Towards the Long-run Impact of a Change in Maximum Markup Regulation[1]

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Abstract

Do product market reforms have a long-term impact in the market? I examine the pricing equilibrium using the repeal of a maximum wholesale and retail markup regulation in an oligopolistic and vertically non-integrated market as an example. Within a difference-in-difference framework, I show that both at the retail and wholesale level the whole price distribution has shifted to the left five years after the change in regulation, leading to a significant decrease in prices corresponding to about €980 million in total added consumer welfare.

JEL Classification: L0, L1, L4, L5

Keywords: Markup regulation, focal point, collusion, ex-post policy evaluation.

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1. Introduction

Over the last two decades, a plethora of market reforms have been implemented across many countries. Their purpose is to boost competition among markets and raise economic growth. Product, labour, and financial market reforms were further adopted to address problems arose out of the 2008 crisis. Although there are a lot of changes, there is not enough empirical evidence on ex-post policy evaluation in general, and in particular on the long-term effects of these policy changes. Governments and competition authorities impose market reforms to stabilise the banking sector, liberalise the labour market, and to increase consumers' welfare through the competitiveness of product markets. These actions, taken both in the US and the European Union, have been of high importance and necessity after the recession followed the economic crisis. Given the increased interest of these reforms, robust ex-post policy evaluation is needed to measure the economic impact of these reforms.

In this paper, I focus in the case study of Greece. Several studies have documented a number of regulated product markets and professions in Greece such as trucks, milk, bakeries, advertisement fees and lawyers (Katsoulakos *et al* [2017]; Meghir *et al* [2010]). More specifically, I concentrate to the maximum markup abolishment for the fruits and vegetables market, a primary market in the food industry, since fruits and vegetables constitute almost the 20 percent of the typical household food expenditure. The short-run impact of this reform had been shown to be positive (Genakos *et al* [2018]), hence, I will examine what is the medium and long-run impact of it, in order to shed more light on the consequences of this reform through the years. Motivated by their work (2018), I use an augmented and partially modified dataset for the fruits and vegetables market in Greece, an oligopolistic and vertically non-integrated market, to study the medium and long run effect of markup deregulation. The data consists of prices for both markets for period 2010 to June of 2016 (five years after the reform). Wholesale prices are in a frequency of three times per week rather than a monthly one. Retail prices are in a daily basis. The markup was implemented in 1946 in all products. Apples, lemons, mandarins, oranges and pears were excepted in 1977. Taking advantage of this exception I estimate the impact of the reform on prices of regulated products, using unregulated products as the control group. The removal of markup took place in 23 June of 2011.

Using a difference in difference framework, I provide new evidence on the medium and long run impact of markup deregulation both in the wholesale and the retail markets. Carranza *et al*

(2015) study the long run impact of price regulation in Canadian gasoline retail market and show that while price controls increase prices in the short run, price increases are offset in the long run, since more firms enter to the market. The purpose of this study is not to investigate any possible entry or exit of firms in this market. Furthermore, retail analysis includes data from supermarkets and street vendors indicating that the number of stores does not change over time. Results indicate that three and a half years after the reform (medium run), the whole price distribution[3] both at the retail and wholesale level has shifted to the left, resulting in 8.2 percent decrease in retail prices. As a consequence, consumer welfare has increased by €331 million on a per year basis[4].

I also provide indirect evidence that another breakdown of collusion, for products with "high" markups has taken place in the medium run, which has not been affected in the short run. Hence, the results of ex-post policy evaluation indicate that the effect of markup deregulation is not an effect that exists only in the short run, but it has a permanent effect in the market. In addition, the medium run effect is more beneficial compared with the short run one. On the other hand, prices in the long run (5 years after the reform) fall by 4.5 percent in the retail market. When isolating the period 2015-2016 the markup distribution shifts a little to the right. But, taking into account all years, the markup distribution indicates that its overall shift to the left is permanent for both markets, although mitigated compared with the medium run result.

This paper contributes to the existing literature in several ways. First, it adds to the growing literature that investigates the impact of a wider regulation abolishment on the competitiveness of a market's sector. Studies have shown that policy interventions may have positive or negative impact on consumer welfare. Carranza *et al* (2015) argue that price controls in Canadian gasoline markets result to the reorganization of market with more or bigger stations, while prices do not increase. Building on these insights, Rey and Tirole (2018) show that negotiated, rather than regulatory, price caps accepted by the antitrust authorities, raise the consumer welfare[5]. On the other hand, Knittel and Stango's paper (2003) indicates that price ceilings in the US credit industry

[3] Genakos *et al* (2018) show that deregulation affected mainly the right tail of price distribution and products with "low" regulated markups.

[4] In Appendix A, I confirm Genakos *et al* (2018) previous results on the short run impact of the change in regulation using for the wholesale market: a) 13 additional product varieties (8 products), and b) the fact that wholesale data is in three times per week, rather than monthly frequency.

[5] Eriksson (2004) finds that after the deregulation of price ceilings in Swedish dental services, prices increase. The main reason for this effect is that government's subsidies, used before deregulation, continue to exist after it. To the same direction, in the laboratory design of Engelman *et al* (2011), although they allow larger incentives for firms to collude at price ceilings than the competitive price and hence to charge higher prices, they fail to support that collusion took place.

provided a focal point for collusion and resulted a negative effect on consumers' welfare. Furthermore, Genakos *et al* (2018) study the repeal of maximum markup regulation in the market for fruits and vegetables in Greece and show that the short run effect of its repeal was the decrease of wholesale and retail prices arguing that initial regulation facilitated collusion for products with "low" regulates markups[6].

Second, from a policy view, results put the debate on regulatory reform under a new light for competition authorities regarding market reforms (European Competition Network, 2012). Third, the paper also contributes to the literature on factors that may facilitate collusion in an industry (see among others, Gilo et al [2016]; Jullien and Rey [2008] and Nocke and White [2007]), showing that markup deregulation decreases prices. Initial regulation was to promote price decreases, as a result someone would expect that its abolishment would have the opposite effect. Hence, this paper provides indirect evidence that regulation facilitated collusion among wholesalers after its implementation.

The remaining of this paper is organized as follows. Section 2 discusses the fruits and vegetables market and the background of the legislation. Section 3 presents data and some descriptive statistics. Section 4 provides the empirical methodology used, while Section 5 reports the medium and long run empirical results of markup deregulation on prices and provides indirect evidence for the collusion hypothesis. Finally, Section 6 concludes.

2. The Market of Fruits and Vegetables

The Greek market for fruits and vegetable includes three levels. First, there is the production level. Second, the wholesale market (Central Market) in which, only licenced sellers can operate. Third, the retail market that constitutes of supermarkets, street vendors and corner stores. Supermarkets typically buy from the wholesale market, although nowadays they also contract directly with producers. Street sellers either buy from the Central Market or they are producers by themselves. Corner stores buy also from the wholesale market.

[6] The experimental setting of Haucap *et al* (2013) for gasoline market indicates that although the maximum markup does not serve as a focal point for collusion, since hardly chosen by firms, it increases their profits. Furthermore, Fotis and Polemis (2018) discuss the impact of milk market deregulation in Greece and find that it reduced wholesale prices through the full openness of the local market.

After the Second World War the Greek government imposed several regulations on prices and markups for essential and scarce products such as bread, meat, fruit and vegetables, and pharmaceutical products. The markup regulation[7] for fruits and vegetables was implemented in 1946. Some years later, Central Market was created by the law 3475/1955 in order to provide transparency to producers for wholesale prices.

Markup regulation initially imposed to all fruits and vegetables. Five products (apples, lemons, mandarins, oranges, and pears) were exempted in 1977. The law provided product-specific maximum markups, as Table B1 (Appendix B) reports, ranging between 8 and 12 percent for the wholesale market, 20 to 40 percent for supermarkets and grocery stores, and 17 to 35 percent for street vendors. The repeal of the maximum markup took place on 23 June 2011, after international suggestions to liberalize product markets in Greece.

3. Data

I obtained daily retail prices for fruits and vegetables in Athens from the Ministry for Development and Competitiveness. The data contains information on 36 products, further divided into 72 varieties, from 28 supermarkets and 28 street markets[8] and covers the period from 4 January 2010 to 6 June 2016. Products and varieties are reported in Table B2 in the Appendix B. Furthermore, i also obtained median, minimum and maximum prices of fruits and vegetables in a three times per week frequency from the administration of the Central Market for the same period. The wholesale data consists of 44 products and 72 product varieties. From them 59 are common to the retail ones. The deviation among 72 retail product varieties and the 59 matched when merging datasets, consists of almost only imported product varieties, which do not appear in the wholesale market. On the other hand, there are 13 product varieties (8 products) in the wholesale market[9], that do not exist in the retail data. Table 1 summarizes data and shows differences from Genakos *et al* (2018) work. I will first investigate the impact of the reform in each market separately. Then i look at the matched dataset.

[7] Maximum markups are computed over the price, before adding VAT. Transportation costs are included in price.
[8] Central Market is included to street markets, since it operates as a retail market as well for retail buyers from 2013.
[9] The extra product varieties are: vlita, drill and parsley, kontoules (pear), kossia (pear), santa maria (pear), sour cherry, damson, quince, satsoumes (mandarin), loquat, white-pulp peach, pomegranate and fig.

Table 1
Data comparison with Genakos *et al* (2018) paper

Period	2010-2012	2010-2014	2010-2016
	Before the policy change & Short run	Medium run	Long run
Retail Market	Same dataset as Genakos et al (2018)	New	New
Wholesale Market	i) There are 13 additional product varieties (8 products), ii) Three times per week frequency rather than a monthly one	New	New

Notes: This paper adds on Genakos *et al* (2018) work by providing evidence for the medium and long run effect of the policy change for both markets, using a differentiated wholesale dataset.

Figure 1A plots the time series of year-month average log price of fruits and vegetables for the retail sector. The dashed black line shows products affected by regulation (treatment group), while the dashed grey one shows the five products not affected by regulation (control group). The average price of products not affected by regulation (the solid grey line) practically does not change in the period following the policy change. Instead, the average price of products affected by regulation (the solid black line) shows a large drop, indicating a significant reduction in the price of these products. Figure 1B plots the corresponding figure for the wholesale market. As in the retail market, the average price of products affected by regulation significantly drops, whereas, the average price of products in the control group remains at the same level.

Figure 2A reports the distribution of retail prices for products affected by the policy change, before it (the black line), in the short run (the blue line), in the medium run (the green line) and in the long run (the red line) followed its implementation. According short sun, notice that the distribution is shifted to the left, being stronger in the left tail. These effects are stronger in the medium and long run, where the whole distribution shifts to the left, affecting slightly the right tail as well. In the same vein, mean gradually drops, so does at any percentile and variance increases.

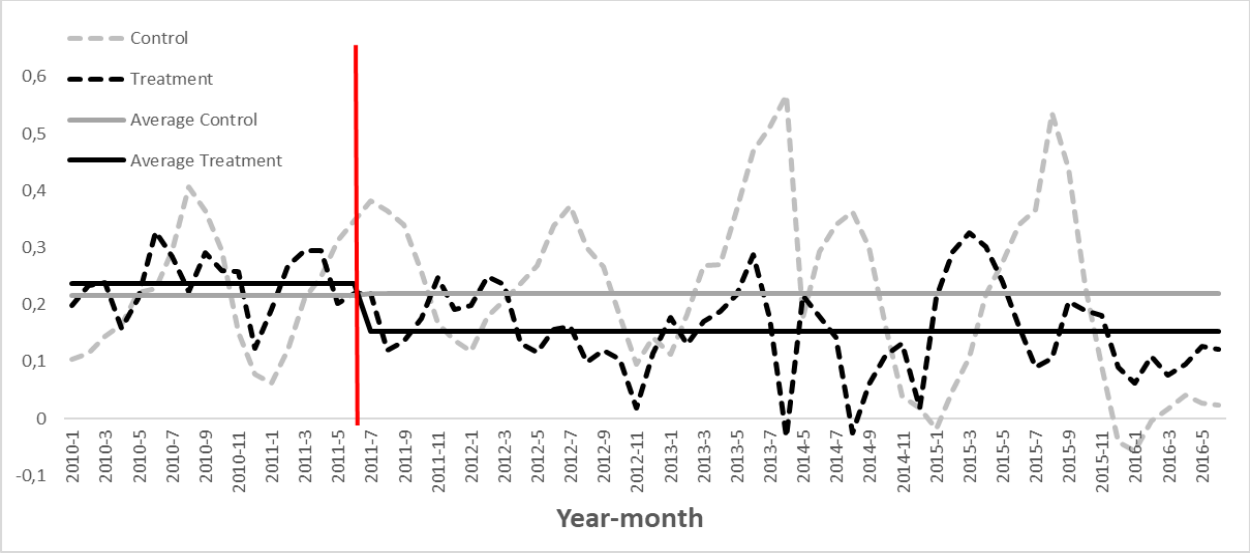

Figure 1A
Average Retail Prices of Regulated (treatment) and Unregulated Products (control)

Notes: The figure reports the monthly average of the logarithm of fruits and vegetables products' prices affected by the markup regulation (treatment group, black dashed line) and not affected by regulation (control group, grey dashed line) and their averages (black solid line for the treatment group and grey solid line for the control group) before and after deregulation. **Source**: Author's calculations based on data from the Greek Ministry of Development.

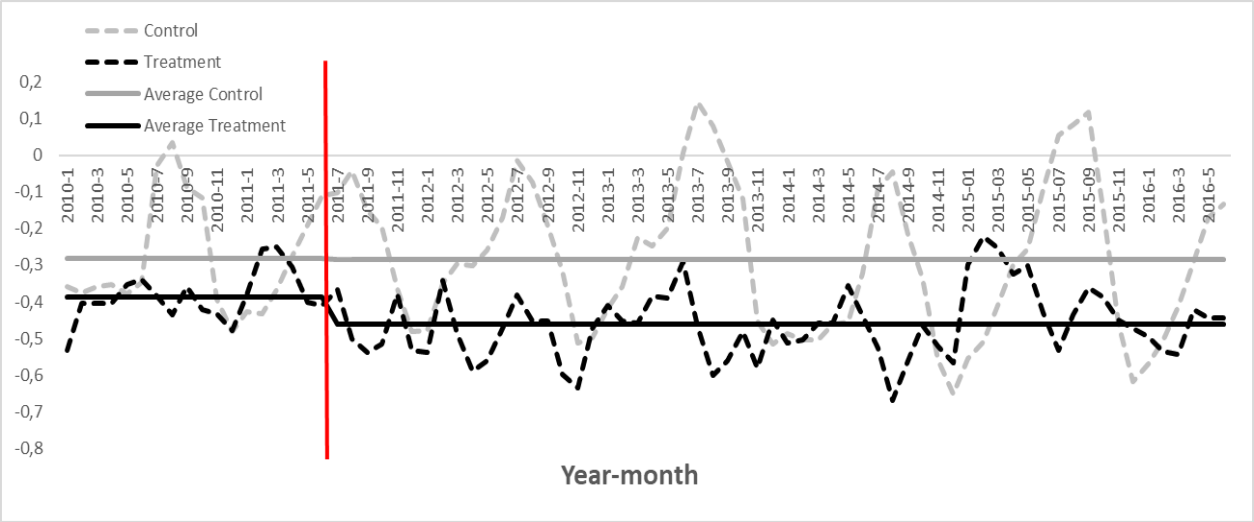

Figure 1B
Average Wholesale Prices of Regulated (treatment) and Unregulated Products (control)

Notes: The figure reports the monthly average of the logarithm of fruits and vegetables products' prices affected by the markup regulation (treatment group, black dashed line) and not affected by regulation (control group, grey dashed line) and their averages (black solid line for the treatment group and grey solid line for the control group) before and after deregulation. **Source**: Author's calculations based on data from the Central Market.

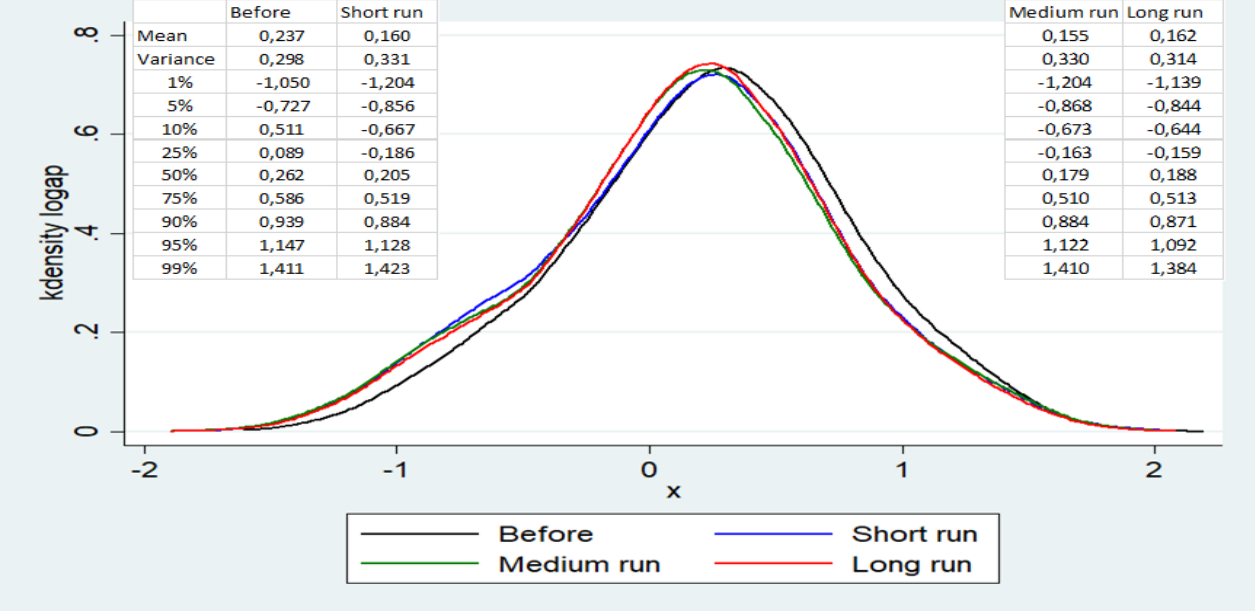

Figure 2A: The Distribution of Retail Prices Before Deregulation, in the Short, Medium and Long Run (Treatment group)

Notes: The figure plots the distribution of log prices of fruits and vegetable products in the treatment group one and a half years before ("Before"), one and a half years after ("Short run"), three and a half years after ("Medium run") and five years after ("Long run") the policy change. Sample statistics are reported in the top corners. **Source**: Author's calculations based on data from the Greek Ministry of Development.

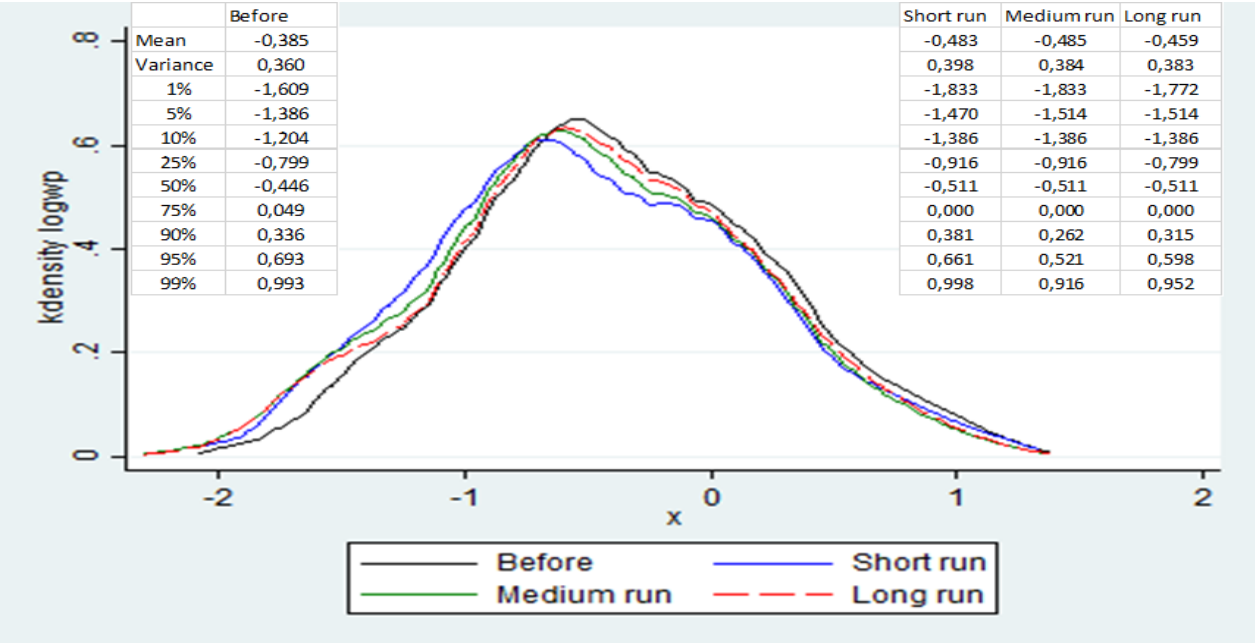

Figure 2B: The Distribution of Wholesale Prices Before Deregulation, in the Short, Medium and Long Run (Treatment group)

Notes: The figure plots the distribution of log prices of fruits and vegetable products in the treatment group one and a half years before ("Before"), one and a half years after ("Short run") , three and a half years after ("Medium run") and five years after ("Long run") the policy change. Sample statistics are reported in the top corners. **Source**: Author's calculations based on data from the Central Market.

Almost the same picture emerges in Figure 2B (wholesale prices), mean has declined and variance has increased, with the only difference that the shift in the right tail is stronger, especially in the medium run. This is one of the new findings of this paper. Notice that the impact in the right tail did not exist in the short run[10]. It is first appearing when analyzing the medium run (2010-2014) and it becomes less strong in the long run (2010-2016). Furthermore, notice that the shift on the left tail becomes bigger in the medium and long run. These results indicate that the long run effect of the markup deregulation is enhanced by the fact that it affects the entire distribution of wholesale prices.

4. Identification and Empirical Methodology

A difference in difference empirical framework is adopted. Denote by P_{ijt} the retail product variety i, in store j[11], in date t. The basic empirical specification is of the form:

$$\ln(P_{ijt}) = b_0 + b_1 Post_t + b_2 Treat_i + b_3 Post_t \times Treat_i + X_{ijt}\, d + e_{ijt} \quad (1)$$

where $Post_t$ is an indicator equal to one after deregulation, $Treat_i$ is an indicator variable equal to one for products affected by the regulation (treatment group), $Post_t$ x $Treat_i$ denotes their interaction, X_{ijt} is a matrix of control variables and e_{ijt} is a random shock with E (e_{ijt}/ $Post_t$, $Treat_i$, X_{ijt}) = 0. b_3 is the parameter of interest, since it captures the impact of the policy change.

The identifying assumption that price trends would be the same (conditional on covariates) is crucial. It becomes realistic adding more appropriate controls in X_{ijt}. Furthermore, Figures 1A and 1B show that after deregulation average prices for the control group do not change. As controls I use VAT rates[12], month indicators variables, store indicator variables, product variety-specific indicator variables, interaction of month and product fixed effects, and a time trend (linear and quadratic) to capture other changes resulted by the economic crisis in Greece.

[10] In line with Genakos *et al* (2018).
[11] The triple panel holds for the retail market. In the analysis of the wholesale market there are no stores.
[12] Before the reform three changes in VAT rates took place. From 9% to 10% on 15/3/2010, from 10% to 11% on 1/7/2010 and from 11% to 13% on 1/1/2011. All these days are included in the dataset.

5. Medium and Long-run Effects

Table 2 reports the results when analyzing the retail data alone in the augmented dataset. A simple before-after estimator in the treatment group (column 1) for the medium run analysis, indicates that the average price decreases by 8.2 percent. The simple difference in difference estimator, without any additional controls (column 2) shows a 12.1 percent decrease in the average price of the treatment group. Adding progressively dummies, such as month fixed effects (column 3), store and product variety fixed effects (column 4) and the interaction between month and product fixed effects (column 5) the negative result on average prices still holds, while smaller in magnitude. Finally, after controlling for a linear and quadratic trend (column 6), the difference in difference estimator indicates an 8.2 percent drop on average prices. Hence, the average price of products affected by regulation falls more[13]. This result is in line with Figures 1A and 2A. This 8.2 percent reduction in prices for fruits and vegetables corresponds to yearly savings of €30 per person[14]. In aggregate I estimate savings of €331 million per year. The long run effect on prices is still negative, although to a lesser extent (4.9 percent decrease) as column 6 reports.

Same situation occurs when looking at the wholesale market. According medium run, Table 3 reports that the simple before-after estimator indicates a 10.0 percent decrease in prices (column1). Adding more indicators (columns 2–6) a 11.2 percent drop in prices is reported in the full set specification regression (column 6), which is smaller than the long run effect (10.2 percent decrease) but, bigger than the short run one (9.2 percent decrease) as reported in Table A1(column 6). These results are also in line with Figures 1B and 2B. In an attempt to evaluate the robustness of these results, the same analysis is applied to the merged dataset (59 products). This analysis insures that the 13 extra product varieties in each market do not influence the results presented in Tables 2 and 3. Still, results indicate a significant drop in average prices for both markets (i.e. 6.6 and 3.2 percent for the retail market and 11.2 and 6.7 percent for the wholesale one for medium and long run respectively – Table B3). Hence, average prices for products affected by the reform decrease for both markets. They are bigger in magnitude in the medium run and smaller in the

[13] The short run analysis of Genakos *et al* (2018) indicates a 6.4 percent price decrease in retail prices.
[14] An 8.2 percent decrease of the price of fruits and vegetables illustrates a 1.58 percent decrease in the price of food for the typical household in Greece and a corresponding 0.3 percent decrease in the price index. The typical household in Greece consists of 2.6 people.

Table 2
The Impact of Deregulation on Retail Prices

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	OLS	FE	FE	FE
Dependent variable	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$
Sample	Treatment only	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Medium run	Medium run	Medium run	Medium run	Medium run	Medium run
$Treat_i \times Post_t$		-0.121**	-0.119**	-0.111***	-0.082***	-0.082***
		(0.054)	(0.053)	(0.028)	(0.021)	(0.021)
$Post_t$ dummy=1 after 22 June 2011	-0.082***	0.039	0.057	0.048*	0.020	0.019
	(0.027)	(0.047)	(0.044)	(0.026)	(0.020)	(0.027)
$Treat_i$		0.028	0.024			
		(0.117)	(0.117)			
Observations	65,645	82,858	82,858	82,858	82,858	82,858
Adjusted R^2	0.005	0.006	0.012	0.788	0.858	0.858

(Continued)

Table 2 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Time period	Long run	Long run	Long run	Long run	Long run	Long run
$Treat_i \times Post_t$		-0.077**	-0.076**	-0.068***	-0.049***	-0.049***
		(0.036)	(0.036)	(0.023)	(0.017)	(0.017)
$Post_t$	-0.075***	0.002	0.011	0.016	-0.001	-0.028
dummy=1 after 22 June 2011	(0.023)	(0.028)	(0.029)	(0.023)	(0.017)	(0.022)
$Treat_i$		0.028	0.024			
		(0.117)	(0.117)			
Observations	89,349	112,534	112,534	112,534	112,534	112,534
Adjusted R^2	0.003	0.003	0.008	0.776	0.845	0.845
Clusters	56	72	72	72	72	72
Month FE			yes	yes		
Store FE				yes	yes	yes
Product variety FE				yes	yes	yes
Month × Product FE					yes	yes
Year-month trend and square						yes

Notes: The dependent variable is the logarithm of the retail price of product variety *i*, in store *j*, and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

Source: Author's calculations based on data from the Greek Ministry of Development.

Table 3
The Impact of Deregulation on Wholesale Prices

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	OLS	FE	FE	FE
Dependent variable	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$
Sample	Treatment only	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Medium run	Medium run	Medium run	Medium run	Medium run	Medium run
$Treat_i \times Post_t$		-0.099*	-0.099*	-0.166***	-0.112***	-0.112***
		(0.052)	(0.051)	(0.039)	(0.024)	(0.024)
$Post_t$ dummy=1 after 22 June 2011	-0.100***	-0.001	-0.015	0.016	-0.039	-0.014
	(0.031)	(0.041)	(0.042)	(0.037)	(0.026)	(0.038)
$Treat_i$		-0.086	-0.092			
		(0.134)	(0.133)			
Observations	16,521	20,783	20,783	20,783	20,783	20,783
Adjusted R^2	0.006	0.016	0.025	0.766	0.866	0.868

(Continued)

Table 3 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Time period	Long run	Long run	Long run	Long run	Long run	Long run
$Treat_i \times Post_t$		-0.068	-0.067	-0.127***	-0.092***	-0.092***
		(0.050)	(0.050)	(0.039)	(0.030)	(0.030)
$Post_t$	-0.074**	-0.006	-0.022	-0.008	-0.051	-0.029
dummy=1 after 22 June 2011	(0.029)	(0.041)	(0.044)	(0.040)	(0.033)	(0.035)
$Treat_i$		-0.086	-0.093			
		(0.134)	(0.133)			
Observations	22,799	28,686	28,686	28,686	28,686	28,686
Adjusted R^2	0.003	0.011	0.019	0.749	0.850	0.851
Clusters	53	72	72	72	72	72
Month FE			yes	yes		
Product FE				yes	yes	yes
Month × Product FE					yes	yes
Year-month trend and square						yes

Notes: The dependent variable is the logarithm of the wholesale price of product variety *i* in day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Central Market.

long run compared with the short-run effect. Furthermore, since the dataset consists of both fruits and vegetables, the impact of the policy change is examined for each category separately. Table B4 reports these results. So, the impact is very similar for both categories in each market and in accordance with those estimated in the short run[15], suggesting that the reform did not have any differential effect between fruits and vegetables.

5.1 The Impact on the Distribution and Range of Prices

In Figures 2A and 2B, there exists a movement of the distribution of prices to the left for both markets. Notice a drop-in mean, particularly at any percentile and an increase to the variance. In Table 4 quantile regressions are used to measure the medium and long run impact of the reform on the distribution of retail price residuals. Results indicate, that five years after the reform (long run), the negative effect still exists. A similar picture emerges when looking at the wholesale market (Table 5). It is worth mentioning that in the medium and long run deregulation affects the whole distribution, instead of mainly the left tail as the short run analysis indicates[16]. Once again, medium run results are stronger in comparison with the other two periods.

Taking advantage of the minimum and maximum wholesale prices for each product, regressions to measure the price variability after the policy change are performed. Table 6 reports these results. It is clear that price variability increases (columns 1 and 2). Furthermore, the same set of regressions is applied to minimum and maximum prices (Columns 3,4 and 5,6 respectively) to explain this increase in price variability. Interestingly, tables indicate that there exists a decrease in both minimum and maximum prices, being stronger for the minimum ones. As a result, the distribution of wholesale prices becomes more dispersed and now it affects the right tail as well[17]. Hence, both quantile and price variability analysis result that deregulation has a permanent effect in the market and particularly, competition works better as years go on.

[15] See Genakos *et al* (2018) Table V, p.257.
[16] See Genakos *et al* (2018) Table VI, p.259 for the retail market and Table A2 of this paper for the wholesale one.
[17] The short run analysis of Genakos *et al* (2018) shows that the distribution of the wholesale prices becomes more dispersed due to the decrease of minimum prices. Similar results are obtained in the Table A3.

Table 4
The Impact of Deregulation on Retail Prices (Quantile Regressions)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable	residuals	residuals	residuals	residuals	residuals	residuals	residuals
		1th percentile	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile	99th percentile
Medium run	$Treat_i \times Post_t$	-0.102***	-0.072**	-0.066***	-0.080***	-0.084***	-0.076***	-0.114***
		(0.031)	(0.029)	(0.020)	(0.017)	(0.021)	(0.027)	(0.041)
	Observations	82,858	82,858	82,858	82,858	82,858	82,858	82,858
Long run	$Treat_i \times Post_t$	-0.053	-0.026	-0.038*	-0.041**	-0.052***	-0.070**	-0.120**
		(0.043)	(0.039)	(0.019)	(0.017)	(0.020)	(0.030)	(0.052)
	Observations	112,534	112,534	112,534	112,534	112,534	112,534	112,534
	Clusters	72	72	72	72	72	72	72

Notes: The dependent variable is the residuals of a regression of the logarithm of the retail price of product variety *i*, in store *j*, and day *t* on store, product variety, month × product fixed effects and a linear and quadratic trend measured in months including binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Greek Ministry of Development.

Table 5
The Impact of Deregulation on Wholesale Prices (Quantile Regressions)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable	residuals	residuals	residuals	residuals	residuals	residuals	residuals
		1th percentile	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile	99th percentile
Medium run	$Treat_i \times Post_t$	-0.050	-0.098*	-0.084***	-0.074**	-0.083***	-0.079**	-0.269***
		(0.047)	(0.051)	(0.025)	(0.030)	(0.031)	(0.036)	(0.047)
	Observations	20,783	20,783	20,783	20,783	20,783	20,783	20,783
Long run	$Treat_i \times Post_t$	-0.078	-0.092	-0.072**	-0.049*	-0.068**	-0.077	-0.151
		(0.115)	(0.100)	(0.033)	(0.028)	(0.027)	(0.092)	(0.111)
	Observations	28,686	28,686	28,686	28,686	28,686	28,686	28,686
	Clusters	72	72	72	72	72	72	72

Notes: The dependent variable is the residuals of a regression of the logarithm of the wholesale price of product variety *i*, in day *t* on product variety and month fixed effects and a linear and quadratic trend measured in months including binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Central Market.

Table 6
The Impact of Deregulation on the Wholesale Price Range, on Minimum and Maximum Prices

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	FE	FE	FE	FE	FE	FE
Dependent variable	Wholesale Price Range$_{it}$	Wholesale Price Range$_{it}$	ln(Wholesale Min Price)$_{it}$	ln(Wholesale Min Price)$_{it}$	ln(Wholesale Max Price)$_{it}$	ln(Wholesale Max Price)$_{it}$
Sample	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Medium run	Long run	Medium run	Long run	Medium run	Long run
$Treat_i \times Post_t$	0.220***	0.215***	-0.184***	-0.159***	-0.070**	-0.050
	(0.071)	(0.072)	(0.029)	(0.026)	(0.028)	(0.038)
$Post_t$ dummy=1 after 22 June 2011	-0.105*	-0.124**	0.005	-0.002	-0.037	-0.059
	(0.057)	(0.057)	(0.043)	(0.035)	(0.037)	(0.038)
Observations	20,783	28,686	20,783	28,686	20,783	28,686
Adjusted R^2	0.398	0.371	0.836	0.816	0.882	0.867
Clusters	72	72	72	72	72	72
Product FE	yes	yes	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes	yes	yes

Notes: The dependent variable (Columns1and 2) is the wholesale price range divided by the minimum price, $(max_{it} - min_{it})/min_{it}$ for product variety *i* in day *t*. The dependent variable Columns 3and 4 (Columns 5 and 6) is the logarithm of the minimum (maximum) wholesale price of product variety *i* in day *t.* All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%. **Source**: Author's calculations based on data from the Central Market.

5.2 Product Specific Effects

The effect of the reform is further investigated, through its impact, on each product's average price. Table 7 – columns 1 and 2 report these results for the retail market, while columns 3 and 4 for the wholesale one. Wholesale results indicate that 34 out of 39 products[18] show a negative coefficient and 30 out of 39 are statistically significant at the 5 percent confidence level in the medium run. Comparing these results with the short run[19], notice that the effect of policy change is stronger, since it indicates a 20 percent in the medium run and a 16 percent in the long run increase on products with statistically significant coefficients. Similar results emerge from the analysis of the retail market. This analysis allows to conclude to two findings. First, as in the short run, the drop of average prices was driven by the majority of products. Second, once again, this effect become stronger through the passing years.

Table 7
The Impact of Deregulation on Retail and Wholesale Prices by Product

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Wholesale Price})_{it}$	$\ln(\text{Wholesale Price})_{it}$
Time period	Medium run	Long run	Medium run	Long run
Apricot	-0.208***	-0.154***	-0.201***	-0.162***
	(0.035)	(0.046)	(0.045)	(0.046)
Artichoke	-0.073***	0.035*	-0.162***	-0.063*
	(0.015)	(0.017)	(0.022)	(0.034)
Banana	-0.030	-0.001	0.052***	0.057**
	(0.020)	(0.015)	(0.017)	(0.021)
Beans	-0.075**	-0.061**	-0.043	-0.046
	(0.028)	(0.023)	(0.036)	(0.035)
Beetroot	-0.056**	-0.002	-0.030*	0.024
	(0.020)	(0.015)	(0.018)	(0.026)
Broccoli	-0.123***	-0.041**	-0.154***	-0.109***
	(0.016)	(0.017)	(0.018)	(0.025)

(Continued)

[18] There are eight more products in the wholesale market together with data availability for the watermelon. Data for watermelon is limited for the retail market, therefore it is excluded.
[19] See Appendix A Table A4.

Table 7 (Continued)

	(1)	(2)	(3)	(4)
Cabbage	-0.194***	-0.076***	-0.180***	-0.059**
	(0.018)	(0.014)	(0.018)	(0.025)
Carrot	-0.085***	-0.042**	-0.006	0.026
	(0.020)	(0.014)	(0.017)	(0.021)
Cauliflower	-0.125***	-0.021	-0.181***	-0.090***
	(0.017)	(0.014)	(0.018)	(0.024)
Cherry	-0.063**	-0.086***	-0.109***	-0.154***
	(0.026)	(0.018)	(0.028)	(0.026)
Cucumber	-0.009	0.002	-0.036**	-0.031
	(0.021)	(0.015)	(0.017)	(0.021)
Eggplant	-0.066***	-0.050***	-0.065***	-0.066**
	(0.019)	(0.014)	(0.023)	(0.030)
Fresh onion	-0.047**	0.010	-0.136***	-0.069**
	(0.020)	(0.015)	(0.018)	(0.027)
Grapes	-0.013	-0.007	-0.082	-0.053
	(0.031)	(0.020)	(0.053)	(0.044)
Greens	0.005	0.050***	0.041**	0.082***
	(0.020)	(0.015)	(0.017)	(0.021)
Kiwi	0.005	0.012	-0.004	-0.069**
	(0.075)	(0.073)	(0.019)	(0.031)
Leek	-0.081***	0.012	-0.111***	-0.042
	(0.017)	(0.015)	(0.018)	(0.028)
Lettuce	-0.098***	-0.081***	-0.176***	-0.150***
	(0.020)	(0.015)	(0.017)	(0.021)
Mellon	-0.166***	-0.155***	-0.201***	-0.180***
	(0.052)	(0.052)	(0.019)	(0.015)
Nectarine	-0.213***	-0.228***	-0.159***	-0.161***
	(0.030)	(0.020)	(0.019)	(0.013)
Okra	-0.096***	-0.077***	0.120***	0.147***
	(0.033)	(0.021)	(0.023)	(0.015)
Onion	-0.222***	-0.127***	-0.202***	-0.111***
	(0.020)	(0.015)	(0.017)	(0.021)
Peach	-0.221***	-0.251***	-0.176***	-0.221***
	(0.029)	(0.019)	(0.026)	(0.024)
Peas	-0.144***	-0.120***	-0.412***	-0.407***
	(0.018)	(0.018)	(0.022)	(0.037)
Pepper	-0.123***	-0.102***	-0.074***	-0.062*
	(0.025)	(0.023)	(0.020)	(0.031)

(Continued)

Table 7 (Continued)

	(1)	(2)	(3)	(4)
Potato	-0.074***	-0.064***	-0.120**	-0.139**
	(0.019)	(0.020)	(0.047)	(0.051)
Spinach	-0.046**	0.020	-0.002	0.060**
	(0.018)	(0.014)	(0.017)	(0.026)
Strawberry	-0.094***	-0.037*	-0.116***	-0.099**
	(0.017)	(0.018)	(0.020)	(0.037)
Tomato	-0.074***	-0.068***	-0.201***	-0.167***
	(0.020)	(0.015)	(0.017)	(0.023)
Zucchini	-0.127***	-0.124***	-0.148***	-0.126***
	(0.020)	(0.015)	(0.017)	(0.021)
Watermelon			-0.118***	-0.085***
			(0.016)	(0.018)
Vlita			-0.074***	-0.041**
			(0.017)	(0.017)
Dill & parsley			-0.151***	-0.160***
			(0.017)	(0.021)
Pomegranate			-0.282***	-0.311***
			(0.022)	(0.013)
Quince			-0.135***	-0.151***
			(0.021)	(0.014)
Damson			-0.264***	-0.242***
			(0.016)	(0.027)
Fig			-0.079***	-0.143***
			(0.024)	(0.016)
Loquat			-0.259***	-0.216***
			(0.018)	(0.035)
Sour cherry			0.065***	-0.032*
			(0.019)	(0.015)
Store FE	yes	yes		
Product variety FE	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes

Notes: The dependent variable in Columns 1 and 2 is the logarithm of the retail price of product variety *i*, in store *j*, and day *t*. The dependent variable in Columns 3 and 4 is the logarithm of the wholesale price of product variety *i* in day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

Source: Author's calculations based on data from the Greek Ministry of Development and the Central Market.

5.3 Pass-through Regressions

The fact that retail prices are depended on wholesale prices is explored in Table 8. After controlling for wholesale prices in the merged dataset, Column 1 indicates that the markup deregulation affected retail prices indirectly, throw wholesale prices. Columns 2 – 8 report pass-through coefficients for the years 2010-2016. All of them are statistically significant and close in magnitude to column 1. Finally, adding an interaction between the wholesale prices and the post indicator, in an attempt to capture possible changes after the reform (column 9), has no effect, since the estimator is statistically insignificant. Hence, it is getting clear that retail prices follow wholesale prices, since the later are inputs to the former.

5.4 The Heterogeneous Impact of the Reform

Another explanation that the policy affects more the wholesale than the retail market, emerges by the differential effect on prices in supermarkets and street markets. Supermarkets typically buy from the Central Market, while street markets to a lower extend. Table 9 – Column 1 indicates that prices at supermarkets face a significant drop (10.8 and 6.5 percent for the medium and long run respectively), while prices at street markets were typically unaffected.

Furthermore, as mentioned in Genakos *et al* (2018) work, there are products that even streets markets have to heavily rely their buy on Central market. Peaches is one of them. Lettuce is a counterexample, since street markets almost never buy them from Central market. The remaining of Table 9 reports a restructured dataset, containing only lettuce, peaches and products belong in the control group. The results suggest a significant drop in prices 12.6 and 11.7 percent (column 2). Column 3 confirms previews result from Column 1. Finally, after controlling for the differential effect of the reform managing the cases of low/high dependence to Central market and whether it is street/super market (column 4) results indicate that lettuce (low) in street markets has no significant impact, whereas peaches (high) have a significant one for each period. Furthermore, prices in supermarkets fall for both products. As a result, even five years after the reform, products purely bought by Central market, still appear a significant drop in their prices. Both long run results of this paragraph make the collusion hypothesis more robust, providing additional evidence that

Table 8
The Impact of Pass-through on Retail Prices (Robustness)

	(1)	(2)	(3)	(4)	(5)
Estimation method	FE	FE	FE	FE	FE
Dependent variable	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$
Sample	Merged Retail & Wholesale data (all years)	Merged Retail & Wholesale data (2010)	Merged Retail & Wholesale data (2011)	Merged Retail & Wholesale data (2012)	Merged Retail & Wholesale data (2013)
$\text{Treat}_i \times \text{Post}_t$	-0.010				
	(0.010)				
$\ln(\text{Wholesale Price})_{it}$	0.460***	0.373***	0.335***	0.356***	0.347***
	(0.025)	(0.022)	(0.035)	(0.031)	(0.024)
$\ln(\text{Wholesale Price})_{it} \times \text{Post}_t$					
Post_t	-0.016				
dummy=1 after 22 June 2011	(0.014)				
Observations	101,108	15,227	16,940	17,119	12,499
Adjusted R^2	0.881	0.897	0.900	0.895	0.914
Clusters	59	51	57	57	56
Store FE	yes	yes	yes	yes	yes
Product variety FE	yes	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes	yes

(Continued)

Table 8 (Continued)

	(6)	(7)	(8)	(9)
Estimation method	FE	FE	FE	FE
Dependent variable	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$	$\ln(\text{Retail Price})_{ijt}$
Sample	Merged Retail & Wholesale data (2014)	Merged Retail & Wholesale data (2015)	Merged Retail & Wholesale data (2016)	Merged Retail & Wholesale data (all years)
$\text{Treat}_i \times \text{Post}_t$				-0.010
				(0.010)
$\ln(\text{Wholesale Price})_{it}$	0.317***	0.353***	0.338***	0.465***
	(0.026)	(0.023)	(0.031)	(0.026)
$\ln(\text{Wholesale Price})_{it} \times \text{Post}_t$				-0.006
				(0.011)
Post_t				-0.018
dummy=1 after 22 June 2011				(0.013)
Observations	11,903	20,754	6,666	101,108
Adjusted R^2	0.903	0.893	0.905	0.881
Clusters	53	55	48	59
Store FE	yes	yes	yes	yes
Product variety FE	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes

Notes: The dependent variable is the logarithm of the retail price of product variety *i*, in store *j*, and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%. **Source**: Author's calculations based on data from the Greek Ministry of Development and the Central Market.

the initial decrease of prices was not driven by other reasons, but clearly by the markup deregulation, which triggered the breakdown of collusion in the wholesale market.

Table 9
The Impact of Deregulation on Retail Prices (Selected Products)

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$
Sample	Merged Retail & Wholesale data	Retail data	Retail data	Retail data
Time period	Medium run	Medium run	Medium run	Medium run
$Treat_i \times Post_t$		-0.126***		
		(0.037)		
$Treat_i \times Post_t \times$ Street $market_j$	-0.040*		-0.052	
	(0.023)		(0.045)	
$Treat_i \times Post_t \times$ Super $market_j$	-0.108***		-0.234***	
	(0.034)		(0.033)	
$Treat_i \times Post_t \times Low_i \times$ Super $market_j$				-0.220***
				(0.026)
$Treat_i \times Post_t \times High_i \times$ Super $market_j$				-0.295***
				(0.035)
$Treat_i \times Post_t \times Low_i \times$ Street $market_j$				-0.014
				(0.020)
$Treat_i \times Post_t \times High_i \times$ Street $market_j$				-0.170***
				(0.027)
$Post_t$	-0.003	-0.058*	-0.063*	-0.066*
dummy=1 after 22 June 2011	(0.029)	(0.033)	(0.032)	(0.032)
Observations	73,371	20,521	20,521	20,521
Adjusted R^2	0.860	0.874	0.877	0.877

(Continued)

Table 9 (Continued)

	(1)	(2)	(3)	(4)
Time period	Long run	Long run	Long run	Long run
$Treat_i \times Post_t$		-0.117**		
		(0.043)		
$Treat_i \times Post_t \times$ Street $market_j$	-0.009		-0.046	
	(0.020)		(0.049)	
$Treat_i \times Post_t \times$ Super $market_j$	-0.065**		-0.216***	
	(0.025)		(0.039)	
$Treat_i \times Post_t \times Low_i \times$ Super $market_j$				-0.186***
				(0.017)
$Treat_i \times Post_t \times High_i \times$ Super $market_j$				-0.333***
				(0.022)
$Treat_i \times Post_t \times Low_i \times$ Street $market_j$				-0.004
				(0.018)
$Treat_i \times Post_t \times High_i \times$ Street $market_j$				-0.194***
				(0.019)
$Post_t$	-0.055**	-0.052*	-0.057*	-0.061**
dummy=1 after 22 June 2011	(0.023)	(0.030)	(0.030)	(0.028)
Observations	101,108	27,667	27,667	27,667
Adjusted R^2	0.846	0.859	0.862	0.863
Clusters	59	19	19	19
Store FE	yes	yes	yes	yes
Product variety FE	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes

Notes: The dependent variable is the logarithm of the retail price of product variety *i*, in store *j*, and day *t*. The sample includes all the products assigned to the control group (see Table B2) but only lettuces ("Low") and peaches ("High") in the treatment group. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Greek Ministry of Development.

5.5 Collusion and the Level of Regulated Markups

Following Genakos *et al* (2018) analysis, it is explored whether the heterogeneous impact of the reform, according to the level of products' regulated markups, still exists. For this reason, products are categorized to "low" and "high" maximum markups according Table B1. Table 10 reports that deregulation has a significant drop for both categories in the wholesale market (column1) in the medium run, opposed to short run. Column 2, after performing the same methodology based now on maximum markups of products in supermarkets, shows that either "low" markup regulated products or "high" markup regulated products have significant negative coefficients. Finally, when retail products are classified according to the level of their maximum markups at the Central market (column 3), both categories face a significant drop.

Combining the results of columns 1 and 3, someone could say that the medium run effect of policy change provides evidence, once more, that competition works better after some years of the reform, that is why significand results for both levels of regulated markups are reported. In other words, policy change initially leads to the breakdown of collusion for products with low markups[20], where collusion is easier to maintain. Later, it also affects products with high markups through enhanced competition. On the other hand, long run results suggest that the effect is similar to the short run one, that is prices fall almost for products with "low" maximum markups.

An alternative explanation for the last results is that another breakdown of collusion has taken place in the medium run for products with higher regulated maximum markups. Since markup was implemented in 1946, it is possible that wholesalers learned during this period that they cannot collude on the maximum markup ceilings, since deviating behavior is profitable as theory indicates too. As a consequence, someone could think that they decided to undercut by little from the focal point and collude on a lower markup ceiling (Haucap and Müller 2013). This is further confirmed by the shift to the left of the right tail of distribution as Figure 2B indicates for the medium run, by the negative significant coefficients indicated by quantile regressions for the right tail (Table 4), and by the drop of wholesale maximum prices (Table 5). It turned out, the new focal point to be more robust after the reform (related to the one at "low" markups), explaining why such an effect does not appear on the short run, as Rey and Tirole (2018) say that someone would expect focal

[20] As stated in Genakos *et al* paper (2018) and confirmed by the short run analysis (see Table A5).

Table 10
The Impact of Deregulation on the Level of Regulated Markups

		(1)	(2)	(3)
	Estimation method	FE	FE	FE
	Dependent variable	ln(Wholesale Price)$_{it}$	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$
Medium run	$Treat_i \times Post_t \times$ Low markup regulation$_j$	-0.141***		-0.078**
	Wholesale markup regulation ≤ 10%	(0.026)		(0.034)
	$Treat_i \times Post_t \times$ High markup regulation$_j$	-0.074***		-0.059**
	Wholesale markup regulation > 10%	(0.026)		(0.027)
	$Treat_i \times Post_t \times$ Low markup regulation$_j$		-0.065**	
	Retail markup regulation ≤ 30%		(0.031)	
	$Treat_i \times Post_t \times$ High markup regulation$_j$		-0.066**	
	Retail markup regulation > 30%		(0.028)	
	Observations	20,783	28,810	28,810
	Adjusted R^2	0.890	0.894	0.894
Long run	$Treat_i \times Post_t \times$ Low markup regulation$_j$	-0.128***		-0.075**
	Wholesale markup regulation ≤ 10%	(0.027)		(0.033)
	$Treat_i \times Post_t \times$ High markup regulation$_j$	-0.039		-0.028
	Wholesale markup regulation > 10%	(0.029)		(0.026)
	$Treat_i \times Post_t \times$ Low markup regulation$_j$		-0.061**	
	Retail markup regulation ≤ 30%		(0.029)	
	$Treat_i \times Post_t \times$ High markup regulation$_j$		-0.032	
	Retail markup regulation > 30%		(0.027)	
	Observations	28,686	41,277	41,277
	Adjusted R^2	0.873	0.871	0.871
	Clusters	72	72	72
	Store FE		yes	yes
	Product variety FE	yes	yes	yes
	Month × Product FE	yes	yes	yes
	Year-month trend and square	yes	yes	yes

Notes: The dependent variable is the logarithm of the wholesale (column 1) and retail (columns 2 and 3) price of product variety *i* and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%. **Source**: Author's calculations based on data from the Greek Ministry of Development and the Central Market.

points not to disappear immediately. But, through the passing of years, the enhanced competition made this collusion also unsustainable.

On the other hand, long run results suggest that a possible reconstruction of collusion takes place for products with "high" maximum markups[21]. This view is reinforced by some other results. First, the long run distribution of wholesale prices compared with the medium run one shows a shift to the right for the right tail (Figure 2B). Second, quantile regressions for the wholesale market report insignificant coefficients for the last two percentiles (Table 4). Third, also insignificant coefficient is reported for the effect of the reform on wholesale maximum prices in the long run (Table 5- column 6) and, fourth, by the number of products with positive coefficients reported in Tables 7 and A4. Notice that 6 products have positive coefficients (statistically significant or not) in the short run, 3 in the medium run and they increase to 6 in the long run. All of these products[22] belong in the "high" maximum markup group (Table B2).

1. Conclusion

In this paper, I tried to shed some light on the effects of maximum markup regulation on prices. The implementation of maximum markup aims to trim the right tail of the markup distribution, where products with higher markups exist. Since, markups are positive correlated with prices, the repeal of this regulation should have the opposite effect. Surprisingly, the whole distribution of prices shifts to the left in the long run. This effect is stronger in the medium run, affecting in addition products with higher markups. Results indicate that the abolishment of markup regulation has a permanent effect on prices for both markets. The decrease of retail prices corresponds to total consumer savings (for the five years after the reform) about €980 million. Moreover, findings provide indirect evidence for the collusion hypothesis. Hence, this ex post policy evaluation indicates that competition works better when markets (at least some of them) operate without regulation.

[21] These results should be interpreted with care, since increased prices for "high" maximum regulated products may be the outcome of other factors, such as seasonality due to bad weather conditions (a typical phenomenon in fruits and vegetables production process).

[22] These products are banana, greens, okra and are common for each period. Additionally, beans, fresh onion and grapes for the short run and spinach, beetroot and carrot for the long run.

This paper is only a first step in investigating the long run impact of maximum markup deregulation. Further research is required to study first, the impact of markup regulation in other product markets as well, and second, the impact of the reforms on a broader market restrictions agenda. Furthermore, an important limitation of this paper lies in the fact that the difference in difference framework illustrates only the direct impact of a policy change on prices. As a consequence, an augmented analysis is needed to take into account other effects of the policy change, such as, the outcome of this reduction in prices to other sectors of the economy (indirect price effect), and whether quality, innovation, structure of market -with entry or exit of firms- are influenced (non-price effect).

All this future research will add on the debate of reforms, discussed over the last two decades, answering the question whether market liberalization raises competitiveness and boosts economic growth. This research will also provide evidence to whether these reforms lead to distributional equity among society as political economy indicates.

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APPENDIX A

The results of the short run analysis (2010-2012) for the wholesale market are presented in this section. This analysis is the same with Genakos *et al* (2018) work. However, there are two differences: a) there are 8 more products, further divided into 13 product varieties, and b) data is in three times per week, rather than a monthly frequency. Results do not change in any fundamental way. Tables are presented in the same order as in the long run analysis.

Table A1
The Impact of Deregulation on Wholesale Prices (Short run)

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	OLS	FE	FE	FE
Dependent variable	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$
Sample	Treatment only	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
$Treat_i \times Post_t$		-0.108*	-0.112*	-0.178***	-0.101***	-0.102***
		(0.059)	(0.057)	(0.043)	(0.034)	(0.034)
$Post_t$ dummy=1 after 22 June 2011	-0.099***	0.009	-0.038	0.012	-0.048	-0.055
	(0.036)	(0.047)	(0.048)	(0.041)	(0.034)	(0.036)
$Treat_i$		-0.086	-0.091			
		(0.134)	(0.134)			
Observations	9,775	12,294	12,294	12,294	12,294	12,294
Adjusted R^2	0.006	0.014	0.024	0.783	0.882	0.882
Clusters	53	72	72	72	72	72
Month FE			yes	yes		
Product FE				yes	yes	yes
Month × Product FE					yes	yes
Year-month trend and square						yes

Notes: The dependent variable is the logarithm of the wholesale price of product variety *i* in day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Central Market.

Table A2
The Impact of Deregulation on Wholesale Prices (Quantile Regressions – Short run)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	residuals	residuals	residuals	residuals	residuals	residuals	residuals
	1^{th} percentile	5^{th} percentile	25^{th} percentile	50^{th} percentile	75^{th} percentile	95^{th} percentile	99^{th} percentile
$Treat_i \times Post_t$	-0.273***	-0.197***	-0.144***	-0.103***	-0.128***	0.031	0.385***
	(0.036)	(0.056)	(0.040)	(0.036)	(0.048)	(0.053)	(0.037)
Observations	12,294	12,294	12,294	12,294	12,294	12,294	12,294
Clusters	72	72	72	72	72	72	72

Notes: The dependent variable is the residuals of a regression of the logarithm of the wholesale price of product variety *i*, in day *t* on product variety and month fixed effects and a linear and quadratic trend measured in months including binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Central Market.

Table A3
The Impact of Deregulation on the Wholesale Price Range, on Minimum and Maximum Prices

	(1)	(2)	(3)
Estimation method	FE	FE	FE
Dependent variable	Wholesale Price Range$_{it}$	ln(Wholesale Min Price)$_{it}$	ln(Wholesale Max Price)$_{it}$
Sample	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Short run	Short run	Short run
Treat$_i$ × Post$_t$	0.239***	-0.176***	-0.048
	(0.061)	(0.037)	(0.030)
Post$_t$ dummy=1 after 22 June 2011	-0.090*	-0.046	-0.085**
	(0.050)	(0.039)	(0.032)
Observations	12,294	12,294	12,294
Adjusted R^2	0.471	0.849	0.895
Clusters	72	72	72
Product FE	yes	yes	yes
Month × Product FE	yes	yes	yes
Year-month trend and square	yes	yes	yes

Notes: The dependent variable (Column1) is the wholesale price range divided by the minimum price, $(max_{it} - min_{it})/min_{it}$ for product variety *i* in day *t.* The dependent variable Column 2 (Column 3) is the logarithm of the minimum (maximum) wholesale price of product variety *i* in day *t.* All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%. **Source**: Author's calculations based on data from the Central Market.

Table A4
The Impact of Deregulation on Wholesale Prices by Product (Short run)

	(1)
Estimation method	FE
Dependent variable	ln(Wholesale Price)$_{it}$
Apricot	-0.284***
	(0.027)
Artichoke	-0.146***
	(0.033)
Banana	0.049*
	(0.028)
Beans	0.012
	(0.030)
Beetroot	-0.019
	(0.029)

(Continued)

Table A4 (Continued)

	(1)
Broccoli	-0.124***
	(0.029)
Cabbage	-0.136***
	(0.030)
Carrot	-0.054*
	(0.029)
Cauliflower	-0.202***
	(0.029)
Cherry	-0.010
	(0.027)
Cucumber	-0.000
	(0.027)
Eggplant	-0.048
	(0.030)
Fresh onion	0.044
	(0.028)
Grapes	0.038
	(0.046)
Greens	0.151***
	(0.028)
Kiwi	-0.105***
	(0.030)
Leek	-0.087***
	(0.028)
Lettuce	-0.163***
	(0.028)
Mellon	-0.162***
	(0.035)
Nectarine	-0.122***
	(0.034)
Okra	0.181***
	(0.047)
Onion	-0.218***
	(0.029)
Peach	-0.090
	(0.056)
Peas	-0.263***
	(0.033)

(Continued)

Table A4 (Continued)

	(1)
Pepper	-0.068**
	(0.028)
Potato	-0.191***
	(0.063)
Spinach	-0.013
	(0.029)
Strawberry	-0.063*
	(0.032)
Tomato	-0.221***
	(0.027)
Zucchini	-0.109***
	(0.027)
Watermelon	-0.094***
	(0.029)
Vlita	-0.076**
	(0.029)
Dill & parsley	-0.110***
	(0.028)
Pomegranate	-0.223***
	(0.035)
Quince	-0.075**
	(0.032)
Damson	-0.268***
	(0.036)
Fig	0.124**
	(0.046)
Loquat	-0.229***
	(0.032)
Sour cherry	0.359***
	(0.047)
Product variety FE	yes
Month × Product FE	yes
Year-month trend and square	yes

Notes: The dependent variable is the logarithm of the wholesale price of product variety *i* in day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Central Market.

Table A5
The Impact of Deregulation on the Level of Regulated Markups

	(1)
Estimation method	FE
Dependent variable	$\ln(\text{Wholesale Price})_{it}$
$\text{Treat}_i \times \text{Post}_t \times$ Low markup regulation$_j$	-0.139***
Wholesale markup regulation ≤ 10%	(0.035)
$\text{Treat}_i \times \text{Post}_t \times$ High markup regulation$_j$	-0.044
Wholesale markup regulation > 10%	(0.036)
Observations	12,294
Adjusted R^2	0.903
Clusters	72
Product variety FE	yes
Month × Product FE	yes
Year-month trend and square	yes

Notes: The dependent variable is the logarithm of the wholesale price of product variety *i* and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%. **Source**: Author's calculations based on data from the Greek Ministry of Development and the Central Market.

APPENDIX B

Table B1
Maximum Retail and Wholesale Markups

Product	Wholesale maximum markup	Retail maximum markup (supermarkets and grocery stores)	Retail maximum markup (street markets)
Potato	8%	25%	23%
Dry onions	10%	20%	17%
Artichoke, cucumber, tomatoes, vlitta*, drill & parsley*	10%	25%	22%
Zucchini, cauliflower, beetroot, lettuce, spinach, cabbage, broccoli, greens, leek, peas, carrots, fresh onions, peppers, okra, eggplant.	12%	35%	32%
Apricot	10%	35%	32%
Peach	10%	35%	30%
Grapes, beans.	12%	28%	25%
Strawberry	12%	40%	35%
Bananas	12%	30%	27%
Other fruits i.e.: cherry*, damson*, fig*, kiwi*, loquat*, mellon*, nectarine*, pomgranate*, quince*, sour cherry*, watermellon*.	10%	30%	27%

Source: Ministerial decision A2-1045 (Gazette B' 1502/22-6-2011). **Note***:* Products with a star (*) did not exist in Genakos *et al* (2018) paper.

Table B2
Product Classification

Treatment Group			Control Group
Apricot	**Eggplant**	**Peach**	**Apple**
Apricot (Diamantopoulou)*	Tsakonian eggplant*	Peach (common)*	Apple (Golden)*
Apricot (common)*	Eggplant (common)*	Peach (white-pulp)**	Apple (Golden-imported)*
Artichoke	Eggplant (imported)	**Peas**	Apple (Grand Smith)*
Artichoke (common)*	**Fig****	**Pepper**	Apple (Grand Smith-imported)*
Artichoke (imported)	**Fresh onion**	Pepper (longish)*	Apple (Starkin)*
Banana	**Grapes**	Florinis peppers*	Apple (Starkin-imported)*
Beans	Grape (common)*	Green pepper (large)*	**Lemon**
Bean Barbouni*	Sultana grapes (raisin)*	Green pepper (large-imported)	Lemon (common)*
Bean Barbouni (imported)	**Greens**	**Pomegranate****	Lemon (imported)*
Bean Tsaouli*	**Kiwi**	**Potato**	**Mandarins**
Beetroot	Kiwi (common)*	Potato (common)*	Clementin mandarin*
Broccoli	Kiwi (imported)	French potato*	Clementin mandarin (imported)
Broccoli (common)*	**Leek**	Potato (imported)*	Mandarin (common)*
Broccoli (imported)	**Lettuce**	Potato Cyprus	Mandarin (satsoumes)**
Cabbage	Lettuce (common)*	**Quince****	**Orange**
Carrot	Lettuce (kg)	**Sour cherry****	Valencia orange*
Cauliflower	**Loquat****	**Spinach**	Orange (navalines-merlin)*
Cauliflower (common)*	**Melon**	**Strawberry**	**Pear**
Cauliflower (imported)	Melon (common)*	**Tomato**	Pear (imported)*
Cherry	Melon (Argitis)*	Tomato (common)*	Pear Krystali*
Cherry (petrokeraso)*	Melon (Thrace)*	Tomato (imported)*	Pear Krystali (imported)
Cherry (crisp)*	**Nectarine**	**Vlitta****	Pear (kontoules)**
Cucumber	**Okra**	**Watermelon***	Pear (kossia)**
Cucumber small*	Thick okra	**Zucchini**	Pear (santa maria)**
Cucumber large*	Fine okra*	Zucchini*	
Damson**	**Onion**	Zucchini (imported)	
Dill & Parsley**	Onion (common)*		
	Onion (imported)		

Notes: The table reports information on the classification of all the products (and their varieties) used in the estimation. A star (*) indicates the product varieties matched in the wholesale data. Two stars (**) indicates the products or product varieties appear only in the wholesale data.

Table B3
The Impact of Deregulation on Retail & Wholesale Prices (Merged Dataset / Robustness)

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$
Sample	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Medium run	Long run	Medium run	Long run
$Treat_i \times Post_t$	-0.066***	-0.032*	-0.112***	-0.067**
	(0.024)	(0.017)	(0.036)	(0.029)
$Post_t$ dummy=1 after 22 June 2011	0.005	-0.048**	0.025	-0.046
	(0.028)	(0.022)	(0.042)	(0.037)
Observations	73,371	101,108	73,371	101,108
Adjusted R^2	0.859	0.846	0.851	0.828
Clusters	59	59	59	59
Store FE	yes	yes		
Product variety FE	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes

Notes: The dependent variable is the logarithm of the retail price of product variety *i*, in store *j*, and day *t* (Columns 1 and 2). For Columns 3 and 4 the dependent variable is the logarithm of the wholesale price of product variety *i*, and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

Source: Author's calculations based on data from the Greek Ministry of Development and the Central Market.

Table B4
The Impact of Deregulation on Retail & Wholesale Prices (Robustness)

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	ln(Retail Price)$_{ijt}$	ln(Retail Price)$_{ijt}$	ln(Wholesale Price)$_{it}$	ln(Wholesale Price)$_{it}$
Sample	Control & Treatment	Control & Treatment	Control & Treatment	Control & Treatment
Time period	Medium run	Long run	Medium run	Long run
$Treat_i \times Post_t \times Fruit_j$	-0.074**	-0.057*	-0.106***	-0.104**
	(0.035)	(0.034)	(0.039)	(0.040)
$Treat_i \times Post_t \times Vegetable_j$	-0.084***	-0.048***	-0.101***	-0.068**
	(0.021)	(0.018)	(0.024)	(0.028)
$Post_t$ dummy=1 after 22 June 2011	0.019	0.094***	-0.020	-0.051
	(0.027)	(0.021)	(0.037)	(0.033)
Observations	82,858	112,534	20,783	28,686
Adjusted R^2	0.858	0.855	0.890	0.872
Clusters	72	72	72	72
Store FE	yes	yes		
Product variety FE	yes	yes	yes	yes
Month × Product FE	yes	yes	yes	yes
Year-month trend and square	yes	yes	yes	yes

Notes: The dependent variable is the logarithm of the retail/wholesale price of product variety *i*, in store *j*, and day *t*. All regressions include binary indicators for the changes in VAT rates. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.
Source: Author's calculations based on data from the Greek Ministry of Development and the Central Market.