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EVALUATION OF COMPETITIVE IMPACTS OF GOVERNMENT INTERVENTIONS

-- Paper by Christos Genakos, Pantelis Koutroumpis, and Mario Pagliero --

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THE IMPACT OF MARKUP REGULATION ON PRICES

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Abstract

1. We test the impact of markup ceiling regulation in an oligopolistic market, using data from the retail market for fresh fruits and vegetables in Greece. In 2011, as part of a larger package of market reforms, the Greek government repealed a law that had imposed maximum wholesale and retail margins for all but five fruits and vegetables. To identify the impact of deregulation on prices, we compare the prices of products affected by regulation before and after the policy change and use the unregulated products as a control group. We find that abolishing markup regulation led to a significant decrease in both retail and wholesale prices. However, after accounting for wholesale prices, retail prices were not significantly affected. This suggests that markup regulation affected wholesalers and only indirectly retailers, who adjusted their price level but not their markups. We provide additional evidence consistent with markup ceilings providing a focal point for collusion among wholesalers.

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1. Introduction

2. Government regulation of maximum retail markups is common. Monopolists have long been subject to markup regulation in the telecom and utility markets around the world and regulation has also been used in oligopolistic markets, such as the market for pharmaceutical products. According to the World Health Organization (2011), around 60% of low and middle-income countries report regulating wholesale or retail mark-ups. In high-income countries, markups are also commonly regulated and typically accompanied by a complex system of price regulation.[4] Markup regulation has also been implemented in other markets. For example, markups in the gasoline market have been regulated in some Canadian provinces, Luxemburg, and Mexico, and until the late 1990s they were regulated in other countries, such as Spain.

3. The objective of markup regulation is to reduce the price paid by consumers, limit the effects of market power and ultimately increase welfare. In the case of monopolies, evaluating the effects of regulation has been a central theme in the literature on regulation. The effects of markup regulation in markets with different market structures have been the focus of much less attention. In these markets, the main argument for regulating markups is to trim the right tail of the markup distribution, hence limiting the most extreme instances of exploitation of market power. This is expected to put downward pressure on prices, without affecting firms with smaller markups (e.g., a competitive fringe). If binding, markup ceilings will force some firms to reduce prices. If not binding, prices will not be affected. Hence, the average price will weakly fall. The logic of the argument is clear and simple, so much so that the predicted effect of markup regulation has never been subject to systematic empirical testing.

4. In this paper, we take this seemingly uncontroversial prediction to the data and estimate the impact of markup regulation on prices. We take advantage of the repeal of maximum markup regulation in the Greek market for fresh fruits and vegetables. First implemented after the Second World War, markup regulation was hastily canceled on 22 June 2011 as part of a larger package of reforms aiming at liberalizing the Greek economy, deeply affected by the global recession.

5. Regulation consisted of maximum wholesale and retail margins (between 8 and 35 percent) on many fruit and vegetable products. Markup regulation covered about 86 percent of the main product categories in this market. However, five types of fruit (apples, lemons, mandarins, oranges, and pears) were not subject to regulation. Moreover, other grocery products had never been regulated. To identify the impact of deregulation on prices, we compare prices of products affected by regulation before and after the policy change and use the unregulated products as a control group. After accounting for product and store characteristics, time trends and yearly price cycles (typical of fruit and vegetable products), deregulation provides some plausibly exogenous variability that allows estimating the impact of regulation.

6. Our dataset comprises three types of data. First, it includes weekly store-specific retail prices for each fruit and vegetable product category (44,000 observations). Our sample covers one and a half years before and after the policy change, from 4 January 2010 to 28 December 2012. Second, we have median monthly wholesale prices for the same product categories from Athens Wholesale Market (about 1,000 observations). Third, the data set includes retail prices of 14 non-fruit and vegetable products sold in supermarkets in the same area and period.

[4] This is usually part of a comprehensive pricing strategy related to the reimbursement of costs of medicines under a national health service or insurance system. Such systems usually involve the control or setting of either manufacturer/importer selling prices or the final retail sales price.

7. Surprisingly, we find that abolishing markup regulation led to three percent *lower* average retail prices. This result is robust to a number of alternative econometric specifications and different methods of selecting the control group. Prices of goods in the control group were not affected by the policy change. Wholesale prices also decreased as a consequence of deregulation (by 8 to 15 percent). This result is also robust to a number of alternative specifications. Similarly, wholesale prices of products in the control group were not affected.

8. Did regulation affect the behavior of wholesalers, retailers, or both? We find that, after accounting for wholesale prices, retail prices were not significantly affected by changes in regulation. This suggests that although regulation had a direct affect on wholesalers, it only indirectly affected retailers, who responded to deregulation by adjusting their price levels but not their markups.

9. Further evidence also indicates that regulation directly affected the wholesale market and only indirectly retailers. The supermarkets in our sample typically buy from wholesalers, and we find that the prices of goods sold in supermarkets were all affected by deregulation. In contrast, retailers in Athens' Central Market (a large organized marketplace for smaller retailers) rely on wholesalers for imported goods, buying locally grown products from a fragmented market of local producers. We find that goods sold in this market were not uniformly affected by deregulation. The retail price of imported goods fell as much as in supermarkets, while the retail price of locally grown products was not significantly affected.

10. Additional data shows that the wholesale market for fruit and vegetable products is more concentrated than the retail market and less affected by entry and exit. Firms (in terms of sale volume) are larger and more likely to be incorporated. These differences are huge when comparing the wholesale market with retailers in Athens' Central Market (Hellenic Competition Commission, 2013). This additional evidence is consistent with maximum markups providing a focal point for collusion among wholesalers. Concentration in the wholesale market facilitates collusion, while the existence of a fragmented market for local products deters collusion.

11. In oligopolistic markets, maximum markups may limit the price charged by firms facing a binding constraint, but they may also alter the pricing behavior of firms not subject to a binding constraint. The effect on the average price is thus ambiguous. Our findings resonate with the results of Knittel and Stango (2003), who show that mandatory price ceilings in the credit card market had the perverse effect of increasing average prices. They suggest collusion as a likely explanation and were the first to highlight the possibility of these two countervailing effects of regulation.

12. Markup regulation is clearly related to price regulation, but it differs in two important ways. First, markup regulation provides more flexibility to the regulator by allowing prices to depend on marginal cost. Second, marginal costs are not typically observed, so monitoring is difficult. These two main differences have been central themes in the literature on the economics of regulation. The main problem in the empirical study of markup regulation is that the researcher cannot directly observe which firms are constrained and which are not, as observation of individual prices is not enough to infer markups. A second empirical problem arises when the market is not vertically integrated. In this case, regulation might affect the markup at the wholesale and retail level. We overcome these problems using a difference in difference approach and studying the impact of a policy change on the conditional distribution of prices at the retail and wholesale level.

13. The evidence on the effect of markup regulation in oligopolistic markets is scarce. In the market for pharmaceutical products, the evidence is mixed (World Health Organization 2011). In these markets, markup regulation is generally introduced along with a number of other regulations; hence, it is difficult to isolate its effect. Very few studies exist in other markets (Suvankulov et al. 2012, Sen et al. 2011).

14. The structure of the paper is as follows. Section 2 describes the data. Section 3 illustrates our empirical methodology and the assumptions required to exploit the variability induced by the policy change. Section 4 presents our empirical results.

2. The data

15. The introduction of markup regulation in Greece was accompanied by a comprehensive monitoring program. Supermarkets were required to report their posted prices on a weekly basis for all of the main grocery products. Individual retailers in Athens' Central Market were sampled with the same frequency.[5] We obtained individual seller data for 36 product categories in 43 supermarkets in the Attica region (Athens and neighboring area) and Athens' Central Market from 4 January 2010 to 28 December 2012. Our sample does not cover independent retailers who are not supermarkets and who do not operate in Athens' main marketplace (such as small corner stores or retailers in smaller street markets).

16. Monitoring also extended to wholesale prices in Athens' Central Wholesale Market, where wholesalers sell to retailers. Our data set includes monthly median prices of individual transactions in the wholesale market for the same period and product categories. Table 1 provides the list of product categories in the two datasets. We also have data on prices of 14 grocery products other than fruits and vegetables sold in supermarkets. None of these products was affected by regulation.

17. The maximum allowed markups changed several times following introduction of regulation. In our sample period, they ranged between 8 and 12 percent in the wholesale market, between 20 and 35 percent in supermarkets, and between 17 and 32 percent in Athens Central Market and other smaller street markets. Table 2 reports maximum markups by product category and market type.

18. The policy change was highly visible and prominently featured in national newspapers, and the process leading to deregulation was speedy. Deregulation was the outcome of mounting international pressure to liberalize the economy, in an attempt to limit the effects of the spiraling recession. The policy was implemented on 23 June 2011, a few weeks after the government presented a road map of reforms. Therefore, although some anticipation effects are possible, they would likely have been limited to a few weeks.

19. Other policies where implemented during our sample period. More specifically, three subsequent increases in VAT occurred: from 9% to 10% on 15/3/2010, from 10% to 11% on 1/7/2010, from 11% to 13% in 1/1/2011. However, we could find no evidence of any specific policy that affected regulated and unregulated products differently.

[5] Athens' Central Market is a large indoor market for grocery products. It is open 5 days per week and rents its facilities to a large number of individual retailers. These are typically small family businesses, with no connection to the supermarket chains. The market has traditionally been the main venue for grocery shopping in Athens.

2.1 Identification and Empirical Specification

20. Identification of the impact of the policy change is obtained within a difference in difference framework. Denote by P_{ijt} the retail price of product *i*, in store *j*, in week *t*. The basic empirical specification is of the form

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

where Post_t is an indicator variable equal to one after deregulation, Treat_i is an indicator variable for products affected by the regulation (treatment group), Post_t x Treat_i denotes the interaction of Treat_i and Post_t, and e_itj is a random shock with $\text{E}(\text{e}_\text{itj}|\text{i},\text{t},\text{j}) = 0$. X_ijt is a matrix of control variables including product specific VAT rate, time trend, and product-specific indicator variables. b_3 is the crucial parameter capturing the impact of the policy change.

21. The key identifying assumption is that price trends would be the same (conditional on covariates X_{ijt}) in the treatment and control groups in the absence of treatment. This assumption becomes increasingly credible as we add appropriate controls in X_{ijt}. First, we control for VAT rates. Second, we include in X_{ijt} product-and-month-specific indicator variables capturing the yearly price cycle of each grocery product. Third, we include a linear trend (measured in weeks) interacted with the treatment indicator variable. This relaxes the key assumption of parallel trends and allows prices in the two groups to follow different trends. These three groups of controls can be added because we observe three years of data, many different products, and many different prices for the same product in each period.

22. The difference in difference approach also assumes that the policy change does not affect the control group (no spillover effects). In our setting, the policy change directly affects the prices of treated products but might also affect the demand for substitute and complementary products, and hence their prices. If this is the case, our estimator will not capture the impact of the policy but only the differential impact of the policy on the two groups. In the absence of a formal randomization into treatment status, the choice of the control group entails a tradeoff. Similar products are more likely to meet the equal trends assumption, but they are also more likely to be related. In Section 4, we investigate the possible bias introduced by substitution effects and also test the robustness of the results using a different control group, comprising only unquestionably unrelated products. The results are not affected.

23. We also estimate a dynamic model interacting $Treat_i$ with indicator variables for L periods before and after the policy change,

$$\ln(P_{ijt}) = b_0 + Post_t\, b_1 + b_2 Treat_i + \sum_{r=-L}^{L}[Treat_i \text{ x } I(t+r)]b_{3,r} + X_{ijt}d + e_{ijt} \quad (2)$$

This allows evaluation of whether the policy impact followed or preceded the policy change (Autor 2003). This approach also allows us to test if the impact of deregulation peaked after the policy change and then decreased or if prices permanently adjusted to the new level instead. The analysis of wholesale prices (WP) uses the same empirical specification with the caveat that median wholesale prices are recorded by product type and not by store. The dynamic effects of the reform can also be evaluated in this case.

2.2 Did markup regulation increase prices? Empirical Results

24. Table 3 shows that the mean prices (and standard deviations) of regulated and unregulated fruits and vegetables are very similar. The other grocery products in our sample tend to be more expensive on average. Table 4 reports the before-after comparison of the price of products covered by regulation. On average, the price of these products was 8 percent lower after deregulation. This difference is not affected when controlling for product-specific price cycles or product fixed effects. Controlling for product-specific

linear trends (number of months), quadratic trends, and product variety fixed effects (subgroups of each product category) leads to estimated coefficients that are about 3 percentage points smaller.

25. Table 5 reports our main results from specification (1). The simple difference in difference estimator, with no controls, shows that prices did not significantly change after deregulation for the control group. However, the average price of the treatment group fell by 10 percent. In columns 2 and 3, the negative impact of deregulation survives the inclusion of product-specific yearly cycles, and of linear and quadratic product-specific trends. After controlling for these covariates, the estimated impact of deregulation is about 3.5 percent. The coefficient of $Treat_i$ indicates no significant difference in average price between the treatment and control group.

2.3 How can maximum markups lead to higher prices?

26. Table 6 reports the results of our difference in difference approach using wholesale data. Without control variables, the difference in difference estimate of the impact of the policy change is about -10 percent, which is remarkably similar to the result obtained in Table 5, column 1. The wholesale prices of regulated products fell after deregulation. Including product-specific yearly price cycles and product fixed effects leads to a smaller estimated impact of deregulation (-8.7 percent). When controlling for product-specific time trends we obtain estimates of about -15 percent. However, standard errors are larger than in Table 5 and the estimated coefficients are not significantly different from the corresponding estimates in Table 5.

27. In Table 7, we investigate the impact of the policy change on retail prices holding wholesale prices constant. This requires collapsing the retail price data at the monthly level. Column 1 reports the results of our benchmark specification controlling for product-specific price cycles, product-specific quadratic trends, and product variety fixed effects. The impact of deregulation is about -3 percent, as in Table 5, column 4. Table 7, column 2 reports the impact on prices in supermarkets and in Athens Central Market separately. Deregulation affected prices in supermarkets (-10 percent) but not in Athens Central Market.

28. Column 3 controls for wholesale prices. After accounting for the impact of wholesale prices, there is no effect from the policy change. This is consistent with the results in column 2, as supermarkets typically buy all of their grocery products from wholesalers. Fruit and vegetable stand vendors, on the other hand, have access to a variety of small producers of local goods. However, they still have to rely on wholesalers for their supply of imported goods. Table 7, column 4 focuses on prices in Athens Central Market. While the policy change had a large negative impact on the prices of imported goods (-6.8 percent), it had a positive impact on the prices of locally produced goods (+3.2 percent).

29. Since the sample includes a number of periods before and after the policy change, we can use model (2) to gauge the timing of the impact of deregulation. The results are reported in Figures 1 and 2. There seems to be a considerable anticipation effect. This is consistent with our review of newspaper articles published around the date deregulation went into effect.

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TABLE 1. OVERVIEW OF PRODUCT CATEGORIES IN THE DATA SET.

		Regulated	Unregulated
Fruit and vegetable products	Retail Market	apricot, artichoke, aubergine, banana, beans, beetroot, broccoli, cabbage, carrot, cauliflower, cherry, cucumber, eggplant, fresh onion, grapes, greens, kiwi, leek, lettuce, melon, nectarine, okra, onion, peach, peas, pepper, potato, spinach, strawberry, tomato, watermelon, zucchini	apple, lemon, mandarin, orange, pear
	Wholesale Market	Same as above	Same as above
Non fruit and vegetable products	Retail Market	---	beer, biscuit, brandy, bread-toast, cereals, condensed milk, flour, fresh milk, rice, rum, spaghetti, toast, whisky, wine

TABLE 2. MAXIMUM WHOLESALE AND RETAIL MARKUPS.

Product	Wholesale maximum markup	Retail maximum markup (supermarkets and grocery stores)	Retail maximum markup (Athens' Central Market and other street markets)
Artichoke	10%	25%	22%
Cucumber	10%	25%	22%
Zucchini, cauliflower, beetroot, lettuce, spinach	12%	35%	32%
Peas, carrots, fresh onions, peppers, okra, eggplant	12%	35%	32%
Apricot	10%	35%	32%
Dry onions	10%	20%	17%
Bananas	12%	30%	27%
Grapes, beans	12%	28%	25%
Tomatoes	10%	25%	22%
Strawberry	10%	25%	22%
Any other fruit	10%	30%	27%
Potato	8%	25%	23%
Peach	10%	35%	30%

TABLE 3. SUMMARY STATISTICS
(mean and s.d. of prices by regulation and product type)

	Type of product	Retail market			Wholesale market
		Supermarkets	Athens Central Market	Total	
Regulated Products	Fruits and vegetables	1.349 (0.861)	1.456 (0.844)	1.422 (0.851)	0.777 (0.480)
Unregulated Products	Fruits and vegetables	1.400 (0.502)	1.314 (0.556)	1.340 (0.542)	0.776 (0.272)
	Other	4.510 (6.757)	---	4.510 (6.757)	---

Note: For the wholesale market, the data comprises median prices for each product category (computed at the monthly level). The table reports the mean of such prices and their standard deviation.

TABLE 4. THE IMPACT OF DEREGULATION ON PRICES (REGULATED PRODUCTS)

Estimation method	**(1) OLS**	**(2) FE**	**(3) FE**	**(4) FE**
Dependent variable	**log(Retail_Price)$_{ijt}$**	**log(Retail_Price)$_{ijt}$**	**log(Retail_Price)$_{ijt}$**	**log(Retail_Price)$_{ijt}$**
Post$_t$	-0.082***	-0.085***	-0.046**	-0.055***
dummy=1 after 22/6/2011	(0.015)	(0.009)	(0.020)	(0.019)
Observations	44,606	44,606	44,606	44,606
R-squared	0.005	0.755	0.762	0.851
Number of clusters	44	44	44	44
Month FE x Product FE		YES	YES	YES
Trend x Product FE			YES	YES
Trend squared x Product FE			YES	YES
Product FE		YES	YES	
Product Variety FE				YES

Notes: The dependent variable is the logarithm of the average retail price of product *i*, in store *j*, in week *t*. Indicator variables for VAT levels are included in all specifications. Standard errors clustered at the store group level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 5. THE IMPACT OF DEREGULATION ON PRICES (REGULATED AND UNREGULATED PRODUCTS)

	(1)	(2)	(3)	(4)
Estimation method	OLS	FE	FE	FE
Dependent variable	$\log(\text{Retail\_Price})_{ijt}$	$\log(\text{Retail\_Price})_{ijt}$	$\log(\text{Retail\_Price})_{ijt}$	$\log(\text{Retail\_Price})_{ijt}$
$\mathbf{Treat_i \times Post_t}$	-0.101***	-0.0680***	-0.0357**	-0.0339**
	(0.0176)	(0.0156)	(0.0177)	(0.0164)
$\mathbf{Post_t}$	0.0181	-0.0175	-0.00267	-0.0157
dummy=1 after 22/6/2011	(0.0180)	(0.0153)	(0.0170)	(0.0171)
$\mathbf{Treat_i}$	0.0276			
dummy=1 if regulated margin	(0.0264)			
Observations	56,523	56,523	56,523	56,523
R-squared	0.005	0.751	0.759	0.842
Number of clusters	44	44	44	44
Month FE x Product FE		YES	YES	YES
Trend x Product FE			YES	YES
Trend squared x Product FE			YES	YES
Product FE		YES	YES	
Product Variety FE				YES

Notes: The dependent variable is the logarithm of the average retail price of product *i*, in store *j*, in week *t*. Indicator variables for VAT levels are included in all specifications. Standard errors clustered at the store group level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 6. THE IMPACT OF DEREGULATION ON WHOLESALE PRICES

	(1)	(2)	(3)	(4)
Estimation method	OLS	FE	FE	FE
Dependent variable	log(Wholesale_ Price)$_{ijt}$	log(Wholesale_ Price)$_{ijt}$	log(Wholesale_ Price)$_{ijt}$	log(Wholesale_ Price)$_{ijt}$
Treat$_i$ × Post$_t$	-0.113*	-0.087**	-0.151**	-0.149**
	(0.068)	(0.041)	(0.063)	(0.065)
Post$_t$	-0.006	-0.065	-0.042	-0.035
dummy=1 after 6/2011	(0.053)	(0.041)	(0.046)	(0.044)
Treat$_i$	-0.054			
dummy=1 if regulated margin	(0.141)			
Observations	1,083	1,083	1,083	1,083
R-squared	0.015	0.905	0.925	0.945
Number of clusters	59	59	59	59
Month FE x Product FE		YES	YES	YES
Trend x Product FE			YES	YES
Trend squared x Product FE			YES	YES
Product FE		YES	YES	
Product Variety FE				YES

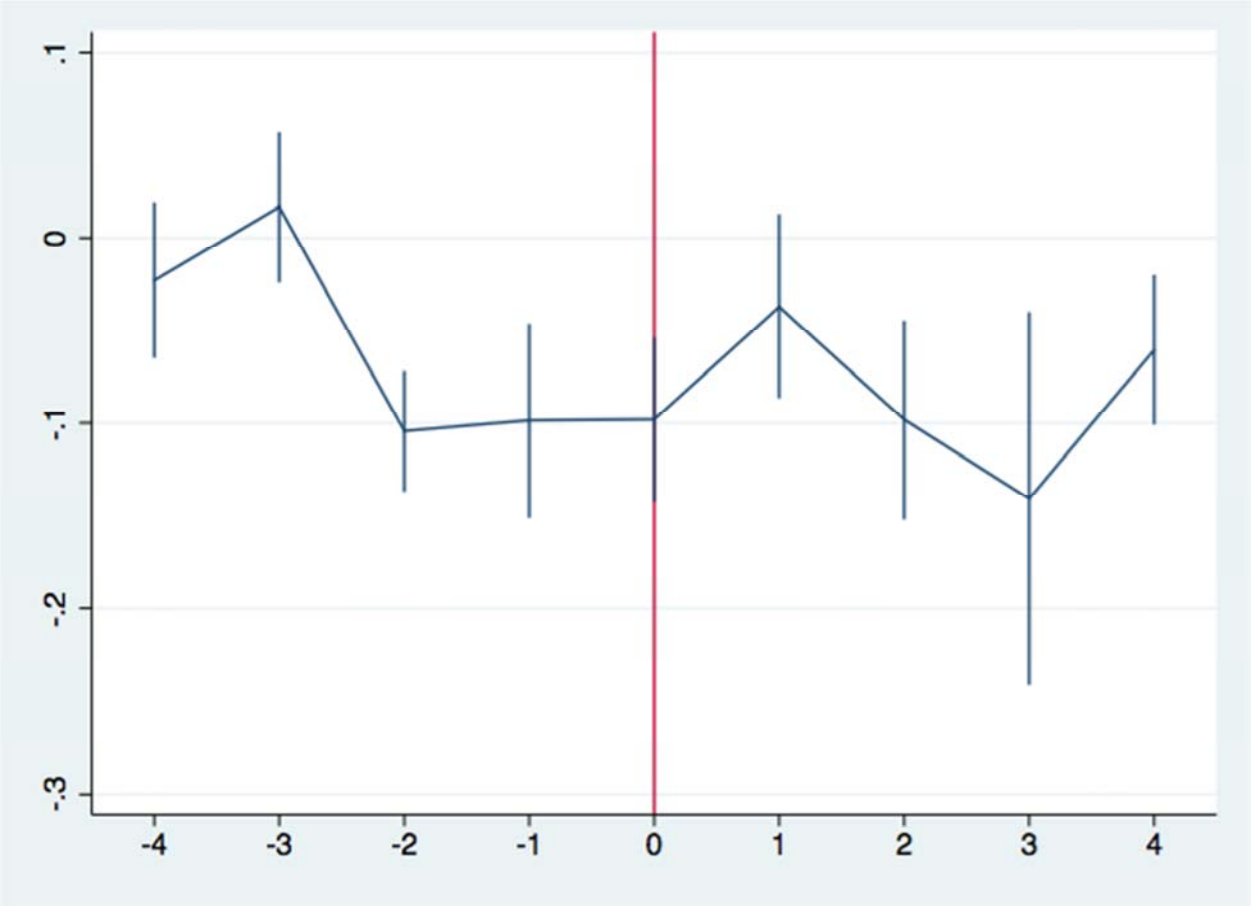
Notes: The dependent variable is the logarithm of the average retail price of product *i*, in store *j*, in week *t*. Indicator variables for VAT levels are included in all specifications. Standard errors clustered at the product variety level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 7 - FURTHER CONTROLS

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	log(Retail_Price)$_{ijt}$	log(Retail_Price)$_{ijt}$	log(Retail_Price)$_{ijt}$	log(Retail_Price)$_{ijt}$
Treat$_i$ × Post$_t$	-0.033*			
	-0.019			
Treat$_i$ × Post$_t$		0.003	0.091***	
dummy=1 for Athens Central Market only		(0.019)	(0.017)	
Treat$_i$ × Post$_t$		-0.111***	-0.024	
dummy=1 for supermarkets only		(0.022)	(0.020)	
Treat$_i$ × Post$_t$				-0.068***
dummy=1 for imported goods only				(0.019)
Treat$_i$ × Post$_t$				0.032**
dummy=1 for locally produced goods only				(0.015)
Post$_t$	-0.032	-0.029	-0.007	0.020
dummy=1 after 6/2011	-0.022	(0.019)	(0.020)	(0.020)
Wholesale Price			0.599***	
log(Wholesale_Price)$_{ijt}$			(0.016)	
Observations	14,991	14,991	14,991	7,930
R-squared	0.856	0.860	0.887	0.796
Number of clusters	44	44	44	44
Month FE x Product FE	YES	YES	YES	YES
Trend x Product FE	YES	YES	YES	YES
Trend sq. x Product FE	YES	YES	YES	YES
Product Variety FE	YES	YES	YES	YES
Flea market only (dummy=1 for flea markets only)				YES

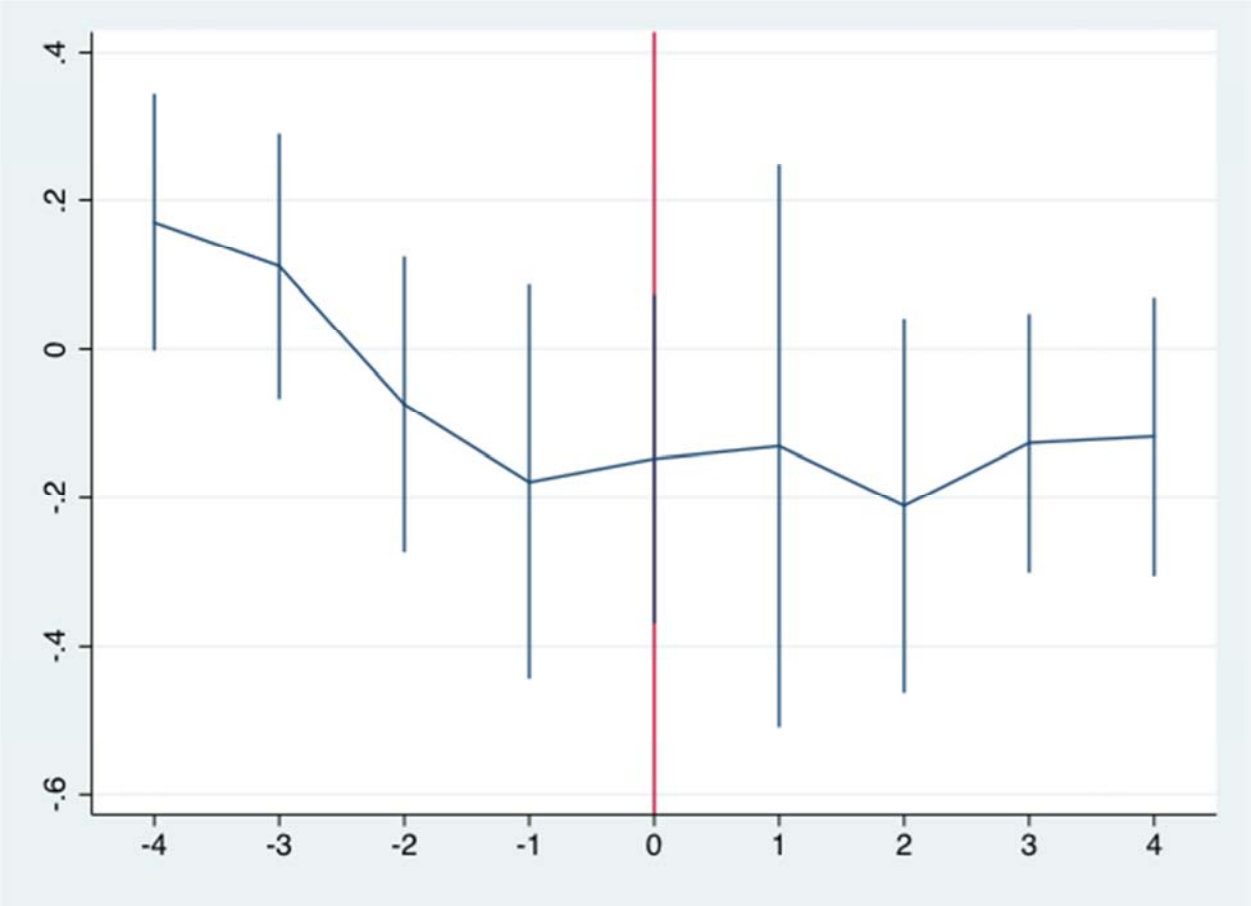
Notes: The dependent variable is the logarithm of the average retail price. Indicator variables for VAT levels are included in all specifications. Standard errors clustered at the store group level are reported in parenthesis below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

FIGURE 1. THE TIMING OF THE IMPACT OF DERGULATION ON RETAIL PRICES.



Note: the figure reports the difference in difference estimates of the impact of markup regulation on retail prices as described in equation (2). One period corresponds to two weeks.

FIGURE 2. THE TIMING OF THE IMPACT OF DEREGULATION ON WHOLESALE PRICES.



Note: the figure reports the difference in difference estimates of the impact of markup regulation on wholesale prices. The specification corresponds to model (2) after replacing the log of wholesale price as the dependent variable. One period corresponds to one month.