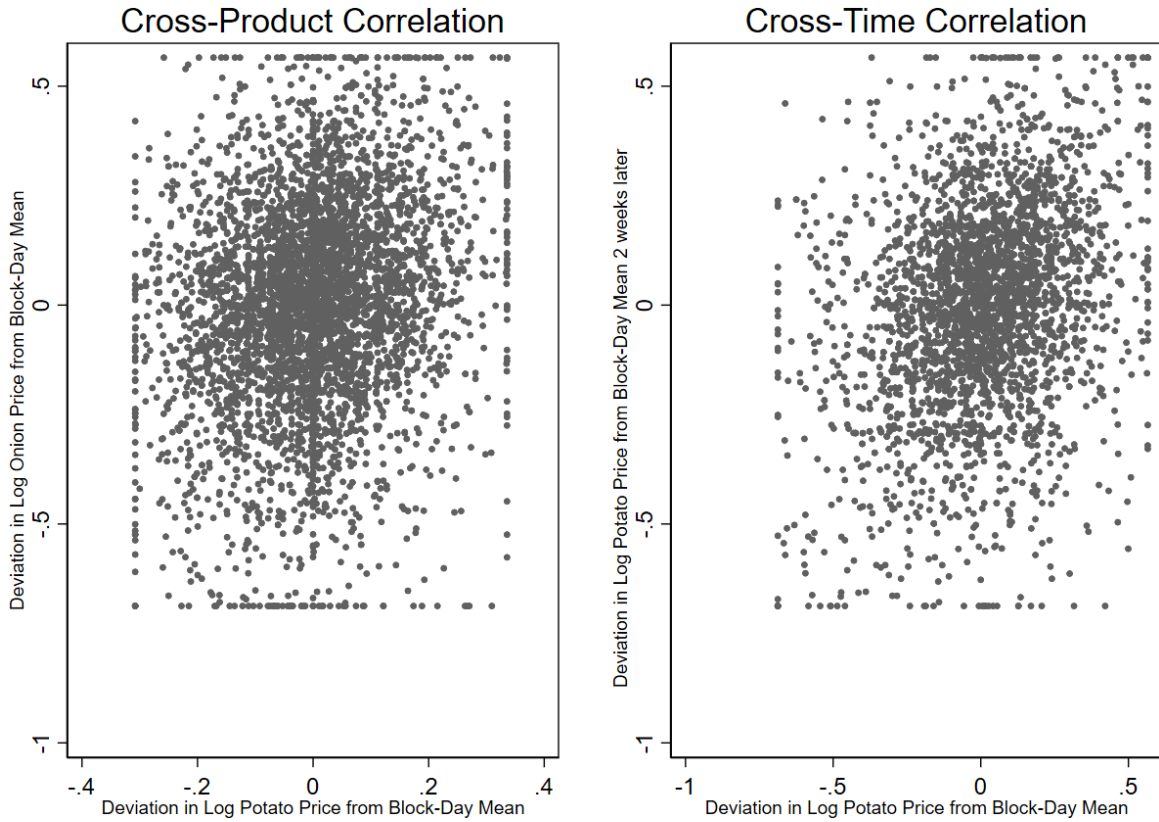
Notes: Figure uses prices from for all retail stores in our sample. The left panel uses all rounds of data and plots winsorized (at the 1st and 99th percentiles) differences of log prices from the block-day mean for potatoes versus onions, and shows having lower than average potato prices is not strongly associated with having lower than average onion prices. The right panel uses only the baseline and first three follow-up rounds to examine prices two weeks apart for potatoes, showing a cheaper than average price today is not strongly associated with having a cheaper than average price 2 weeks later. Results are similar for the other core Agruppa products.

Table 1: Summary Statistics by Treatment Status and Interest in Agruppa

	Proportion Missing Data	Treatment Blocks			Control Blocks			P-values testing equality			
		All (1)	Interested (2)	Uninterested (3)	All (4)	Interested (5)	Uninterested (6)	(1) vs (4)	(2) vs (5)	(3) vs (6)	(2) & (5) vs (3) & (6)
Owner Characteristics											
Owner is female	0.00	0.33	0.35	0.27	0.32	0.32	0.31	0.425	0.195	0.176	0.030
Age of Owner	0.21	43.3	42.3	45.8	43.3	41.6	47.6	0.902	0.611	0.188	0.000
Has primary education or less	0.11	0.52	0.49	0.59	0.46	0.42	0.55	0.013	0.033	0.536	0.000
Has high school education	0.11	0.41	0.43	0.37	0.45	0.47	0.42	0.109	0.328	0.489	0.060
Has post high school education	0.11	0.07	0.08	0.05	0.09	0.12	0.04	0.014	0.002	0.843	0.000
Household size	0.16	3.01	3.05	2.87	2.89	2.80	3.10	0.105	0.014	0.461	0.625
Has a child under 18 in household	0.16	0.53	0.54	0.50	0.53	0.54	0.50	0.398	0.468	0.254	0.217
Is the main income earner	0.12	0.89	0.89	0.90	0.88	0.88	0.88	0.558	0.522	0.417	0.869
Household monthly income (USD)	0.49	413	438	339	414	440	340	0.878	0.837	0.966	0.001
Below the Colombian poverty line	0.47	0.41	0.40	0.42	0.38	0.39	0.36	0.217	0.515	0.343	0.945
Firm Characteristics											
In business 5 years or less	0.00	0.33	0.33	0.34	0.33	0.33	0.32	0.218	0.288	0.144	0.888
Any paid employees	0.07	0.33	0.32	0.35	0.36	0.38	0.31	0.170	0.097	0.138	0.484
Number of core Agruppa products sold	0.00	4.28	4.33	4.18	4.32	4.32	4.32	0.519	0.455	0.177	0.173
Distance to Corabastos (km)	0.00	3.9	4.0	3.7	3.8	4.0	3.3	0.457	0.523	0.370	0.000
Days per week visiting Corabastos	0.04	4.44	4.33	4.68	4.70	4.69	4.74	0.177	0.044	0.597	0.089
Goes everyday to Corabastos	0.04	0.36	0.34	0.42	0.43	0.42	0.45	0.026	0.003	0.987	0.050
Travel time to Corabastos (minutes)	0.24	24.5	25.2	23.0	23.9	25.5	19.7	0.988	0.530	0.086	0.000
Weekly sales (USD)	0.55	1096	1252	719	977	1124	492	0.502	0.563	0.175	0.010
Weekly profits (USD)	0.60	133	137	123	117	135	71	0.370	0.738	0.015	0.034
Proportion of sales from core Agruppa	0.59	0.52	0.50	0.60	0.55	0.53	0.63	0.070	0.173	0.445	0.002
Sample Size		**852**	**586**	**266**	**768**	**536**	**232**				

Notes: firms were asked at baseline if they were interested or not in being a client of Agruppa should Agruppa offer the service in their neighborhood. They were then classified as interested or uninterested firms on this basis. Random assignment of Agruppa services was at the block level within matched pairs.

P-values for testing equality are from regression of variable on a treatment indicator, controlling for pair fixed effects and clustering at the block level.

Table 2: Correlates of Interest, Take-up, and Usage Decisions

	Interested in Agruppa (1)	Ever purchases from Agruppa (2)	Stops buying from Agruppa (3)	Still a customer after one year (4)
Owner is Female	0.241**	-0.098	0.016	-0.045
	(0.101)	(0.116)	(0.162)	(0.144)
Age of Owner	-0.001	-0.001	0.001	0.000
	(0.002)	(0.003)	(0.005)	(0.004)
Owner has primary education or less	-0.075	-0.022	0.256	-0.219
	(0.094)	(0.112)	(0.157)	(0.138)
Owner has child under 18	0.281***	0.194*	-0.219	0.259*
	(0.094)	(0.111)	(0.153)	(0.136)
Household income below poverty line	0.188	-0.185	-0.090	-0.000
	(0.121)	(0.145)	(0.194)	(0.170)
In business 5 years or less	-0.084	-0.056	0.017	-0.040
	(0.100)	(0.121)	(0.162)	(0.145)
Number of core Agruppa products at baseline	0.099**	0.101*	-0.060	0.109
	(0.045)	(0.060)	(0.096)	(0.084)
Distance to Corabastos in kilometers	0.046*	-0.026	0.017	-0.027
	(0.024)	(0.030)	(0.041)	(0.036)
Goes everyday to Corabastos at baseline	-0.168*	-0.455***	0.615***	-0.670***
	(0.100)	(0.121)	(0.186)	(0.163)
Baseline profits (USD)	0.000	0.001	-0.001	0.001
	(0.000)	(0.001)	(0.000)	(0.000)
Baseline profit data missing	-0.057	-0.237	-0.476**	0.293*
	(0.112)	(0.148)	(0.189)	(0.166)
No. of products sold by Agruppa at launch		0.035	0.232***	-0.163***
		(0.028)	(0.060)	(0.050)
Weeks since Agruppa started in first block		-0.021*	-0.025	0.010
		(0.013)	(0.019)	(0.016)
Sample Size	852	586	387	586

Notes:

Coefficients shown are marginal effects from probit estimation. Sample for column 1 is all firms in treatment blocks, for columns 2 and 4 is interested firms in treatment blocks, and for column 3 is interested firms who ever purchase from Agruppa in the treatment blocks.

Robust standard errors in parentheses, *, **, *** denote significance at 10%, 5% and 1%.

Table 3: Impact on Corabastos Travel Time among Interested Firms

	Average impact over all 7 rounds	Short-term impact weeks 2,4,6	Medium-term impact weeks 10,14,26	One-year impact week 52
PANEL A: IMPACT ON NUMBER OF DAYS PER WEEK GOING TO CORABASTOS				
ITT: Assigned to Treatment	-0.091	-0.167**	-0.023	-0.069
	(0.077)	(0.079)	(0.092)	(0.119)
LATE: Used Agruppa in Last Week	-0.269	-0.414**	-0.072	-0.369
	(0.222)	(0.189)	(0.278)	(0.618)
Control Group Mean	4.5	4.7	4.3	4.2
Sample Size	5332	2338	2200	794
PANEL B: TIME SPENT AT CORABASTOS PER VISIT CONDITIONAL ON GOING TO CORABASTOS				
ITT: Assigned to Treatment	-5.5***	-5.9***	-3.1	-9.3**
	(1.8)	(2.0)	(2.2)	(3.6)
LATE: Used Agruppa in Last Week	-16.2***	-14.3***	-10.1	-56**
	(5.2)	(4.8)	(6.7)	(23)
Control Group Mean (minutes)	107	104	108	116
Sample Size	4705	2111	1901	693
PANEL C: IMPACT ON TOTAL WEEKLY CORABASTOS TRAVEL TIME				
ITT: Assigned to Treatment	-37***	-40**	-23	-67*
	(14)	(16)	(16)	(34)
LATE: Used Agruppa in Last Week	-113***	-98***	-75	-425*
	(40)	(38)	(51)	(219)
Control Group Mean (minutes)	729	727	716	769
Sample Size	4923	2185	2002	736
PANEL D: IMPACT ON WORK-LIFE STRESS				
ITT: Assigned to Treatment			-0.037***	-0.014
			(0.009)	(0.017)
LATE: Used Agruppa in Last Week			-0.130***	-0.082
			(0.033)	(0.093)
Control Group Mean of Index			0.263	0.269
Sample Size			851	831

Notes:

All regressions control for baseline value of the outcome variable, randomization pair, and survey round fixed effects. Robust standard errors in parentheses, clustered at the block level. *, **, *** denote significance at the 10, 5, and 1 percent levels respectively.

Work-life stress index is an average of 8 binary variables each coded so that 1 indicates more stress and less work-life balance. Only collected in weeks 26 and 52.

Table 4: Impact on the Extensive Margin of Whether or Not They Sell a Product

	Business is open	Core Five Agruppa Products					Products only introduced later				
		Onions	Plaintains	Potatoes	Tomatoes	Spring Onions	Yuca	Carrot	Lemon	Banana	Pea
Panel A: Pooled over all Rounds											
Offered Agruppa	0.004	-0.005	-0.031	0.008	-0.001	-0.004	-0.074***	-0.068***	-0.180**	-0.156**	-0.201***
	(0.006)	(0.005)	(0.020)	(0.027)	(0.014)	(0.006)	(0.022)	(0.018)	(0.078)	(0.072)	(0.049)
Mean	0.950	0.966	0.804	0.559	0.589	0.954	0.751	0.859	0.810	0.741	0.807
Sample Size	7466	6067	6056	6048	6040	6075	4357	4684	917	920	917
Panel B: Short-term (weeks 2, 4, 6)											
Offered Agruppa	0.014	0.004	-0.049	-0.002	0.019	0.008	-0.087**	-0.070**	-0.251*	-0.260**	-0.248***
	(0.009)	(0.006)	(0.036)	(0.038)	(0.022)	(0.007)	(0.036)	(0.027)	(0.122)	(0.090)	(0.062)
Mean	0.941	0.956	0.786	0.582	0.551	0.939	0.701	0.841	0.734	0.685	0.764
Sample Size	3268	2754	2751	2744	2739	2759	1374	1562	331	330	330
Panel C: Medium-term (weeks 10, 14, 26)											
Offered Agruppa	-0.009	-0.013**	-0.019	-0.005	-0.031*	-0.007	-0.089***	-0.076***	-0.143*	-0.102	-0.177***
	(0.008)	(0.006)	(0.018)	(0.035)	(0.018)	(0.007)	(0.028)	(0.022)	(0.081)	(0.080)	(0.059)
Mean	0.950	0.979	0.817	0.597	0.616	0.969	0.761	0.862	0.846	0.767	0.828
Sample Size	3160	2518	2512	2511	2507	2521	2188	2327	586	590	587
Panel D: One-year											
Offered Agruppa	0.017**	0.006	-0.034	0.023	0.033	-0.014	-0.018	-0.043*	n.a.	n.a.	n.a.
	(0.008)	(0.009)	(0.033)	(0.029)	(0.036)	(0.014)	(0.027)	(0.022)			
Mean	0.978	0.962	0.828	0.359	0.635	0.960	0.807	0.885			
Sample Size	1038	795	793	793	794	795	795	795			

Notes:

All regressions control for baseline value of the outcome variable, randomization pair, survey round fixed effects, and daily fixed effects.

Robust standard errors in parentheses, clustered at the block level. *, **, and *** denote significance at the 10, 5, and 1 percent levels respectively.

Note that non-core Agruppa products were only asked about in a subset of surveys, and n.a. denotes they were not asked at all in this round.

Table 5: Impact on Sales and Profits

	Core Five Agruppa Products		From All Products	
	Log Sales in past day	Log mark-up profit in past day	Log Sales in past week	Log profits in past week
Panel A: Pooled over all Rounds				
Offered Agruppa	-0.001	-0.000	-0.092**	-0.075
	(0.048)	(0.045)	(0.044)	(0.050)
Mean	12.404	11.250	14.670	12.726
Sample Size	4593	4240	3132	2836
Panel B: Short-term (weeks 2, 4, 6)				
Offered Agruppa	-0.008	0.030	-0.090*	-0.137**
	(0.075)	(0.074)	(0.051)	(0.063)
Mean	13.132	11.961	14.638	12.669
Sample Size	1959	1774	1229	1204
Panel C: Medium-term (weeks 10, 14, 26)				
Offered Agruppa	0.027	0.003	-0.052	0.042
	(0.046)	(0.049)	(0.057)	(0.053)
Mean	12.219	11.123	14.601	12.592
Sample Size	1883	1738	1171	1039
Panel D: One-year				
Offered Agruppa	-0.010	0.011	-0.190***	-0.191**
	(0.067)	(0.067)	(0.064)	(0.083)
Mean	10.972	9.793	14.833	13.082
Sample Size	751	728	732	593

Notes:

Regressions control for baseline value of outcome, randomization pair, and survey round fixed effects.

Regressions for daily sales and profits include daily fixed effects, regressions for weekly sales and profits include weekly fixed effects.

Robust standard errors in parentheses, clustered at the block level. *, **, and *** denote significance at the 10, 5, and 1 percent levels respectively.

Caution: item non-response is high for these outcomes.

Table 6: Spillover impacts on Uninterested Firms

	Sale Prices of Agruppa Products					Log Sales Agruppa products	Log Weekly Sales	Log Weekly Profits
	Onions	Plantains	Potatoes	Tomatoes	Spring Onion			
Panel A: Pooled over all Rounds								
In block assigned to Agruppa	-0.044***	-0.019	-0.022**	-0.026**	-0.040***	0.078	0.007	-0.055
	(0.016)	(0.014)	(0.009)	(0.012)	(0.013)	(0.064)	(0.084)	(0.081)
Mean	7.648	7.860	7.192	5.329	7.833	12.341	14.505	12.569
Sample Size	2254	1790	1431	1589	2217	1522	959	862
Panel B: Short-term (weeks 2, 4, 6)								
In block assigned to Agruppa	-0.070***	0.003	-0.041***	-0.036	-0.053**	0.106	-0.057	-0.104
	(0.018)	(0.020)	(0.013)	(0.025)	(0.020)	(0.082)	(0.118)	(0.098)
Mean	7.693	7.974	7.356	7.839	7.874	13.205	14.573	12.510
Sample Size	988	778	659	530	960	642	383	371
Panel C: Medium-term (weeks 10, 14, 26)								
In block assigned to Agruppa	-0.051**	-0.044**	-0.001	-0.040	-0.069***	0.122	-0.074	-0.069
	(0.023)	(0.018)	(0.013)	(0.025)	(0.017)	(0.098)	(0.155)	(0.174)
Mean	7.495	7.841	7.080	7.834	7.707	12.074	14.448	12.565
Sample Size	967	773	626	561	958	595	316	284
Panel D: One-year								
In block assigned to Agruppa	-0.003	-0.059	-0.068***	n.a.	0.010	-0.077	0.037	-0.092
	(0.038)	(0.038)	(0.020)		(0.027)	(0.092)	(0.118)	(0.163)
Mean	7.977	7.579	6.964		8.092	10.987	14.469	12.689
Sample Size	299	239	146		299	285	260	207

Notes:

Sample consists of firms that said they were not interested in Agruppa at baseline.

Regressions control for baseline outcome of interest, randomization pair, survey round, and daily (prices) or weekly (profits and sales) fixed effects. Robust standard errors clustered at the block level in parentheses. *, **, *** denote significance at the 10, 5, and 1 percent levels.

Table 7: Pass-through of Daily Corabastos Prices into Daily Retail Sale Prices

	Retail Price of:				
	Onion	Tomato	Spring Onion	Potato	Plantain
Corabastos Price	1.029***	1.066***	0.980***	1.208***	0.898***
	(0.024)	(0.036)	(0.052)	(0.026)	(0.031)
Sample Size	7027	3495	6898	4236	5710
Test of 1:1 pass-through p-value	0.236	0.069	0.699	0.000	0.001

Notes:

Standard errors in parentheses, clustered at the block level. *, **, *** denote

significance at the 10, 5, and 1 percent levels respectively.

Regressions also include block fixed effects.

Online Appendices

Appendix 1: Corabastos Market

Rows and rows of warehouses, each specializing in different products

Warehouses are separated by product, selling potatoes, onions and other staples in large sacks.

Appendix 2: Study Timeline

Date		Pre-Intervention		Implementation		Follow-up Surveys						
		Mapping	Baseline	Block roll-out	# Products	2 week	4 week	6 week	10 week	14 week	6 month	12 month
2016	J											
	F											
	M											
	A				5							
	M				5							
	J				5							
	J				5							
	A				6 to 7							
	S				7 to 10							
	O				10 to 14							
	N				15 to 20							
	D				20							
2017	J				20							
	F				20							
	M				20							
	A				20							
	M				20 to 22							
	J				22 to 25							
	J				25 to 27							
	A				27 to 28							
	S				28							
	O				28							
	N				28							
	D											

Note: Agruppa ceased operating in January 2018.

Appendix 3: More on Take-up

Take-up rates of Agruppa did not vary with number of products available at the time it was launched in a market block

Figure A3 shows the proportion of firms initially expressing interest in Agruppa that make a purchase within two weeks of launching Agruppa in their block, against the number of different products Agruppa was selling at the time of this launch. The first 15 weeks only had the core 5 products of potatoes, onions, spring onions, plantains and tomatoes, and then other products were phased in. A fitted regression has slope -0.0097 (s.e. 0.006), so that there is a small and statistically insignificant association between take-up rates and number of blocks.

Figure A3: No relationship between take-up rates and the number of products available
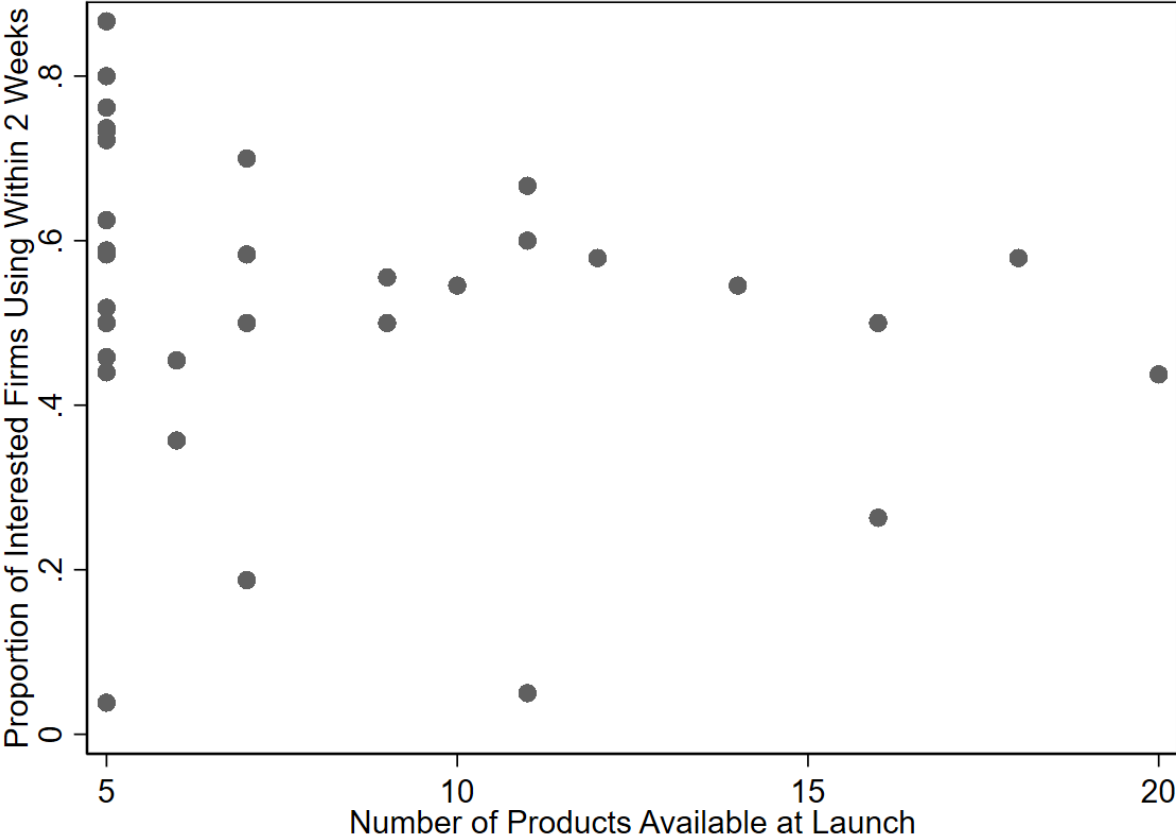
How do baseline daily Corabastos shoppers compare to non-daily shoppers among interested firms?

Take-up, and persistence of usage of Agruppa was most strongly correlated with whether the firms went to Corabastos daily at baseline. Table A3 shows that the firm owners going daily were more likely to be male, had higher household incomes, and the firms were larger in size (employees) and more profitable, and located closer to Corabastos. They derive more of their sales from core Agruppa products.

Table A3: Comparison of Baseline Daily Corabastos Shoppers to Non-daily Shoppers amongst Firms Interested in Agruppa

	Go Daily to Corabastos	Go less than Daily to Corabastos	p-value
Owner Characteristics			
Owner is female	0.26	0.38	0.000
Age of Owner	40.5	42.7	0.006
Has primary education or less	0.49	0.44	0.104
Has high school education	0.43	0.46	0.353
Has post high school education	0.08	0.11	0.242
Household size	2.90	2.97	0.556
Has a child under 18 in household	0.56	0.53	0.317
Is the main income earner	0.92	0.86	0.002
Household monthly income (USD)	498	402	0.070
Below the Colombian poverty line	0.36	0.42	0.192
Firm Characteristics			
In business 5 years or less	0.34	0.33	0.810
Any paid employees	0.48	0.27	0.000
Number of core Agruppa products sold	4.50	4.26	0.000
Distance to Corabastos (km)	3.55	4.21	0.000
Days per week visiting Corabastos	7.00	2.98	0.000
Travel time to Corabastos (minutes)	23.74	26.37	0.028
Weekly sales (USD)	1302	1122	0.671
Weekly profits (USD)	178	110	0.001
Proportion of sales from core Agruppa	0.55	0.49	0.027
Sample Size	410	673	

Appendix 4: Survey Response Rates and Attrition

Table A4.1: Proportion of Firms Interviewed by Survey Round

	Week 2	Week 4	Week 6	Week 10	Week 14	Six months	1 year	At least once
Firms interested in Agruppa								
in Control Blocks	0.82	0.82	0.77	0.76	0.70	0.75	0.74	0.97
in Treatment Blocks	0.84	0.86	0.81	0.80	0.74	0.80	0.77	0.98
p-value of equality	0.056	0.002	0.040	0.069	0.057	0.116	0.502	0.260
Firms not interested in Agruppa								
in Control Blocks	0.62	0.72	0.72	0.69	0.66	0.63	0.73	0.97
in Treatment Blocks	0.68	0.68	0.71	0.74	0.69	0.58	0.63	0.95
p-value of equality	0.322	0.296	0.628	0.017	0.880	0.099	0.000	0.256

Table A4.2: Proportion of Firms Reporting Prices for at least one Agruppa product by Survey Round

	Week 2	Week 4	Week 6	Week 10	Week 14	Six months	1 year	At least once
Firms interested in Agruppa								
in Control Blocks	0.80	0.80	0.77	0.75	0.70	0.79	0.82	1.00
in Treatment Blocks	0.83	0.84	0.79	0.79	0.73	0.79	0.86	1.0
p-value of equality	0.105	0.028	0.194	0.083	0.123	0.708	0.099	0.061
Firms not interested in Agruppa								
in Control Blocks	0.60	0.72	0.71	0.68	0.66	0.63	0.82	1.00
in Treatment Blocks	0.68	0.67	0.70	0.72	0.67	0.63	0.81	1.00
p-value of equality	0.163	0.265	0.514	0.055	0.933	0.788	0.757	

Table A4.3: Proportion of Firms Reporting Profits and Sales by Survey Round

	Week 2	Week 4	Week 6	Week 10	Week 14	Six months	1 year	At least once
Firms interested in Agruppa								
in Control Blocks	0.38	0.40	0.32	0.27	0.25	0.37	0.51	0.90
in Treatment Blocks	0.37	0.36	0.31	0.25	0.25	0.44	0.53	0.91
p-value of equality	0.958	0.241	0.781	0.280	0.583	0.042	0.746	0.752
Firms not interested in Agruppa								
in Control Blocks	0.24	0.36	0.24	0.18	0.17	0.22	0.44	0.80
in Treatment Blocks	0.26	0.21	0.18	0.17	0.15	0.23	0.39	0.81
p-value of equality	0.417	0.000	0.058	0.340	0.358	0.878	0.362	0.805

Appendix 5: Individual Items in Work-Life Stress Index

Table A5: Impact on Quality of Life and Work-Life Balance among Interested Firms

	Not Satisfied with Life	Not Satisfied with Work	Work is Frequently Stressful	Work Stressful Most days	Tired Most Days	Upset in Last Week	Lack time Most Days	Frequently No Time for Family	**Work-Life Stress Index**
PANEL A: IMPACT AT 6 MONTH FOLLOW-UP									
ITT: Assigned to Treatment	-0.013	-0.015	-0.011	0.008	-0.046	-0.082*	-0.053*	-0.058*	-0.037***
	(0.013)	(0.014)	(0.025)	(0.019)	(0.029)	(0.047)	(0.030)	(0.029)	(0.009)
LATE: Used Agruppa in Last Week	-0.046	-0.052	-0.039	0.027	-0.162	-0.281*	-0.184*	-0.202**	-0.130***
	(0.043)	(0.049)	(0.083)	(0.062)	(0.099)	(0.158)	(0.104)	(0.100)	(0.033)
Control Mean	0.108	0.095	0.256	0.147	0.261	0.584	0.258	0.398	0.263
Sample Size	851	851	847	847	846	770	770	844	851
PANEL B: IMPACT AT 12 MONTH FOLLOW-UP									
ITT: Assigned to Treatment	-0.006	0.025	-0.011	0.019	-0.022	0.001	-0.061**	-0.029	-0.014
	(0.019)	(0.029)	(0.028)	(0.026)	(0.031)	(0.036)	(0.029)	(0.029)	(0.017)
LATE: Used Agruppa in Last Week	-0.033	0.141	-0.063	0.107	-0.129	0.004	-0.338**	-0.168	-0.082
	(0.106)	(0.160)	(0.154)	(0.147)	(0.167)	(0.197)	(0.151)	(0.163)	(0.093)
Mean	0.126	0.138	0.259	0.198	0.316	0.375	0.344	0.399	0.269
Sample Size	831	830	830	828	828	762	762	827	831

Notes:

Regressions control for baseline value of outcome variable and for randomization pair.

Robust standard errors in parentheses, clustered at the block level. *, **, *** denote significance at the 10, 5, and 1 percent levels.

All outcomes are binary variables, except work-life stress index, which is the average index of the first eight columns.

Quality of life and work-life balance questions were not asked in the short-term high-frequency surveys.

Appendix 6: ITT and LATE Impacts on Prices and Mark-ups

Table A6: Impact on Prices and Mark-ups on Core Agruppa Products

	Onions			Potatoes			Plantains			Tomatoes			Spring Onions		
	Buy Price	Sell Price	Mark-up	Buy Price	Sell Price	Mark-up	Buy Price	Sell Price	Mark-up	Buy Price	Sell Price	Mark-up	Buy Price	Sell Price	Mark-up
PANEL A: AVERAGE IMPACT OVER ALL ROUNDS															
ITT	-0.079***	-0.026***	0.043***	-0.055***	-0.032***	0.025***	-0.050***	-0.027***	0.012	-0.062***	-0.016	0.025***	-0.060***	-0.012	0.045***
	(0.019)	(0.009)	(0.016)	(0.008)	(0.008)	(0.009)	(0.007)	(0.008)	(0.009)	(0.012)	(0.010)	(0.007)	(0.010)	(0.009)	(0.008)
LATE	-0.225***	-0.082***	0.120***	-0.155***	-0.099***	0.071***	-0.145***	-0.087***	0.033	-0.168***	-0.050*	0.116***	-0.175***	-0.038	0.129***
	(0.056)	(0.027)	(0.044)	(0.026)	(0.024)	(0.024)	(0.023)	(0.025)	(0.025)	(0.035)	(0.030)	(0.032)	(0.033)	(0.027)	(0.025)
Control Mean	7.165	7.616	0.502	6.724	7.143	0.454	7.356	7.813	0.439	4.736	5.702	0.280	7.484	7.795	0.370
Sample Size	3953	5920	3941	2297	3429	2292	3387	4830	3380	1952	3009	3069	3959	5826	3947
PANEL B: SHORT-TERM IMPACT OVER WEEKS 2, 4 and 6															
ITT	-0.095***	-0.017	0.078***	-0.063***	-0.046***	0.021	-0.053***	-0.025**	0.013	-0.072***	-0.036**	0.029*	-0.077***	-0.023*	0.043**
	(0.022)	(0.013)	(0.017)	(0.011)	(0.011)	(0.014)	(0.010)	(0.009)	(0.011)	(0.019)	(0.015)	(0.017)	(0.015)	(0.012)	(0.016)
LATE	-0.234***	-0.047	0.188***	-0.152***	-0.127***	0.051	-0.133***	-0.073***	0.032	-0.193***	-0.111***	0.077*	-0.186***	-0.063**	0.103***
	(0.060)	(0.033)	(0.044)	(0.031)	(0.028)	(0.034)	(0.026)	(0.027)	(0.027)	(0.049)	(0.042)	(0.042)	(0.035)	(0.031)	(0.036)
Control Mean	7.221	7.616	0.484	6.973	7.291	0.415	7.604	7.933	0.355	7.435	7.823	0.440	7.498	7.799	0.395
Sample Size	1667	2625	1659	1000	1599	997	1323	2104	1318	939	1500	935	1626	2579	1620
PANEL C: MEDIUM-TERM IMPACT OVER WEEKS 10, 14, and 26															
ITT	-0.067**	-0.033***	0.020	-0.043***	-0.018*	0.027**	-0.055***	-0.033***	0.011	-0.060***	0.003	0.059***	-0.058***	-0.007	0.059***
	(0.026)	(0.010)	(0.022)	(0.012)	(0.009)	(0.013)	(0.009)	(0.012)	(0.013)	(0.016)	(0.014)	(0.018)	(0.016)	(0.012)	(0.013)
LATE	-0.186**	-0.106***	0.054	-0.132***	-0.060**	0.083**	-0.154***	-0.105***	0.030	-0.171***	0.012	0.168***	-0.167***	-0.024	0.166***
	(0.074)	(0.034)	(0.058)	(0.036)	(0.029)	(0.034)	(0.027)	(0.037)	(0.034)	(0.046)	(0.041)	(0.049)	(0.045)	(0.037)	(0.036)
Control Mean	6.944	7.518	0.572	6.536	7.033	0.493	7.283	7.778	0.470	7.407	7.836	0.439	7.337	7.700	0.376
Sample Size	1618	2501	1614	1018	1532	1016	1427	2055	1425	1013	1509	1012	1631	2464	1625
PANEL D: ONE-YEAR IMPACT															
ITT	-0.075***	-0.030*	0.026	-0.049***	-0.026	0.012	-0.043***	-0.018	0.021	n.a.	n.a.	n.a.	-0.029	-0.005	0.013
	(0.017)	(0.016)	(0.021)	(0.018)	(0.016)	(0.015)	(0.012)	(0.021)	(0.024)				(0.018)	(0.012)	(0.013)
LATE	-0.388***	-0.160**	0.136	-0.179***	-0.101*	0.044	-0.230***	-0.096	0.110	n.a.	n.a.	n.a.	-0.166*	-0.027	0.072
	(0.092)	(0.080)	(0.096)	(0.061)	(0.052)	(0.051)	(0.070)	(0.100)	(0.140)				(0.100)	(0.059)	(0.072)
Control Mean	7.558	7.936	0.383	6.469	6.931	0.459	6.991	7.542	0.551				7.783	8.082	0.300
Sample Size	668	794	668	279	298	279	637	671	637				702	783	702

Notes:

All regressions control for baseline value of the outcome variable, randomization pair, survey round fixed effects, and daily fixed effects.

Robust standard errors in parentheses, clustered at the block level. *, **, and *** denote significance at the 10, 5, and 1 percent levels respectively.

All prices are expressed in log Colombian pesos per kilogram, and are for a specific variety and size, n.a. denotes not available.

Fewer observations are available for buy prices than sell prices, since sell prices can be observed in many cases when owner does not record or report their buying price.

Mark-up is the difference between the log of the input purchase price and the sale price.

Appendix 7: Impact on Quality

In the six month and twelve month surveys, our enumerators examined the produce being sold for quality, rating it in four dimensions observable to customers: whether the produce was firm or soft to the touch, whether it has the right color or is over- or under-ripe or spotty, whether the produce is faulty in any way, and whether the shape is regular or misshapen. We use these four measures to form a score from 0 (all of these defects exist) to 4 (none of these defects exist) for each of the core Agruppa products. Table A7 shows the resulting ITT impacts. We see no significant impact on product quality for four out of five products, and a small, but statistically significant, improvement in plantain quality.

Table A7: Impact on Produce Quality

	Onions	Plantains	Potatoes	Tomatoes	Spring Onion
Offered Agruppa	-0.003	0.097**	-0.071	-0.066	-0.035
	(0.035)	(0.046)	(0.048)	(0.077)	(0.030)
Mean	3.882	3.778	3.881	3.849	3.831
Sample Size	1565	1327	727	466	1544

Notes:

ITT impacts shown, pooling together six and twelve month surveys. Quality was not measured in high-frequency short-term follow-up surveys.

Regressions control for survey round, randomization pair, and daily fixed effects.

Robust standard errors clustered at the block level in parentheses.

*, **, *** denote significance at the 10, 5, and 1 percent levels respectively.