

THE EFFECT OF THE DISPOSABLE PRODUCTS TAX ON THEIR PRICES: SINGLE-USE CUPS AS A TEST CASE¹

- On November 1, 2021 a tax of NIS 11 per kilogram was introduced on certain plastic disposable goods. This paper examines the effect of the tax on the prices of those products using a test case: examining the change in the price of plastic single-use cups.
- The actual increase in the prices of the cups was 70 percent higher than the increase derived from the imposition of the tax: an average increase of about NIS 22 per kilogram compared with an increase of about NIS 13 (NIS 11 plus VAT that applies on the tax), derived from the imposition of the tax.
- The actual increase beyond the tax liability supports the possibility that the market is not operating in perfect competition due to the structure of the supply side of the market or because the information available to consumers is incomplete.
- A substantial part of the differences in the price increases between stores is explained by the marketing chain to which the store belongs. The various brands are much less important than the marketing chains in explaining the variance, apparently because consumers do not attribute great importance to the brand of single-use cups.
- When we control for the marketing chain to which the store belongs, the population size of the locality and the average wage in the locality do not contribute to explaining the variance of the price increase between stores.
- An excess increase in prices following the imposition of similar taxes is a well-known phenomenon globally. In our case, it seems that the consumer's difficulty in identifying the increase derived from the tax—which is due to the fact that the tax is based on weight, which the customer has difficulty estimating—made it easier to raise the price beyond the tax. The increase in global prices of raw materials and the acceleration of the inflation rate at the same time may also have made it easier to raise prices.
- The excess increase in prices indicates a need to find the proper balance between setting a tax that simplifies its collection and is consistent with the achievement of its goal, and a definition that the customer understands. Setting a tax as a percentage of the consumer price would make it easier for consumers to compare between it and the actual increase in price, but may also present other difficulties. Alternatively, the imposition of a set tax can be accompanied by requiring producers/importers to indicate the product's weight, and even the tax that applies to the product, on the packaging.

1. INTRODUCTION

On November 1, 2021, a new tax was introduced on plastic disposable goods in Israel. The new tax is intended to reduce the use of such goods due to the damage they cause to the environment. This tax joins other environmental legislation in recent years that is intended to reduce the quantity of waste using economic incentives.² As opposed to most of these laws, which focus on reducing the quantity of waste

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² The economic incentives may apply to the producer or to the consumer. Most of the existing legislation in Israel imposes the responsibility on the producer, but it is reasonable to assume that the additional cost will be at least partly passed on to the consumer. For a discussion of the economic tools used in handling the issue of waste in Israel, see for instance: Bank of Israel (2020) and Lavi (2020). For more details on the laws of producer responsibility in Israel regarding waste, see https://www.gov.il/he/departments/guides/extended_producer_responsibility (in Hebrew).

by encouraging recycling, the tax on disposable goods—similar to the impost on disposable bags³—is intended to reduce the source of the waste by lowering the use of the product. This is an important value in the environmental view. The tax on disposable goods is similar to the impost on disposable bags, and differs from the other legislation in that it has a direct impact on the consumer price, which is immediate and more easily identifiable.⁴

Even though the declared aim of the tax is to reduce the consumption of plastic disposable goods, this study does not examine its effect on the purchased quantity of these products. The aim of this study is to examine another aspect of the tax: how it affected the final consumer price in the short term, immediately after its imposition. The findings of the study may help us understand the transmission mechanisms operating on prices in the economy, particularly how cost shocks roll over to the consumer price, and may help us derive lessons on how to design similar taxes in the future. The data also point to substantial variation in retailers' responses to the new tax. However, this information does not enable us to examine retailers' characteristics so that we would be able to connect those characteristics with the differences in their response to the tax. We examine these questions by focusing on a single product—simple plastic single-use cups.

2. LITERATURE REVIEW: THE EFFECT OF SIMILAR TAXES ON THE PRODUCT'S PRICE – FINDINGS FROM ABROAD

The use of taxes on specific products is widespread around the world, and exists in Israel as well. Their purpose is frequently to reduce consumption of products that involve negative externalities or harm (mostly regarding health) to the user. Common examples of such taxes are those focused on fuel, cigarettes, alcohol, and sweetened drinks. These taxes, imposed on the producer or on the importer, are generally in the form of a set amount per consumption unit. This is in contrast with more general indirect taxes such as VAT or customs, which are set as a percentage of the product's price.

Economic research deals at length with the potential effects of taxes on specific products. These effects can be divided into two major groups (that are not independent of each other): the effect on the consumer price and the effect on the amount consumed. This study focuses on the first aspect—how the consumer price changed as a result of the imposition of the tax. A central issue that the literature deals with in this context—both theoretical and empirical—is the extent of the “tax pass-through” to the consumer as reflected in the price paid by the consumer—partial, full, or even beyond full.

The theoretical analysis of the link between the market structure—the extent of competition, the information available to the consumers, and the nature of demand for the product—and the consumer price's response to the increase in taxes is complex. In general, the less demand for the product responds to an increase in price, the greater we can expect a price increase to be due to the imposition of the tax. Moreover, according to theory, if competition in the market is imperfect, there may be over-shifting, meaning an increase in the consumer price beyond the increase in the tax. Sullivan and Dutkowsky (2012) show that under conditions of monopolistic competition, if the demand function is linear or concave, the tax pass-through

³ For a description of the impost and its effect on consumer behavior, see Box 6.2 in the Bank of Israel *Annual Report* for 2017.

⁴ The Bottle Deposit Law imposes a direct cost to the consumer, but the consumer can avoid it by redeeming the deposit. This reflects the purpose of the law—to encourage recycling, rather than to reduce consumption. The impost on bags applies on shopping bags that are distributed for free, such that it is not relevant to the discussion of an effect on their price, but is only relevant to the volume of their use.

to the consumer price will be partial or full but not beyond that. In contrast, if under such conditions the demand function is convex, it is certainly possible that the consumer price will increase by more than the tax increase.⁵ They note that it is more likely that this would occur with regard to products with relatively inelastic demand. The authors emphasize that while this analysis shows that in a noncompetitive market, the pass-through may be partial, full, or even beyond, in a fully competitive market, over-shifting is not possible.

Incomplete information on the part of consumers may also support an excessive price response. Consumers may, for instance, believe that since all producers are taxed by the same amount, they will increase the price by an identical rate. They therefore avoid making the necessary effort to compare prices (between producers or between stores), or to change their consumption patterns.⁶ In this context, and as we emphasize below, the manner of setting the tax on disposable goods in Israel exacerbated the problem of consumer information, because of the difficulty in calculating the additional price per unit sold to the consumer as derived from the tax.

Many studies around the world have empirically examined the effect of introducing a tax on specific products, particularly on cigarettes, alcohol, and sweetened drinks. Many of them found that the transmission from the tax to the product's price is greater than 1, meaning that the consumer price increased by more than the size of the new tax. For instance, Shang et al. (2020) examined the effect of introducing a tax on various types of alcohol in the OECD countries, and found that for most products, the price increase was greater than the tax, for some the transmission was not different than 1, and that there were only a few products where the tax was only partially passed on to the consumer. In contrast, Cawley and Frisvold (2017) examined the effect of introducing a tax on sweetened drinks in Berkeley, California, and found that the transmission was smaller than 1. In their assessment, the finding reflects consumer's ability to purchase these drinks at other places, where there is no tax. However, they note that in many studies on various products, a transmission of 1 or larger was found. Grogger (2016) found that the tax on sweetened drinks in Mexico was passed on to the consumer price at a rate of greater than 1. Similar findings were obtained for Denmark (Bergman and Hansen (2016)). Dutkowsky and Sullivan (2014) note a number of studies that found a transmission of greater than 1 for taxes on cigarettes. We did not find studies on the imposition of tax on disposable goods.

3. THE TAX ON DISPOSABLE GOODS AND ITS IMPLICATIONS FOR THE RESEARCH METHOD

As stated above, on November 1, 2021, a purchase tax was introduced on disposable goods made of plastic or that contain a layer of plastic. The tax took the form of a set impost (excise) of NIS 11 per kilogram of product.⁷ Since VAT is calculated on the price including the new tax, the actual new tax amounts to NIS

⁵ Weyl and Fabinger (2013) too show that under imperfect competition, the extent of the price's response to a tax depends not only on the elasticity of supply and demand, but also on additional features of demand.

⁶ See also Cabral and Fishman (2012).

⁷ Customs Rate and Exemptions and Purchase Tax on Goods Order (Amendment Number 3), 5782–2021. This rate also applied initially to disposable products made of paper coated in plastic, but it was later reduced for such products. This study does not deal with products of this type.

12.87 per kilogram.⁸ The tax is collected on the basis of a declaration by the manufacturer or the importer regarding the total weight of the merchandise.

Even though the tax applies to a wide variety of disposable products, we chose to limit our examination to one type of product. Alongside the disadvantages of such a limitation, it should be emphasized that focusing on a product as homogeneous as possible improves the ability to distill the effect of the tax on the change in price. Among other things, it may eliminate potential effects of the various types of products on the price's response to the tax, for instance because of differences in the elasticity of demand for different products.

This study therefore deals only with simple disposable plastic cups (as opposed to premium, for example), intended for cold drinks, with a volume of 180–200 ml. This is a very common and readily available product, the use of which is more common than almost any other disposable product.⁹ In order to further increase homogeneity, we restricted the examination to large packages (100–150 cups). Even though there are various brands (manufacturers and importers) of the product, it is reasonable to assume that in this case, consumers do not attribute any importance to a particular brand. (This matter will be discussed in greater detail below.)

As stated above, the Order defines the tax per kilogram of product, while the product is sold to the consumer by number of units in the package, and not by weight, and the weight is not marked on the package. In order to compare the change in the consumer price of a package that is taxed per kilogram of product, we must convert the size of the package to weight terms based on the number of cups in the package and their weight. Although we focus on a very homogeneous product, it turns out that there is some difference in the weight of the cups, which means a considerable difference in the actual tax imposed on the packages of various brands (which include the same number of cups). Accounting for these differences is essential when examining the change in price of these brands.

It is important to note that the fact that only the number of cups is marked on the package, but not their weight, makes it difficult for consumers to estimate the change that should have taken place in the price due to the tax, compared with the actual change. This may have an impact on the extent of the tax's pass-through to the consumer, which means that it also raises policy questions, as will be discussed below.

Since the order set out a clear date for the tax to take effect (November 1, 2021), our research method is based on comparing the price in the period prior to that date with the price in the period immediately following it.¹⁰ Limiting our examination to these periods greatly reduces the concern that the price change during that time was also affected by other factors. (See below for further discussion of potential effects

⁸ Imported disposable plastic products are also subject to an existing customs tax of 8–12 percent. In contrast with VAT, the customs tax is calculated on the price excluding the purchase tax.

⁹ According to a survey conducted for the Ministry of Environmental Protection, 73 percent of Israelis reported that they use simple disposable plastic cups for cold drinks at home, even if only occasionally. This rate is higher than the rate for any other type of disposable product except for paper cups for hot drinks. The rate of those using simple disposable plates was 63 percent, and the rate of those using simple disposable cutlery was 58 percent. See: Ministry of Environmental Protection (2020) (in Hebrew).

¹⁰ The intention to impose a tax of NIS 11 per kilogram was announced in July 2021, as part of the discussions on the State Budget, and was approved in Government Decision number 261 on August 1, 2021. The decision did not set the precise date for introducing the tax, but it did state that the tax would be introduced no later than January 1, 2022. Final confirmation that the tax would be introduced, and of the date on which it would be introduced, was given with the Minister of Finance's signature of the regulations on October 19, 2021. The Order was given final approval by the Knesset Finance Committee on November 30, 2021.

such as these). However, this examination may show only a partial picture of the tax's effect on the price, while the effect over time may be greater or smaller than the immediate effect.

4. THE DATA

The main data source for this study is the prices that the large supermarket chains are required to post on their websites each day.¹¹ These data enable a unique identification of each product by its barcode number. In addition to the date and the daily price of the product, the data also include the product name (including the name of the marketer—hereinafter the “brand name”), and details of the branch (store) at which it is sold (the chain to which the branch belongs and the locality in which the branch is located).

The study examines the change in price immediately after the tax took effect, compared with the preceding period (base period). We define the base period as the two months preceding the imposition of the tax: August 15, 2021 to October 15, 2021. We define the period following the imposition of the tax as November 7, 2021 to November 30, 2021. We omit the two-week period immediately prior to the imposition of the tax and the first week after its implementation, on the assumption that price changes during this period reflect a price update period that may vary from one store to another, and not the representative price in either of the comparison periods. Expanding the basis period to two months is intended to eliminate the potential effects of the holiday period that took place in September—a period that generally has few business days and may reflect unique effects on prices.

As explained above, the weight of the cups is essential in our discussion. This weight does not appear on the package or in the product details that appear on the supermarkets' websites. Therefore, the final sample includes only the 6 barcodes that we were able to weigh on our own. This limitation decreases the sample size only slightly, so in our assessment, the sample properly covers the population of cups sold at the supermarket chains.¹² The price per kilogram is calculated in accordance with the weight of the cups with the appropriate barcode.

In order to examine the effect of locality characteristics on the price's response to the tax, we use the Central Bureau of Statistics “local authorities file”. The characteristics are: average wage in the locality; rate of *Haredim* (ultra-Orthodox Jews) in the locality; and rate of large families in the locality. The rate of *Haredim* in the locality is estimated using election data: the number of votes received by the *Haredi* parties (United Torah Judaism and Shas) as a percentage of total valid votes in the locality in the elections for the 24th Knesset (March 2021). The rate of large families is estimated using child allowance payment data: the number of children in the locality, for whom child allowance was paid, in families with five or more children, as a percentage of total children in the locality for whom child allowance was paid.

¹¹ Our data therefore do not include total consumption of disposable plastic products in Israel. Sales to households are estimated at about 70–75 percent of total consumption, and are divided between the barcoded market (about 48 percent of these sales) and the rest of the market (mainly stores specializing in household goods and in disposable products). The barcoded market itself is divided among the large supermarket chains, which are required to publish prices on the Internet and which are covered by our data, and small chains, neighborhood grocery stores, and so forth, which are not obligated to publish prices on the Internet and are therefore not included in our data. Estimates on sales distribution are based on Ministry of Environmental Protection (2020) and Eliyahu (2021).

¹² The omission of 5 barcodes that we were unable to weigh, out of the 11 that were in the refined sample, led to the omission of just 29 stores out of the 641 in the sample, and to the omission of 2 supermarket chains.

The sample was therefore limited to localities for which the necessary data exist, meaning only those that constitute a municipality on their own (city or local council), and does not include smaller localities (that belong to regional councils). This limitation does not have a material impact on the number of stores in our sample or on their characteristics, since the data we have relate, as stated, to large supermarket chains that are generally not located in the small localities. The stores that are typical of such localities (neighborhood groceries, minimarkets, and so forth) are not included in the data that we have.¹³

Our database also includes information regarding the products sold through the websites of some of the supermarket chains. We obviously cannot attribute these websites to a particular locality, and our treatment of them is explained below.

5. THE SAMPLE COVERAGE: DESCRIPTIVE STATISTICS

The number of stores, supermarket chains, and localities included in the sample show that the data available to us have sufficiently broad coverage (Table 1). Each observation describes the change in the average daily price per kilogram of a particular barcode sold at a particular store between the period prior to the imposition of the tax and the period after its imposition, with the characteristics of the product and of the place of sale.¹⁴

Table 1: Descriptive statistics of the sample¹	
Variable	Number of appearances in the sample
Number of observations	738
Number of stores	612
Number of supermarket chains ²	25
Number of barcodes (products)	6
Number of chains selling more than one barcode	9
Number of stores selling more than one barcode	101
Number of barcodes sold at more than one chain	6
Number of localities in the sample	99
<i>of which:</i> Localities in which there is only one store in the sample	19
¹ The sample discussed in the Table includes only stores in municipalities. A slightly broader sample, which includes 805 observations and also includes stores in smaller localities and online stores belonging to the supermarket chains, is used in some of the estimations as described below. ² We defined subsidiary chains that belong to the same parent chain as separate chains.	

¹³ The large supermarket chains sometimes place stores in commercial areas belonging to regional councils, and some of the chains are active in the rural sector. These stores are not included in the sample. In contrast, the sample does include small stores (such as convenience stores) that belong to the large chains. In total, the limitation of the sample to municipalities led to the omission of 54 stores. The sample contains almost no Arab localities, since the data are limited to the large supermarket chains.

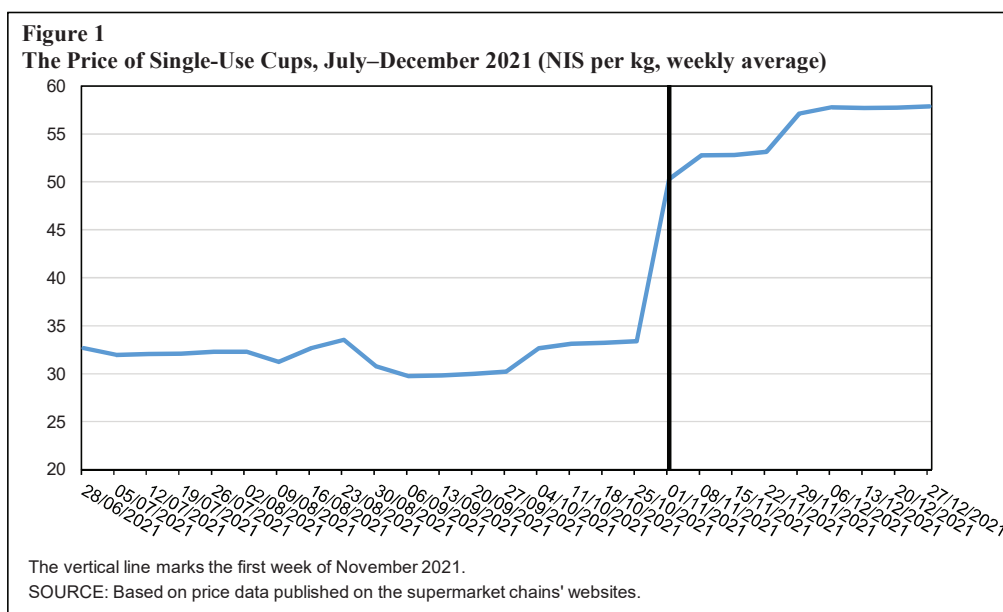
¹⁴ We omitted a product sold at a certain store if the number of days on the basis of which we calculated the average price during the pretax or post-tax period was less than 4. We related to the price including sales discounts that are not limited to customer club members or those with a supermarket credit card. All observations receive equal weighting, regardless of the volume of the product's sales at the store. We do not have data on that volume.

The number of observations is greater than the number of stores because some of the stores sell more than one barcode of the six that are included in the sample. For one-fifth of the localities, the sample includes only one store in that locality. This is partly due to the low number of supermarket chains represented in the smaller localities, and may attest to a low level of competition in those localities. However, we obviously cannot derive from this that this is the only store in the locality, since the data do not include stores that don't belong to the large supermarket chains.

6. FINDINGS

6.1 Price change over time – evidence for identifying the tax effect

The sharp, immediate, and extraordinary increase in the price of cups (per kilogram) around the time the tax took effect (November 1, 2021) is clearly noticeable in Figure 1.¹⁵ This greatly strengthens the argument that the price increase we examine in this study is mainly due to the tax, and not to other factors such as an increase in the price of raw materials. Section 7 below presents additional examinations that support this. The figure also prominently shows that the supermarket chains and/or suppliers avoided raising the price during the period prior to the imposition of the tax, even though the intention to impose the tax soon, and then the precise date as well, were known some time in advance.¹⁶



¹⁵ At the beginning of December, there was an additional jump in prices, although it was much smaller than the one at the beginning of November. This jump was due to the fact that two of the supermarket chains revised their prices on the cups only at the later date.

¹⁶ See the previous note. Even though prices increased slightly at the beginning of October relative to September, their level was similar to the August level. It is reasonable to assume that this increase was a correction of the temporary price decline during the September holiday period, and is not connected with the expected tax. Even if there was a price increase connected with the expected tax in the first two weeks of October, which are included in the base period of our test, it means that our estimate of the tax's effect on the price is conservative relative to the actual increase. The Order was given final approval by the Knesset Finance Committee on November 30, 2021, after certain changes were made to it that do not relate to the cups being examined in this study.

As we know, expectations of a price increase may lead to bringing purchases forward, and therefore to a temporary increase in demand that may support an increase in price even before the tax is introduced. The avoidance of raising the price before the tax took effect may show that the supermarket chains or suppliers were concerned about raising the price without justification in the eyes of consumers. However, they also did not wait, and raised the price immediately with the imposition of the tax.¹⁷ The rapid change in the consumer price following the tax increase is consistent with the findings of studies in other countries.¹⁸ An initial look at Figure 1 shows that the change in the price per kilogram is significantly greater than the level of the tax—a price increase of more than NIS 20, compared to the tax that was set at NIS 13 (including VAT).

6.2 Change in the average price and what it means

The tax on disposable products was set as an excise in shekels, similar to other taxes on defined products, and not as a percentage of the product's price as most purchase taxes are. However, in contrast with the excise on fuel, which is defined in relation to the measurement unit at which the product is sold to the consumer, and the price of which (shekels per liter) the customer knows (and where the final consumer price is supervised and published), the tax on disposable goods is set in relation to a measurement unit (kilograms), which is completely disconnected from the measurement unit at which the product is sold to the customer (number of units in the package). Moreover, the weight of the package is not marked on the package, not published, and may vary from one product to another where the products are completely identical from the consumer's standpoint (for instance, between various barcodes of simple plastic cups).¹⁹ This means that the consumer has no practical way of knowing what the effective tax is on the product he is buying, and even more so has no way of comparing it to the actual increase in the price of the product.

This section compares the actual price increases with the set level of the tax. For this purpose, we consider the average price of the cups. However, the data show that there is tremendous variance in the rate of the price increases. In the following sections, we will examine the factors that may explain this variance.

Even though all calculations in the study relate to the price per kilogram, Table 2 presents the numbers also in terms of the package's consumer price in order to illustrate the scope of the prices that the consumer actually sees. The "translation" of the excise to the additional price per package sold to the consumer depends on the number of cups in the package and their weight. The tax liability ranges from NIS 1.7 to NIS 2.7 per package of 100 cups (according to their weight), which was between 37 and 50 percent of the average price during the base period (Columns 5 and 6 in the table). Looked at slightly differently, the tax was the equivalent of 42 percent of the price per kilogram during the base period. This means that the tax rate is very substantial.

In practice, the average price of a package of cups increased by 70 percent, markedly higher than the increase implied by the tax (Column 4 compared with Column 6).

¹⁷ The tax also applies to existing inventory, other than some reservations in Section 3 of the Order.

¹⁸ For a review of findings regarding the speed of response, see Cawley and Frisvold (2017).

¹⁹ We found that the weight of the cups defined as "simple" ranges from 130 to 210 grams per hundred cups. The weight of the cups with a volume of 200 ml ranges from 190-210 grams per hundred cups. The weight of cups with a volume of 180 ml ranges from 130-170 grams per hundred cups.

Table 2: Tax level and actual change in the average price of cups

	Average price during the base period (Aug 15 – Oct 15, 2021) (NIS)	Average price after the imposition of the tax (Nov 7-30, 2021) (NIS)	Change in average price (NIS)	Rate of change in the average price (%)	Tax liability (NIS)	Rate of change derived from tax liability (%)
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)
Per package of 100 cups	5.5	9.3	3.8	70%	1.7–2.7	37-50%
Per kilogram of cups	31.0	53.2	22.3	70%	12.87	42%

Price per package: Simple average of the prices in all observations. The prices of packages of 150 cups were equalized to the price of a package of 100.

Tax liability per kilogram – As set in the Order, plus VAT.

Tax liability per package – The rate relates to the lowest (130 grams per 100 cups) and highest (210 grams) weight of cup packages from among the barcodes in the sample.

As discussed in Section 2 above, according to economic theory, if the market is not perfectly competitive, the change in price due to the imposition of a tax may be less than the tax—such that the producer and the consumer split the cost—equal to the tax, or even greater than it (a pass-through of greater than 1 in the effect on the consumer price). In contrast, under perfect competition, a pass-through of greater than 1 is not possible. The actual increase in the price above and beyond the tax liability supports the possibility that the market is not operating under perfect competition due to the structure of the market’s supply side or because the information available to consumers is incomplete. In particular, the lack of sufficient information regarding the price change implied by the tax may make it easier to increase the price excessively.

As mentioned previously, the way the tax was defined makes it very difficult for consumers to interpret it in terms of consumer price. The policy implications of this are discussed below. The relative rigidity of demand for cups, or other features of demand, may also contribute to the magnitude of the price increase. In order to examine these possibilities, and in order to learn the extent to which the tax and the additional price increase that accompanied it affected the quantity purchased (at least in the supermarket chains), a study that will also look into the quantity sold (data that we do not have) is necessary.

Another potential explanation for the sharp increase in price is that the extensive publicity that accompanied the imposition of the tax created a public “justification” to raise prices. This, alongside the consumer’s difficulty in identifying the change in price due to the tax, made it easier to raise prices. Moreover, as opposed to other processes that gradually raise the producer’s costs (such as an increase in the prices of raw materials), the fact that the tax was introduced on a set date made it easier for retailers to carry out a relatively large one-time price increase. As we saw above, most supermarket chains were quick to attach the price increase to the date the tax took effect, and did not choose, for instance, to raise prices gradually. It is also possible that suppliers or retailers exploited the opportunity in order to raise prices that they wanted to increase earlier but did not due to concerns over consumers’ reactions in the absence of a visible justification. Hendel et al. (2017) analyzed the effect of the “cottage cheese protest” in 2011 on the price of cottage cheese and the quantity sold, and argue that the reduced ability to raise the price of cottage cheese was apparent even six years after the protests. According to them, the findings show a significant concern on the part of firms regarding consumers’ response to price increases. Cabral and Fishman (2012) offer

a theoretical explanation for the fact that producers are deterred from increasing prices following a small increase in the cost of production, due to concern that it would encourage consumers to compare the prices of competing producers, and may therefore harm their sales.

An argument can be made that the price increase was also necessary in view of the increase in the costs of raw materials at that time. In the months preceding the imposition of the tax, there was a significant increase in the prices of “plastic” raw materials. However, an examination of the behavior of the Producer Price Index and of the consumer price of similar products shows that we cannot attribute most of the increase in the price of cups to an increase in the prices of raw materials (see Section 7). Finally, one can argue that the acceleration of inflation in Israel to an annual pace of about 2 percent in the months prior to the imposition of the tax—although inflation was still within the target range—and news of rising raw material prices around the world, also contributed to the public atmosphere that was more accepting of the excess increase in the prices of the cups.

6.3 Variance in the rates of the price increases—general overview

Alongside the marked increase in the average price of cups due to the new tax, the rate of increase varies greatly between stores. Below, we analyze this variance and examine a number of factors that may explain it. The analysis can also show the nature of the market, and how a uniform shock to the cost of a product is translated to significant differences in the increase of the consumer price among various sellers.

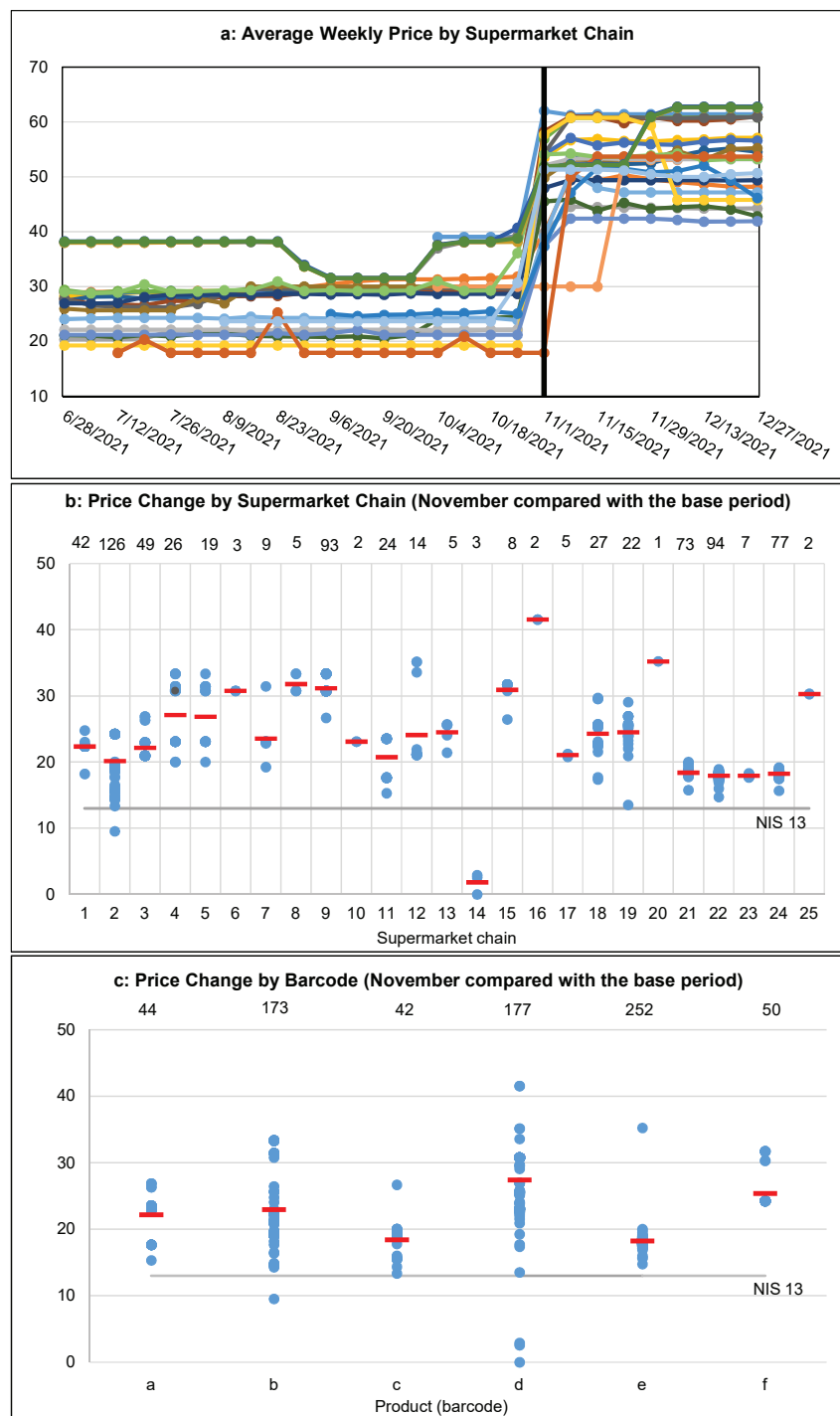
We begin our analysis of the variance in the price increase with two dimensions of the market’s supply side: the variety of brands (barcodes), and the supermarket chains. Figure 2c shows that the variance in the price increase between different stores selling the same barcode is much greater than the variance between the average price of the various barcodes.²⁰ This is consistent with the assessment that consumers do not consider the brand of disposable cups to be important, and we therefore must seek other factors to explain the variance in the price increase. Another point strengthening this assessment is the fact that only about one-sixth of the stores sold more than one barcode (among the barcodes in the sample, Table 1), which may indicate that the stores do not see demand for variety in this product.

Figure 2a shows that even before the tax was introduced, the price of the cups varied between the chains, and that this variance increased after the tax was introduced. This means that the rate of the price increase due to the tax also varied between the supermarket chains. It should be noted that Hendel et al. (2017) also found a marked increase in the spread of prices between the stores due to the “Cottage Cheese protest”.²¹ In contrast, the high uniformity in the timing of the price increase due to the new tax is clear, and it is also clear (Figure 2b and 2c) that almost all stores raised the price by more than NIS 13 per kilogram) (the increase implied by the tax). Figure 2b indicates variation between stores of the same supermarket chain with regard to the rate of the price increase, which may attest to other factors, such as the store’s location, influencing the price increase. The regressions below will help us examine the effect of a number of such factors.

²⁰ Figure 2c shows that the variation within one of the brands is particularly small, despite the high number of stores selling it. This has to do with the overlap that exists in this case between the brand and the supermarket chain. This overlap also shows that the distinction between the two dimensions—brands and supermarket chains—is not completely clearcut.

²¹ They show the increase in the spread of prices between stores in each format (low-cost chains, convenience stores, regular grocery stores, and so forth), but do not indicate whether the increase in the variance was between the chains or within them.

Figure 2
Prices and Price Changes of Single-Use Cups by Supermarket Chain and Barcode



6.4 Estimating the factors that influence the price change after the introduction of the tax

The analysis thus far shows that the change in the price per kilogram following the introduction of the tax at the beginning of November 2021 was significantly greater than the tax that was introduced, and that the magnitude of the change varies, both among the various barcodes of simple single-use cups and among the supermarket chains. This section presents the findings of an estimation of a linear regression, the aim of which is to assess what factors explain the variance in the change of the price per kilogram. The dependent variable is the change in price between the two periods (converted to shekels per kilogram) of a package of cups with a certain barcode, sold in a certain store.

Table 3a: Results of the basic estimation								
Dependent variable: Change in price (NIS per kg) of a package of single-use cups								
	1	2	3	4	5	6	7	8
Constant	22.6*** (0.20)	24.5*** (1.12)	22.2*** (0.60)	27.4*** (1.15)	35.7*** (1.16)	38.1*** (1.71)	22.5*** (0.20)	27.4*** (1.15)
Price per kg before the tax was introduced					-0.43*** (0.04)	-0.42*** (0.05)		
Dummy for supermarket chain		√		√		√		√
Dummy for Haredi supermarket chain							1.93* (1.05)	
Dummy for barcode			√	√		√		√
Dummy for online site								-0.63 (0.87)
Adj. R2	0.00	0.80	0.45	0.85	0.14	0.86	0.00	0.85
*** is statistically significant to a level of 1 percent; ** - 5 percent; * - 10 percent. The standard deviation appears in parentheses. Number of observations in each estimation: 805.								

Table 3a summarizes the main results of the estimation, including a number of store characteristics.²² Column 1 shows the estimation with a constant only, and therefore shows the average change in the price per kilogram. As shown in Table 2, we find that the average increase in the price per kilogram was about NIS 22, much greater than the price increase implied solely by the tax.

As stated above, the sample includes 25 supermarket chains, and we treat subsidiary chains belonging to the same parent chain as separate chains. Columns 2 and 3 show the same estimation, with the addition of dummy variables for chain and barcode separately, and Column 4 shows the estimation with both the chain and barcode dummies. It is the distinction between the chains that contributes the most substantial explanation to the variance in the price change (Column 2 compared to all the other columns). In particular, its contribution to the explanation of the variance is far greater than that of the distinction between the various barcodes. The coefficients obtained for the various supermarket chains (which are not presented

²² The results in the table relate to the basic sample, which includes 59 observations for stores located outside the cities or towns, and 8 observations relating to supermarket chains' online sites. This is in contrast with the smaller sample that includes only physical stores in localities that are cities or towns, and which serves for estimating regressions that also include demographic variables (Table 3b). The estimation of the specifications shown in Table 3a for the smaller sample barely changed the results.

in the Table) show sizable differences between the chains in terms of the size of the price change. These differences can reach up to about NIS 15 per kilogram (without the two outliers). In contrast, the differences in price increases between barcodes are smaller—NIS 8 at the most. Despite the dominant role of the differences between chains in explaining the variance in the price increases, the data we have do not enable us to analyze the reasons for these differences.²³

Columns 5 and 6 show the contribution of the price before the introduction of the tax to explaining the variance in the price change. In this case as well, most of the explanation has to do with the variance between chains. We do not find significant evidence that the price increase in stores belonging to chains appealing to the *Haredi* community was any different than at stores belonging to other chains (Column 7).²⁴ Column 8 shows that there is no significant difference between prices posted on the chains' online sites and the prices in the physical stores.

Table 3b shows additional estimations where we examined whether the demographic characteristics of the population living in the locality in which the store operates have an effect on the price change in response to the introduction of the tax.²⁵

Columns 1 and 3 show that neither the wage nor the rate of *Haredim* in the locality on their own contribute any explanation for the variance of the price response to the tax in various stores.²⁶ It seems that the larger the locality is (Columns 5 and 6), and the higher the average wage is (Column 6), the greater the increase in price was. However, the shekel difference between the price increase in the various localities was lower than the differences we saw between the various supermarket chains, some of which operate in the same localities. Thus, the difference between the largest and smallest localities in the sample reaches about NIS 3, while the difference between the localities with the highest and lowest wages reaches about NIS 4.3. If we include the dummy variables for supermarket chain and for barcode in the estimation, the explanatory power increases dramatically, similar to the results in Table 3a, and the contribution of the demographic variables disappears. It therefore seems that a store's attachment to a particular chain provides significant information on the behavior of prices, and obviates the need for information on the demographic characteristics of the locality.

The importance of the supermarket chains, as opposed to the locality's characteristics, to the ability to explain the variance in the price increase may be affected by the fact that we are examining locality-level data rather than more detailed data such as neighborhood or statistical area. This examination does not enable us to take into account the large variance within the locality, either with regard to product prices

²³ We do not have the necessary information regarding various characteristics of the supermarket chains. For instance, we cannot properly classify all chains in the sample as either "discount", "premium", or other categories. We also do not have information regarding the price at which the chain purchases the product from the supplier, or regarding the nature of their contract. The differences between chains may also reflect other considerations having to do with their pricing policy, their customers, and so forth. We have no access to this type of information either.

²⁴ Shahrabany (2021) found that the price of cooking gas was lower in Haredi localities than in others. A possible explanation that he offers is the relatively heavy use of this product, as well as perhaps community organization that works to lower the prices offered in those localities. It should be noted that our sample does not include all of the chains that target the Haredi sector.

²⁵ The number of observations in these estimations is lower than in Table 3a, because they relate only to localities for which there are data regarding characteristics of this type, as explained above.

²⁶ Alternatively, we also examined the share of large families in the locality and the locality's socioeconomic cluster, which are both correlated (in opposite directions) with the average wage in the locality, and we did not find that either had any statistically significant effect. We related to the rate of Haredim (and large families), since this sector uses disposable goods heavily, and the public discussion surrounding the new tax dealt a lot with its impact on this sector. In this regard, see Ministry of Environmental Protection (2020) and Eliyahu (2021).

Table 3b: Estimation results—demographic characteristics							
Dependent variable: Change in price (NIS per kg) of a package of single-use cups							
	1	2	3	4	5	6	7
Constant	18.8*** (2.33)	27.2*** (1.42)	22.4*** (0.26)	27.5*** (1.02)	17.6*** (1.97)	20.6*** (2.87)	33.0*** (2.33)
Price per kg before the tax was introduced						-0.40*** (0.04)	-0.22*** (0.08)
Log of average wage in the locality	1.47 (0.98)	0.07 (0.40)				3.59*** (0.95)	0.30 (0.40)
Percentage of Haredim in the locality			-0.00 (0.02)	-0.00 (0.01)			
Log of population size in the locality					0.40** (0.17)	0.50*** (0.16)	-0.07 (0.06)
Dummy for supermarket chain		√		√			√
Dummy for barcode		√		√			√
Adj. R ²	0.00	0.87	0.00	0.87	0.00	0.13	0.88
*** is statistically significant to a level of 1 percent; ** - 5 percent; * - 10 percent. The standard deviation appears in parentheses. Number of observations in each estimation: 738.							

or with regard to the identity of the chains operating in that locality. For instance, Eizenberg et al. (2021) document a high level of variance between neighborhoods in Jerusalem in terms of the prices of groceries. Some of the variance between chains is also reflected in their location within the locality (for instance, commercial areas vs. residential neighborhoods or the city center), such that price differences between the chains may also reflect differences between the areas within the locality. As Eizenberg et al. (2021) note in their study, price differences within the locality may endure over time, partly due to entry barriers that make it difficult for additional stores to enter residential neighborhoods, which increases the market power of the existing stores.

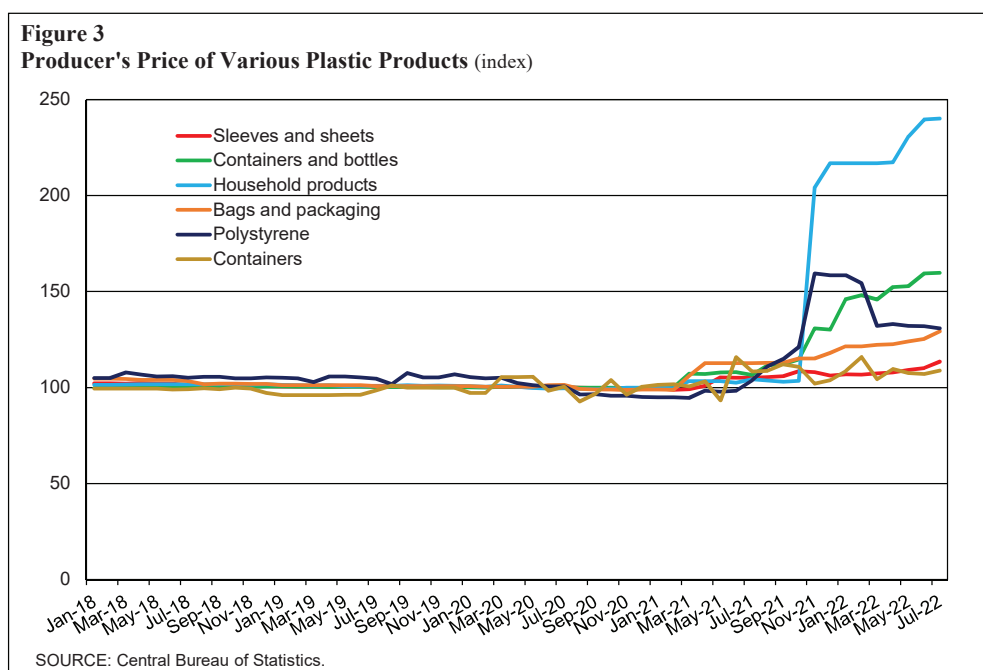
The estimations presented here illustrate, as we have seen above, that the price of the single-use cups increased far more than the increase implied by the tax alone. Beyond that, the main insight gleaned from these estimations is that belonging to a supermarket chain explains much of the variance. Since each chain sells a small number of barcodes, and each barcode is sold only at a small number of chains, there is some correlation between the brand and the chain. However, it seems that the important variable is the supermarket chain, and that the barcode is less important, since we can assume that consumers do not attach much importance to the brand (barcode) of the generic single-use cups we examined.

7. CONTROL GROUP: OTHER PLASTIC PRODUCTS

The analysis presented in this work indicates that the price of single-use cups increased at the beginning of November, significantly more than the increase that would have been due to the new tax.

One possible argument is that, in addition to the tax, the change in the consumer price of the cups reflects an adjustment to the increase of global prices of raw materials. During the reviewed period, there was indeed a significant increase in the producer prices of similar products. In order to obtain an impression of the price changes of products based on similar raw materials, we examined the manufacturing producer price indices for the domestic market, as measured by the Central Bureau of Statistics.²⁷ Figure 3 shows the indices for a number of such products. The prices of plastic boxes increased by only 7 percent during 2021 (December 2021 compared with December 2020). The prices of packaging bags increased by 19 percent, and the prices of plastic containers and bottles increased by about 30 percent.

In contrast, the prices of plastic housewares, which include the prices of single-use products, increased by about 120 percent, almost all of which was in November—when the tax was introduced. Polystyrene prices also increased sharply in November, apparently at least partially reflecting the tax, since the tax also applies to single-use products made of this material.²⁸ These data indicate that the price increase with the introduction of the tax may also have included a response to the increase in the prices of raw materials. However, based on these raw data, we cannot assess whether the rate of increase in the producer's price reflects an excess increase in the price compared to the new tax, or whether, to the extent that there was such an excess increase in the producer's price, it was in line with the increase in the prices of raw materials.



²⁷ These prices reflect the price that the producer receives when selling to a direct purchaser, and include purchase tax and VAT.

²⁸ The fact that the increase in the producer's price of polystyrene was much smaller than that of plastic housewares is consistent with the fact that polystyrene has many other uses, beyond the production of single-use products. The tax did not apply to these other uses, and so did not affect their price.

We can also compare the increase in the price of single-use cups to the change in the consumer prices of other products sold by the supermarket chains, which are made of similar raw materials, but are not subject to the tax. Figure 4 shows the behavior of the prices of two such common products. The fact that we cannot distinguish an increase in price in the last two months of 2021 apparently weakens the argument regarding the increase in raw material prices, since such an increase should have led to similar behavior of the consumer price for the comparison products as well. However, as mentioned above, insofar as the changes in cost are relatively small, sellers may avoid raising consumer prices out of concern that the consumers would shift their purchases to competitors.



8. CONCLUSION AND POLICY IMPLICATIONS

Following the introduction of a tax on disposable products, the prices of simple single-use plastic cups increased sharply—far beyond what should have been the result of the tax. The findings are consistent with the theoretical literature, which shows that such a result is possible given certain features of the market structure and of demand. They are also consistent with numerous empirical studies regarding the effect of similar taxes introduced abroad. We further found that the increase in prices was immediate in most stores, but that the rates of increase varied greatly between them. A large part of this variance was due to differences between the supermarket chains. However, the data do not allow us to analyze the chains' characteristics that may explain these differences. The results demonstrate how a uniform shock to the cost of production—in our case a purchase tax—may have a very different impact on the price for different customers.

The marked increase in the price of the cups beyond what would be derived from the tax raises interesting policy questions. As explained in detail, determining the tax as a set excise per kilogram means that the consumer is practically unable to figure out the level of the tax imposed on the product he is purchasing, or to compare it to the actual price increase. Insofar as this contributed to the price increase beyond what was derived from the tax, we can learn significant policy lessons, mainly having to do with increasing transparency for the consumer. This insight indicates a need to find the proper balance between defining the tax in a way that simplifies its collection or that is in line with achieving its objective and defining it in a way that is understandable to the consumer.

Setting the tax as a percentage of the consumer price would have made it easier for the consumer to compare it to the actual price increase. However, it may undermine the tax's ability to achieve its objective (reducing the use of plastic for environmental reasons), since the link between the tax level and the weight of plastic in the product is weaker. Moreover, setting the tax as a percentage of the price is common with regard to general purchase taxes, while taxes on specific products such as fuel, cigarettes, and alcohol are generally imposed as a set excise. In view of these considerations, and taking into account that the various disposable products are not sold to the consumer by uniform units regarding which the tax can be levied, the use of a set excise can be accompanied by obligating producers or importers to mark the product weight on the package, and even to mark the amount of the resulting tax.²⁹

²⁹ The obligation to add information on the packaging to help customers exists with regard to a variety of products. The marking of nutritional information on food products is an important example in this regard, since it also provides an example of adjusting information to comparable units (such as per 100 grams of product), and saves the consumer the need to calculate this on his or her own. This is also the case regarding the labelling of a product price by unit weight, and not just by package, on store shelves.

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