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TARGETED PRICE CONTROLS ON SUPERMARKET PRODUCTS

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ABSTRACT

We study the impact of targeted price controls for supermarket products in Argentina from 2007 to 2015. Using web-scraping, we collected daily prices for controlled and non-controlled goods and measured the differential effects on inflation, product availability, and price dispersion. We first show that, although price controls are imposed on goods with significant CPI weight, they have a temporary effect on aggregate inflation and no downward effect on other goods. Second, contrary to common beliefs, we find that controlled goods are consistently available for sale. Third, firms compensate for price controls by introducing new product varieties at higher prices. This behavior, which increases price dispersion within narrow categories, is consistent with a standard vertical differentiation model in the presence of price controls.

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1 Introduction

In many countries, governments often consider some form of price controls when the prices of popular goods rise above desired levels. On increasingly rare occasions, these price controls are imposed across-the-board, affecting all goods and causing widespread shortages.[1] But in most cases, governments prefer to implement a more subtle form of "targeted" price controls on a limited number of carefully-selected goods.[2] Traditionally, these targeted controls were limited to easy-to-regulate sectors, such as pharmaceuticals, utilities, or gas prices.[3] More recently, the availability of online data, mobile phone apps, and electronic records has dramatically increased the ability of governments to implement, monitor, and enforce targeted price controls in all kinds of consumer goods. In particular, developing countries such as Argentina, Ecuador, Israel, and Panama have had in the recent years some form of targeted price controls for food and grocery products.[4]

Despite the increased interest in the use of targeted price controls, there is still little empirical research investigating their economic effects. Are these controls binding? Do they affect prices and inflation of related goods? Can they avoid shortages associated with more generalized controls? What strategies do firms employ to deal with potentially lower profits and better enforcement?

In this paper, we try to answer some of these questions by studying the rich and volatile experience with price controls in Argentina from 2007 to 2015. These were mostly

[1] Venezuela is a particularly troubling recent case of across-the-board price controls. The armed forces are in charge of a strict price controls and food supply program. The country had over 250% inflation in 2016 and is experiencing an unprecedented economic crisis with massive food shortages. See New York Times: http://nyti.ms/220pqO1; Financial Times: http://on.ft.com/2ba0eCM; The Wall Street Journal: http://on.wsj.com/29z2nCL. In May 2017, President Maduro announced that he was considering a complete freeze of prices that would be enforced by "people in the streets". See El Nacional: http://bit.ly/2pGhxSo.

[2] Targeted controls are also referred to as "selective controls" in the literature (Rockoff (2004)).

[3] For example, developed countries such as Australia, Canada, and Switzerland currently have targeted price control programs for pharmaceutical drugs. See http://www.pbs.gov.au/pbs/home; http://www.pmprb-cepmb.gc.ca/home; https://www.trade.gov/td/health/drugpricingstudy.pdf; http://nyti.ms/2yYIzWt. In the US, the main candidates in the recent presidential election suggested they would push for legislation to control drug prices. See, for example, New York Times: http://nyti.ms/1FuGLq8, http://nyti.ms/1NqhboW; Bloomberg: http://bloom.bg/2aFZHna; Forbes: http://bit.ly/2ljpBX1.

[4] See http://www.consumers.org.il/category/Price-monitoring; http://bit.ly/2i1rbNK; http://bit.ly/2yXldjT.

targeted controls, affecting a selected set of consumer products (e.g. whole milk, 1 liter, brand X) while similar varieties remained free from any kind of restrictions. To help with the visibility and enforcement programs, the government required retailers to display labels identifying individual goods as being under a "government agreement", including when the goods were being sold online (as many Argentine supermarkets do). This meant we could use the information found on supermarket's websites to distinguish price-controlled goods and track their prices on a daily basis. In particular, we used web-scraping technologies to collect daily prices from October 2007 to May 2015 for more than 50 thousand products sold by one of the largest supermarkets, including approximately 1.4 thousand that were under a price control at some point in time.[5]

With this high-frequency panel of controlled and non-controlled goods, we examine the before-and-after impacts of price controls from micro and macro perspectives. Our main results can be summarized as follows:

First, we show that price controls tend to be imposed on goods that have significant weights in the CPI basket and for varieties sold by leading brands. This result is consistent with Cox (1980), who argues that focusing on products with high CPI weight and on concentrated industries would ensure the greatest impact on CPI inflation as well as the ability of the government to enforce the controls.

Second, the impact of targeted price controls on aggregate inflation is temporary and small. Controlled goods are sold at "government agreement" prices, which are on average 3.3% lower than before the control. This lower price is usually compensated by a similar increase in prices as soon as the controls are relaxed.

Third, contrary to common beliefs, we find that controlled goods are seldom discontinued and that their general availability is similar to that of non-controlled goods. They have a higher probability of going temporarily out of stock, but stockouts are short-lived and goods are only occasionally discontinued. One likely explanation is that the government's

[5]See Cavallo (2016) and Cavallo and Rigobon (2016) for details on the scraping methodology. Cavallo (2017) compares online and offline prices for 56 large multichannel retailers in 10 countries and shows that prices tend to be identical most of the time.

enforcement of both prices and stocks was aided by new technologies, including a mobile app allowing consumers to scan product barcodes in the stores, check "government agreement" prices, and send online complaints to an enforcement agency in cases of price discrepancies or stockouts.

Fourth, given that price controls are binding in prices and availability, we study how firms might offset lower profit margins. Consistent with the predictions of a standard vertical differentiation model in the presence of price controls, we find evidence that firms expanded their product line with new varieties at higher prices. We further show how this strategy increased price dispersion within controlled categories, which suggests an additional welfare cost from search frictions. In addition, once we construct price indices using URL average prices (i.e. products listed on the same URL narrow sub-categories), we find higher inflation for non-controlled goods than similar controlled good. This effect cannot be captured using traditional matched-model price indices. In contrast to some reports in the Argentine media, we find no evidence suggesting that firms reduced package sizes or that per-gram and per-liter inflation was higher.

Our paper contributes to different strands of literature. A first strand is related to an extensive literature on price controls from a macroeconomic perspective, most of which focuses on the US price and wage controls program during Richard Nixon's presidency in the 1970s.[6] The Argentine experience is more closely related to Israel's, where the government has often controlled the price of subsets of basic food products, fuel, and public transportation (Cukierman and Leiderman (1984)).[7] We contribute to this literature by using micro data and comparing inflation rates for both controlled and non-controlled goods within narrow categories.

Our work is also related to a literature that studies price controls from a micro or

[6] Rockoff (2004) provides an excellent overview of the history of price controls in the United States, ranging from the Revolutionary War to the Vietnam War. Galbraith (1952), Friedman (1966), and Solow (1966), provide early formal treatments on the subject. Helpman (1988) shows that the macroeconomic effects of price controls depend on the market structure. Other papers include U.S. Council of Economic Advisers (1973), Gordon (1973), Gordon (1975), Gordon (1977), Schultze (1975), Darby (1976a), McGuire (1976), Oi (1976), Cox (1980), and Blinder and Newton (1981).

[7] See http://www.consumers.org.il/category/Price-monitoring.

industrial organization perspective. Fershtman and Fishman (1994) and Rauh (2001) study the relationship between price controls and consumer search behavior. Kyle (2007) finds that price controls in one market affect entry strategies and the introduction of new products in other markets. Leffler (1982) provides a model where firms decrease quality until shortages from binding maximum prices are eliminated. Besanko, Donnenfeld, and White (1987) and Besanko, Donnenfeld, and White (1988) find that maximum price regulation can counteract the quality distortion in a monopoly price setting, and that firms may deteriorate quality for lower willingness-to-pay consumers. Raymon (1983) argues that binding price ceilings can decrease quality and consumer welfare in competitive markets.[8]

Finally, our work also relates to the growing literature that uses online good-level prices to conduct research in macro and micro economics. Scraped online prices are being applied to many areas, including offline and online pricing (Brynjolfsson and Smith (2000)), consumer search and online elasticities (Ellison and Ellison (2009)), synchronization and pass-through (Gorodnichenko and Talavera (2014)), and retail pricing dynamics (Cavallo (2016)). See also Ellison and Fisher Ellison (2005) and Edelman (2012) for interesting overviews on research in online markets, and its relationship with offline markets. Our results suggest that while the Internet may have increased the ability of governments to monitor and enforce price controls, these targeted programs have limited effects on aggregate inflation and can cause potentially welfare-reducing effects through higher price dispersion and average prices.

The remainder of the paper is as follows. Section 2 describes the price controls in Argentina from 2007 to 2015. Section 3 describes the web-scraping technology and the micro dataset. Section 4 discusses the impact of price controls on inflation and product availability. Section 5 presents a simple model and evidence of firms' behavior in the presence of controls. Section 6 concludes.

[8]These price controls differ from the price-cap regulation in natural monopolies (Laffont and Tirole (1993)).

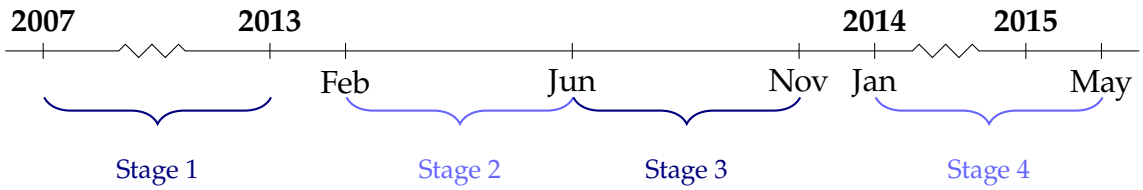
2 Price controls in Argentina

Argentina has a long history of price controls. In 1939, Congress passed a law to prevent stockouts during the Second World War. And although originally conceived as a temporary mean to lower inflation, subsequent governments have continued to rely on various forms of price controls.[9]

We study the recent 2007–2015 period, during which the government experimented with various types of targeted price controls in supermarket products. These price controls were meant to curb inflation, which rose from 10% in 2006 to over 35% in 2016 (according to unofficial estimates).[10] These controls focused on food and beverages, which constitute nearly 40% of the CPI basket. Despite the fact that they did not appear to have much of an impact on the inflation rate, these programs were popular with voters, which explains why they persist today. According to recent consulting and media surveys, 60% of Argentines supported price controls policies, and 25% of consumers bought price-controlled goods, which accounted for up to 20% of retailers' revenues in supermarkets.[11]

This period of price controls can be divided into four stages, as shown in Figure 1. Stages 1, 3, and 4 are examples of targeted price controls, and Stage 2 was a temporary freeze of all goods sold by large supermarkets. Table 1 shows descriptive statistics for each of these Stages.

Figure 1: Timeline



[9] See FIEL (1990) for a review of price controls prior to 1990.

[10] In addition to price controls, Argentina's main strategy to deal with inflation was to manipulate the official inflation statistics. See Cavallo (2012) for more details.

[11] The new government elected in 2015 continued the "Precios Cuidados" program. Current details can be seen in http://www.precioscuidados.com.ar. For evidence on their popularity, see Clarin: http://clar.in/20uTXBO; Telam: http://bit.ly/1vDUKnt; Pagina 12: http://bit.ly/2cOI5Ip; Cronista: http://bit.ly/1I5PBFB.

The first stage lasted six years, from 2007 to 2013. It was characterized by confidential ad-hoc price agreements with major supermarkets, which had to freeze prices temporarily for selected goods. There were no official press releases or announcements that disclosed the specific products being controlled, but some retailers showed a "government agreement" label next to the product. We use this label to identify controlled products through scraping technologies. Numerous news articles throughout the period reported that this policy resulted in major shortages, but there is no evidence of long-lasting shortages in our data, as we discuss later.[12]

Table 1: Stages of Targeted Price Controls

		Isolated Controls	*Look to Protect*	*Protected Prices*
		Stage 1	Stage 3	Stage 4
(i)	Period	Oct 2007 to Feb 2013	June 2013 to Nov 2013	Jan 2014 to May 2015[c]
(ii)	Public Information	No	Yes	Yes
(iii)	Same Goods all Retailers	No	No	Yes
(iv)	Target Number of Products		500	100
Information obtained from our data:				
(iv)	Goods Identified (all time)	651	606	409
(v)	CPI Categories	47	50	48
(vi)	Retailer's Categories	203	205	156
(vii)	Average CPI Weight per Product	1.235	0.953	1.108
(viii)	Total CPI Weight	34.58	37.33	38.02
(xiv)	Median Days Controlled[a]	70	218	220
(x)	Average Days Controlled[a]	261	315	334
(ix)	Percent of Time Under Controls[b]	20%	15%	26%

Notes: We exclude Stage 2 because it was not "targeted". [a]Amount of time under price controls is computed over entire time series since items can be controlled throughout different stages. [b]Calculated over entire time series and including non-missing observations (in stock for sale). [c]Our data ends in May 2015, but the *Protected Prices* program continued after that.

[12]Bloomberg: http://bloom.bg/1AtknZp.

The second stage started in February 2013, when unofficial inflation reached 25%.[13] The government announced that it had reached a new agreement with the largest retailers in Argentina to freeze prices of all products for 60 days, and later extended it for another 60 days until May 31st.[14] The number of products available for sale fell significantly around this time, as discussed in Section 4.2. Prices remained stable for a few weeks but soon started to rise again.

A third stage started in June 2013, when the government lifted the general freeze on all but 500 products. In this instance the government released to the public the names and "government agreement" prices for those 500 products, which included food, beverages, cleaning, and health and personal care items. It first targeted major retailers in Buenos Aires and then expanded throughout the country. Because not all retailers sold the same brands or categories, each supermarket had its own list of 500 products whose prices had to stay constant for six months. This price agreement was formalized under the name "Mirar para Cuidar" (*Look to Protect*). The government increased program enforcement as well as its advertising in public media. A political organization with close ties to the President, "La Campora", developed a web and mobile phone app that allowed "militants" to help monitor and enforce the price controls. Several store locations were temporarily closed or fined due to shortages.[15]

In December 2013, amid significant changes in cabinet,[16] the government announced a new stage of price controls called "Precios Cuidados" (*Protected Prices*). Launched in January 2014, it drastically reduced the product list to 100 different goods (194 varieties in total) that were by then common in all major retailers. In an attempt to facilitate the diffusion

[13]See www.inflacionverdadera.com.

[14]Bloomberg: http://bloom.bg/1xujXRj.

[15]See Clarin (http://clar.in/2rQkLlp) and the Wall Street Journal (http://on.wsj.com/13Raffy). Figure 9 in the Appendix shows how the government increased the intensity of the price controls starting in 2013, relative to the first stage of targeted controls. The number of distinct retailer categories (URLs) that had controlled goods on a monthly basis significantly increased. A similar pattern is obtained when using distinct goods instead of categories, and when changing the time window. For example, in July 2013, the retailer had at least one controlled-good in 50 distinct categories. As shown in Section 4.2, the ups and downs of price controls intensity are not related to data-scraping problems.

[16]Several high-ranking government officials left around that time, including the Secretary of Commerce, the Minister of Economy, and the Central Bank President. See La Nacion: http://bit.ly/2cP1Mnf.

of price lists, the new program started with fewer categories and varieties that steadily increased over time. *Protected Prices* also required producers to inform the government of new product introductions that resembled those under controls. This clause was added amid criticism that, in previous controls, firms launched similar products or varieties to circumvent maximum prices.[17] We discuss evidence of that strategy in Section 5.2.

The government also increased the firms' costs of violating the agreements and implemented tighter and more sophisticated monitoring strategies.[18] The government developed a website with all product lists and prices, and made the information accessible with a mobile phone app that allowed consumers to scan product barcodes and report stockouts or incorrect prices. Militant groups close to the government posted pictures of CEOs and owners of supermarket chains in the streets and encouraged people to help monitor prices. These strategies were extensively advertised in public media, including radio, television, newspapers, and official press releases.[19] [20]

As of the time of writing, *Protected Prices* remains active and updated on a quarterly basis, with new products and new maximum prices.[21] This is consistent with price controls sometimes being very popular and politically convenient, e.g. during the 1970s in the Unites States (Nixon (1978), Blinder (1979)) and in Sweden (Jonung (1990)).

[17] See La Nacion: http://bit.ly/1wSlVFS.

[18] The government controlled for stockouts, wrong labeling, incorrect prices, incorrect product weight. The agreements also stipulated that retailers should not limit purchases of controlled goods per household. Companies and supermarket chains could be subject to temporary store closures and large monetary fines. For evidence on retailers receiving fines see: La Nacion (http://bit.ly/1k9seGZ, http://bit.ly/2rpz1oL), Telam (http://bit.ly/1nHbTpk), Buenos Aires Herald (http://bit.ly/2DsaqnH).

[19] See La Nacion: http://bit.ly/1m3Ub0b; Fortuna: http://bit.ly/1uokRLq.

[20] The Israeli government has also faced challenges to enforce targeted price controls. See http://bit.ly/2w3GEzD.

[21] The product list can be found at http://precioscuidados.gob.ar. Opposition leader President Mauricio Macri, who took office after former President Cristina Fernandez de Kirchner in December 2015, broadened the program's scope. Telam: http://bit.ly/1Y9e096, http://bit.ly/2c4sHcn.

3 Scraped online prices

We use online prices from thousands of products sold online each day from 2007 to 2015 by one of the largest retailers in Argentina in terms of market share.[22] The data were scraped off the internet by the Billion Prices Project (BPP), an academic initiative at the Massachusetts Institute of Technology that collects online prices from hundreds of retailers around the world.[23] See Cavallo (2016) for a detailed overview of scraped online prices. The data and scripts to reproduce the results in this paper will be publicly available at http://www.thebillionpricesproject.com.

The scraping software is designed to search the HyperText Markup Language (HTML) public code of a retailer's website and to automatically store the pricing data of all goods on a daily basis. In the occasional days when the scraping fails (e.g., a webpage is temporarily broken), then prices are assumed constant until they are back online. The retailer assigns a unique ID to each product sold online.

We identified price-controlled goods in two ways. First, from 2007 to 2015, the scraping algorithm read a special HTML (ID-specific) tag next to each controlled good sold online. This method accounts for about 75% of the controlled goods in our database. Second, after the government started publishing lists of controlled goods in 2013, we manually identified each these goods in our database.

3.1 Data description

Table 2 provides summary statistics of the data coverage. We have daily prices for more than 50,000 distinct products from 2007 to 2015, and a yearly average of about 14,000 distinct goods. The supermarket scraped data covers categories such as food, beverages, electronics, household appliances, kitchen utensils, and health and personal care items, which collectively account for about 45% of the CPI weights.

[22] The same retailer is also used in Cavallo (2012) and Cavallo (2016).
[23] See http://bpp.mit.edu and Cavallo and Rigobon (2016).

Table 2: Summary Statistics

		All Goods	Non-Controlled	Controlled Goods
(i)	Time period	October 2007 to May 2015	October 2007 to May 2015	October 2007 to May 2015
(ii)	Observations (with price)	15,796,787	15,139,656	657,131
(iii)	Distinct goods	51,779	50,319	1,460
(iv)	Distinct brands	3,518	3,466	438
(vi)	Retailer's categories[a]	964	963	302
(vi)	CPI categories	75	75	54
(vii)	Total CPI weight	44.6	44.6	39.7
(viii)	Average CPI weight per category	0.859	0.802	0.923
(ix)	Average CPI weight per product	0.860	0.853	1.094
(x)	Average CPI weight per product[b]	0.001	0.001	0.034
(xi)	Median control time	-	-	75 days
(xii)	Median control events[c]	-	-	2 times
(xiii)	Percent of time under control[d]	-	-	23%
(xiv)	First control at higher price[e]	-	-	6%
(xv)	First control at lower price	-	-	32%
(xvi)	First control at same price	-	-	51%
(xvii)	Average price change at control[f]	-	-	-3.3%

Notes: [a] Website retail categories (e.g. dairy), which are broader than URL-based retail sub-categories (e.g. yogurt). [b]Weighted by number of products in each category (e.g., if a category weights 3 and there are 10 products, then each product's weight is 0.3), then averaged across all goods. [c]Number of (non-consecutive) times a product received price controls, and then median across controlled goods. [d]Calculated using non-missing observations (in stock for sale). [f]Fraction of controlled goods whose first control was set at a higher price, relative to its last available price without controls. Similarly for (xv) and (xvi). The remaining fraction are new items and have no price change available. [e]Based on the average price ten days before and after the first control.

We label products as controlled if they had a price control at least one day during the scraping period. This results in 1,460 controlled goods, which is about 3% of the total products in the database. Although a relatively small set, these goods have a significantly higher weight in the CPI basket, as seen in Table 2.[24]

[24]In Appendix A.1 we expand on some of the key determinants of price controls, and find that for a unit increase in the CPI weight (i.e. 1 percentage point) the odds of a control increase by 24%. Price controls are less likely in less concentrated or homogeneous markets, as approximated with the number of brands, products,

On average, goods were controlled for six months, with a median of two and a half months. About 25% of the controlled goods had price controls lasting more than 7 months. If a product price was controlled more than once, there were usually no gaps in between. Controlled goods were under price controls about 22% of the time. And a stable subset of items consistently remained under price controls throughout the scraping period.[25] Price controls were generally imposed at the existing price level, but in about a third of the cases, the new price was set lower. On average, the price change was -3.3%.

4 Aggregate impact of price controls

In this section we study the impact on inflation and product availability.

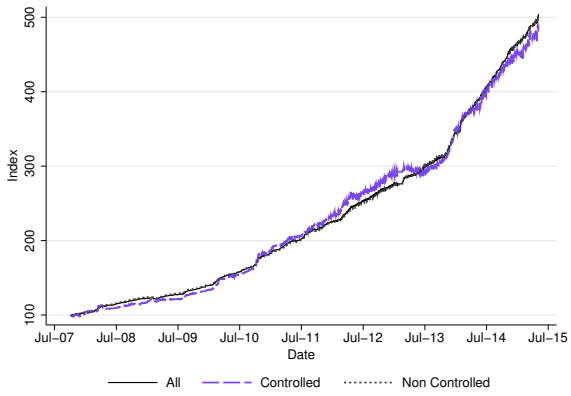
4.1 Aggregate inflation

We first construct a price index using a weighted arithmetic average of category indices. Each category index is a Jevons geometric average of all products sold online. If an item is out of stock we assume constant prices. And if an item is discontinued, then it no longer impacts the index. Products that are out-of-stock are momentarily unavailable for online purchase, while discontinued products were no longer offered online until the end of our scraping period. Price changes are weighed using Argentina's National Statistics Office (INDEC) official weights by CPI category. See Cavallo (2012) and Aparicio and Bertolotto (2016) for evidence that these type of online price indices can closely track and forecast official CPIs.

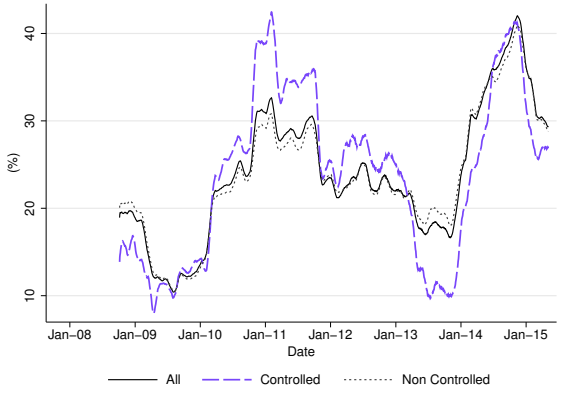
Figure 2 shows the price indices and the annual and monthly inflation rates based on a 30-day moving average. We report results on three samples: all goods, controlled goods, and non-controlled goods.

and varieties within the URL-category (i.e. narrow sub-categories). These findings are consistent with the predictions in Cox (1980), who describes the policymakers' problem as maximizing the impact on the price index while reducing enforcement or deadweight costs.

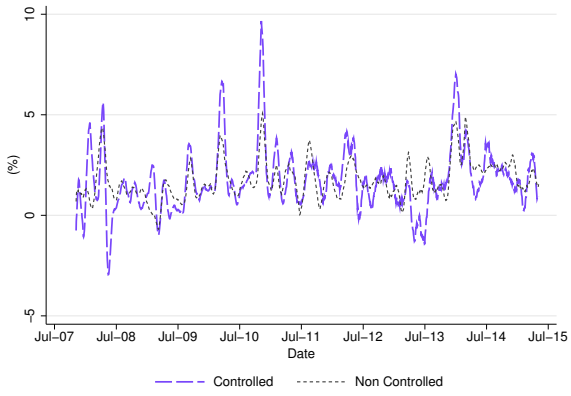
[25]For visual evidence on the duration of price controls, see the histogram in Figure 10 in the Appendix.



(a) Price Index



(b) Annual Inflation Rate



(c) Monthly Inflation Rate

Figure 2: Price Index and Inflation Rates for Different Samples

Notes: The price index is calculated using official weights by CPI categories and unweighted geometric averages of price changes for subcategories without official weights. The annual and monthly inflation rates are computed using a 30-day moving average of the price index.

The price index shows that the impact of price controls on aggregate inflation was small and temporary. From 2007 to 2015, all price indices had recorded about 400% accumulated inflation. There are periods when the inflation rate of controlled goods appears significantly different than that of non-controlled varieties, as shown in the volatility of the monthly inflation rate in panel (c). These periods are associated with weak or strong periods of price agreements, but the difference was never large enough to have a significant impact on the aggregate inflation rate for all items, as shown in panel (b). However, because we do not have weights for individual goods within subcategories, it is possible that the government chose specific varieties based on their perception as "leading brands". But regardless of the magnitude, the impact was temporary. Periods of low inflation in controlled goods were quickly followed by higher inflation for those same goods. For example, controlled goods had lower inflation until 2009 then much higher inflation in 2010 and 2011.

4.1.1 Effect on non-controlled goods

To determine if firms increased the price of related goods after price controls were imposed, we split the sample of non-controlled goods into two parts: "related" and "unrelated". Related non-controlled goods are sold in subcategories that have goods under price controls at the same time. One example of such subcategory could be 'cereals'. Unrelated non-controlled goods are sold in subcategories that had no price controls at all.

The related sample is constructed as follows. Each time an item is controlled for the first time, we randomly select another product from the same subcategory such that (i) is in stock that day, (ii) that is not controlled during the scraping period, and (iii) that has not already been selected as related to another good (i.e. we draw without replacement). The unrelated sample is constructed in a similar way but from non-controlled categories. The controlled, related, and unrelated samples comprise 1,460, 1,321, and 1,400 distinct items, respectively.

For each good, we keep prices for 90 days before and after it received the first price

control.[26] This method produces a balanced panel for each sample (except for some censored observations in some price spells for discontinued goods). We then compute the 30-day rolling inflation at the good-level and average it across goods each day. This generates an approximation of the average monthly inflation, shown in Figure 3 for a 90-day window around the day the control is first introduced.

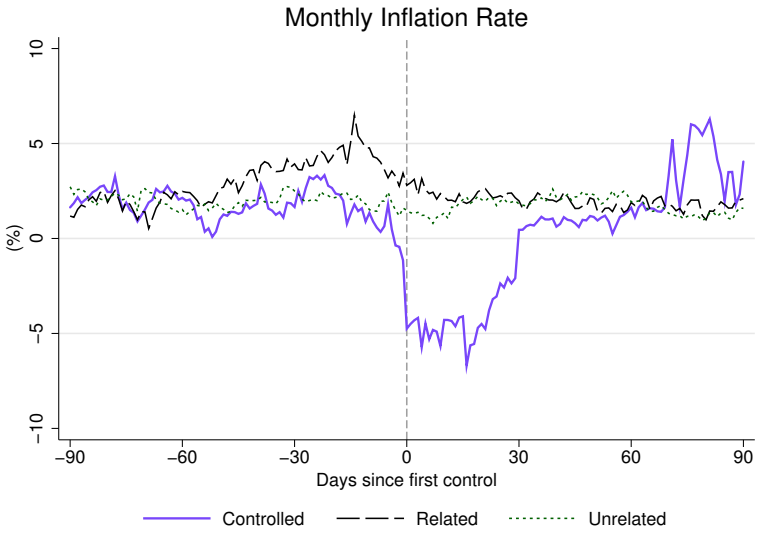


Figure 3: 90-day window before and after the first price control

This figure highlights three findings. First, consistent with the previous discussion, there were temporary effects on controlled-goods prices. The monthly inflation rate falls to -5% immediately after the control is imposed, and 30 days later the monthly inflation is close to 0% (indicating that prices remain fixed). However after two months, the inflation rate rises to +5%, compensating for previous declines.

Second, non-controlled goods in related categories do not have higher inflation rates after the control. Their behavior is similar to that of non-controlled goods in unrelated categories, suggesting that firms were not compensating for the controls by increasing prices of related goods. In some cases, the government explicitly monitored the behavior of related goods, which likely limited firms' ability to compensate through the prices of existing

[26] We focus on the first event to avoid picking up behaviors that are connected to previous controls, but the results are similar if we make no distinctions for repeated controls.

varieties.

Third, a surprising result is that related goods have higher inflation *before* the controls are imposed. Their prices start to rise faster 60 days before the control, and the inflation difference peaks 15 days before the control is imposed. Goods that will later be under a price control, and those in unrelated categories, do not experience similar price increases. One possible explanation is that firms increased prices of some varieties to make potential candidates for a price control appear relatively cheap already. Overpricing varieties that were less likely to be under a price control could be a strategy to negotiate a higher price ceiling on the cheap variety.[27]

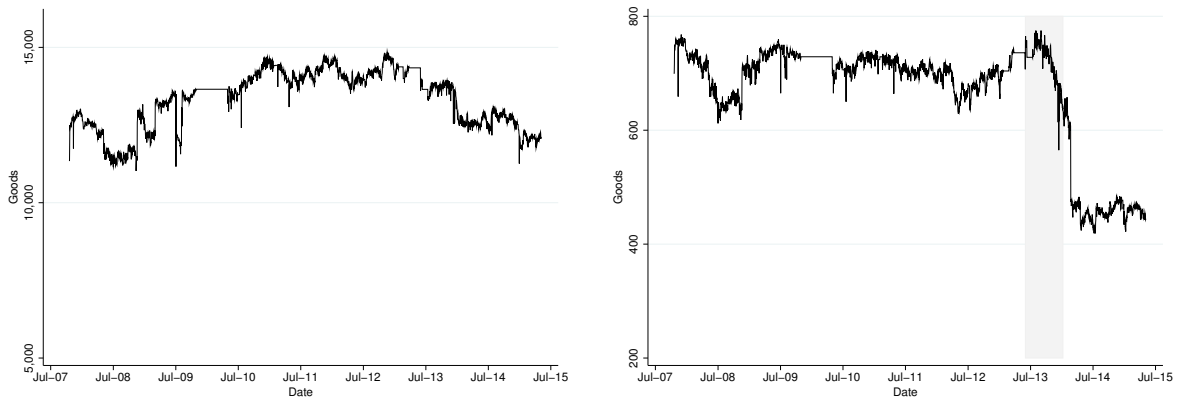
In summary, price controls on specific goods did not seem to have a downward effect on the inflation rate of related goods in the same categories. This applies to goods that were being sold at the time of the price control. In Section 5.2 we explore whether targeted price controls affected the price of new varieties introduced after a price control takes place.

4.2 Product availability

Price controls are typically expected to produce shortages. But can better monitoring tools prevent them? In order to answer this we compute a measure of "product availability", defined as the number of items available for sale online on a given day.[28] Panel (a) in Figure 4 shows that the retailer sold over 13,000 products per day, of which about 700 were controlled-goods. The flat line between late 2009 and early 2010 is due to partial scraping failures.

[27] See also Blinder (1979) on related overpricing strategies during price controls in the Unites States.

[28] Cavallo (2016) shows that in Argentina, close to 100% of the goods found offline are also available online and have similar prices.



(a) All Goods

(b) Controlled Goods

Figure 4: Product Availability

The availability of controlled goods was surprisingly stable over time, at around 700 items per day. Although newspapers claimed that price controls produced major stockouts, we found no such evidence in our data. We also simulated online purchases on several occasions and found no shipping delays nor limits on the number of units that could be purchased.[29]

The only major drop in availability occurred when the government imposed a total price freeze (shaded region). About 100 goods were discontinued during that period, and another 200 disappeared when controls ended. Once the programs became targeted again, in Stage 3, the availability of controlled goods stabilized, though at a much lower level.[30]

4.3 Temporary stockouts

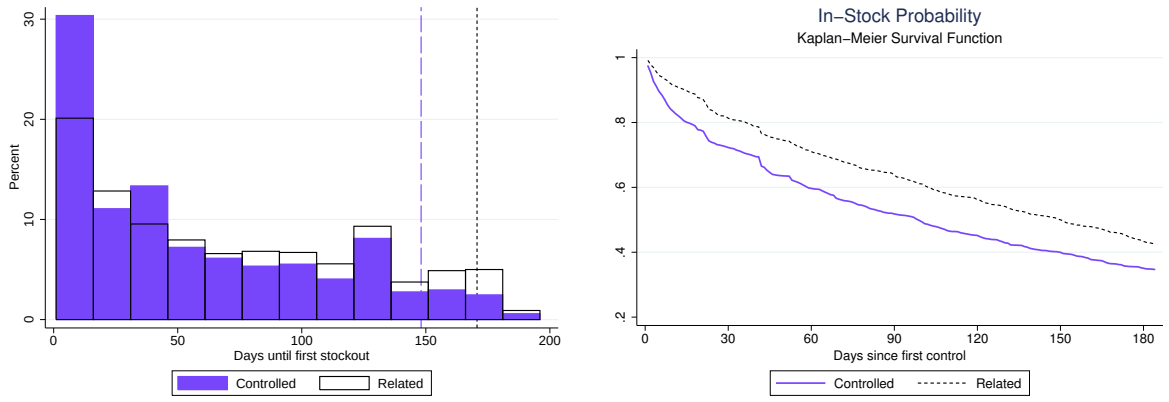
Even if the government can prevent retailers from discontinuing goods, we expect controlled goods to experience more frequent stockouts. In this section, we use survival analysis to study the risk of stockouts across samples.

[29] A potential explanation is that price ceilings were being set above the intersection of demand and marginal cost curves in non-competitive industries (Darby (1976b), Helpman (1988)), so profits margins could be smaller but still positive.

[30] These discontinuities explain why availability did not recover. In Figure 13 in the Appendix we plot product introductions and discontinuities over time, and show that these were more pervasive when the government increased the intensity of price controls.

The onset of risk, or t_0, is defined as the day each good received its first price control during the scraping period from 2007 to 2015. The end date, or failure event, is the day of the first stockout after the control is imposed. If the scraping package fails, no price observations are recorded for that date. We control for these cases and for right-censored observations (i.e., controlled goods that did not go out of stock by the end of the scraping period).

Panel (a) in Figure 5 shows a histogram of the number of days until the first stockout, that is for each good we compute the number of days between t_0 and the failure event. We find that controlled goods do experience a relatively faster stockout: one and a half months after the first price control more than 50% of the goods have gone out of stock, compared to 40% in the related non-controlled varieties. Vertical lines depict average days for each sample.



(a) Days Until the First Stockout

(b) Probability of Being In-Stock

Figure 5: Stockout behavior

Notes: Histogram computed for less than six months for better visualization. Average days until first stockout in vertical lines. The survival function is computed for all months, but axis is also restricted to six months.

We also estimate the survival function $S(t)$, defined as the survival probability (or in-stock probability) past time t, i.e. the probability of failing after t, for both controlled and

related goods. We use the non-parametric algorithm from Kaplan and Meier (1958):

$$\hat{S}(t) = \prod_{j|t_j \leq t} \left(\frac{n_j - d_j}{n_n} \right)$$

Where n_j is the number of goods at time t_j and d_j is the number of stock-out events at time t_j, and where the product is computed over all observed failure times until time t.

Panel (b) in Figure 5 shows the estimated survival function for both controlled and related goods.[31] Although survival functions exhibit similar shapes, the probability of being in stock is about 15% higher for (related) non-controlled goods a month after controls were imposed.

5 How do firms respond to price controls?

The previous sections show that targeted controls in Argentina, while do not significantly affect the aggregate inflation rate, they do force some firms to sell goods at lower prices and keep them in stock most of the time. So how do firms cope with price controls?[32] Although we find no evidence that firms increased prices of existing goods, we find that firms introduced new varieties at higher prices, which in turn increased price dispersion within controlled categories. We first motivate the effect of targeted price controls on firms' pricing behavior with a simple vertical differentiation model, and then discuss the empirical evidence.

[31] Results remain robust to alternative functions, such as the non-parametric Nelson–Aalen cumulative hazard function (Kaplan and Meier (1958)).

[32] Some firms actually benefited from the price agreements by gaining market share. In principle, these price agreements provided advertising and facilitated product distribution to major retailers throughout the country. For example, an Argentine firm producer of vinegar, mayonnaise, and other dressings, reported that 27% of its 2014 sales could be attributed to the *Protected Prices* program, and that these products exhibited a 28% increase in gross sales. Participating in the price agreements allowed the firm to access new retailers and supermarket chains in segments that were previously restricted to major brands. See Telam: http://bit.ly/1GTMC4q, Clarin: http://clar.in/1NgLtrH, http://clar.in/1T1ldFY; La Nacion: http://bit.ly/1Kzq2P6.

5.1 A simple model of price controls

We assume consumers have unit demands per unit of time and preferences separable in quality and price (i.e. no income effects).[33] The indirect utility from consuming good i is given by

$$U(\theta, s) = \theta s_i - p_i \tag{1}$$

And zero if no good is purchased. Where s and θ stand for quality level and willingness-to-pay for quality. Consumers have heterogenous tastes over quality. We assume θ is uniformly distributed over the interval $[\underline{\theta}, \bar{\theta}]$ and a density of 1. For simplicity we report results for $\underline{\theta} = 0$ and $\bar{\theta} = 1$.

Although the monopolist cannot observe θ and perfectly discriminate, she can supply combinations of quality and price given the distribution of tastes and the market size.[34] We assume the monopolist supplies one good, and faces a fixed cost f_i per good and variable quadratic costs of quality improvement $C(s)$, with $C'(s) > 0$ and $C''(s) > 0$. We further assume the standard form $C(s) = \alpha s^2$, and that costs are independent of the quantity supplied.

The firm's problem can be described as a two-stage game: the monopolist chooses quality in the first stage and prices in the second. This sequence of decisions makes sense in our micro context. Once the retailer introduces good i, a salient quality attribute s is presumably fixed throughout the life of a good, whereas the price can more easily be updated. The Appendix discussed the case when quality is flexible.

In the absence of price controls, the optimal monopolist quality and price are $s^m = \frac{1}{3\alpha}$ and $p^m = \frac{2}{9\alpha}$.[35] Relative to a social planner who maximizes aggregate surplus, the monopolist supplies the same quality but serves half the market. Specifically, the social planner chooses

[33] Vertical differentiation models have become a standard framework in industrial organization since Mussa and Rosen (1978), Gabszewicz and Thisse (1979), Shaked and Sutton (1982), and Tirole (1988). See also Moorthy (1988), Motta (1993), and Cheng and Peng (2014).

[34] Note that θ can be reinterpreted as the inverse of the marginal rate of substitution between income and quality (Tirole (1988)). Therefore the above preferences can reflect consumers with identical tastes but heterogenous income (a higher θ denotes a lower marginal utility of income).

[35] See proof in Appendix A.5.1.

$p^{sp} = \frac{1}{9\alpha}$ and thus $\hat{\theta}^{sp} = 1/3$, while $\hat{\theta}^{m} = 2/3$.

Now imagine that, with the intention of reducing prices to increase the pool of consumers for an essential good, the government imposes a binding price ceiling $\bar{p} = \tau p^m$, with $0 < \tau < 1$. We assume that firms are subject to capacity constraints. In other words, if $\bar{p}$ is set too low, the firm cannot possibly serve the entire demand. We thus let $D(s^m, \bar{p}) < \tilde{D} = D(s^m, p^m)\gamma$, with $\gamma > 1$, be an upper bound to what the firm can serve. To offset its impact, a firm could readjust quality or introduce a new good. These results are explained in the following Remarks.

Remark 1. *If price $\bar{p} < p^m$ is fixed but quality s is flexible, the monopolist downgrades quality regardless of the cost of quality improvement α.*

Proof. See Appendix A.5.2. □

Remark 2. *The monopolist benefits from introducing a new, higher price-quality variety. A new good also deters a rival firm from entering the market to steal excess demand.*

Proof. See Appendix A.5.3. □

The monopolist can reduce the price-ceiling burden by introducing a new and more expensive variety. This strategy results in higher profits relative to a wait-and-see attitude (continue to sell one good), and it prevents a rival firm from entering and exploiting a distorted product line. Let $\bar{p}_L$, s_L, and θ_L stand for the incumbent's price, quality, and marginal consumer for the (original) low-quality good. Then an entrant could introduce a better-quality good, H, and set p_H and s_H such that $\theta_H = \theta_L$, and steal the entire market. Where $\theta_H = \frac{\Delta p}{\Delta s}$ and $\theta_L = \frac{p_L}{s_L}$. Recall that $p_H > p_L = \bar{p}$ is possible, because price ceilings affect a subset of goods.[36]

[36]The monopolist would prefer to discontinue the controlled good and introduce a similar variety. Alternatively, she could introduce a second good and, once controls are removed, discontinue the controlled good. We abstract from dynamic considerations but note that a richer model might consider strategic responses that depend on the expected duration of price controls and the probability of getting caught cheating. The Appendix discusses extensions to this model.

Depending on the price ceiling, capacity constraint, and cost asymmetries between firms, the monopolist would in general be in a better position to crowd the product line, relative to an entrant that needs to position a new product. Moreover, that a monopolist may attenuate the impact of price controls through new products can be related to an extensive literature on brand proliferation and entry deterrence.[37]

Figure 6: Marginal consumers

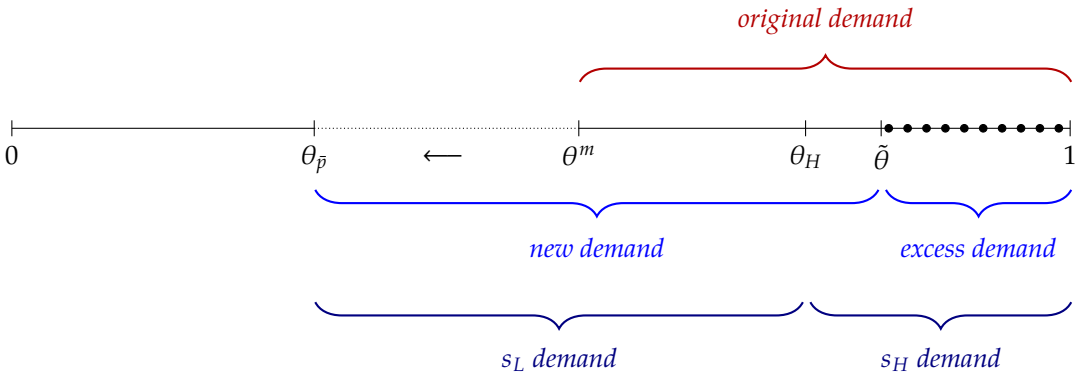


Figure 6 illustrates the main intuitions from the model. Initially, the firm sells a single good at price p^m, and demand is $1 - \theta^m$. A price ceiling $\bar{p} < p^m$ lowers the marginal consumer for the (original) low-priced s_L good from θ^m to $\theta_{\bar{p}}$. A sufficiently low price ceiling binds the capacity constraint and generates excess demand $(1 - \tilde{\theta})$ for the controlled good. To deter entry and benefit from the high willingness-to-pay consumers, the monopolist is incentivized to segment the market with a new and more expensive good s_H. This increases price dispersion within controlled categories. Introducing a new good is Subgame Perfect Nash Equilibrium (SPNE): it is only after the price control that the firm is better off supplying a second good. Moreover, that price controls can increase market share is consistent with anecdotical evidence reported in the news.[38]

[37] See Caves and Porter (1977), Schmalensee (1982), and Urban, Carter, Gaskin, and Mucha (1986) on the advantages of pioneering brands, and Lutz (1997) on the monopolist's ability to deter (or accommodate) entry under vertical differentiation. See Hay (1976), Prescott and Visscher (1977), Schmalensee (1978), Bonanno (1987), Shaked and Sutton (1990), Gilbert and Matutes (1993) on brand proliferation.

[38] See footnote 32 for an example describing how price controls provide free advertising and facilitate access to new markets. We assume consumers are perfectly informed about the attributes of the good; however, one might also think of advertising as a new margin to attract consumers under product differentiation (Grossman and Shapiro (1984)). See the Appendix for additional discussions.

5.2 Evidence from firms' behavior

For targeted price controls, an effective strategy might be to introduce new varieties at higher prices.[39] For example, in January 2014, the government controlled the popular kids' dessert *Chocolate Vanilla Shimy* and *Dulce de Leche Vanilla Shimy*. Several days after the first control, the firm introduced the new variety *Vanilla Chocolate Shimy* at a 50% higher price. In June 2013, Royal's *Dulce de Leche, 65 grams* cake powder was controlled; the same week Royal introduced *Light Dulce de Leche, 40 grams* at a -24% lower price (but bulk-adjusted represented a 23% increase). Examples like these are numerous and easy to find.

Traditional matched-model price indices, such as those used in Section 4.1, are unable to capture the impact of new varieties. The reason is that they are based on the price changes of goods that are present in two time periods. The prices at introduction of new product varieties are therefore ignored and do not affect the price index.

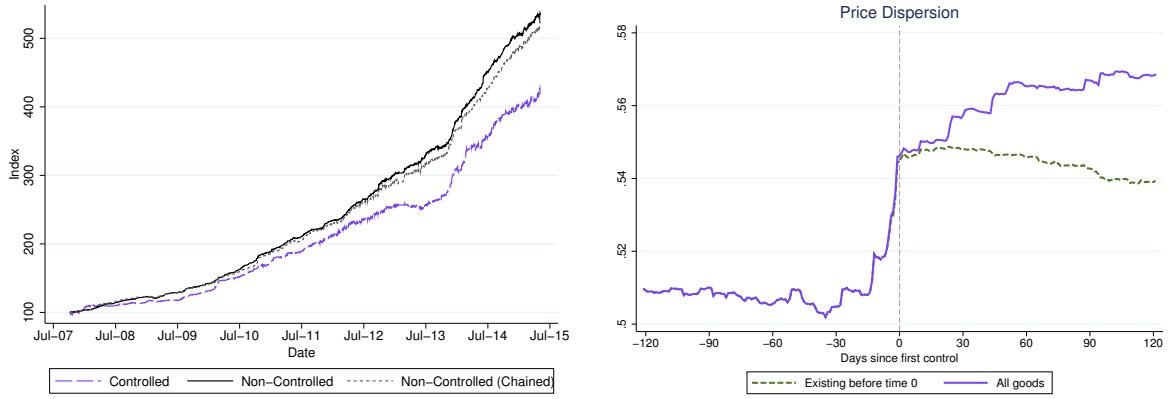
A simple way of detecting the introduction of higher priced varieties is by constructing *average-price* indices, which are based on average prices for all varieties sold each day in a narrowly defined category.[40] To measure the impact of new and exiting varieties, we first compute average-price indices for both controlled and non-controlled goods in the same subcategories, and then build aggregate price indices using official CPI category weights. Our data are well suited for this analysis, because the web-scraping package adds goods to our sample on the first day that they appear on the store.

As Figure 7 panel (a) shows, the inflation rate for non-controlled goods is higher once we account for the price levels of new varieties at the time of introduction. The average-price index has more inflation than the corresponding matched-model (chained) index that uses only prices changes, and significantly more inflation than the average-price index for controlled goods. We also find that the average price index for controlled goods is lower than its corresponding chained index (shown in Figure 2), widening the gap in inflation with

[39] See Bourne (1919), Darby (1976a), Jonung (1990), Rockoff (2004) for other references in the literature.

[40] Parsing out the product description string into grams and liters amounts per item, we find no evidence that firms systematically reduced package sizes to cope with price controls. However, if they did, the results would be stronger (a smaller size would increase the per-unit price of the new product).

non-controlled goods.



(a) Price index using average prices

(b) 6-month before-and-after first price control

Figure 7: Price Index and Price Dispersion

Notes: In Panel (a), "Controlled" and "Non-Controlled" are average price indices as described in the text; "Non-Controlled (Chained)" is a standard chained or matched-model price index.

We can also detect higher-priced varieties also by looking at price dispersion before and after controls are introduced. This can be seen in Figure 7 panel (b), which plots the price dispersion within subcategories for all goods and the subset of "continuing" goods.[41] In both cases, price dispersion rises a few days before the price control is introduced, but in the sample that includes new varieties (all goods), the dispersion continues to rise after the control is in place.

6 Conclusions

During the past ten years, Argentina has experienced various forms of targeted price controls in which the government set price ceilings for specific supermarket goods. We use web-

[41]We compute price dispersion as the coefficient of variation, i.e. standard deviation of prices over average prices, per week and URL. We then averaged these URL-level time series for each week, 6 months before and after the first control. Panel (b) in Figure 7 shows that price dispersion increases by around 12% during the first weeks post-control. Furthermore, the dispersion is primarily driven by new goods following price ceilings and does not revert to its initial levels. See Appendix A.2 for further discussion on price dispersion, including similar results using monthly-URL regressions. See also Table 7 and Figures 13 and 14 in the Appendix for evidence on the introduction of non-controlled varieties in controlled URLs. We find that after price controls were introduced, the number of non-controlled varieties increased over 15%.

scraping technologies to collect online prices from one of the largest retailers in the country and construct a detailed micro panel dataset with more than 50,000 goods, which we use to evaluate the impact of price controls.

We show that, although price controls targeted goods with high CPI weight, they had minor and temporary effects on inflation. Price controls were binding, both in price and availability, but we find evidence that firms introduced new varieties at higher prices to compensate for reduced profit margins. This increased price dispersion within narrow categories of controlled goods.

Our results suggest that new technologies, such as the Internet and mobile phones, may allow governments to better enforce targeted price controls programs. Still, this does not make price controls an effective policy to reduce aggregate inflation, because the effects are short-lived and do not spill over to non-controlled goods. Furthermore, firms adjust to targeted price controls by using strategies that may obfuscate consumer options and increase price dispersion.

Future research should weigh the temporary income effects from price ceilings against the welfare losses associated with search frictions from price transparency and price dispersion, administrative enforcement costs, and investments in the retail industry.

References

Alvarez, F., M. Gonzalez-Rozada, A. Neumeyer, and M. Beraja (2016): "From hyperinflation to stable prices: Argentina's evidence on menu cost models," *University of Chicago, Working Paper*.

Aparicio, D., and M. I. Bertolotto (2016): "Forecasting inflation with online prices," *MIT Working Paper*.

Ater, I., and O. Rigbi (2017): "The effects of mandatory disclosure of supermarket prices," *Working Paper*.

Benabou, R. (1992): "Inflation and efficiency in search markets," *The Review of Economic Studies*, 59(2), 299–329.

Besanko, D., S. Donnenfeld, and L. J. White (1987): "Monopoly and quality distortion: effects and remedies," *The Quarterly Journal of Economics*, pp. 743–768.

——— (1988): "The multiproduct firm, quality choice, and regulation," *The Journal of Industrial Economics*, pp. 411–429.

Blinder, A. S. (1979): *Economic policy and the great stagflation*. New York: Academic Press.

Blinder, A. S., and W. J. Newton (1981): "The 1971–1974 controls program and the price level: An econometric post-mortem," *Journal of Monetary Economics*, 8(1), 1–23.

Bonanno, G. (1987): "Location choice, product proliferation and entry deterrence," *The Review of Economic Studies*, 54(1), 37–45.

Bordalo, P., N. Gennaioli, and A. Shleifer (2013): "Salience and Consumer Choice," *Journal of Political Economy*, 121(5), 803–843.

Bourne, H. E. (1919): "Food Control and Price-Fixing in Revolutionary France: II," *The Journal of Political Economy*, pp. 188–209.

Brynjolfsson, E., and M. D. Smith (2000): "Frictionless commerce? A comparison of Internet and conventional retailers," *Management science*, 46(4), 563–585.

Burstein, A., and C. Hellwig (2008): "Welfare costs of inflation in a menu cost model," *The American Economic Review*, 98(2), 438–443.

Cavallo, A. (2012): "Online and official price indexes: measuring Argentina's inflation," *Journal of Monetary Economics*, 60(2), 152–165.

Cavallo, A. (2016): "Scraped data and sticky prices," *Review of Economics and Statistics, forthcoming*.

——— (2017): "Are Online and Offline Prices Similar? Evidence from Large Multi-Channel Retailers," *The American Economic Review*, 107(1), 283–303.

Cavallo, A., and R. Rigobon (2016): "The Billion Prices Project: Using online prices for measurement and research," *The Journal of Economic Perspectives*, 30(2), 151–178.

Caves, R. E., and M. E. Porter (1977): "From entry barriers to mobility barriers: Conjectural decisions and contrived deterrence to new competition*," *The quarterly journal of economics*, pp. 241–261.

Champsaur, P., and J.-C. Rochet (1989): "Multiproduct duopolists," *Econometrica: Journal of the Econometric Society*, pp. 533–557.

Cheng, Y.-L., and S.-K. Peng (2014): "Price competition and quality differentiation with multiproduct firms," *Journal of Economics*, 112(3), 207–223.

Cox, C. C. (1980): "The enforcement of public price controls," *The Journal of Political Economy*, pp. 887–916.

Cukierman, A., and L. Leiderman (1984): "Price controls and the variability of relative prices," *Journal of Money, Credit and Banking*, 16(3), 271–284.

Darby, M. R. (1976a): "The US Economic Stabilization Program of 1971–1974," *The Illusion of Wage and Price Control, Vancouver: Fraser Institute*.

Darby, M. R. (1976b): "Price and wage controls: The first two years," *Carnegie-Rochester Conference Series on Public Policy*, 2, 235–263.

Drenik, A., and D. Perez (2016): "Price Setting Under Uncertainty About Inflation," *Stanford Working Paper, SSRN 2434171*.

Edelman, B. (2012): "Using internet data for economic research," *The Journal of Economic Perspectives*, 26(2), 189–206.

Ellison, G., and S. F. Ellison (2009): "Search, obfuscation, and price elasticities on the internet," *Econometrica*, 77(2), 427–452.

Ellison, G., and S. Fisher Ellison (2005): "Lessons about Markets from the Internet," *The Journal of Economic Perspectives*, 19(2), 139–158.

Fershtman, C., and A. Fishman (1994): "The ?perverse? effects of wage and price controls in search markets," *European Economic Review*, 38(5), 1099–1112.

FIEL (1990): *Control de Precios e Inflacion: La Experiencia Argentina Reciente*. Ediciones Manantial.

Friedman, M. (1966): "What price guideposts?," in Shultz and Aliber (1966), pp. 17–39.

——— (1974): "Inflation, taxation, indexation," in *Inflation: Causes, Consequences, Cures*, pp. 71–81. London: Institute for Economic Affairs.

Gabszewicz, J. J., and J.-F. Thisse (1979): "Price competition, quality and income disparities," *Journal of economic theory*, 20(3), 340–359.

Galbraith, J. K. (1952): *A Theory of Price Control*. Harvard University Press.

Gilbert, R. J., and C. Matutes (1993): "Product line rivalry with brand differentiation," *The Journal of Industrial Economics*, pp. 223–240.

Gordon, R. J. (1973): "The response of wages and prices to the first two years of controls," *Brookings Papers on Economic Activity*, 1973(3), 765–779.

——— (1975): "The impact of aggregate demand on prices," *Brookings Papers on Economic Activity*, 1975(3), 613–670.

——— (1977): "Can the Inflation of the 1970s be Explained?," *Brookings Papers on Economic Activity*, 1977(1), 253–279.

Gorodnichenko, Y., and O. Talavera (2014): "Price setting in online markets: Basic facts, international comparisons, and cross-border integration," .

Grossman, G. M., and C. Shapiro (1984): "Informative advertising with differentiated products," *The Review of Economic Studies*, 51(1), 63–81.

Hay, D. A. (1976): "Sequential entry and entry-deterring strategies in spatial competition," *Oxford Economic Papers*, 28(2), 240–257.

Helpman, E. (1988): "Macroeconomic Effects of Price Controls: The Role of Market Structure," *Economic Journal*, 98(391), 340–54.

Jonung, L. (1990): *The political economy of price controls: the Swedish experience 1970-1987*. Gower Pub Co.

Kaplan, E., and P. Meier (1958): "Nonparametric Estimation from Incomplete Observations," *Journal of the American Statistical Association*, 53(282), 457–481.

Kyle, M. K. (2007): "Pharmaceutical price controls and entry strategies," *The Review of Economics and Statistics*, 89(1), 88–99.

Laffont, J.-J., and J. Tirole (1993): *A theory of incentives in procurement and regulation*. MIT Press.

Lal, R., and C. Matutes (1994): "Retail pricing and advertising strategies," *Journal of Business*, pp. 345–370.

Leffler, K. B. (1982): "Ambiguous changes in product quality," *The American Economic Review*, 72(5), 956–967.

Lutz, S. (1997): "Vertical product differentiation and entry deterrence," *Journal of Economics*, 65(1), 79–102.

Malmendier, U., and S. Nagel (2016): "Learning from inflation experiences," *The Quarterly Journal of Economics*, 131(1), 53–87.

McGuire, T. W. (1976): "On estimating the effects of controls," in *Carnegie-Rochester Conference Series on Public Policy*, vol. 2, pp. 115–156. North-Holland.

Moon, C.-G., and J. G. Stotsky (1993): "The effect of rent control on housing quality change: a longitudinal analysis," *Journal of Political Economy*, pp. 1114–1148.

Moorthy, K. S. (1988): "Product and price competition in a duopoly," *Marketing Science*, 7(2), 141–168.

Motta, M. (1993): "Endogenous quality choice: price vs. quantity competition," *The Journal of Industrial Economics*, pp. 113–131.

Mussa, M., and S. Rosen (1978): "Monopoly and product quality," *Journal of Economic theory*, 18(2), 301–317.

Nakamura, E., and J. Steinsson (2013): "Price Rigidity: Microeconomic Evidence and Macroeconomic Implications," *Annual Review of Economics*, 5(1), 133–163.

Nixon, R. M. (1978): "RN: The Memoirs of Richard Nixon," *New York: Grosset & Dunlap*.

Oi, W. Y. (1976): "On measuring the impact of wage-price controls: a critical appraisal," in *Carnegie-Rochester Conference Series on Public Policy*, vol. 2, pp. 7–64. North-Holland.

Prescott, E. C., and M. Visscher (1977): "Sequential location among firms with foresight," *The Bell Journal of Economics*, pp. 378–393.

Rauh, M. T. (2001): "Heterogeneous beliefs, price dispersion, and welfare-improving price controls," *Economic Theory*, 18(3), 577–603.

Raymon, N. (1983): "Price ceilings in competitive markets with variable quality," *Journal of Public Economics*, 22(2), 257–264.

Rockoff, H. (2004): *Drastic measures: A history of wage and price controls in the United States*. Cambridge University Press.

Schmalensee, R. (1978): "Entry deterrence in the ready-to-eat breakfast cereal industry," *The Bell Journal of Economics*, pp. 305–327.

——— (1982): "Product differentiation advantages of pioneering brands," *The American Economic Review*, 72(3), 349–365.

Schultze, C. L. (1975): "Falling profits, rising profit margins, and the full-employment profit rate," *Brookings papers on economic activity*, 1975(2), 449–471.

Shaked, A., and J. Sutton (1982): "Relaxing price competition through product differentiation," *The review of economic studies*, pp. 3–13.

——— (1990): "Multiproduct firms and market structure," *The RAND Journal of Economics*, pp. 45–62.

Shultz, G. P., and R. Z. Aliber (eds.) (1966):. University of Chicago Press Chicago.

Solow, R. M. (1966): "The Case against the Case against the Guideposts," in Shultz and Aliber (1966), pp. 41–54.

Tirole, J. (1988): *The theory of industrial organization*. MIT press.

Urban, G. L., T. Carter, S. Gaskin, and Z. Mucha (1986): "Market share rewards to pioneering brands: An empirical analysis and strategic implications," *Management Science*, 32(6), 645–659.

U.S. Council of Economic Advisers (1973): *Economic Report of the President*. Washington: U.S. Government Printing Office.

Woodford, M. (2003): *Interest and prices: Foundations of a theory of monetary policy*. Princeton university press.

A Appendix

A.1 Determinants of price controls

We expand on some of the key determinants of price controls. In relation to the price-wage control in the United States, Cox (1980) argues that policymakers balance between two forces: control industries with higher weight on the price index, while minimizing enforcement or inefficiency costs. One might expect that the degree of price controls is increasing in: the CPI weight of a given good, elastic demand or inelastic supply, industry concentration, or more homogenous goods. See also Galbraith (1952). The scraping technology applied to the selective program in Argentina offers an attractive setting to test for these determinants.

We formalize the analysis as follows. For each good sold online by the retailer, we manually matched each URL-based category with the official CPI categories from Argentina's NSO. This allows to obtain good-level weights. Industry concentration is approximated by the number of distinct available brands (or products) per URL, and homogenous goods are approximated by the average number of varieties per brand-URL. A good's brand is recognized by parsing out the scraped product description and keeping a string of letters with special font.[42] We then run simple Logit binary regressions of the controlled dummy on a series of covariates.[43]

Table 3 shows the results. $Controlled$ is a dummy variable equal to 1 if the good had a price control; *CPI Weight* is a good's CPI weight, which in our sample ranges from 0.03% to 6%; $Products$, $Brands$, and $Varieties$ are the number of distinct goods, brands, and varieties (in tens) per subcategory.

Coefficients are expressed in terms of the odds ratio. Consider for instance the specifi-

[42]Once we obtain the number of brands (products), varieties, and good-level weights, we collapse the panel data into a cross-section by taking the average over time at the good level. One observation per ID is appropriate in our case since these variables tend to be stable over time. Controlled-goods use only information through the first price control to take into account that the number of varieties or products are affected once firms receive price controls. See Section 5.2.

[43]Results remain very similar under probit or OLS regressions, as well as using pooled category-level data. Table 4 shows the results for the OLS specification.

cation in column (3). For a unit increase in the CPI weight (i.e. 1 percentage point), the odds of a control increase by 24%. The sign is consistent with the statistics in Section 3 showing that controlled-goods have a higher CPI weight relative to the other goods. The estimates also suggest that if the number of products in the URL increase by 10, i.e. a more competitive industry, the odds of a control decrease by over 7%. Price controls are also less likely the more varieties of the good.

Table 3: Determinants of price controls

	(1)	(2)	(3)	(4)	(5)	(6)
Controlled						
CPI Weight	1.232**	1.242**	1.237**	1.222*	1.280**	1.260**
	(0.120)	(0.132)	(0.129)	(0.127)	(0.133)	(0.127)
Products			0.929***			
			(0.0224)			
Brands				0.799***		0.778***
				(0.0639)		(0.0646)
Varieties					0.575***	0.522***
					(0.123)	(0.107)
Observations	38,908	38,908	38,908	38,908	38,908	38,908
Sector FE	NO	YES	YES	YES	YES	YES

Notes: Coefficients from Logit regressions expressed as odds-ratio. Sectors are CPI broad categories. Standard errors clustered at the URL level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Determinants of price controls

Controlled	(1)	(2)	(3)	(4)	(5)	(6)
CPI Weight	0.00725*	0.00876*	0.00764	0.00821*	0.00938*	0.00890*
	(0.00414)	(0.00488)	(0.00498)	(0.00487)	(0.00486)	(0.00485)
Products			-0.00159***			
			(0.000490)			
Brands				-0.00475***		-0.00545***
				(0.00152)		(0.00169)
Varieties					-0.0136***	-0.0167***
					(0.00486)	(0.00499)
Observations	38,908	38,908	38,908	38,908	38,908	38,908
R^2	0.001	0.018	0.020	0.019	0.019	0.020
Sector FE	NO	YES	YES	YES	YES	YES

Notes: Standard errors clustered at the URL level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

A.2 Price Dispersion

It has become part of folk wisdom that price controls can indirectly benefit the inflationary process through inflation expectations.[44] To the extent that price controls are intensely advertised and discussed in the media and in a government's agenda, and affect salient and essential goods, households could potentially adjust their inflation expectations based on individual supermarket purchases (Malmendier and Nagel (2016)).[45]

However, inflation expectations have remained relatively flat even around key price controls announcements (see Figure 12 in the Appendix). The fact that price controls reduce inflation momentarily but its effect weakens soon afterwards might help explain why inflation expectations remain stable over time. Moreover, as discussed in Section 4.1, there is no

[44]See Galbraith (1952), Friedman (1974), Blinder and Newton (1981), Rockoff (2004).

[45]In fact, controlled goods must exhibit a special price tag in the supermarket aisles. These stickers increase the advertising channel, draw further attention to controlled-goods, and potentially enhance price differences. See Bordalo, Gennaioli, and Shleifer (2013).

noticeable effect on non-controlled goods. Perhaps more importantly, price controls increase price dispersion within controlled-categories. A visual average difference-in-differences effect of the initial price control on price dispersion is depicted in Panel (b) in Figure 7.

We identify the first time a price control was applied to any product within each category-URL. Price dispersion or the coefficient of variation, defined as the standard deviation of prices over average prices, is computed per week and URL. We then averaged out these URL-level time series for each week 6 months before and after the first control, and found that price dispersion increases by around 12% during the first weeks post-control. When we distinguish between all goods and those introduced before the event, we find that the divergence is mostly driven by newly introduced goods; price dispersion within pre-existing goods comes down a few weeks later. Furthermore, we find that dispersion increases among the expensive varieties, but not among cheaper ones: the 50-10 percentile ratio is relatively stable, while the 90-10 or 90-50 increases after time 0. This suggests, as we document in Section 5.2, that firms respond to price ceilings through new higher-priced non-controlled goods.

We formalize these findings in a regression framework that quantifies the effect on price dispersion using price controls indicators and a series of covariates. Observations are aggregated to the monthly-URL level (similar estimates are obtained with weekly observations). The estimates in Table 5 can be interpreted as price ceilings raising price dispersion between 8-18%. Although large, these magnitudes are comparable to Drenik and Perez (2016), who study the effect of manipulating inflation information in Argentina, and find that uncertainty about official inflation increased price dispersion in an E-Trade platform.

These results alone are relevant to an extensive literature on the welfare costs from price dispersion, e.g. macro models of sticky prices and staggered price changes, and industrial organization models on consumer search.[46] In this case, we note that higher

[46]See for example Benabou (1992), Woodford (2003), Burstein and Hellwig (2008)), Nakamura and Steinsson (2013), Alvarez, Gonzalez-Rozada, Neumeyer, and Beraja (2016), and many references mentioned therein. See also Ater and Rigbi (2017) for evidence on the positive relationship between price dispersion and price levels in Israel.

price dispersion within existing goods is unambiguously welfare decreasing. And this is exacerbated if competing retailers respond in a similar way. However, price dispersion on newly introduced goods need not be welfare decreasing if these products are, for example, of higher quality and consumers have preferences with "love for variety". Finally, a higher price dispersion also suggests the unsuccessful efforts to reduce aggregate inflation. Even though price controls target leading brands, are intensively advertised, and hence potentially salient to a consumer's shopping experience (Bordalo, Gennaioli, and Shleifer (2013), Malmendier and Nagel (2016)), low-price references can be confounded in a highly inflationary and price dispersed retail industry.

Table 5: Effect of price controls on price dispersion

Coef. Variation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}\{$*Controlled this month*$\}$	0.052***	0.083***	0.083***	0.096***		0.041**	
	(0.018)	(0.019)	(0.019)	(0.020)		(0.019)	
$\mathbb{1}\{$*Controlled before*$\}$					0.101***		0.091***
					(0.020)		(0.022)
π_t			-0.001	-0.002	-0.001	-0.000	-0.000
			(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
$\sigma(\pi_t)$			-0.038***	-0.036***	-0.048***	-0.046***	-0.073***
			(0.011)	(0.012)	(0.012)	(0.013)	(0.015)
$\Delta\, e$			-0.000	-0.000	0.001	-0.001	0.001
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean CV	.468	.468	.468	.468	.468	.492	.492
Observations	68,077	67,771	67,771	67,771	67,771	26,336	26,336
Category FE	NO	YES	YES	NO	YES	YES	YES
Time FE	NO	YES	YES	YES	YES	YES	YES
Sector FE	NO	NO	NO	YES	NO	NO	NO

Notes: Observations are aggregated to the URL-monthly level. We let $\mathbb{1}\{$*Controlled this month*$\}$ and $\mathbb{1}\{$*Controlled before*$\}$ take 1 when a price ceiling affects any good on a certain URL-month, and after a certain URL had any good controlled, respectively. π is the online-measured monthly inflation rate, $\sigma(\pi)$ is the standard deviation of the rolling two-year monthly inflation rate; Δe is the monthly depreciation rate. Categories are CPI sub-categories and sectors are CPI broad categories. Columns (6) and (7) restrict the sample to controlled URLs. Standard errors clustered at the URL level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

A.3 Tables

A.3.1 Summary Statistics By Stage

Table 6: Summary Statistics By Stage

		Isolated Controls	*Look to Protect*	*Protected Prices*
		Stage 1	Stage 3	Stage 4
(i)	Period	Oct 2007 to Feb 2013	June 2013 to Nov 2013	Jan 2014 to May 2015
(ii)	Goods Identified	651	606	409
(iii)	CPI Categories	47	50	48
(iv)	Retailer's Categories	203	205	156
(v)	Average CPI weight per product	1.235	0.953	1.108
(vi)	Total CPI Weight	34.58	37.33	38.02
(vii)	Median Days Controlled[a]	70	218	220
(viii)	Average Days Controlled[a]	261	315	334
(xiv)	Percent of time under controls[b]	20%	15%	26%

Notes: Stage 2 excluded since government aimed to freeze all goods. [a]Controlled time calculated over entire time series since items can be controlled throughout different stages. [b]Calculated over entire time series and including non-missing observations (in stock for sale).

A.3.2 Brand Proliferation

Table 7: Effect of price controls on non-controlled varieties

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Distinct Varieties							
$\mathbb{1}\{$*Controlled this month*$\}$	8.426***	7.360***	3.929***	4.791***		3.843**	
	(1.792)	(1.414)	(0.840)	(0.896)		(1.533)	
$\mathbb{1}\{$*Controlled before*$\}$					13.84***		9.066***
					(1.619)		(1.635)
Mean NC Varieties	19.15	19.15	19.15	19.15	19.15	16.31	16.31
Observations	65,276	65,021	55,647	55,647	55,647	21,381	21,381
Category FE	NO	YES	YES	NO	YES	YES	YES
Time FE	NO	YES	YES	YES	YES	YES	YES
Brand FE	NO	NO	YES	YES	YES	YES	YES
Sector FE	NO	NO	NO	YES	NO	NO	NO
Sample	All	All	All	All	All	Controlled	Controlled

Notes: Observations are aggregated to the URL-weekly level. Dependent variable is the number of distinct (non-missing) non-controlled goods. We let $\mathbb{1}\{$*Controlled this month*$\}$ and $\mathbb{1}\{$*Controlled before*$\}$ take 1 when a price ceiling affects any good on a certain URL-month, and after a certain URL had any good controlled, respectively. Categories are CPI sub-categories and sector are CPI broad categories. Columns (6) and (7) restrict the sample to controlled brands and controlled URLs. Standard errors clustered at the URL level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

A.4 Figures

A.4.1 Price Controls' Official Website

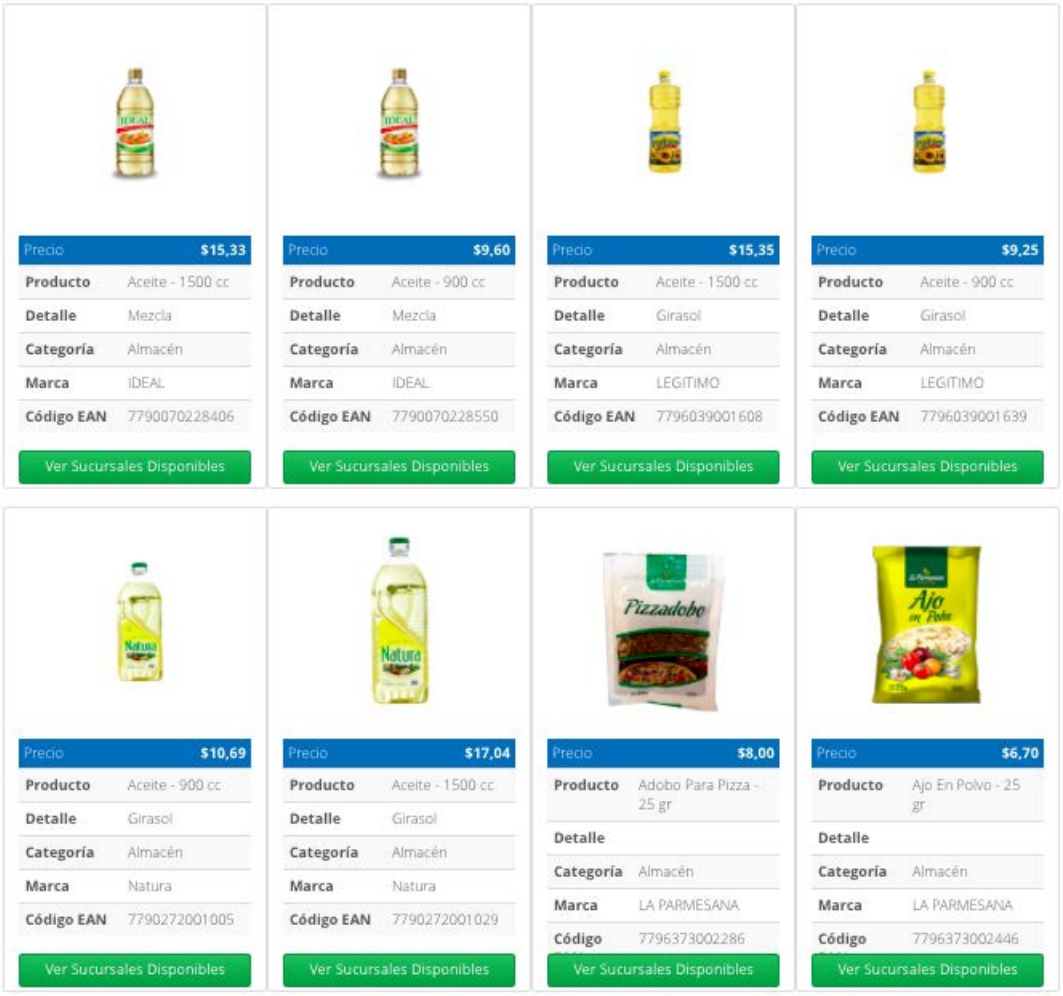


Figure 8: Example of controlled-goods in the City of Buenos Aires

Notes: Screenshot from the official government's website dedicated to price controls. The lists of controlled-goods include product details, price, and a sample picture. This allows a unique match against the online scraped database. Source: http://precioscuidados.gob.ar. Retrieved on July 14th, 2015.

A.4.2 Price Controls Intensity

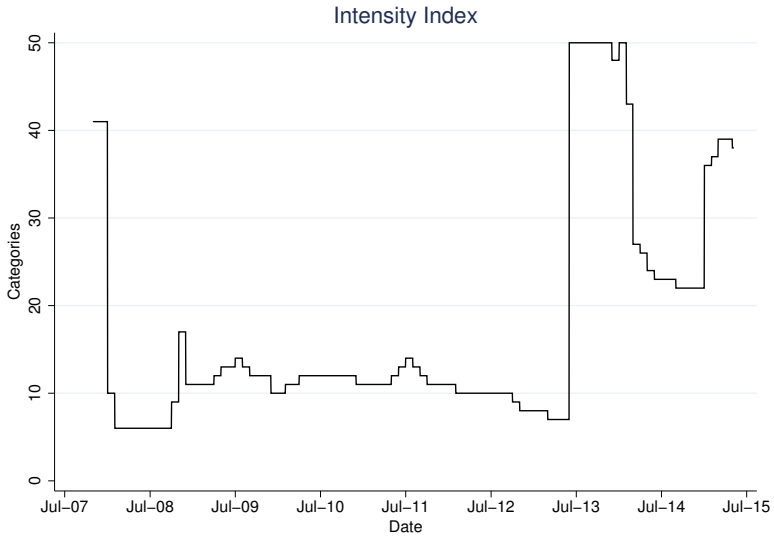


Figure 9: Intensity Index

Note: Retailer's categories under price controls.

A.4.3 Histogram Price Control Days

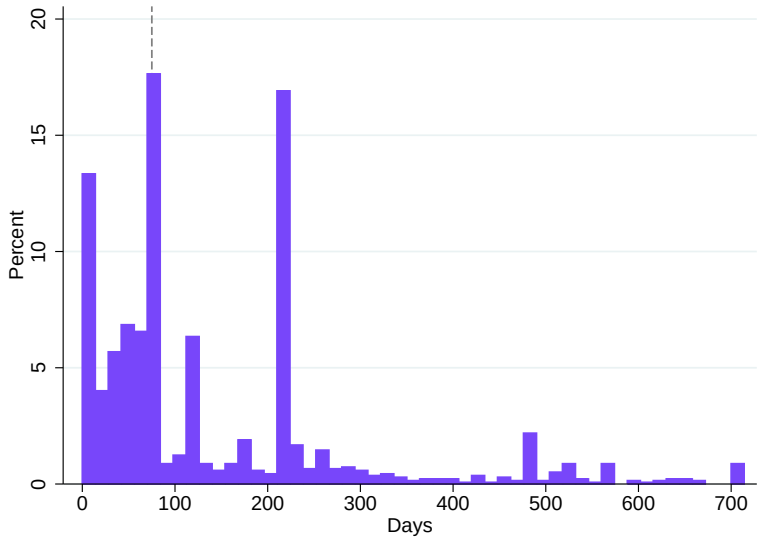


Figure 10: Histogram of Price Control Time

Note: Axis restricted to two years for better visualization. Vertical line depicts median control time of 75 days. The average is over 120 days. Note that the statistics from this calculation are right-censored, and in particular more so for the recent price controls rounds. Our scraping period stops in May 2015 but hundreds of products are still being controlled. The spike around 220 control days is driven by controlled-goods from stage 3.

A.4.4 "Excess" Annual Inflation Rate

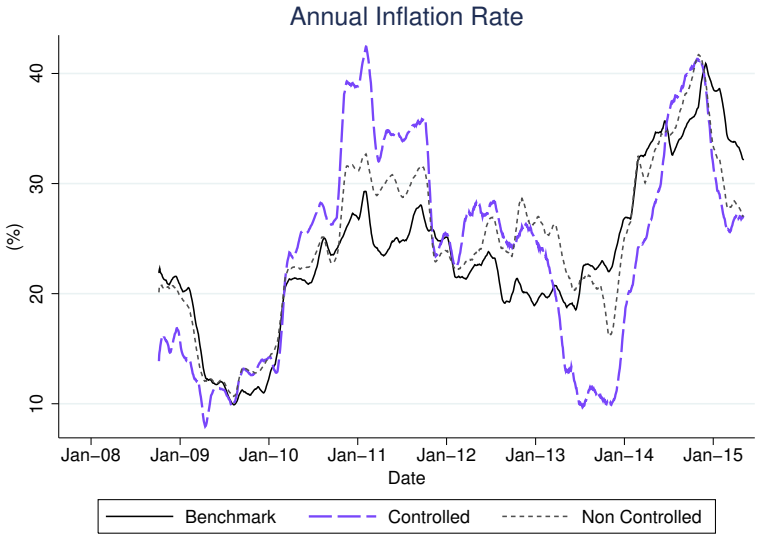


Figure 11: Excess Inflation

A.4.5 Annual Inflation Rate and Monetary Policy

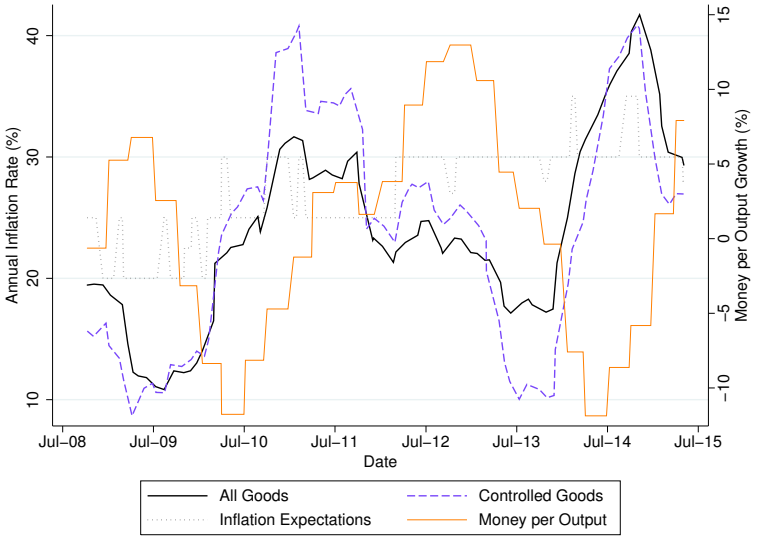


Figure 12: Price Controls and Money per Output

Notes: Median inflation expectations (next 12 months) surveyed by Universidad Torcuato Di Tella. Money per output calculated as the ratio of M2 to GDP. M2 is obtained from the Ministry of Finance and GDP from INDEC. Price indices computed as described in the text.

A.4.6 Product Introductions and Discontinuities

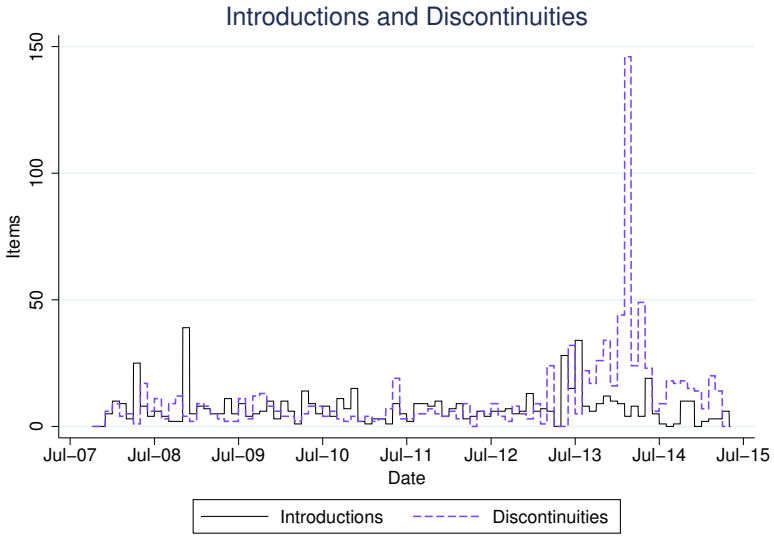


Figure 13: Introductions and Discontinuities

Note: Calculated on a monthly basis for the controlled-goods.

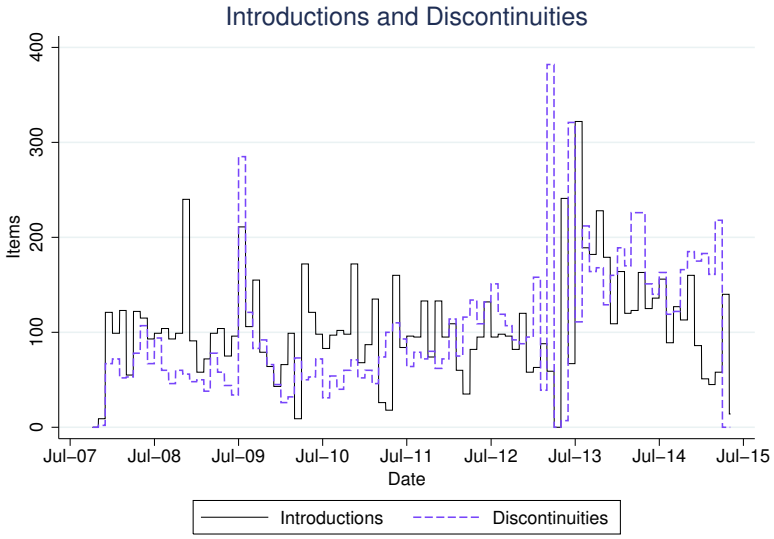


Figure 14: Introductions and Discontinuities

Note: Calculated on a monthly basis for non-controlled goods from the same brands and retailer's categories that received price controls.

A.5 Theory

A.5.1 Single-Product Monopolist

In the single product case with an uncovered market, demand is given by $\bar{\theta} - \hat{\theta}$, where $\hat{\theta}$ stands for the marginal consumer for which $\theta s - p \geq 0$. In stage two, price is set to maximize profits given quality, i.e. $p^*(s) = \frac{s(1+\alpha s)}{2} = \arg\max \left\{ \left(1 - \frac{p}{s}\right)\left(p - \alpha s^2\right) \right\}$. In stage one, quality is chosen to maximize $\pi\left(p^*(s), s\right)$. This yields $p^m = \frac{2}{9\alpha}$ and $s^m = \frac{1}{3\alpha}$. (The alternative solution $p^m = \frac{1}{\alpha}$ and $s^m = \frac{1}{\alpha}$ does not satisfy the second order conditions) Then $\hat{\theta} = \frac{2}{3}$. Fixed costs f_1 and f_2 are such that the firm decides to introduce one good. This holds as long as $f_2 > \frac{1}{\alpha}\frac{2}{675}$.[47]

A social planner who maximizes aggregate surplus would set a price such that $\max_p \int_{p/s}^{1} \left(\theta s - \alpha s^2\right) d\theta$. And then choose quality to maximize $AS\left(p(s), s\right)$. This yields $p^s = \frac{1}{9\alpha}$ and $s^s = \frac{1}{3\alpha}$, and thus $\hat{\theta} = \frac{1}{3}$. (The alternative solution $p^s = p^s = \frac{1}{\alpha}$ does not satisfy the second order conditions)

A.5.2 Proof of Remark 1

When $\bar{p}$ is fixed and exogenously set below p^m, the new optimal $\tilde{s}^m$ is lower than s^m. Let $\pi\left(\bar{p}(\tau, \alpha), s\right) - \pi\left(\bar{p}(\tau, \alpha), s^m\right)$ be the extra profit when s can be re-optimized. Replace $s^m = \frac{1}{3\alpha}$, $\bar{p} = \frac{2}{9\alpha}\tau$, and $s = \frac{1}{3\alpha}x$, where x is positive but finite. Then it can be shown that the profit difference is negative when $x > 1$, and does not depend on the cost α. Alternatively, one can think of the profit function $\pi(\tau, \alpha, s)$ in terms of monotone comparative statics. $\pi(\tau, \alpha, s)$ is a twice continuously differentiable function in (τ, s), and $\mathcal{T}$ and S can be thought of as convex. Then it can be shown that $\pi(\tau, \alpha, s)$ has increasing differences in (τ, s). In other words, the extra benefit of increasing s (quality) is higher when τ is higher.

Under the new price $\bar{p}$, the firm would like to set a lower quality $\tilde{s} < s^m$ regardless of cost α. For instance, when $\tau = 0.9$, the new quality is about 7% lower. Although we cannot empirically measure quality, we note that quality downgrades substituting for price

[47] We assume costs take the standard form $C(s) = \alpha s^2$, and that are independent of the quantity supplied. Convex quality costs are common in the literature (see Mussa and Rosen (1978), Besanko, Donnenfeld, and White (1987), Champsaur and Rochet (1989)).

increases were common in past experiences. For instance, see Bourne (1919) on France in the years following the French Revolution, Darby (1976a) on the 1970s U.S. wage-price controls, Rockoff (2004) on the US during the World World II, or Moon and Stotsky (1993) on rent control programs in the US. However downgrading quality, particularly in essential goods, can be costly in terms of reputation and potential fines.

A.5.3 Proof of Remark 2

When the firm waits-and-sees, i.e. sit tight and wait until the price control is over, she obtains a profit equal to $\pi = D(\bar{p}, \tau, \gamma)\left(\frac{1}{9\alpha}\right)(2\tau - 1) - f_1$. Where $D(\bar{p}, \tau, \gamma) = \min\left\{\left(1 - \frac{2}{3}\tau\right), (1 - 2/3)\gamma\right\}$ to account for possible capacity constraints. However, wait-and-see is not SPNE, because a potential entry has now extra incentives to serve the higher willingness-to-pay for quality consumers. In particular, the entrant would like to set s_H and p_H such that $\theta_H = \frac{\Delta p}{\Delta s} = \theta_L$, while also satisfying (1) $s_H > s_L$, (2) $p_H > p_L = \bar{p}$, (3) $\theta_H < 1$, and therefore steal the entire market. The extent to which an entrant can enter depends on α, τ, and the fixed cost differential across firms.

However, if τ or f_2 are low enough, the monopolist is better off introducing a new higher price-quality good.[48] This allows to capture the excess demand via market segmentation, i.e. discriminate between different θ-tastes for quality consumers. Let s_L and $p_L = \bar{p}$ denote the original's single-product optimal quality and afterwards controlled price, respectively. And then let s_H and p_H be the second product's optimal quality and price. The demand for good L and H are given by the marginal consumers θ_L and θ_H, namely $D_L = \frac{\Delta p}{\Delta s} - \frac{p_L}{s_L}$ and $D_H = \bar{\theta} - \frac{\Delta p}{\Delta s}$.

Formally, the firm's problem can be stated as follows[49]: $\max_{s_H} \pi\left(s_H, p_H^*(s_H), \tau, \alpha, \gamma\right)$

[48] Our model differs from previous work which focus on across-the-board price controls, e.g. Raymon (1983), Besanko, Donnenfeld, and White (1987), Besanko, Donnenfeld, and White (1988). For instance in Besanko, Donnenfeld, and White (1987) the monopolist offers a continuous quality array, and $p(\theta) < \bar{p}$, $\forall\theta$. The price controls that we study are only binding for a subset of goods.

[49] For simplicity it is assumed that the firm does not leave "holes" in the demand line when introducing a new good, i.e. no excess demand between θ_L and θ_H. Where $\tilde{\theta}$ stands for the maximum willing-to-pay consumer that can be supplied under binding capacity constraints. The same condition is used in A.5.4 for the multi-product monopolist.

subject to the constraints (1) $p_L = \bar{p}_L$, (2) $s_L = s^m$, (3) $p_H > p_L$, (4) $s_H > s_L$, and (5) $\underline{\theta} < \theta_L < \theta_H < \tilde{\theta}(\gamma) < \bar{\theta}$. Where we set $\underline{\theta} = 0$ and $\bar{\theta} = 1$. The firm's response is SPNE in the sense that introduces a new good that, in the absence of price controls, decided not to introduce.

A.5.4 Multi-product monopolist

We briefly mention the case of a multi-product monopolist. Consider a two-good monopolist that supplies a low quality good s_L at price p_L, and a high quality good s_H good at price p_H. In the absence of price controls, it can be shown that the optimal prices and qualities are $p_L = \frac{3}{25\alpha}$, $s_L = \frac{1}{5\alpha}$, and $p_H = \frac{7}{25\alpha}$, $s_H = \frac{2}{5\alpha}$. Now consider a price ceiling $\bar{p}_L < p_L$ on the low-priced good. Intuitively, the response depends on the trade-off between extra profits from introducing a third good, the magnitudes of fixed costs and quality costs, the lost excess demand from capacity constraints, and harshness of the price ceiling. The firm may want to re-adjust s_H and p_H, possibly a price decrease and quality downgrade, wait-and-see if she is compelled to serve the excess demand, or finally introduce a third variety resulting in higher average non-controlled prices.

Formally, that the monopolist may want to decrease p_H leaving s_H constant follows from the first-order condition for p_H in the two-goods' problem: $p_H = \bar{p}_L + \frac{\Delta s}{2} + \frac{\alpha(s_H^2 - s_L^2)}{2}$. The first-order condition for s_H does not depend on p_L. If changing prices are subject to no product holes (serve excess demand), depending on the harshness of $\bar{p}_L$, costs α and f_i, and the degree of capacity constraints, the firm could either wait-and-see, i.e. ration supply for controlled-good s_L with no price changes, or introduce a third variety, possibly resulting in higher average quality at the expense of higher non-controlled price dispersion and higher average prices.

The constrained three-goods problem can be stated as follows:
$\max_{s_M, s_H} (\frac{\Delta p_M(s)}{\Delta s_M} - \frac{p_L}{s_L})(p_L - \alpha s_L^2) + (\frac{\Delta p_H(s)}{\Delta s_H} - \frac{\Delta p_M(s)}{\Delta s_M})(p_M(s) - \alpha s_M^2) + (\bar{\theta} - \frac{\Delta p_H(s)}{\Delta s_H})(p_H(s) - \alpha s_H^2) - f_1 - f_2 - f_3$ subject to (1) $p_L = \bar{p}_L$, (2) $s_L = s_L^m = \frac{1}{5\alpha}$, (3) $\bar{p}_L < p_M < p_H$, (4) $s_L < s_M < s_H$, and (5) $\underline{\theta} < \theta_L < \theta_M < \tilde{\theta}(\gamma) < \theta_H < \bar{\theta}$. We set $\underline{\theta} = 0$ and $\bar{\theta} = 1$.

The firm's problem with targeted price ceilings could be extended in several ways. A multi-firm problem would be better addressed using both horizontal and vertical differentiation, i.e. consumers have heterogeneous preferences over brands and quality, respectively. From stylized demands for differentiated products, where $q_L = a_L - b_L p_L + c p_H$ and $q_H = a_H - b_H p_H + c p_L$, one notes that the effects of price controls are not straightforward. The effects depend on price or quantity competition, strategic complements or substitutes, and the capacity constraints. Other domains to enhance the analysis are, for example, the effects of advertising, costly consumer search, consumer switching costs, anticipated and unanticipated price ceilings, and overshooting from costly price changes or stickiness. Aggressive price ceilings, even below marginal costs, can be related to an interesting literature on loss-leaders (Lal and Matutes (1994)).