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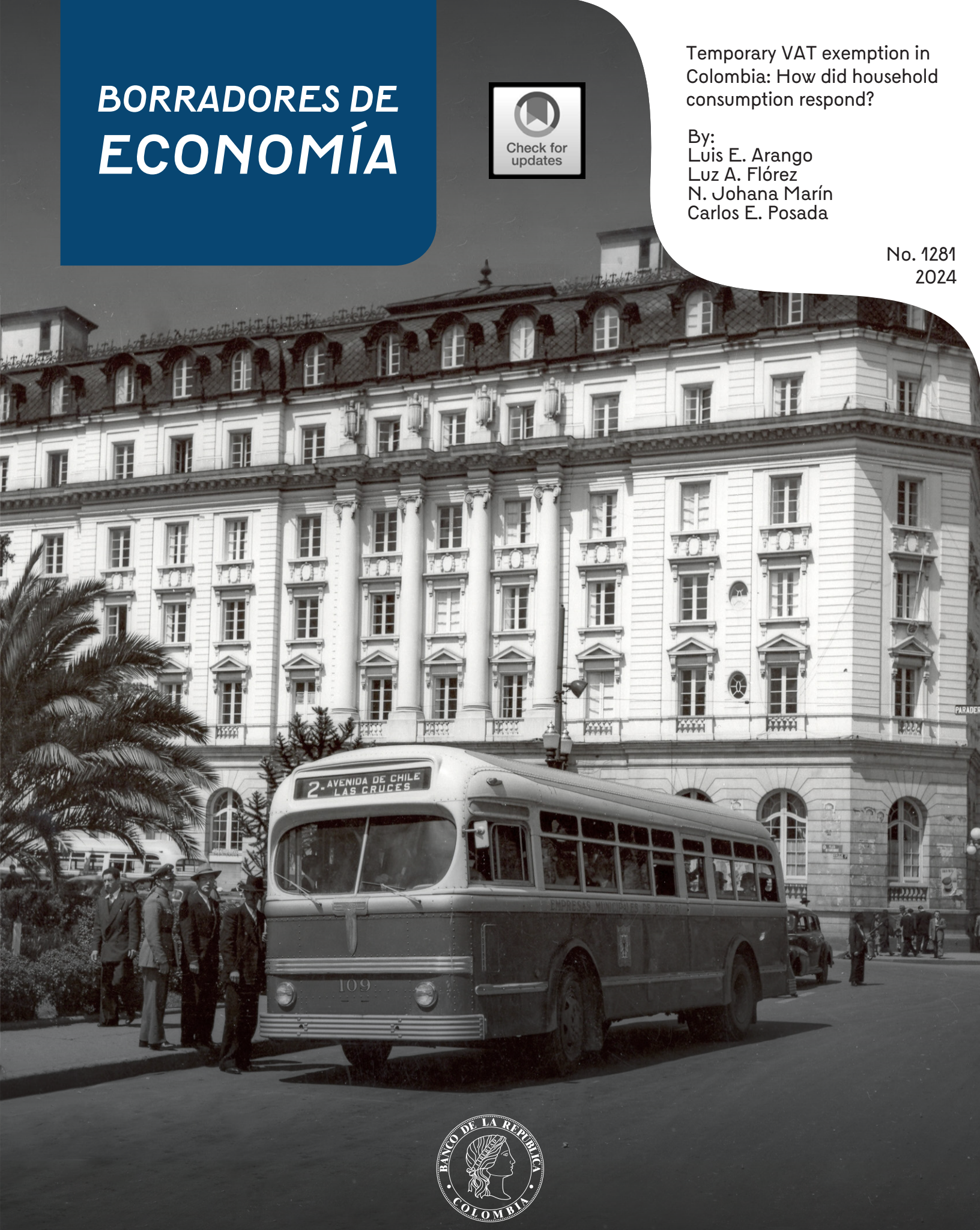

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Abstract

This paper analyzes whether the policy of VAT exemption days, implemented in Colombia between 2020 and 2022 for some products and merchandise lines, had a positive effect on the consumption of such exempted goods. The evidence show an intertemporal substitution in consumption of the items that benefited from the VAT exemption policy around the months when the policy came into effect; that is, purchases of these goods decreased in the months before and after the month of the VAT-free day, on which purchases increased. Moreover, we find that the VAT exemption days have a transitory positive effect on the items covered by the policy compared with those not covered. In terms of prices, we also find evidence of a transitory reduction in prices.

JEL classification: D12, D15, D61

Keywords: VAT exemption, household consumption, intertemporal substitution, intratemporal substitution, cost–benefit

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Días sin IVA en Colombia: ¿Cómo respondió el consumo de los hogares?

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Resumen

Este articulo estudia si la política de días sin IVA implementada en Colombia durante 2020-2022 tuvo un efecto positivo en el consumo de los bienes exentos de dicho impuesto. Los resultados indican la existencia de una sustitución intertemporal en las categorías exentas del IVA en los meses cercanos a la adopción de la política; esto es, las compras de estos bienes se redujeron en los meses anterior y posterior al mes del día sin IVA, en el cual las compras aumentaron. Adicionalmente, nuestros resultados indican que los días sin IVA tuvieron un efecto positivo pero transitorio en el consumo de los bienes exentos de dicho impuesto comparados con aquellos no exentos. En términos de precios, los resultados también muestran una reducción transitoria en precios.

Clasificación *JEL*: D12, D15, D61
Palabras clave: días sin IVA, consumo de los hogares, sustitución intertemporal, sustitución intratemporal, análisis costo-beneficio.

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1. Introduction

Temporary exemption from Value Added Tax (VAT) is a very common policy, motivated by distributional concerns, which is aimed at items that have large shares in the budgets of the poor, such as school supplies, clothing, computers, among other products. However, evidence from the European Union (EU) shows that this policy, which may benefit low-income families, is a very expensive way to reduce poverty (Benzarti and Carloni, 2019; Benzarti et al., 2020; Warwick et al., 2022).

In the United States, there is no VAT like the one applied in Colombia and elsewhere. Instead, there is a Sales Tax, which is similar, as it is a tax on consumption, but it is collected in a different way. Nevertheless, the United States also has Sales Tax Holidays (STHs). The STH policy is a very well-known policy implemented for first time in New York in 1997; 20 years later, in 2017, around 16 states implemented STHs (Henchman and Drenkard, 2017). Evidence for STHs shows that this policy is an inefficient way of helping low-income consumers, as it introduces unjustifiable distortions in the economy (Henchman and Drenkard, 2017) where higher-income households and those with more access to credit gain more from such a policy (Agarwal, Marwell and McGranahan, 2017).

After the COVID-19 pandemic, and with the intention of reactivating the economy and increasing household consumption, the Colombian Government implemented "VAT-free days". This program was enacted by law (Decree 682 of 2020), so that for 24 hours on three chosen days of the year, consumers are able to purchase items from an important group of products, such as clothing, computers, toys, and school and sports supplies, without having to pay the VAT, of 19%. These VAT-free days were implemented eight times between 2020 and 2022, three in 2020, three in 2021, and two more during the first half of 2022, after which the policy was suspended. The intention behind the policy is that consumers save, businesses increase their sales, and the economy is boosted.

The aim of this paper is to provide evidence on whether the policy of VAT-free days has a transitory positive effect in household consumption for the goods that were exempted from VAT, and if there is evidence of intertemporal substitution and cross-categories as might be expected, according to economic theory. Our analysis is based on the retail trade indices published monthly by the National Administrative Department of Statistics (hereafter DANE, which is the acronym of its Spanish name). These retail and retail trade indices, which are our proxy of household consumption, are defined by DANE (2002) as "the resale (sale without transformation) of new or used merchandise or products, available for view of the public, intended exclusively for personal or domestic consumption or use. Trade activities such as commercial activities carried out in pawn shops, telemarketing, lottery outlets, mobile sales stands and

in homes with economic activity are excluded; likewise, maintenance and repair activities associated with commerce or sale of used merchandise."

To analyze the effect of VAT exemption days we follow two strategies. First, we use a time series approach. Our findings in this case suggest an intertemporal substitution on consumption for the items that benefited from the VAT exemption policy around the period that the policy came into effect; that is, purchases of these goods decreased in the months before and after the month of the VAT-free day, on which purchases increased. This response is not clearly observed in the lines of products that do not benefit from the policy. Secondly, we use the difference-in-differences (DID), event study (ES), and synthetic DID (SDID) approaches. Regarding these approaches, our results show that the temporary VAT-free days in Colombia had a positive effect on consumption (17% with traditional DID and 9% with the SDID) for the items covered by the measure, compared with those items that were not covered. In terms of prices, we find evidence of a reduction in prices (between 6% with the traditional DID and 3% with the SDID). With the ES methodology, we found that the effect of the policy on consumption and prices was transitory, remaining significant only between one and two months after the event.

The rest of the paper is organized as follows. In Section 2, we give a brief summary of the literature on temporary VAT exemptions. In Section 3, we provide the context for the policy of VAT-free days that was implemented in Colombia, and we describe the data used in the empirical estimation. In Section 4, we present a description of the empirical strategies, and we summarize our main results. In Section 5, we discuss the results using a more appealing strategy such as SDID, confirming the previous results. Finally, we outline our main findings in Section 6.

2. Literature review

The literature that evaluates exogenous VAT changes has focused on developed economies, mainly in the European countries, where the European Commission (1999, 2006) allowed its members to undertake VAT rate reductions for a sample of labor-intensive services, with the intention of stimulating the economy and evaluating the incidence of VAT on prices and employment. As part of this program, Finland implemented a reduction of VAT for hairdressing services from 22% to 8% in January 2007 and an increase from 9% to 23% in January 2012. The program excluded from this reduction other similar services such as beauty salons; thus, this line of services was used as a control group. Using this natural experiment, Benzarti et al. (2020) evaluate the asymmetric response of prices to exogenous VAT changes. They show that prices respond twice as much to VAT increases as to VAT decreases, resulting in these asymmetric results in higher equilibrium profits and markups, where firms with low profit

margins tend to pass through more of the VAT increase than of the decrease, while firms with high profit margins are more likely to behave symmetrically. Their results are similar to those found by Kosonen (2015) who evaluated the incidence and distributional effects of the first VAT cut in Finland, and those of Gaarder (2019) who estimated the effects of a VAT cut on food items in Norway. Benzarti et al. (2020) also evaluate the VAT changes that occurred in the EU from 1996 to 2015, finding similar results.[1]

More recently, studies for Germany have also contributed to the understanding of how consumers respond to temporary VAT cuts (Funke and Terasa, 2022; Fedoseeva and Van Droogenbroeck, 2024; Fuest, Neumeier and Stöhlker, 2024). For example, Fedoseeva and Van Droogenbroeck (2024) focused on German online grocery retailers; their results indicate that multichannel retailers passed on the VAT cut almost completely, whereas online-only retailers made fewer price changes. Similarly, Fuest et al. (2024) employ a web-scraped dataset for supermarket products in Germany, comparing them with those in Austria for causal identification. The study finds that the reduction of VAT rates led to a price decrease of 1.3%, with 70% of the VAT cut being passed on to consumers. The authors also found a higher pass-through for vertically integrated products. Finally, Funke and Terasa (2022) take a different approach by employing a dynamic stochastic general equilibrium (DSGE) framework to study the efficiency of the VAT cut in mitigating the consequences of the recession caused by the COVID-19 pandemic.

Other authors have studied the effect of VAT changes on other outcomes, such as how the number of workers, owners of firms, consumer preferences, and suppliers of material goods are affected. For example, Benzarti and Carloni (2019)[2] evaluate the effect of a large VAT reform in France (a VAT cut for French sit-down restaurants in 2009) using firm-level data. In July 2009, the VAT rate for meals consumed in French sit-down restaurants was reduced from 19.6% to 5.5% while the VAT rates applied to the rest of the economy were unaffected. They find that owners of firms pocketed more than 55 % of the VAT cut, while the rest of the benefit from the VAT cut was shared among consumers, sellers of material goods, and employees, with the consumers benefiting the least. So far, the evidence suggests that using temporary VAT cuts or STHs to benefit consumers may have the opposite effect, as in the long run this will result in higher equilibrium prices, benefiting the owners of firms at the expense of consumers. Additionally, these policies end up being too expensive; for example, the VAT cut for French sit-down restaurants cost 3 billion euros in 2010 (Benzarti and Carloni, 2019).

[1] Some authors have also estimated the pass-through of tax changes (Kenkel, 2005; Doyle and Samphantharak, 2008; Hanson and Sullivan, 2009; Benedek et al., 2020), while others have explored the effect of VAT on international trade (Feldstein and Krugman, 1990; Desai and Hines, 2005) and sales (Chouinard and Perloff, 2004; Carbonnier, 2007).

[2] The authors build in Auerbach and Hines (2002) theoretical framework, to estimate a reduced-form coefficients for the welfare analysis.

In the case of the United States, some authors have evaluated the incidence of STHs, which is a very popular policy implemented in different states. In 2012, 18 states offered STHs, affecting over 120 million consumers (Agarwal et al., 2017). This policy consists of a temporary exemption of the sales tax on particular items such as clothes, shoes, and school supplies. Agarwal et al. (2017) evaluate the effect of STHs on household consumption in the United States. They found that the STH policy increases consumption of goods that are covered during the holidays, which is not offset by declines in spending before or after the holidays. Similarly, Cole (2009) analyzes the effect on consumption of a STH on computers and evaluates the fiscal impact of this policy. Recently, Agarwal, Koo and Qian (2022) evaluated the response of consumption to the annual sale event in Singapore.[3] They found that consumers significantly increase their spending during the sale event. Moreover, they found evidence of intertemporal substitution and substitution across categories of goods. Therefore, consumers spend less immediately before the event and decrease their consumption of items unaffected by the sale event. However, these substitution effects are limited when consumers use credit cards or when they are liquidity constrained. These substitution effects can limit the overall effect on consumption.

However, the evidence shows that, in general, the STH policy neither promotes economic growth nor significantly increases consumer purchases. This is not only because consumers shift the timing of purchases, but also because retailers raise prices during the STH, thus reducing consumer savings. Therefore, the STH ends up being an inefficient way to help low-income consumers and has a higher fiscal cost (Henchman and Drenkard, 2017; Warwick, et al., 2022).[4] (Figure A1 in Appendix A shows how the recent literature between 2020 and 2024 has also focused on VAT exemption polices.)

3. VAT-free days in Colombia: context and data

3.1 Background

During the COVID-19 pandemic, the Colombian Government implemented a VAT exemption policy with the aim of boosting the economy and increasing consumption. Decree 682 of 2020 proposed a VAT exemption of the following items:

[3] Products included in but not limited to the Great Singapore Sale event are apparel and accessories, watches, jewelry, toys, books, stationery, music CDs, homeware, furniture, electrical appliances, beauty and wellness services, food and beverages, and many products sold at department stores (Agarwal et al., 2022).

[4] There are also additional studies that explore the response of consumption to various fiscal stimulus programs (such as tax refunds, reductions on tax withholding, rebate checks, among others) and have found a positive but limited response of consumption (Shapiro and Slemrod, 1995, 2003a, 2003b; Parker, 1999; Souleles, 1999, 2002; Stephens, 2003, 2008; Johnson, Parker, and Souleles, 2006; Agarwal, Liu, and Souleles, 2007; Stephens and Unayama, 2011; Mian and Sufi, 2012; Parker et al., 2013; Agarwal and Qian, 2014), while others present evidence of zero response as predicted by the life-cycle/permanent income model (Browning and Collado, 2001; Hsieh, 2003).

i) clothing and textiles, with prices up to 20 UVT (unit of taxable value);[5]
ii) home appliances, computers, and communication equipment, with prices up to 80 UVT;
iii) sports supplies, with prices up to 80 UVT;
iv) toys and games, with prices up to 10 UVT;
v) school supplies such as books, notebooks, etc., with prices up to 5 UVT;
vi) goods and inputs for the agricultural sector, with prices up to 80 UVT.

This Decree also included a reduction in the consumption tax of restaurants and bars and VAT exemption for housing or commercial rents; however, in this paper we do not focus on these exemptions. The Decree proposed three days in 2020 where the VAT of 19% was not charged for the items previously mentioned.[6] In order to benefit from this exemption, there were three conditions: (i) stores must be able to generate an electronic bill for the purchase; (ii) payment should be made with debit or credit cards; and (iii) there was a limit of three products for the same category per person. During 2021 and 2022, the Decrees 1314 and 290 also introduced additional days for these VAT exemptions (see Table 1).

Table 1. Calendar for VAT exemption days

Year	Days without VAT	Decree
2020	19 June 3 July 21 November	682 of May 2020 1044 of November 2020
2021	28 October 19 November 3 December	1314 of October 2021
2022	11 March 17 June	290 of February 2022

Source: Public Function website, https://www.funcionpublica.gov.co/eva/gestornormativo.

3.2 Data on consumption and prices

3.2.1. *Consumption indices*

As a measure of the final consumption of households, we use real retail sales indices measured by DANE, as these represent the total sales to the final consumer. Over time, DANE has conducted various surveys with some modifications. However, the official entity's website registers the following methodologies. The first is the Monthly Sample of Retail Trade (MMCM), which began in 1989 but underwent a redesign in 2003, a year from which records are available. Subsequently, in 2013, DANE redesigned the survey,

[5] The UVT was COP$35.605 in 2020, COP$36.308 in 2021, and COP$38.004 in 2022.
[6] In Colombia not all products have a VAT rate of 19%. There are some products with lower rates and others that, depending on their price, are excluded from VAT; for example, computers, tablets, and mobiles with low prices (lower than 50 UVT) are excluded from VAT.

which became known as the Monthly Survey of Retail Trade (EMCM). In 2019, the latest modification to date was presented, and the survey was renamed as the Monthly Trade Survey (EMC), with the significant difference that it now includes retail trade and wholesale trade. For this study, we use the MMCM and EMC surveys.

Considering the above, DANE provides two time cuts for the retail trade sales indices. The first sample spans from January 2003 to December 2019, encompassing both the MMCM and the EMCM. This period includes 15 merchandise lines and ten classifications based on the fourth revision of the International Industrial Classification (ISIC), with the base year set in 2013. The second sample period goes from January 2013 to December 2022, comprising 16 merchandise lines (including the fuels category, not considered previously) and six ISIC categories based on 2019. In this case, we use information at monthly frequency from 2014 up to 2022, classified in 14 categories:[7] food and non-alcoholic beverages; alcoholic beverages and tobacco; clothing and textiles; footwear, leather goods, and leather substitutes; pharmaceuticals and medicinal products; personal care products, cosmetics, and perfumery; household appliances and furniture; household goods and utensils; products for the household toilet; computer and telecommunications equipment for personal or domestic use; books, stationery, newspapers, magazines, and school supplies; vehicle spare parts, accessories, and lubricants; motor vehicles and motorcycles mainly for household use; and other goods for personal or domestic use, not specified.

3.2.2. *Relative price indices*

Given that we use merchandise lines or ISIC categories to explore the effects of VAT-free days, it is necessary to consider the relative prices, for some purposes that will be evident below, when we estimate the consumption of different lines under the time series approach. To compute the relative prices, we use historical information from the consumer price index (CPI). In an initial stage, the specific CPI was calculated for the 14 categories of interest. This process required the computation of a weighted average of the different items, multiplying the values of each category by its respective weight in the CPI and summing up to obtain the total line category. Finally, to calculate the relative price, the result of the sum of products was divided by the total weight of the items used in the calculation for each category.

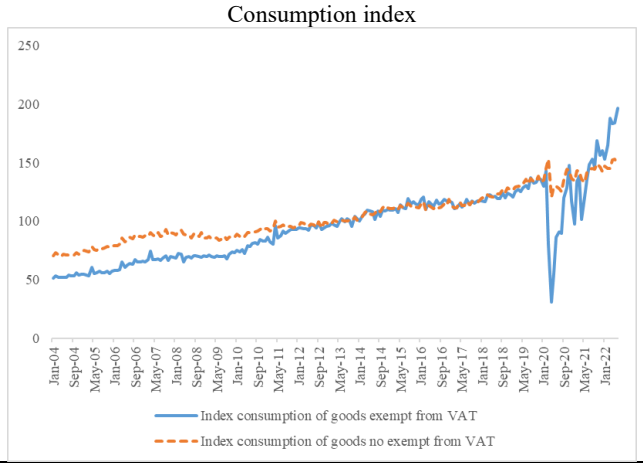
Figure 1(a) presents the dynamics of the aggregate consumption of categories with the VAT exemption versus the categories without the VAT exemption. As we can observe, both categories have increased over time; however, since 2020 after the reduction caused by the pandemic, there is a recovery

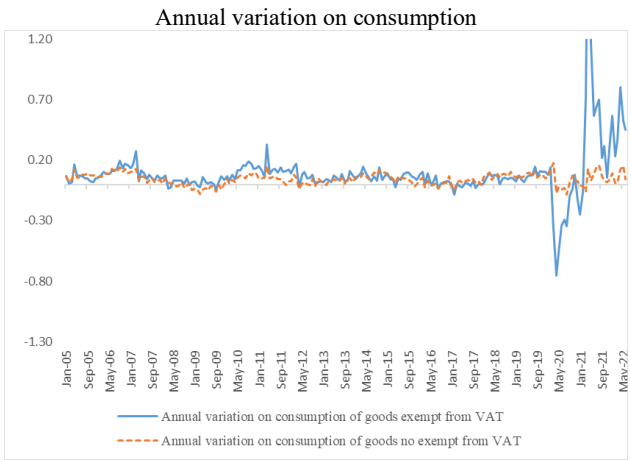
[7] For the estimates below we do not include the category of hardware goods and paints as we do not have the index price of this category.

in both consumption categories, with an important growth especially for those goods with the VAT exemption. Moreover, Figure 1(b) presents the dynamics on the aggregate relative prices for both categories. We observe an important decreasing trend since 2004 in the exempted category while the non-exempted category shows an increasing trend. Appendix B present the dynamics on consumption and prices of each item.[8]

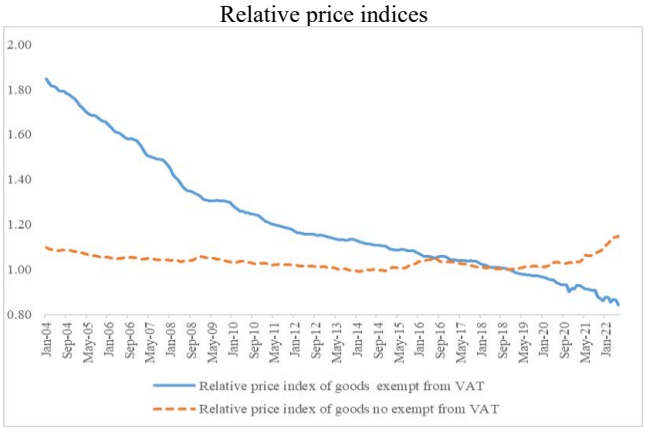
Figure 1. Relative price index and consumption index as aggregate categories

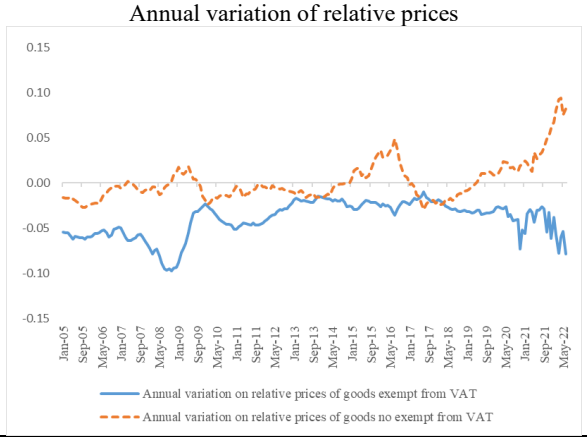
(a) Consumption index





(b) Relative price indices





Source: DANE – Banco de la República; authors' calculations

[8] Figure B1 of Appendix B presents the dynamics of prices and consumption indices for items eligible for VAT exemption on VAT-free days since 2004. As we can observe, all price indices of the items exhibit a decreasing trend while consumption has an increasing trend. Moreover, since 2020, there has been a significant increase in the consumption index for all items except for the category of books and newspapers. Figure B.2 presents prices and consumption indices of items not considered eligible for the VAT-free days. In this case, there is a heterogeneity among prices across the categories. For example, vehicles, household goods and utensils, personal care products and other personal goods present a decreasing trend, while food and pharmaceutical and medical products have an increasing trend. Other categories such as alcoholic beverages, products for household cleaning, and accessories and vehicle parts have a more cyclical dynamic. However, consumption in all these categories has an increasing trend and presents a significant recovery after the COVID-19 pandemic.

4. Empirical strategies and results

The approach to test the hypothesis that VAT-free days did not have any effects of consumption is twofold. First, we employ a time series strategy and then we use an ES methodology within a DID framework.

4.1 Time series analysis

To evaluate the effect of the VAT-free days in Colombia, we first explore the change of dynamics in consumption across time. This analysis closely follows both the theoretical and empirical approaches used by Arango et al. (2024). The empirical model corresponds to

$$\Delta c_t = \alpha + \sum_{i=1}^{J} \nu_i \Delta c_{t-i} + \lambda \Delta y_{t-1} + \pi \Delta CC_{t-1} + \theta r_{t-1} + \varphi \Delta CCI_{t-1} + \varepsilon_t, \quad (1)$$

where c stands for consumption of any category, y for income, proxied here by the Economic Situation Indicator (ISE), CC for the percentage annual variation of consumer credit in real terms, r for the interest rate, and CCI for the consumer confidence index, as a proxy of uncertainty. In all cases, Δ corresponds to annual percentage change (c, y, and CC) and annual variation (CCI); r is in levels.

As explained by Arango et al. (2024), the variables in equation (1) retain the flavor introduced by Campbell and Mankiw (1990), Carroll et al. (2019), and Carroll and Toche (2009). To explore any intertemporal substitution on consumption as a response to the VAT-free days for each category of consumption, we slightly modify the specification given by equation (1) as

$$\Delta c_t = \alpha + \sum_{i=1}^{J} \nu_i \Delta c_{t-i} + \delta VATex_{t-1} + \beta VATex_t + \rho VATex_{t+1} + \varphi X_{t-1} + \varepsilon_t, \quad (2)$$

where φX_{t-1} corresponds to $\lambda \Delta y_{t-1} + \pi \Delta CC_{t-1} + \theta r_{t-1} + \varphi \Delta CCI_{t-1}$, as in equation (1). Here, $VATex$ is a dummy that takes the value of 1 in the current month in which the VAT exemption is carried out, $VATex_{t-1}$ is a dummy one month previous to the VAT exemption, and $VATex_{t+1}$ a dummy one month after the VAT exemption. Additionally, following Arango et al. (2024), we include some pandemic dummies for the 2020 and 2021 period. Finally, ε denotes the error term of the estimation.

Table 2 presents the results using the aggregate consumption for goods with VAT exemption and those without the exemption. In this case, and especially for the sample since 2004, we find evidence of a significant increase in consumption of 7% during the VAT exemption month, driven by a significant increase in consumption of those items that benefited from the policy (13%). Those items that do not benefit from the VAT exemption did not have a significant change in consumption. These results are in line with those found by Agarwal et al. (2022), who showed that expenditure increases during the Great Singapore Sale (an annual sale event in Singapore) but decreases a week before and after the event.

Table 2. Effects of VAT-free days for different consumption products (with and without VAT exemption)

Variables	2004–2021			2014–2022		
	With VAT exemption	Without VAT exemption	Total consumption without fuels and vehicles	With VAT exemption	Without VAT exemption	Total consumption without fuels and vehicles
VAT exemption ($t-1$)	-0.08^{**}	−0.01	−0.03	-0.13^{**}	−0.03	−0.03
	(0.04)	(0.02)	(0.02)	(0.06)	(0.02)	(0.02)
VAT exemption (t)	0.13^{***}	0.00	0.07^{***}	0.08	−0.02	0.05^{**}
	(0.05)	(0.02)	(0.02)	(0.06)	(0.02)	(0.02)
VAT exemption ($t+1$)	-0.17^{***}	−0.02	-0.07^{***}	−0.03	0.00	−0.01
	(0.05)	(0.02)	(0.02)	(0.06)	(0.02)	(0.02)
Lags of dependent variable	2	2	2	3	3	3
Observations	201	201	213	98	98	98
R^2	0.89	0.81	0.83	0.89	0.78	0.83
F-statistic (prob)	0.00	0.00	0.00	0.00	0.00	0.00
Durbin–Watson	2.00	2.02	1.86	2.02	1.87	1.81
Breusch–Godfrey autocorrelation test (prob)	0.95	0.72	0.11	0.78	0.42	0.34

Note: All regressions include $\lambda\Delta y_{t-1} + \pi\Delta CC_{t-1} + \theta r_{t-1} + \varphi\Delta CCI_{t-1}$ and COVID-19 dummies (see Arango et al., 2024).
Source: EMC-DANE; authors' own calculations.

For the subperiod 2014–2022, the results are less clear than for the period 2004–2021. Thus, for the total consumption without fuels and vehicles the intertemporal substitution remains and for the treated lines. Such a dynamic response seen for the purchases of goods that benefited from VAT exemption should have been taken into account when considering the effects of the policy of VAT-free days.

Appendix C shows the results of the policy of VAT-free days for all the merchandise consumption lines. In this case, the specification given by equation (2) also includes the relative price of the respective line, as each specification has the flavor of a demand function for a merchandise line. By using information from 2014–2022, we found strong responses of consumption to the VAT exemption of products such as household appliances, computers and telecommunications, with a half reduction after the event (see Table C1 in Appendix C). For the period 2004–2021, we also find a positive response for consumption of clothing, footwear, household appliances, and computers and telecommunications, while for the products that do not benefit from the policy, there was no significant response of consumption. This result, given the negative sign for food and alcoholic beverages, might indicate a potential intratemporal substitution effect across categories (substitution between purchases of exempted and not exempted products[9]). All in all, we find a significant response on consumption for all goods excluding fuels and vehicles in the period of the VAT exemption, explained by the response on consumption of

[9] It also could be the case that households increase consumption of goods that do not benefit from VAT exemption, given the surplus generated by the reduction in prices of exempted goods. The firms that sell goods that are not VAT exempt could also behave strategically to respond to the policy; for example, they could reduce prices close to the VAT-free days. These facts and strategic responses could make it more difficult to estimate the intratemporal and intertemporal substitution effects caused by the policy.

those affected products; moreover, after the event we also see a reduction in consumption, indicating an intertemporal substitution, which is also observed in the aggregate consumption without fuels and vehicles (see Table C2 in Appendix C). This dynamic response seen for purchases is a fact that must be considered when considering the effects of this policy in Colombia.

Although these results show us the dynamics for consumption of each product line across time during the policy, the time series approach, as we have used it, does not allow us to estimate the direct effect of the policy. To address this issue, we use a DID approach to estimate the response across time of both exempt and non-exempt products before and after the policy. These results are presented in the following subsection.

4.2 Difference-in-differences and event study approaches

4.2.1. *The model*

Following Benzarti and Carloni (2019), we use a DID framework to estimate the mean impact of the VAT-free days in Colombia. Our treatment group consists of all product lines exempt from VAT. These merchandise lines are clothing and textiles; footwear, leather goods, and leather substitutes; books, stationery, newspapers, magazines, and school supplies; computer and telecommunications equipment for personal or domestic use; and household appliances. In the control group, we have all the items that are not exempt from VAT, such as: food and non-alcoholic beverages; alcoholic beverages and tobacco; pharmaceuticals and medicinal products; personal care products, cosmetics, and perfumery; household furniture; household goods and utensils; products for the household cleaning; vehicle spare parts, accessories, and lubricants; motor vehicles and motorcycles; and other goods for personal or domestic use. In total, we have 14 merchandise lines of consumption: five in the treatment group and nine in the control group.[10] We use information in monthly frequency from 2018 to 2022. Our aim is to observe how consumption between those two groups changes once the VAT exemption policy is implemented. To estimate the mean effect of the VAT change on those outcomes, we use the specification given by

$$\log x_{it} = \eta Treat_i \times VATex_t + \lambda_t + \omega_i + \epsilon_{it}\,, \qquad (3)$$

where $\log x_{it}$ is the logarithm of the consumption or logarithm of relative prices, i identifies each merchandise line, and t denotes the time period. We include λ_t to control for time fixed effects and ω_i to control for individual unobservable characteristics that do not change over time. $Treat$ is a dummy

[10] Note that these categories are aggregated; however, there can be some products that are exempt from VAT but are included in a category that we regard as not exempted. We assume that the weight of such goods is small enough so as not to weaken the evidence presented here.

variable that takes the value of 1 if the consumption item belongs to the group of goods exempted from the VAT, and 0 otherwise. $VATex$ is a dummy that takes the value of 1 in the month in which the VAT exemption policy comes into effect. Finally, the error term ϵ_{it} captures unobservable shocks. In this way, the parameter η captures the average differential in consumption or relative prices between the treated and control groups, once the VAT exemption policy is implemented.

We can also explore the dynamics of consumption and relative prices once the VAT exemption takes place. To explore the dynamics of the outcomes of interest, we augment the model in equation (3) by interacting the dummy variable $Treat_i$ with a group of dummy variables for each month between 2019 and 2022. The reference period to compare the effects of the exogenous change corresponds to the month before the application of the policy (in this case is May 2020):

$$\log x_{it} = \sum_{\tau=1}^{T} \eta_i \, Treat_i \times 1\{t = \tau\} + \lambda_t + \omega_i + \epsilon_{it}. \qquad (4)$$

The advantage of the event-history analysis is that it allows us to interpret the coefficient η_i as the percentage change in the outcome of interest in each given month relative to the reference month before the implementation of the policy. This specification also allows us to assess whether changes are temporary or long-lasting, thus distinguishing between the short-run, medium-run, and long-run effects of the reform.

4.2.2. *Effects on consumption*

Table 3 presents the results of the DID estimation for the log of consumption. The model in Column (1) presents the results when using all the VAT exemption days between 2020 and 2022. In this case, we found a significant increase (around 17%) of the consumption of the items with the VAT exemption policy compared to those items not covered by the policy. If we separate the sample to evaluate the effect of the VAT exemption policy by sub-periods, we find significant differences during the VAT exemption days in 2021 and 2022: In these cases, the increase in the consumption is around 10% and 25%, respectively (see columns 3 and 4).

Table 3. Difference-in-differences: Log consumption

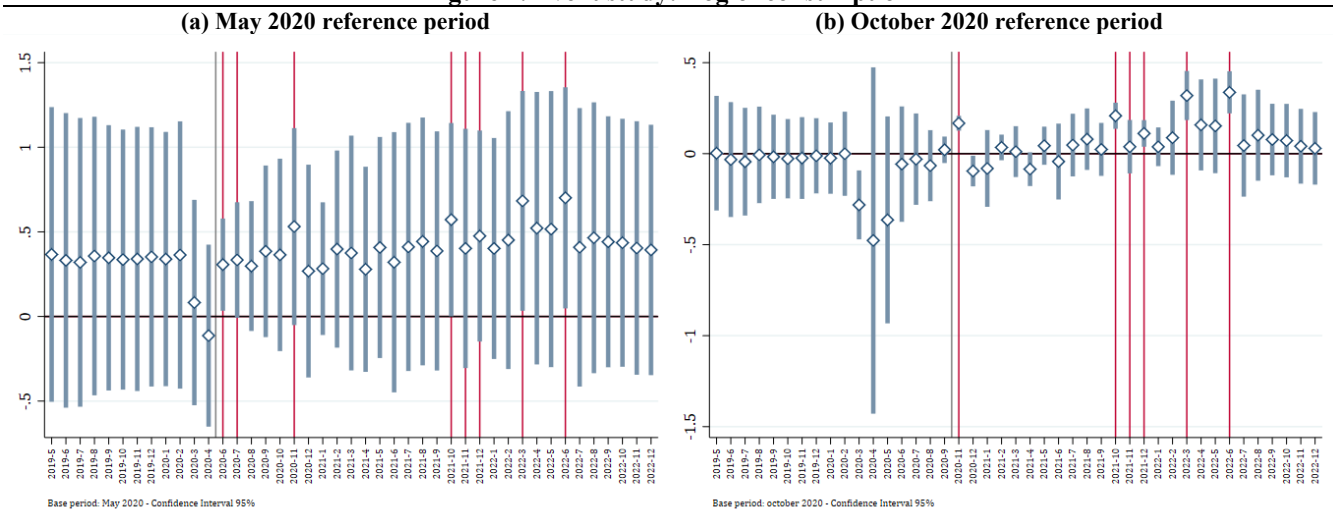
Variable	All control groups			
	2018–2022	2018:1–2021:5	2021:3–2022:2	2022:1–2022:12
	(1)	(2)	(3)	(4)
$Treat \times VATex$	0.17*	0.10	0.10***	0.25***
	(0.08)	(0.15)	(0.03)	(0.06)
Constant	4.93***	4.85***	5.04***	5.13***
	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.79	0.72	0.96	0.97
Observations	840	574	140	168

Note: All regressions control by the category fixed effect and time.
Source: EMC-DANE; authors' own calculations.

Because our policy has been implemented in different periods, we might use a correction like the one proposed by Callaway and Sant'Anna (2021), where the reference period corresponds to the first moment when the policy is implemented. Note that, in our case, once a group is treated, it remains treated and our control group is never treated, so the parallel trends assumption is not violated. Therefore, our dummy $VATex$ takes the value of 1 for all periods after the first day (month) in which the policy is implemented. The results for this correction are presented in Appendix D where we can see that they are very similar to those presented in Table 2, with an average effect of 15%, but the magnitude of the coefficient reduces with time passing, especially for the subsample 2022:1–2022:12.

We also present the results of the ES. Figure 2(a) shows that there was a significant increase in the consumption of items affected by the policy, especially during the VAT-free days in June 2020 and in March and June 2022, using May 2020 as a reference period (i.e. one month before the policy was implemented in 2020). However, at the beginning of 2020, there was a significant change in consumption caused by the shock of the COVID-19 pandemic. Thus, we prefer to remove this period and change the reference month for October 2020, in order to implement the ES only for VAT-free days presented between November 2020 and June 2022. In this case, we find similar results (see Figure 2(b)). In general, the effect is significant but transitory, and we show evidence of a non-significant pre-trend in our estimation.

Figure 2. Event study: Log of consumption

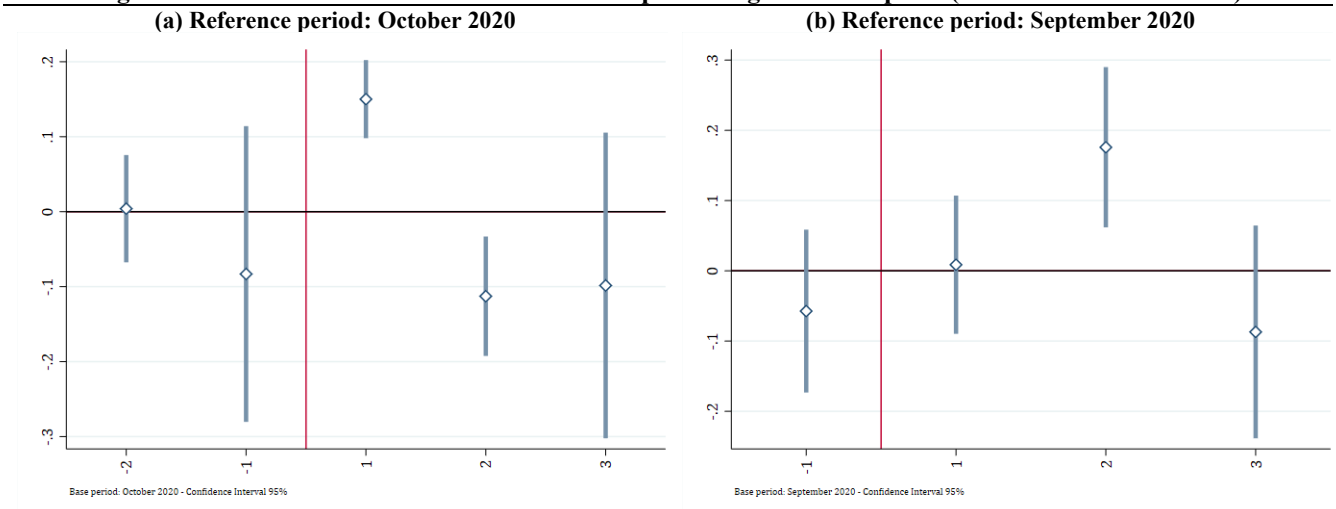


Source: EMC-DANE; authors' calculations.

The fact the VAT-free days are, in some cases, very close to each other, as in 2020 and 2021,[11] might introduce difficulties in the identification process. This closeness of months with VAT-free days might mean that households make overlapping decisions between current purchases and saving for future purchases in the upcoming month, which also comes with a VAT-free day.

Thus, we also study the responses of the treatment group in relation to the control group when there are no VAT exemptions in the neighboring months. With this aim, we focus on the event of November 2020. In this period, we have three months before and ten months after without any policy intervention. Figure 3(a) presents the results using October 2020 as the reference period, one month previous to the policy being implemented. In this case, we can observe a significant increase of around 15% in the consumption of items treated by the policy. However, the effects vanish in the upcoming months after the exemption.

Figure 3. Effects before and after the VAT exemption: Log of consumption (event in November 2020)



Source: EMC-DANE; authors' calculations.

Note that, in this case, there is also evidence of intertemporal substitution, because after the VAT-free day there is a significant reduction in the consumption of treated items compared with the non-treated group. This evidence is in line with the results found in the time series section. Appendix E presents the results using all the events. In this case, we also observe a positive significant effect on consumption during the VAT-free day and a reduction a month later; however, the results are not significant, possibly because the decisions (i.e. between current purchases and saving for future purchases) are overlapping.

Figure 3(b) shows a similar result but we move the reference period back to September 2020. In this case, we want to observe whether there is a potential anticipation of the policy. However, as we can

[11] June and July 2020, and October, November, and December 2021.

observe, there is no significant effect before the implementation of the policy and the effect is significant only in November 2020, when the policy came into effect.

In summary, our results show that the VAT exemption policy increases consumption of items exempted from VAT compared those without the exemption. This increase was around 15% on average, but it was transitory; that is, it lasted only during the month that the policy came into effect. In addition, we find a potential intertemporal substitution effect, because after the event there is a reduction in consumption of items in the group that was exempted.

4.2.3. *Effects on relative prices*

The materialization of the VAT exemption consists of price reductions in the amount of the exemption. That is, the prices of the treatment group should be reduced as now they do not need to pay the VAT of 19% (this reduction in prices can be a maximum of 16% (1/1.19) for items with the full VAT rate, whereas in other cases it would be lower). Moreover, the prices of the control group might also react endogenously to the policy. That is, sellers of items in the control group, not eligible for the exemption, can reduce prices to compete with those in the treatment group. But it is also possible that the application of the policy of exemption VAT to some merchandise lines generated a reaction by sellers and stores, who made some price variations on their own. For example, those who sell merchandise eligible for VAT exemptions can increase prices to some extent in the days previous to the exemption, and then reduce them. Therefore, it is important to analyze what could have happened with prices during the VAT-free days and around the time they occurred. This variation in prices would, in the end, affect the demand (final consumption) for each item. In the next section, we see that, in general, goods eligible for VAT exemption have a persistent decreasing trend in their relative prices. However, those goods that were excluded from VAT exemption do have a more heterogeneous trend in prices (see Appendix B).

Thus, we also explore the results on relative prices as a result of the VAT exemption policy.[12] Table 4 shows the results of DID estimation using relative prices (which corresponds to the ratio between the price of each category and the total CPI). The model in Column (1) presents the results when using all the VAT-free days between 2020 and 2022. In this case, we find a significant reduction in prices of around 6% for the items that benefit from the VAT exemption policy compared with those items that are not exempt. If we separate the sample to evaluate the effect of the VAT exemption policy by years, we observe a significant reduction in prices during the VAT-free days of 2020 and 2021, when the reduction in prices was around 5% and 3%, respectively (see Columns (2) and (3)).

[12] We also replicate this exercise using the nominal prices of each category and we obtain the same results.

Table 4. Difference-in-differences: Log of prices

Variable	All control groups			
	2018–2022	2018:1–2021:5	2021:3–2022:2	2022:1–2022:12
	(1)	(2)	(3)	(4)
$Treat \times VATex$	-0.06^{***}	-0.05^{**}	-0.03^{***}	0.00
	(0.02)	(0.02)	(0.01)	(0.01)
Constant	-0.01^{***}	-0.01^{***}	-0.02^{***}	-0.02^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.53	0.45	0.96	0.97
Observations	840	574	154	168

Note: All regressions include fixed effects to control for category fixed effect and quadratic trend.
Source: EMC-DANE; authors' own calculations.

We also implement the correction proposed by Callaway and Sant'Anna (2021), where the reference period corresponds to the first time the policy is implemented; therefore, our dummy $VATex$ takes the value of 1 for all periods after the first day (month) in which the policy is implemented. The results of this correction are presented in Appendix F, where we can see that the results are very similar to those presented in Table 4, but less significant. When comparing the results of the ES, we also observe that there is a significant reduction in prices especially for the event of November 2020. In this case, we also control by the decreasing trend observed for each category (see Figure 4). Notice that controlling by the decreasing trend for the treated group can help to satisfy the parallel pre-trends assumption. However, Arkhangenlsky et al. (2021) suggested another way to control by this pre-existing trend, as we show in the next section.

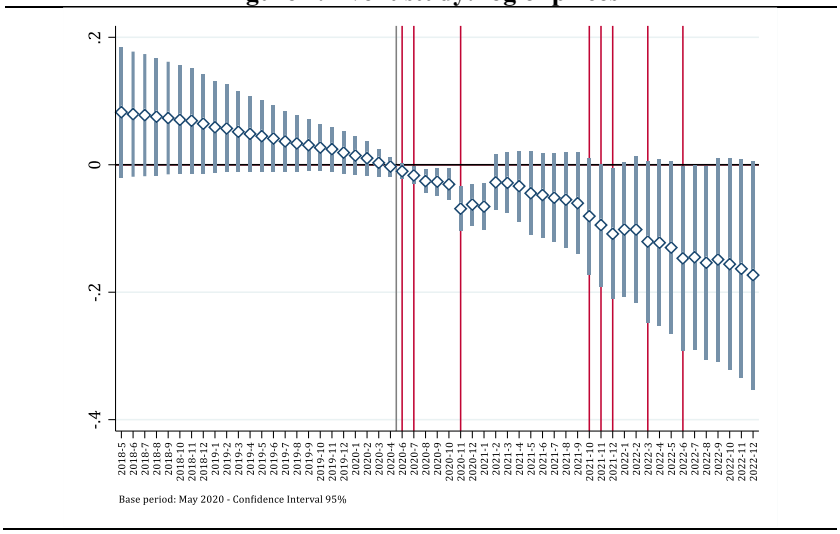
5. A synthetic difference-in-differences analysis

In the previous section, we observed that relative prices have negative trends during the sample period, especially for the categories covered by the policy. This pre-trend can potentially affect our results as the assumption of parallel trends might be violated. To have a control group more comparable with our treatment group, we follow a SDID technique, as suggested by Arkhangenlsky et al. (2021). According to them, the use of only similar units and periods makes the estimator more robust relative to the standard DID estimator. This method re-weights and matches pre-exposure trends of control versus treated groups so the parallel trend assumption is satisfied. In this way, the methodology creates a synthetic control group that gives more weight to the units that, on average, are similar (in terms of their trend) to the treated units.

Figure 5 presents the results of the SDID estimator with the weights used to average pre-treatment time periods. Moreover, there was also a disruption in trade during 2021 (given the increase in the price of containers after the COVID-19 pandemic and a supply-chain channel breakdown, etc.) that affected

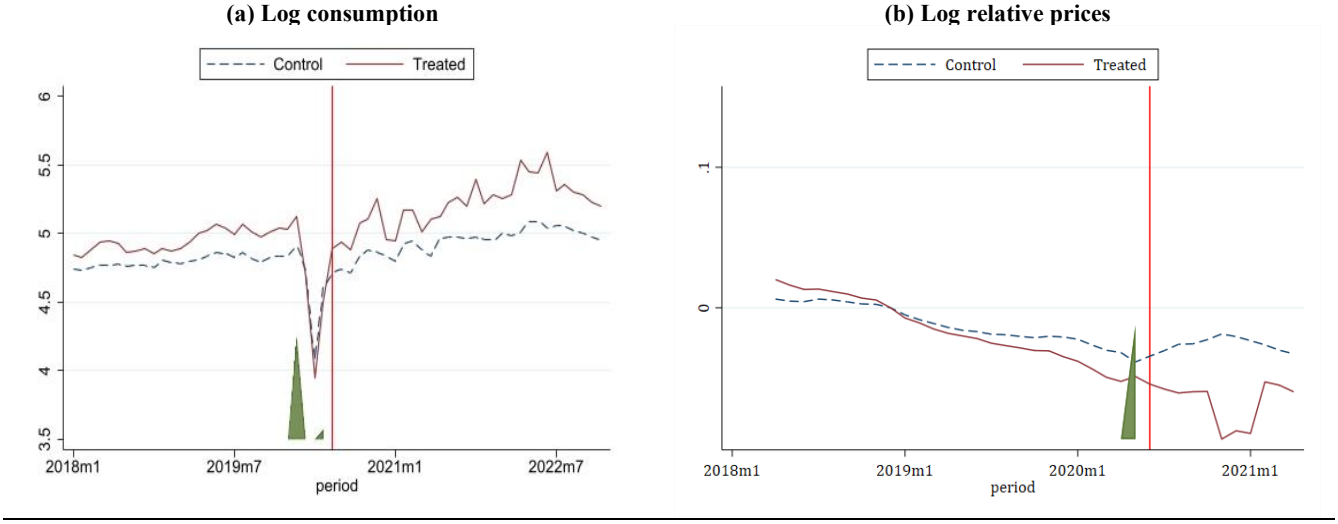
the relative prices of both groups (treated and non-treated), so the period of analysis goes up to April 2021.

Figure 4. Event study: log of prices



Note: This regression also includes a quadratic trend.
Source: EMC-DANE; authors' calculations.

Figure 5. Synthetic difference-in-differences analysis



Note: The figure shows the trends (on treated and untreated groups) in consumption and relative prices. The green areas indicate the weights used to average pre-treatment time periods and the red vertical lines for May 2020 indicate the month before the implementation of the policy.
Source: EMC-DANE.

Table 5. Results of synthetic difference-in-differences analysis

Variable	Log consumption	Log prices
	(1)	(2)
$Treat \times VATex$	0.09*	-0.03***
	(0.05)	(0.02)
Observations	840	518

Note: The *p*-values of a 95% confidence interval are based on large-sample approximations, as suggested by Arkhangelsky et al. (2020).
Source: EMC-DANE, own calculations.

Figures 5(a) and (b) present the pre-trends in consumption and prices before and after the VAT-free days. In this case, we can see that the pre-trends between treated and non-treated groups (log consumption and log prices) are more comparable. Table 5 also presents the SDID estimation. Using the confidence interval at the 95% significance level, as suggested by Arkhangelsky et al. (2020), we find that the VAT exemption policy means that there is a positive and significant increase in consumption of around 9% and a reduction on relative prices of around 3% for the goods covered by the policy. These coefficients suggest that both consumption and prices were less responsive than with the DID approach; however, both move in the expected direction.

6. Final remarks and future research

In this paper, we measure the potential effects on household consumption of the policy of VAT-free days carried out recently in Colombia. This policy aimed to increase aggregate demand and boost economic activity. Between 2020 and 2022, there were eight days in which a basket of goods benefited from such a policy. Our analysis is based on the retail trade indices (our proxy for household consumption) published monthly by DANE, and on the merchandise lines and classifications based on the fourth revision of the ISIC.

We implement a twofold methodology. The first follows the times series modeling approach used by Arango et al. (2024) to establish the main drivers of household consumption in Colombia. These models were slightly modified to observe the behavior of consumption and merchandise lines in the months when the policy came into effect, as well as in the months close to these months. The results of this methodology suggest that there is a dynamic response in purchases, because there is an intertemporal substitution in consumption for items exempted from VAT on VAT-free days. Although this result is in line with the literature, in this study it has been particularly challenging that the VAT-free days in June and July 2020 and in October, November, and December 2021 are so close to each other. This means that the estimates of the intertemporal substitution might be affected because decisions on saving for purchases in future and previous months could overlap with other simultaneous purchasing decisions.

In the second methodology, we use the DID, ES, and SDID approaches. Regarding the DID approach, our results show that the VAT-free days in Colombia have a temporary positive effect on consumption (17% with traditional DID and 9% with SDID) for items covered by the policy, compared with those that are not covered. In terms of prices, we find evidence of a temporary reduction in prices (6% with the traditional DID and 3% with the SDID). The ES shows that the effects for consumption and prices were transitory, remaining significant only between one and two months after the application of the policy.

Because one of the goals of the VAT-free days policy is to increase the consumption of eligible items, we find some positive effects; however, given the intertemporal substitution mentioned above, this positive effect on total consumption is limited (Agarwal et al., 2022).

Despite providing valuable insights into the impact of Colombia's temporary VAT exemption policy on consumer behavior and prices, our study has certain limitations. First, it does not consider the multiplier effect of the policy to boost the economy, given that the effect on household consumption is transitory. Nevertheless, on this regard we find that the effect on household consumption is transitory. Second, the study lacks analysis on the fiscal cost or benefit of this policy. There is an extensive literature suggesting that this type of temporary VAT exemption policy is an inefficient way of helping low-income consumers and reduce poverty, as it introduces unjustifiable distortions in the economy. Moreover, these demographic groups have a limited access to credit and debit cards and, consequently, cannot easily benefit from the VAT exemption policy (Henchman and Drenkard, 2017; Agarwal et al., 2017; Benzarti and Carloni 2019; Benzarti et al., 2020; Warwick et al., 2022). With respect to the fiscal dimension of the policy, not studied in this paper, in the Decree 2357 of 2022, the National Tax and Customs Directorate of Colombia (DIAN) estimated the fiscal cost of one day of VAT exemption. According to this institution, "… the VAT-free day on December 3, 2021, involved a fiscal cost of COP224 billion (Anglo-Saxon terms), which implies that there were sales not taxed due to the VAT-free of a maximum of COP1.17 trillion and that these sales represent 10.4% of total sales with electronic invoices. If we maintain this last percentage and assume a nominal GDP growth of around 20% for this year, in line with the last information available from DANE, we would expect sales on the VAT-free day of around COP13.9 trillion and untaxed sales of COP1.45 trillion, which would imply costs of COP276 billion" (Decree, 2357, page 2). Using this measure of December 3 and considering that during 2021 there were three VAT-free days, the total cost during 2021 can be estimated around 1.4% of the total VAT-taxes collected during 2021. In the same line, the Commission of Experts on Tax Benefits of 2021 also recommended to eliminate the VAT-free day after the Covid pandemic crisis was over since "this policy might generate inequality, discourage compliance with the law and distort the efficient functioning of the market" (National Government of Colombia, page. 87, 2021). Given that Colombia has a very limited resources, policies that focus directly on those low-income families such a Cash Transfer Programs (CTP)[13] can be more effective and less expensive (Warwick, et. al 2022). Also, in Colombia the retail trade sector uses to implement periodic sales very well-known such as cyber-days, black-days and son

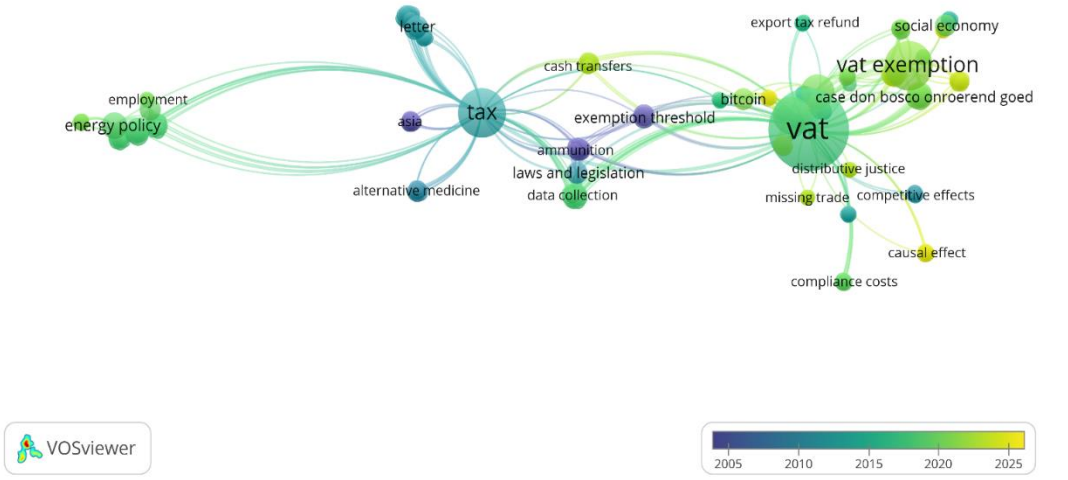
[13] Colombia has different CTP that focus on low-income families such as *Familias en Acción*, *Jovenes en Acción*, and *Colombia Mayor,* among some others.

on aimed to boost the sales of the sector whose real effect should be analyzed before suggesting the continuation of VAT-free days policy.

At the same time, while informative, our approaches lack granularity. Micro-level analyses could provide a more nuanced understanding of individual and demographic responses. Finally, any remaining influence of the COVID-19 pandemic might still pose some challenges for isolating the effects of the policy accurately. Future research should address these limitations to refine our understanding of the implications of VAT exemption policies.

Appendix A: Internet search

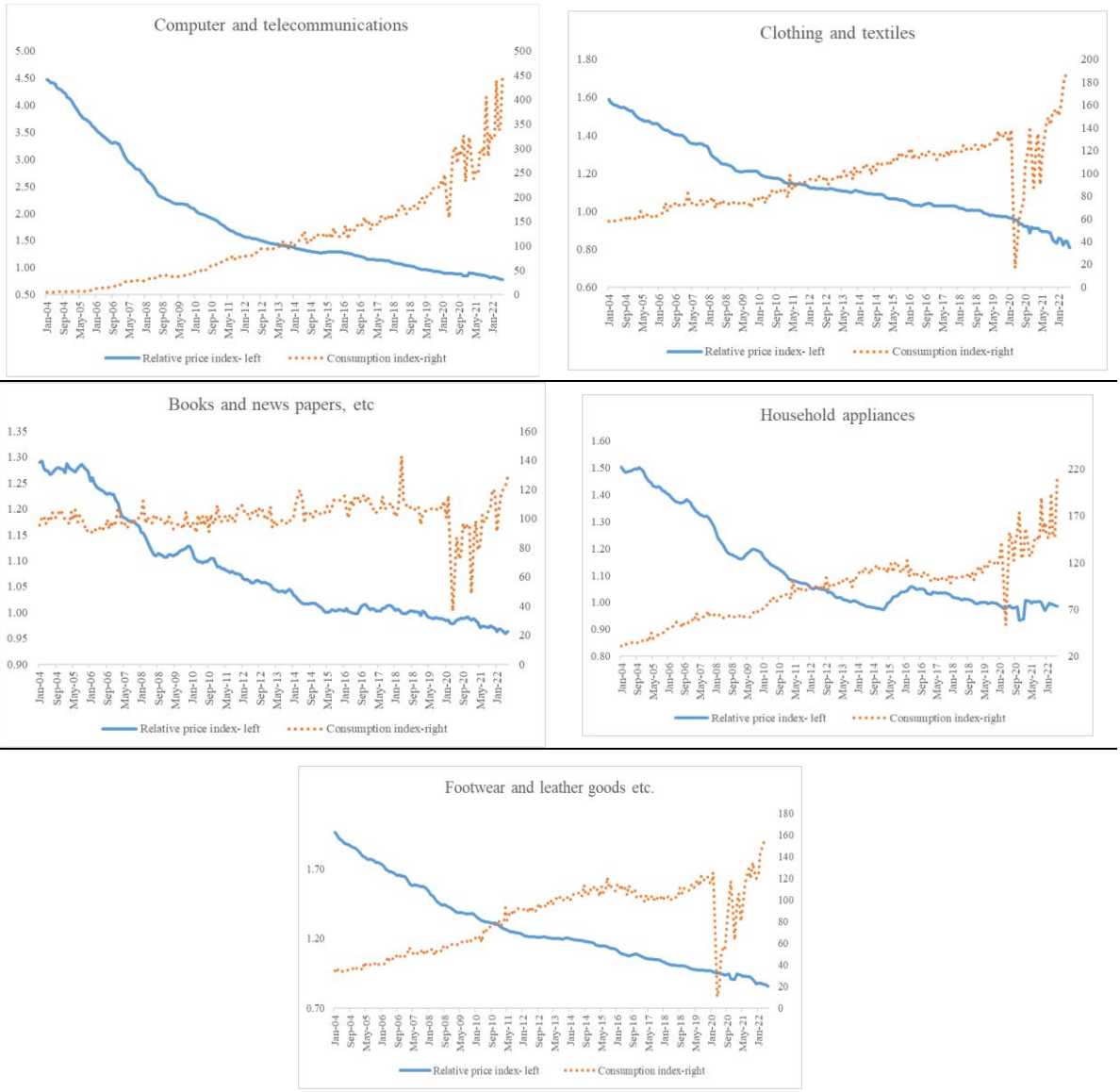
Figure A1. Network of co-occurring keywords for the search terms "VAT exemption" OR "Sales Tax Holidays"



Source: Authors' own research using VOSviewer, based on data from Scopus and WoS databases.

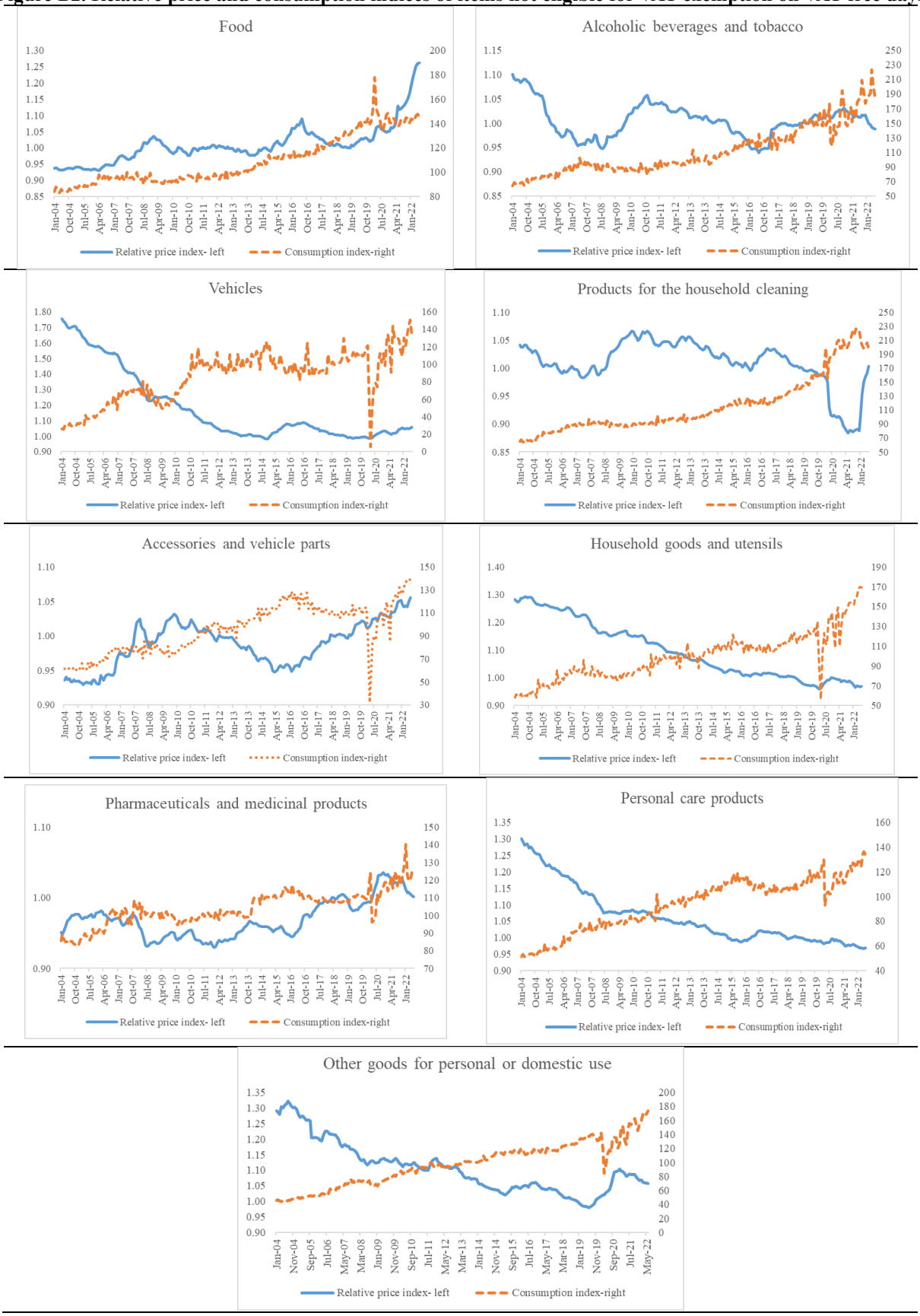
Appendix B: Relative price and consumption indices

Figure B1. Relative price and consumption indices of items eligible for VAT exemption on VAT-free days



Source: EMC-DANE; Banco de la República; authors' calculations.

Figure B2. Relative price and consumption indices of items not eligible for VAT exemption on VAT-free days



Source: EMC-DANE; Banco de la República; authors' calculations.

Appendix C: Effects of VAT-free days on different lines of products

Table C1. Period 2014:1–2022:6

Panel A: Effects of VAT-free days in product lines with the exemption

Variables	Clothing	Footwear	Household appliances	Computers and telecommunications	Books	Consumption with fuels and vehicles
VAT exemption ($t-1$)	−0.15**	−0.13*	−0.06	−0.06	−0.00	−0.03
	(0.07)	(0.07)	(0.04)	(0.05)	(0.06)	(0.02)
VAT exemption (t)	−0.00	0.01	0.24***	0.33***	−0.01	0.05**
	(0.07)	(0.07)	(0.05)	(0.06)	(0.06)	(0.02)
VAT exemption ($t+1$)	0.14**	0.11	−0.10**	−0.12*	0.14**	−0.01
	(0.07)	(0.07)	(0.05)	(0.07)	(0.05)	(0.02)
Lags of dependent variable	3	3	3	3	3	3
Observations	98	98	98	98	98	98
R^2	0.94	0.97	0.76	0.70	0.74	0.83
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00
Durbin–Watson	1.91	1.99	1.98	1.87	1.89	1.81
Prob (Breusch–Godfrey autocorrelation test)	0.01	0.16	0.98	0.18	0.08	0.28

Panel B: Effects of VAT-free days in product lines without the exemption

Variables	Food	Alcoholic beverages	Personal care	Household goods and utensils	Products for household cleaning	Other goods for personal use	Accessories and vehicle parts	Vehicles	Pharmaceuticals products
VAT exemption ($t-1$)	−0.02	0.02	−0.02	−0.03	−0.01	−0.03	0.05	0.02	0.01
	(0.01)	(0.04)	(0.02)	(0.05)	(0.02)	(0.02)	(0.04)	(0.07)	(0.02)
VAT exemption (t)	−0.03**	−0.06	−0.02	0.02	0.01	0.00	−0.03	−0.12	−0.01
	(0.01)	(0.04)	(0.02)	(0.05)	(0.02)	(0.03)	(0.04)	(0.08)	(0.02)
VAT exemption ($t+1$)	−0.01	0.06	0.03	0.07	0.00	0.01	0.05	−0.00	0.04**
	(0.01)	(0.04)	(0.02)	(0.05)	(0.02)	(0.02)	(0.04)	(0.07)	(0.02)
Lags of dependent variable	3	3	3	3	3	3	3	3	3
Observations	98	98	98	98	98	98	98	98	98
Adjusted R^2	0.87	0.59	0.76	0.68	0.86	0.86	0.91	0.99	0.77
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Durbin–Watson	1.88	1.97	1.94	2.04	1.94	1.79	1.80	1.65	1.96
Prob (Breusch–Godfrey autocorrelation test)	0.04	0.07	0.80	0.42	0.53	0.23	0.38	0.04	0.26

Note: All regressions include $\theta r_{t-1} + \lambda \Delta y_{t-1} + \pi \Delta CC_{t-1} + \varphi \Delta CCI_{t-1}$ and COVID-19 dummies (see Arango et al., 2024).
Source: EMC-DANE; authors' own calculations.

Table C2. Period 2004:1–2021:12

Panel A: Effects of VAT-free days in product lines with the exemption						
Variable	**Clothing**	**Footwear**	**Household appliances**	**Computers and telecommunications**	**Books**	**Consumption with fuels and vehicles**
VAT exemption ($t-1$)	−0.18***	−0.24***	−0.07	−0.07*	−0.02	−0.03
	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.02)
VAT exemption (t)	0.11**	0.14**	0.22***	0.10**	0.07	0.07***
	(0.06)	(0.06)	(0.05)	(0.04)	(0.05)	(0.02)
VAT exemption ($t+1$)	−0.15***	−0.19***	−0.25***	−0.09**	−0.05	−0.07***
	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.02)
Lags of dependent variable	3	4	3	3	3	2
Observations	212	211	212	212	212	213
Adjusted R^2	0.95	0.97	0.80	0.93	0.68	0.83
F-statistic (prob)	0.00	0.00	0.00	0.00	0.00	0.00
Durbin–Watson	2.11	2.24	1.91	2.00	1.95	1.86
Breusch–Godfrey autocorrelation test (prob)	0.12	0.03	0.01	0.03	0.83	0.11

Panel B: Effects of VAT-free days in product lines without the exemption							
Variable	**Food**	**Alcoholic beverages**	**Household goods and utensils**	**Products for household cleaning**	**Other goods for personal use**	**Accessories and vehicle parts**	**Vehicles**
VAT exemption ($t-1$)	−0.02	0.02	−0.05	−0.06**	−0.06**	−0.02	−0.09
	(0.01)	(0.04)	(0.04)	(0.02)	(0.02)	(0.08)	(0.08)
VAT exemption (t)	−0.01	−0.03	0.11**	0.01	0.04	0.01	-0.03
	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)	(0.09)	(0.09)
VAT exemption ($t+1$)	−0.02	-0.06	−0.11**	−0.01	−0.07***	−0.08	−0.07
	(0.02)	(0.04)	(0.05)	(0.03)	(0.03)	(0.09)	(0.09)
Lags of dependent variable	3	3	3	3	3	3	3
Observations	212	212	212	212	212	212	212
Adjusted R^2	0.77	0.57	0.66	0.79	0.87	0.46	0.99
F-statistic (prob)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Durbin–Watson	1.95	2.01	2.02	1.99	2.05	1.86	1.62
Breusch–Godfrey autocorrelation test (prob)	0.76	0.29	0.62	0.93	0.63	0.01	0.01

Note: The merchandise lines of computers and telecommunications are not stationary for this period. All regressions include $\theta r_{t-1} + \lambda \Delta y_{t-1} + \pi \Delta CC_{t-1} + \varphi \Delta CCI_{t-1}$ and COVID-19 dummies (see Arango et al., 2024).
Source: EMC-DANE; authors' calculations.

Appendix D

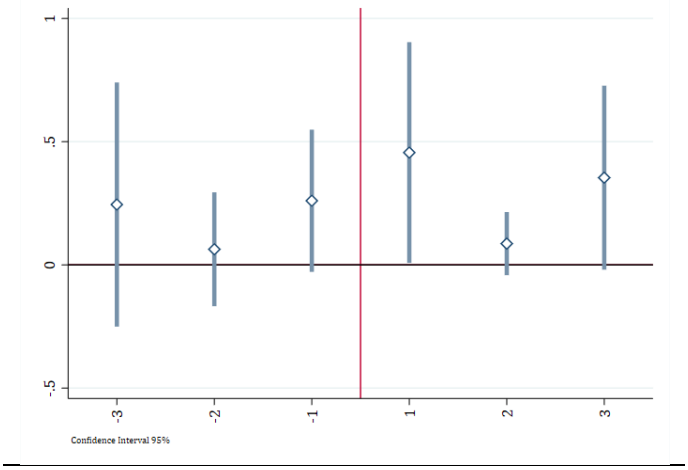
Table D1. Difference-in-differences: Log consumption (estimation of Callaway and Sant'Anna, 2021)

Variable	**All control groups**			
	2018–2022	**2018:1–2021:5**	**2021:3–2022:2**	**2022:1–2022:12**
	(1)	**(2)**	**(3)**	**(4)**
$Treat \times VATex$	0.15*	0.08	0.09**	0.07**
	(0.07)	(0.12)	(0.03)	(0.03)
Constant	4.91***	4.84***	5.04***	5.13***
	(0.01)	(0.01)	(0.00)	(0.01)
R^2	0.79	0.72	0.96	0.95
Observations	840	574	140	168

Note: All regressions control by the category fixed effect and time.
Source: EMC-DANE; authors' own calculations.

Appendix E

Figure E1. Effects before and after the VAT exemption: All events



Source: EMC-DANE; authors' calculations.

Appendix F

Table F1. Difference-in-differences: Log prices (estimation of Callaway and Sant'Anna, 2021)

Variable	All control groups			
	2018–2022	2018:1–2021:5	2021:3–2022:2	2022:1–2022:12
	(1)	(2)	(3)	(4)
$Treat \times VATex$	-0.09	-0.04	-0.05***	-0.03*
	(0.05)	(0.03)	(0.01)	(0.02)
Constant	-0.05	-0.16	0.15	-0.09
	(0.17)	(0.12)	(0.25)	(0.26)
R^2	0.65	0.61	0.98	0.98
Observations	840	574	140	168

Note: All regressions control by the category fixed effect and quadratic trend.
Source: EMC-DANE; authors' own calculations.

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