Working papers W-71

Can selective price controls fight off inflation? Lessons from milk products in Croatia

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Zagreb, September 2023.

HRVATSKA NARODNA BANKA
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Može li regulacija cijena suzbiti inflaciju? Pouke iz ograničenja cijena mlijeka u Hrvatskoj

Sažetak

U radu istražujemo učinke postavljanja cjenovnih plafona na prehrambene proizvode osmišljene za ublažavanje tereta inflacije na kućanstva. Kao dio šireg paketa pomoći, Vlada je u rujnu 2022. godine snizila i fiksirala cijenu osnovnih prehrambenih proizvoda, uključujući trajno mlijeko s 2,8 posto mliječne masti. Iako regulacija cijena prehrambenih proizvoda ima socijalnu motivaciju, postavljanje preniskih cjenovnih plafona može dovesti do nestašice kontroliranih proizvoda, a time i smanjenja blagostanja potrošača. Koristeći identifikacijsku strategiju razlike-u-razlikama na tjednim podacima o dostupnosti i cijenama mlijeka na uzorku trgovina u Hrvatskoj, Sloveniji i Bosni i Hercegovini, procjenjujemo uzročne učinke politike ograničenja cijena. Nalazimo kako je regulirano mlijeko približno za 35% jeftinije nego što bi bilo bez ograničenja, dok se njegova dostupnost nije znatnije promijenila. Proizvođači i/ili trgovci istodobno nisu dodatno povećavali cijene srodnih proizvoda, ostalih vrsta mlijeka,, iako su pojedine vrste mlijeka postale šire dostupne. Kako je trajno mlijeko jedan od najzastupljenijih proizvoda u potrošačkoj košarici, ograničenje njegove cijene blago je spustilo inflaciju u godini nakon njegova uvođenja, uz potencijalni učinak u pojedinim mjesecima od najviše 0,4 postotna boda. Pritom je ograničenje cijene malo više pomoglo siromašnijim kućanstvima, s obzirom na to da je udio njihove potrošnje na mlijeko u ukupnim rashodima prosječno tri puta veći od udjela za kućanstva s najvišim prihodima.

Ključne riječi: inflacija, kontrola cijena, dostupnost, supstitucija

JEL klasifikacija: E31, G50, E64

Can selective price controls fight off inflation? Lessons from milk products in Croatia*

Ivan Mužić† and Ivan Žilić‡

Abstract

In this paper, we analyze the effects of a price control program designed to mitigate the inflation burden for households. In particular, as a part of a larger relief package, in September 2022 the Croatian government lowered and fixed the price of essential food products, including long-term milk. While selective price controls on food products have a social dimension, setting the price ceiling too low might lead to shortages and a decrease in consumer welfare. Applying a difference-in-difference identification strategy and using weekly data on milk availability and pricing across a number of stores in Croatia, Slovenia, and Bosnia and Herzegovina, we estimate the causal effects of the price-ceiling policy. We find that the regulated milk was around 35% cheaper than it would have been if there was no program, and we find no adverse effect on the regulated milk availability. We document that the price of substitutes (other types of milk) did not increase, but we do record an increase in the availability of close substitutes of the regulated milk type. While our back-of-the-envelope calculation indicates that the effect of milk price ceilings on overall inflation is negligible, we show that this inflation-soothing effect is more prominent for poorer households.

Keywords: inflation, price controls, availability, substitution

JEL classification: E31, G50, E64

*The views and conclusions expressed in this paper are those of the authors and do not necessarily reflect the position of institutions that the authors work for. We thank anonymous HNB working papers referee, Davor Kunovac, Maroje Lang, Gorana Lukinić Čardić, Ivica Rubil, Maja Sabol, Vedran Šošić, Marina Tkalec, and Jurica Zrnc for their comments on the previous version of the manuscript, as well as the participants of the 4th Sljeme Workshop and EFST Challenges of Europe Conference. All remaining errors are our own.

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Contents

1. Introduction

High inflation in the last two years had a severe adverse impact on households across the world, prompting governments to introduce policies to alleviate the burden of increasing living costs. Some governments resorted to direct price regulation of essential goods and services, mainly in the form of energy price ceilings, which were introduced in most European countries to fight off increasing energy costs. Furthermore, the increasing food prices, which have a greater impact on households with lower incomes, have also compelled governments to implement direct controls on food prices; for example, Hungary and Serbia mandated price ceilings on food products in 2021.

From an economic standpoint, if the price ceiling is too low and below production costs, price controls could lead to shortages and a decrease in consumer welfare (see, for example, Cox (1980) and Rockoff (2004)). In addition, price caps may have other negative consequences, such as a decrease in product quality (Leffler, 1982) and decreased firm entry into the regulated markets (Kyle, 2007).[1] However, a recent paper by Aparicio and Cavallo (2021), analyzing across-the-board price regulation in Argentina using online prices, concludes that price controls are not an effective tool to curb inflation as their effects are short-lived, but, however, finds no shortages of regulated products.

We contribute to this literature, and to the ongoing public debate on the effectiveness of selective price controls, by analyzing the effects of short-run food price controls introduced in Croatia. In particular, in September 2022, the Croatian Government introduced a package of measures to ease the inflation burden, which, among others, administrated price ceilings on essential food products.[2] We focus on one of the restricted products – long-term ultra-high-temperature (UHT) milk with 2.8% milk fat, for which the government prescribed that the highest retail price must not exceed 7.39HRK (0.98€) per liter, which is a price reduction of about 18%.[3] This regulated product was, prior to the price cap, the most available in stores and, on average, the cheapest type of milk, which emphasizes the social motivation of the price ceiling. We focus on milk as a traditional staple food in the Croatian diet, whose price increased by over 40% from August 2021 to August 2022. In addition, from a consumer and production perspective, a certain type of milk has close substitutes, and the milk industry is highly concentrated in Croatia, which increases the incentives for price and supply distortions (see Raymon (1983) and Besanko et al. (1988)).

In order to estimate the effect of price control on prices and availability of controlled milk as well as the substitutes, we use weekly data from a sample of stores in Croatia and compare them to those in Slovenia and Bosnia and Herzegovina, which did not introduce price controls. Stores in the sample consist of local grocery stores which sell their products online via an aggregation platform, as well as big supermarkets with dedicated online shops. We use descriptive statistics to analyze the availability of milk in stores in Croatia, as well as the difference-in-differences identification to estimate the effect on price. In particular, given that we have pre- and post-price cap data on prices of milk in Croatia, and Slovenia/Bosnia and Herzegovina, we can identify the causal effect on the prices of regulated as well as non-regulated milk.

We find that the milk subject to price restriction was around 35% cheaper than in a hypothetical

[1] For a comprehensive overview of price controls and its consequences see Galbraith (1980) and Rockoff (2004).

[2] Edible sunflower oil, milk, flour, granulated sugar, chicken, pork, and minced meat; for more information, see Vlada Republike Hrvatske (2022).

[3] As of July 2023, the price ceiling are still active; however, the administrated price of UHT milk with 2.8% of milk fat was increased by 5 cents on March 30th 2023. Our sample does not include this change.

scenario where there is no control, and we find no adverse effect on the restricted milk availability. In addition, we find that the prices of substitutes (other types of milk) did not increase due to the price restrictions, but for some of them, we do find an increase in availability. In order to corroborate our results, we use different specifications and different compositions of control groups. Our results are in line with the findings in Aparicio and Cavallo (2021).

We also assess the effect of price caps on headline inflation, as well as household-specific inflation across the income distribution. Using the Household Budget Survey we show that the overall effect of milk price control is negligible, however, for poorer households, this inflation-soothing effect is more prominent. In particular, for poor households (first decile of the income distribution) the inflation-soothing effect is three times higher than for wealthy households (tenth decile of the income distribution). While the combination of these effects benefits the consumers, especially poorer households, we also conjecture why we do not find any price or supply distortions. We argue that the interplay of the temporary nature of the price restrictions, the aim to maintain the consumer base and market position, the small number of products that are regulated, the increase in the availability of substitutes, and the profit margins of the dairy industry drove this result.

Our empirical analysis and reasoning benefit and inherit mostly from Aparicio and Cavallo (2021). However, there are a few important points of departure. Aparicio and Cavallo (2021) analyze across-the-board price restrictions, with an on-and-off structure using daily data from one of the largest retailers. We analyze an ongoing price cap on a specific good, using weekly data, but we have access to data from more than local 200 stores, enabling us to construct better availability proxies. Given that we have data from Slovenia and BiH, which did not impose selected price controls, we can construct a clear control group. Furthermore, we analyze the effect of selected price controls not only on headline inflation but also on the distributional aspect of price increases.

The paper is structured as follows: the next section explains data and estimation, the third section exposes the results of our analysis, the fourth the impact on inflation, and the last section gives a discussion and conclusions.

2. Data and estimation

The data on the prices of milk comes from a sample of stores in Croatia, as well as Slovenia, and Bosnia and Herzegovina (BiH) – the latter two we use as a control group to account for the broader price movements. The data comes from stores that sell their products online via an aggregation platform, as well as big supermarkets with dedicated online shops. Overall, we have data from 187 stores in Croatia and 15 in Slovenia and BiH, and we focus on 56 (86 in Slovenia and BiH) distinct products. Compared to Aparicio and Cavallo (2021), given that we also sample local stores, we have a more comprehensive network of shops in our sample, as well as stores from neighboring countries. We record weekly information on the milk products, from the beginning of August 2022, four weeks before the price-cap implementation, up to April 2023 (see Table 1 for more details). To ensure that our sample represents the official statistics, we compare the evolution of milk prices from our sample with the official Harmonised index of consumer prices (HICP) milk subcategory for each of the countries (BiH data is not available), and the price dynamics are very similar.

For each product, we observe the price, packaging, size, fat percentage, and producer. Some of

TABLE 1 — Dataset description

	Croatia (treated)	**Slovenia, BiH (controls)**
Number of stores	187	15
Number of products	56	86
Period	August 2022 - April 2023	
Frequency	Weekly	
Price records	31	
Product information	price, availability, type of product, packaging, size, producer, milk fat	

the smaller producers are subsidiaries of larger corporations, so we take this into account while constructing producer information. Following Aparicio and Cavallo (2021), we construct the availability on the extensive margin: we observe if a product (or group of products) is available in a certain store at a certain point in time. This does not translate to quantities directly, but it is an indicator of whether consumers can buy a product in a local shop.

We group products into 4 categories, with only the first one being subject to price regulation: (i) UHT 2.8% milk (category with price-ceiling); (ii) UHT 2.8% milk in smaller packaging (below on liter) which is identical to the previous group, but not regulated; (iii) UHT milk with fat percentages other than 2.8% (whose price has not been capped); and (iv) fresh milk (also not restricted). Grouping products enables us to compare prices in Croatia to those in Slovenia and BiH, as there is little overlap among products across the border. It also allows us to inspect whether there is a substitution effect from the producer side in supplying certain milk categories, especially if the product only differs in packaging.

To analyze the effects of price restrictions on product availability, we resort to descriptive statistics showing the dynamics of the availability of milk types in Croatia. The reason is twofold: (i) the descriptive statistic of availability is the object of interest, as we want to know whether the controlled product can be found on a shelf; (ii) the availability series in the control group (Slovenia and BiH) is volatile given that the number of stores is small.

In order to estimate the effect on prices of controlled milk and other groups, we apply a standard difference-in-difference framework across two dimensions: time (before and after the price ceilings) and country (treated and non-treated countries). For example, to estimate the effect of a price cap on the price of the controlled product, we pick controlled products (UHT 2.8% milk) in Croatia, Slovenia, and BiH, and estimate the equation:

$$ln(P_{it}) = \alpha + \beta croatia_i + \gamma post_t + \delta_{DD}(croatia_i \times post_t) + \boldsymbol{\phi}' \boldsymbol{X_i} + \epsilon_{it} \quad (1)$$

where:

- P_{it} represents the unit price (per liter) of the product i at time t,
- $croatia_i$ is an indicator variable for Croatia,
- $post_t$ is an indicator variable taking the value of 1 if the price of the product is observed in a period of price controls (after 9^{th} of September 2022),

- ($croatia_i \times post_t$) is an interaction term that identifies the effect of price controls in Croatia. In particular, it is a dummy variable taking the value of 1 if the price of the product is observed in Croatia and in a period of price controls. Therefore, parameter δ_{DD} (diff-in-diff) shows the effect of targeted controls in Croatia,
- X_i denotes a vector of control variables, namely packaging size dummies, producer dummies, and fat percentage dummies.

As difference-in-difference identification relies on the assumption of parallel trends of potential outcomes, we also run a dynamic version of Equation 1 from which we can infer the dynamics of pre-treatment outcomes across the groups as well as the time-specific difference-in-difference parameter. In particular, following Autor (2003), we estimate:

$$ln(P_{it}) = \beta croatia_i + \gamma post_t + \boldsymbol{\delta_{DD}}'(croatia_i \times \boldsymbol{T}) + \boldsymbol{\phi}' \boldsymbol{X_i} + \epsilon_{it} \tag{2}$$

where, all the coefficients and variables are the same as in the Equation 1, in addition to the term $croatia_i \times \boldsymbol{T}$ which represents the interaction between the treatment dummy ($croatia_i$) and the vector of time periods ($\boldsymbol{T}$). We omit one time dummy to avoid perfect multicollinearity. Our parameter of interest is again $\boldsymbol{\delta_{DD}}$, which is now time-specific. For more details see, among others, Huntington-Klein (2021).

We use this framework also for other milk categories, to analyze the effect of the price cap on the price of substitutes. Moreover, given that there may be spillover effects – Croatian producers might raise prices of controlled products in Slovenia and BiH and therefore compensate for smaller profit margins on regulated products in Croatia – we try different specifications and compositions of control groups.

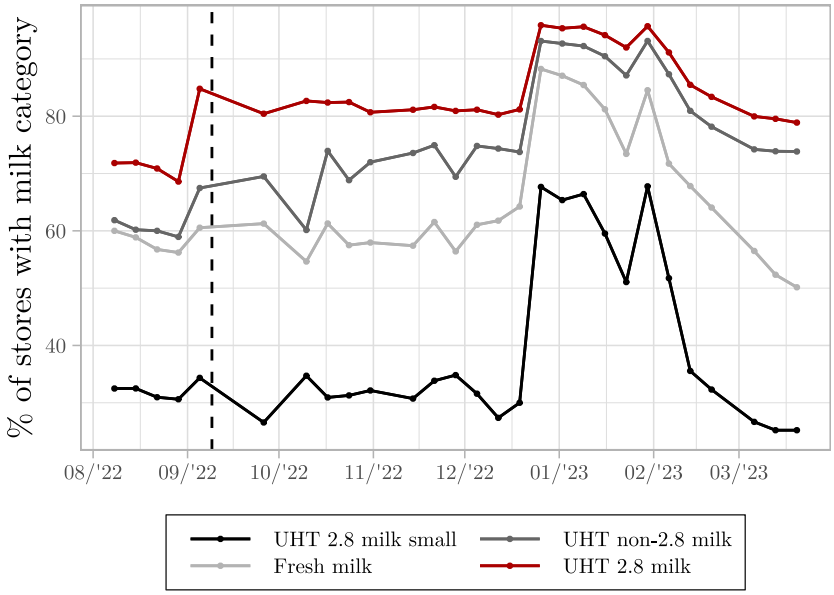
3. Results

3.1. Descriptive evidence: availability and prices

Our definition of availability is group-based (we group milk products into four categories), so Figure 1 shows the percentage of stores where one can find milk that belongs to a group. We see that the UHT 2.8% milk (red line, top line) is the most available category before – which is the reason, arguably, why the price restriction was imposed on that specific milk type – and after the price cap. There are increases in the availability, most notably before the implementation of the price restriction, and before Christmas. In particular, before the price cap, the controlled milk was, on average, available in 73.6% stores, while after the price restriction, the average availability of the same group was 85.3%. While there is no obvious evidence of shortages of the controlled products, it is clear that the close substitute of the controlled product – UHT milk with a fat percentage other than 2.8 (dark grey, second to the top, line on Figure 1) – is becoming relatively more available, especially a few months after the price cap implementation. The average availability of this group before the price restriction was 61.7% and 78.4% after the program. This descriptive evidence points in a direction similar to findings of Aparicio and Cavallo (2021): price-ceilings did not induce shortages, but there are supply substitution effects at work as similar products are becoming more available.

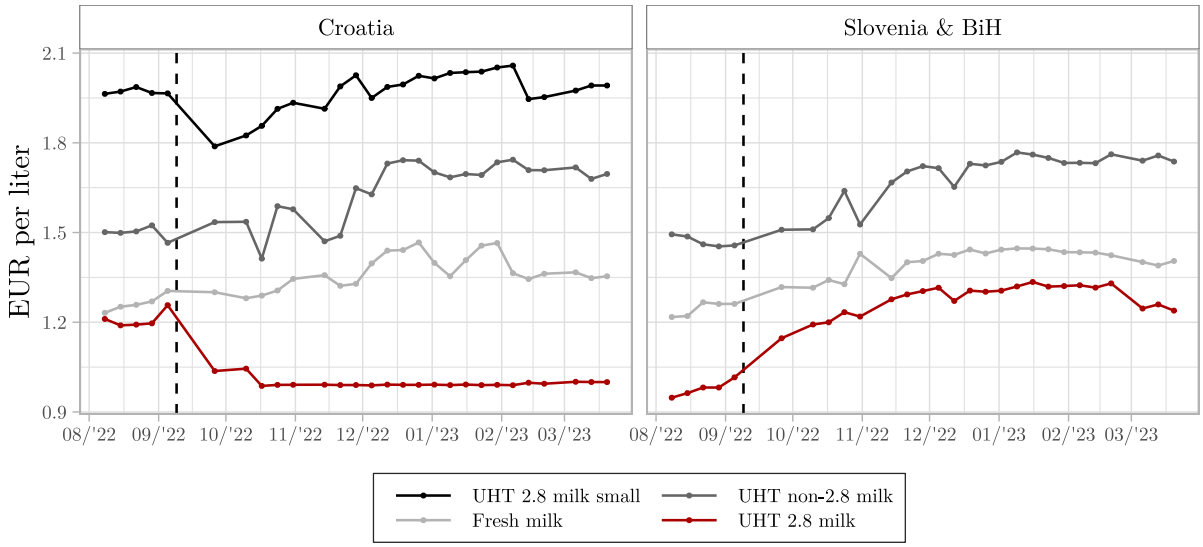
Figure 2 compares the prices of milk groups in Croatia to those in Slovenia and BiH. We exclude the price of one milk group (UHT 2.8% in a smaller packaging) from the right panel as there are

FIGURE 1 — Availability of milk categories in Croatia



Note: Availability is defined as the share of stores in which any product from a specific group (UHT 2.8%, Fresh milk, UHT non-2.8%, and UHT 2.8% small) is available at a certain point in time. A dashed vertical line represents an introduction of price caps for UHT 2.8% milk.

FIGURE 2 — Prices of milk categories in Croatia and Slovenia and BiH



Note: Prices for milk categories are calculated as an average price of all the products from specific categories and across stores at a certain point in time. A dashed vertical line represents an introduction of price caps for UHT 2.8% milk. Prices for UHT 2.8% milk small are omitted in the right panel, due to a small number of products in Slovenia and BiH.

only a few observations per period. In Croatia and Slovenia/BiH long-term milk whose price was capped was the cheapest milk category, emphasizing the social dimensions of the intended price ceiling. In Croatia, once the price restriction is imposed, the price gradually converges to the prescribed limit, from 1.25€ per liter before the program to 0.98€ a few weeks after the menu adjustments have been made. The price of the price-capped group in the control group (Slovenia and BiH) continued its non-interrupted evolution. In a nutshell, our identification strategy relies on comparing the price dynamics of the same milk groups across countries, which yields a

difference-in-difference estimate.

3.2. Difference in difference estimation

From Figure 3, which presents the time-specific effects of price restriction estimated via Equation 2, we can analyze the following: (i) if the parallel trends assumption is plausible; (ii) if the effects change with the introduction of the price ceiling, (iii) and if the effect is changing through time (similar as Autor (2003)). Figure 3a presents the results for the milk products for which the price cap is set (UHT 2.8%), while Figure 3b represents the results for all other milk products grouped together.

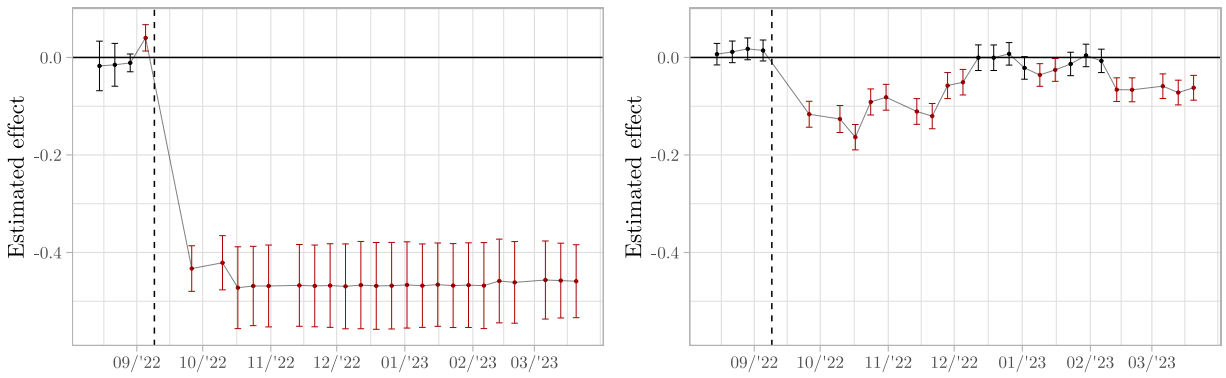
Figure 3a displays a mechanical result – the price of restricted milk plummeted as soon as the price ceiling was implemented. Prior to the introduction of price restrictions, the effect is roughly null, indicating that the parallel trend assumption is reasonable. The magnitude of price drop after the price restriction is around 45%, while the time-specific effects show that this mechanical effect is driven mostly by the initial price drop. Figure 3b shows that the parallel trends assumption is plausible – prior to the price controls, the conditional difference in prices between the treated and control groups was non-significant. After the price restriction, the direction of the effects changes, ranging from negative in the initial and end period, to zero in between. This effect might come from demand and supply: consummers might have shifted their purchases towards regulated milk consequently lowering demand for non-controlled products, while businesses might have wanted to offset the substitution effect of the price caps by lowering non-regulated prices thus motivating consumers to buy higher-margin non-regulated milk. In any case, this volatile profile of effects allows a conclusion that milk price restrictions did not cause an increase in the prices of non-restricted substitutes.

We also run in-time placebo difference-in-difference estimations and find no effect (see Table A1 in Appendix), which, in combination with plausible parallel trends assumption depicted in Figure 3, validate our identification strategy.

FIGURE 3 — Parallel trends and time-specific effects

(A) UHT 2.8 milk

(B) Other milk



Note: The circles show point estimates of time-specific differences in prices between Croatia and the control group of countries (Slovenia and BiH) conditional on packaging size, producer, and fat percentage (coefficients δ_{DD} estimated via Equation 2). Vertical lines show confidence intervals at a 99% level of significance which are calculated using standard errors clustered on the producer levels. The red color indicates statistically significant time-specific effects (at the 1% level). The dashed vertical line represents an introduction of price caps for UHT 2.8% milk.

TABLE 2 — Difference-in-difference estimation results

	Dependent variable: ln price per liter of milk							
	Subsample of milk:							
	UHT 2.8 milk		Other milk		Fresh milk		UHT non-2.8 milk	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Croatia dummy	0.217***	0.138*	0.219***	0.119***	0.102*	0.179***	0.251***	0.146***
	(0.066)	(0.077)	(0.057)	(0.029)	(0.058)	(0.034)	(0.074)	(0.027)
After control dummy	0.281***	0.280***	0.169***	0.154***	0.142***	0.127***	0.183***	0.171***
	(0.019)	(0.019)	(0.020)	(0.018)	(0.032)	(0.032)	(0.021)	(0.018)
Diff-in-diff	−0.472***	−0.466***	−0.063***	−0.054**	−0.057	−0.048	−0.074***	−0.062***
	(0.039)	(0.041)	(0.024)	(0.022)	(0.035)	(0.033)	(0.022)	(0.018)
Packaging size dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Producer dummies	No	Yes	No	Yes	No	Yes	No	Yes
Fat percentage dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
UHT dummy	No	No	Yes	Yes	No	No	No	No
Observations	17,426	17,426	32,677	32,677	9,428	9,428	20,262	20,262
Adjusted R^2	0.500	0.555	0.519	0.677	0.128	0.368	0.527	0.707

Note: Coefficients are estimated using Equation 1 and each coefficient represents the effect of UHT 2.8 milk price cap on the price of subsample group. 'Croatia dummy' denotes parameter β, 'After control' parameter γ, while 'Diff-in-diff' parameter δ_{DD} from Equation 1. In addition to the estimated effect on restricted milk (columns 1-2), we also estimate the effects on non-restricted milk subsamples (UHT non-2.8 milk, fresh milk, and other milk – columns 3-8). Each coefficient is estimated using the same corresponding milk group in a control country using denoted covariates. Standard errors are clustered at the producer level.

*p<0.1; **p<0.05; ***p<0.01

Table 2 unpacks this effect in more detail across the different milk groups. We estimate the difference-in-difference parameters for four different groups, the first one being the restricted milk, and the other three being different groups of non-restricted milk.

To check the robustness of the effects, we include two different specifications for each group, based on the covariate inclusion. The results are consistent with Figure 3: the mechanical effect on restricted milk is around -45% and statistically significant, while the effect on other milk is -6%. We do not find a statistically significant effect on the fresh milk (columns 5 and 6), and a significant effect on close substitutes of restricted milk (UHT non-2.8, columns 7 and 8) is around -6.5%.

We also control for the possibility that Croatian milk producers increased the prices of restricted products in Slovenia and BiH. In particular, our estimated effects on prices of restricted milk might have an upward bias if Croatian producers increased the prices of restricted milk in Slovenia and BiH because of the price cap in Croatia. We circumvent this issue by picking different milk groups in Slovenia and BiH as a control group for the restricted milk in Croatia. In particular, we use the UHT 2.8 milk (restricted) in Slovenia and BiH but without milk from Croatian producers, other milk, and UHT non-2.8 milk as a control group for restricted milk in Croatia. Excluding milk produced by Croatian producers does not change the magnitude of the results while choosing two other types of milk does reduce the effect to around 35% – results are presented in Table 3.

TABLE 3 — Additional difference-in-difference estimation results

	Dependent variable: ln price per liter of controlled milk							
	Control group (types of milk in Slovenia and BiH):							
	UHT 2.8 milk		UHT 2.8 milk without Croatian producers		All other milk		UHT non-2.8 milk	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Croatia dummy	0.217***	0.138*	0.277***	0.501***	0.011	−0.123	0.005	−0.140*
	(0.066)	(0.077)	(0.058)	(0.027)	(0.102)	(0.110)	(0.119)	(0.075)
After control dummy	0.281***	0.280***	0.282***	0.282***	0.185***	0.161***	0.195***	0.179***
	(0.019)	(0.019)	(0.029)	(0.029)	(0.021)	(0.020)	(0.021)	(0.017)
Diff-in-diff	−0.472***	−0.466***	−0.473***	−0.467***	−0.376***	−0.345***	−0.386***	−0.364***
	(0.039)	(0.041)	(0.051)	(0.053)	(0.047)	(0.052)	(0.050)	(0.053)
Packaging size dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Producer dummies	No	Yes	No	Yes	No	Yes	No	Yes
Fat percentage dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
UHT dummy	No	No	No	No	No	No	No	No
Observations	17,426	17,426	16,991	16,991	24,078	24,078	22,387	22,387
Adjusted R^2	0.500	0.555	0.437	0.481	0.732	0.862	0.760	0.889

Note: Coefficients are estimated using Equation 1 and each coefficient represents the effect of UHT 2.8 milk price cap on the price of restricted milk using different control groups controlling for denoted covariates. Standard errors are clustered at the producer level.

*p<0.1; **p<0.05; ***p<0.01

3.3. Effect on the inflation across income deciles

We also assess the effect of price caps on headline inflation as well as household-specific inflation across the income distribution. Using the Household Budget Survey 2015 we use consumption weights across the equivalized income distribution for the regulated milk. The category in which the restricted milk fits is high-fat milk (HICP category CP01141). As reported in Table 4, 10% poorest households spend 1.78% of their consumption on high-fat milk, while 10% richest households spend 0.58%. In an extreme scenario where consumers shift their high-fat milk consumption exclusively to price-controlled milk, an estimated effect of a 35% decrease of the price of UHT 2.8% milk (the lower bound of our estimates) reduces headline inflation for the average household by about 0.2 percentage points in a period from September to April. This effect is heterogenous across income distribution: for the poorest households this effect amounts to a 0.31 percentage point decrease in the annual rate of inflation, while for the richest households this results in a 0.1 percentage points decrease (row 3). Therefore, even if the effect of the price cap on overall inflation is almost negligible, the price control program has a social dimension by introducing a possibility for poor households to buy cheap milk, therefore mitigating the inflation burden relatively more for the poorest households.

TABLE 4 — The impact on headline inflation across income deciles

Deciles by income	01	02	03	04	05	06	07	08	09	10	Average
Weights of a high-fat milk (CP01141) in HICP (%)	1.78	1.48	1.27	1.41	1.08	1.18	0.94	0.93	0.76	0.58	1.14
One-off effect of the price cap on HICP (p.p.)	-0.62	-0.52	-0.44	-0.49	-0.38	-0.41	-0.33	-0.33	-0.27	-0.20	-0.40
Effect of the price cap on annual rate of inflation (p.p.)	-0.31	-0.26	-0.22	-0.25	-0.19	-0.21	-0.16	-0.16	-0.13	-0.10	-0.20

Note: Consumption weights for milk with more than 1.8% fat (CP01141) across income deciles are calculated from the Household Budget Survey 2015. The one-off effect is calculated as the estimated effect presented in Table 3 multiplied by the weight of a specific decile. Effect on annual YoY% if a one-off effect rescaled to six months duration (as the end date of the cap is unknown, YoY% effect is calculated considering only past duration of the cap).

4. DISCUSSION AND CONCLUSIONS

This paper analyzed the effects of a price control program – restricting the price of long-term milk in Croatia – on milk prices and availability thus contributing to the lively debate on the effectiveness of selected price controls as a tool to mitigate inflation stress for households. Our results indicate that the regulated milk was at least 35% cheaper due to the price restriction program, and we find no adverse effect on the regulated milk availability. We also find that the price of substitutes (other types of milk) did not increase due to the price restrictions, but we do record an increase in the availability of close substitutes of the restricted milk.

Therefore, from a consumer perspective, the price restriction program warrants a positive outlook, especially for lower-income households. However, the question remains about how the price restrictions affected businesses – producers and retailers – and why we do not observe adverse price and supply effects. We argue that this is driven by the temporary nature of the price restrictions, the small number of products that are regulated, the increase in the availability of substitutes, and the profit margins of the dairy industry.

In particular, Aparicio and Cavallo (2021) show the ineffectiveness of short-run price restriction programs: "as price controls have only a small and temporary effect on inflation that reverses soon after the controls are lifted". Therefore, businesses in Croatia that are affected by price caps might comply with the restrictions because they are aware that the program is inherently short-lived. In addition, producers and retailers might have wanted to keep their market and consumer bases and therefore chose to endure lower margins on some products to maintain their market positions. Secondly, Croatia implemented price caps on only nine products, in contrast to across-the-board non-selective price controls – therefore, only a few regulated products might not be enough to have a severely adverse impact. Furthermore, in line with Aparicio and Cavallo (2021), we find that after the price restriction, the stores were more supplied with close substitutes of restricted milk, indicating that producers reoriented their production towards products with higher margins. Finally, our estimates of profit margins in the milk industry for 2021 obtained from the financial records are around 20% indicating that the business had a financial buffer to endure price-ceiling on one of their products. To sum up, the dairy industry in Croatia,

operating with profit margins, may have planned to absorb the short-run price restrictions and the implied financial drawbacks of regulating only one product, while adjusting supplying stores more with close substitutes of restricted milk.

The limitations of our analysis are also a signpost for future research. Our product availability measure, although in line with the literature, is a crude proxy for quantities. With the intention of assessing the effect on headline inflation in more detail, we would need supply and purchase quantities, possibly from scanner data. Finally, to assess the welfare effects of price ceilings, we would also need to incorporate broader general equilibrium and spillover effects.

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Appendix

TABLE A1 — Placebo tests for difference-in-difference results

	Dependent variable: ln price per liter of milk			
	Subsample of milk/placebo:			
	UHT 2.8 milk	Other milk	UHT 2.8 milk	Other milk
	(1)	(2)	(3)	(4)
Croatia dummy	0.135*	0.101**	0.140*	0.096*
	(0.068)	(0.047)	(0.069)	(0.049)
After control dummy (placebo 1)	0.050**	−0.004		
	(0.020)	(0.010)		
Diff-in-diff (placebo 1)	−0.005	0.007		
	(0.018)	(0.011)		
After control dummy (placebo 2)			0.037**	−0.010
			(0.013)	(0.015)
Diff-in-diff (placebo 2)			−0.013	0.019
			(0.012)	(0.016)
Packaging size dummies	Yes	Yes	Yes	Yes
Producer dummies	Yes	Yes	Yes	Yes
Fat percentage dummies	No	Yes	No	Yes
UHT dummy	No	Yes	No	Yes
Observations	1,506	2,602	1,506	2,602
Adjusted R^2	0.524	0.745	0.515	0.746

Note: Placebo tests are produced by focusing on the pre-treatment period and falsely assigning the start date of price controls. We run two placebo tests, placebo 1 and placebo 2, by moving the actual start date of price controls one and two weeks ahead, respectively. For each of the placebos, we run a difference-in-difference regression from Equation 1 for two types of milk: UHT 2.8% milk (restricted one) and all other types of milk, using the most comprehensive covariate specifications. Results indicate no difference-in-difference placebo effect, which validates our identification strategy.

*p<0.1; **p<0.05; ***p<0.01

PUBLISHER
Croatian National Bank
Trg hrvatskih velikana 3
10000 Zagreb
T. +385 1 4564 555
www.hnb.hr

ISSN 1334-0131 (online)

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ISSN 1334-0131 (online)