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Competition in the Israeli Economy and its Effect on Prices: A Sector-Based Phillips Curve Analysis

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השפעת התחרות במשק הישראלי על המחירים: ניתוח באמצעות עקומת פיליפס ענפית

שולמית נייר

תקציר

בשנים האחרונות נרשמת ירידה בקצב האינפלציה בישראל, למרות שהמשק נמצא בסביבה של תעסוקה מלאה. הערכה רווחת היא שהתגברות התחרות, בפרט בענפים הסחירים היא אחד מהגורמים שאחראים לתופעה. נייר זה מציג ניתוח של הגורמים המשפיעים על רמת המחירים ברמה ענפית במשק הישראלי, בחמישה ענפים: הלבשה, מזון, תקשורת, צורכי רחצה וקוסמטיקה, והבראה, נופש וטיולים. בנוסף לגורמים המסורתיים אשר משפיעים על שיעור האינפלציה (שע"ח, מחירי ייבוא, תוצר), נמדוד את השפעת התחרות. במאמר זה אנו נעשה שימוש בשתי חלופות למדידת רמת התחרות ברמה ענפית: (i) שיעור הרווח (היחס בין הכנסות לעלויות המכר והתפעול) ו-(ii) יחס ההוצאות (היחס בין הוצאות מכירה ושיווק בענף ביחס להכנסות). האינדיקטור הראשון קיים בספרות והוא קשור למדד לרנר. האינדיקטור השני הוא לא משתנה קלאסי למדד תחרות אך תואם את הנסיבות הספציפיות שנצפו בישראל. התוצאות עקביות עם קיומו של קשר שלילי בין עלייה בתחרות בענפים שנסקרו לבין שיעור האינפלציה הענפית. כמו כן, הקשר השלילי בולט במיוחד בענף ההלבשה.

Competition in the Israeli Economy and its Effect on Prices: A Sector-Based Phillips Curve Analysis

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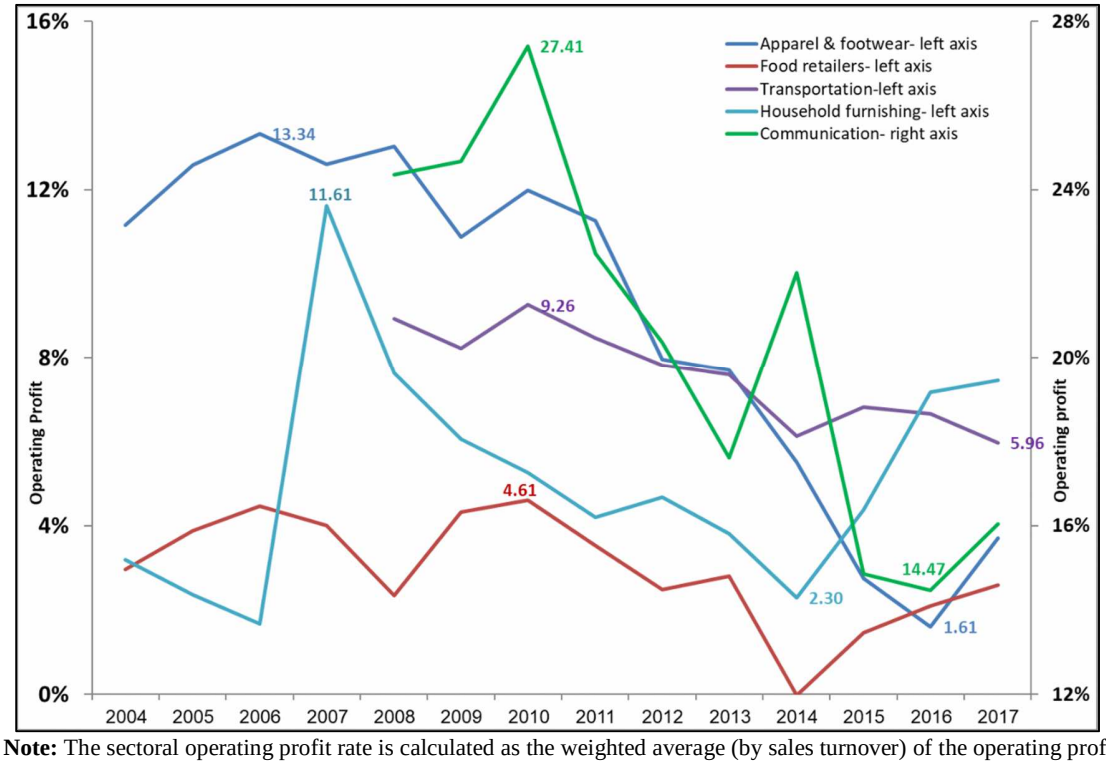
Abstract

In recent years, the rate of inflation in Israel has declined, despite the fact that the economy is around a state of full employment. The prevailing belief is that one of the factors responsible for this trend is stronger competition, particularly in the tradable sectors. This paper presents an analysis of the factors that influence price levels in the Israeli economy, on a sectoral basis in five different sectors: apparel, food, communications, toiletries and cosmetics, and tours and recreation. In addition to the traditional factors affecting the rate of inflation (exchange rate, import prices, output), we will measure the effect of competition. In this study, we use two alternatives measures for the level of competition, computed at the sector level: (i) markup (sales divided by the sum of the cost of goods sold and selling, general & administrative expenses), and (ii) the expenses ratio (the ratio of selling and marketing expenses to sales). The first indicator has been used in the literature and is related to the Lerner Index. The second indicator is not a classic variable for measuring competition but it fits the specific circumstances that have been observed in Israel. The results are consistent with the existence of a negative relationship between a sector's increase in competition and its rate of inflation. The evidence for the negative relationship is mostly present in the apparel sector.

1. Introduction

Between 2014 and 2017, the annual rate of inflation in Israel deviated significantly downwards from the boundaries of the target inflation range and for much of the time was even in negative territory. This contrasts with what might have been expected in a tight labor market with wage pressures. It is often hypothesized that stronger competition, influenced by greater exposure to imported products through e-commerce, together with increased consumer awareness after the social protest of 2011, makes it difficult for companies to raise prices and maintain profit margins. Support for this supposition can be found in the erosion of profitability experienced by companies among a wide range of sectors in the economy operating vis-à-vis the end customer (see Figure 1). This paper examines the hypothesis that competition in the economy influenced the rate of inflation during the period under study.

Figure 1: Operating profit rate in different sectors, based on public companies' data



Note: The sectoral operating profit rate is calculated as the weighted average (by sales turnover) of the operating profit of public companies in the sector traded on the Tel Aviv Stock Exchange (TASE), based on their financial reports. The operating profit rate is defined as the ratio of sales minus operational expenses (cost of goods sold plus selling, general & administrative expenses) to sales. The data were taken from TASE website.

To help identify which factors affected the different sectors and assuming that competition is expressed differently in each one, we will estimate sectoral Phillips curves according to the main categories of the Consumer Price Index. The choice of the sectors used for this

study is based on the extent to which the publicly traded companies on the Tel Aviv Stock Exchange (TASE) correspond to the sectors categorized in the Consumer Price Index. This due to the fact that we will compile the competition indices on the basis of data from the financial reports of these companies. In this way, we will try to explain the phenomenon of competition in about 21 percent of the total Consumer Price Index (CPI), which is the sum of the CPI weight of each of the sectors that compound the study, distributed throughout apparel (2.5 percent), food (13.7 percent), communication (2.5 percent), tours and recreation (0.8 percent) and toiletries and cosmetics (1.5 percent). We will estimate a Phillips curve for each sector separately using the econometric method of Gordon (2011)[1]. The results of the estimation are consistent with the existence of a negative relationship between the intensity of competition and the rate of inflation in the different sectors that were studied. Competition variables that were used for the estimation include (i) markup (sales divided by the sum of cost of goods sold and selling, general & administrative expenses (SG&A)) and (ii) the expenses ratio (the ratio of selling & marketing expenses to sales). Furthermore, in most of the cases, the fit of the regression estimation improves when the competition variable is added, but the intensity of the improvement varies between the sectors. In other words, the effect of competition on inflation is not uniform across the sectors.

My paper is part of a broad literature that deals with sectoral analysis of price dynamics. Some by means of a structural estimation of the Phillips curve based on the approach of Gali and Gertler (1999), and some using the econometric approach of Gordon (2011)[2]. Byrne et al (2013) estimated a hybrid neo-Keynesian Phillips curve at aggregate and sectoral level using data for the period 1971-2005 from 14 developed countries and 14 economic sectors. Imbs et al (2011) estimated a sectoral Phillips curve for the French economy with data from 16 economic sectors between 1978 and 2005. Norkute (2015) estimated a sectoral Phillips curve for 13 countries in the European Union and five economic sectors with data from 1999-2012. Lanau et al (2018) estimated Phillips curves at aggregate and sectoral level for the economy of Colombia using Gordon's econometric approach for the period 2002 through 2017. These papers emphasize the importance of heterogeneity among sectors, and consequently the motivation to conduct a sector-based analysis. However, they did not attempt to identify the effect of the intensity of competition on the sectoral rate of inflation, the primary focus of this paper.

In this context, numerous papers have discussed the measurement of competition using profit rate and markup at the sectoral level, both by using data taken from the national accounts (macro perspective) and by using the data of public companies in the different sectors (micro perspective), as we have done in this paper as well. The first category includes Neiss (2001), Cavelaars (2002), and Roma & Przybyla (2005), who calculated the

[1] See Section 3 below.
[2] See Section 3 below

markup in different countries and/or different sectors and estimated the effect of competition on inflation using this variable. Other papers use microeconomic data taken from firm financial reports to estimate markups via a structural approach based on the estimation of a production function. These include De Loecker & Eeckhout (2017), which is based on De Loecker & Warzynski (2012), and on Hall (1998), and later on Traina (2018). De Loecker & Eeckhout (2017) and Traina (2018) use the Compustat database for firm data in the USA for companies that issue debt or stock and therefore publish financial statements. Like these two papers, we will use data from the financial statements of public companies that are listed on the TASE to calculate the competition indicators. However, they do not examine the effect of the profit rate variables on inflation. In this paper, we will examine this relationship in different sectors of the Israeli economy by using two alternative measures for the level of competition in the economy: (i)markup, which accords with the literature as noted above, and (ii) the expenses ratio, defined as the ratio of marketing and selling expenses to sales. The latter measure is often used as a measure of barriers to entry (Bain (1956)). Its use and interpretation in the current paper are novel.

This paper proceeds as follows. Section 2 addresses the competition variables. Section 3 comprises Phillips curve modelling using Gordon's approach, as well as a sectoral analysis for each of the five sectors we review. It includes a specification of the sector-based Phillips curve, estimations and results. Section 4 offers summary and conclusions.

2. Competition variables

In this section we will define our two competition variables: i) markup (sales divided by the sum of the cost of goods sold and SG&A expenses) and ii) the expenses ratio (the ratio of selling and marketing expenses to sales).

2.1. Markup

Markup as a competition variable is similar in structure to the Lerner Index[3] which measures competition in the market (defined as the ratio of price minus marginal cost to price). Similarly, markup is defined in the relevant literature as the ratio of price to marginal cost. In view of the difficulty in measuring a firm's marginal cost, under suitable assumptions markup can be expressed as the inverse of labor income share in output.

[3] The Lerner Index is defined as $\frac{P-MC}{P}$ where P is the firm's price level and MC is the marginal cost. The Lerner Index identifies the power of a monopoly as the difference between the firm output price and the marginal cost (divided by the output price), at the output level which constitutes the point of maximized profit. The wider the gap between P and MC grows, the greater the power of the monopoly.

Cavelaars (2002), based on Neiss (2001), expresses markup as the inverse of the labor income share multiplied by the elasticity of output with respect to labor, based on profit maximization of the firm:

(1) $$markup = \frac{P}{MC} = \left(\frac{1}{LIS}\right)\frac{\partial Y/\partial L}{Y/L}$$

Where

(2) $$LIS = Labor\ income\ share = \frac{WL}{PY}$$

and *W* is the nominal wage, *L* is the number of employees, *P* is the output price level, *Y* is GDP at constant prices, MC is the marginal cost of the firm and $\frac{\partial Y/\partial L}{Y/L}$ is the elasticity of output with respect to labor input.

In the empirical part of his panel study across countries, Cavelaars (2002) uses *PY/WL* (the inverse of the labor income share) as a measure for markup, under the assumption of equal elasticity of output with respect to labor across countries.

De Loecker & Eeckhout (2017) present an expression for markup derived from an assumption of cost minimization achieved by the adjustment of a variable input:

(3) $$markup = \mu_{it} = \theta_{it}^{V}\frac{P_{it}^{Q}Q_{it}}{P_{it}^{V}V_{it}}$$

Where μ_{it} is the markup, θ_{it}^{V} is the output elasticity of a variable input V, $P_{it}^{Q}Q_{it}$ is the revenue (sales) and $P_{it}^{V}V_{it}$ is the total cost of employing the variable input V in production.

We will use the markup specification in (3) to calculate sectoral markup. Under the assumption of constant elasticity θ_{it}^{V} over time (as in Cavelaars (2002) who did that across countries in a panel study), by assuming that production function does not change in a manner that could affect the value of the elasticity over time, we will difference it out[4]. Consistent with this assumption, De Loecker, Eeckhout & Unger (2020), find that the output elasticities vary very little over time, in a study for US companies during 1955-2016.

As in Traina (2018), I use the whole operating expenses as a direct measure of variable inputs (which includes materials, labor, marketing and management) without making any differentiation between items[5]. Thus the variable cost "$P_{it}^{V}V_{it}$" in (3) will be calculated as

[4] For that reason, we do not make any treatment of the production function for estimating it.

[5] As expressed in Traina (2018) for the case of Compustat database, "public firm financial statements neither commonly nor consistently differentiate between labor and material inputs". This assessment is true also for the case of Israeli company's financial statements published in the TASE website.

the sum of cost of goods sold (COGS) and selling & marketing plus general & administrative costs-SG&A-), like in Traina (2018), as opposed to De Loecker & Eeckhout (2017) who define variable costs exclusively as COGS. Traina (2018) addresses the existence of a significant difference between the ratio of sales to COGS in the US, which has increased significantly since the 1980s, and the ratio of sales to COGS plus SG&A, which has remained relatively stable throughout the period.

Competition variable "markup"

(4)

$$Markup = \frac{P_{it}^{Q} Q_{it}}{P_{it}^{V} V_{it}} = \frac{Sales}{COGS + SG\&A}$$

Our choice is based on the fact that these costs include all the expenses required for the product to reach the customer – from the raw material to the selling and marketing costs – and they are incorporated in the final price. For example, in Figure 2.1 it could be seen the development of the ratio of sales to COGS in Israel's apparel sector, which shows an increase or even stability in most of the period under study, compared with the ratio of sales to COGS plus SG&A, which shows a downward trend in most of the period under study. The difference is due to the significant increase in SG&A expenses relative to sales. The increase in the selling and marketing expenses relative to sales is a possible expression of stronger competition in the Israeli economy in this sector. Figure 2.2 shows both markup variations in the food retail sector. It could be seen a continuous decline from the beginning of the 2010' decade and then an increase from the middle of the decade.

Figure 2.1

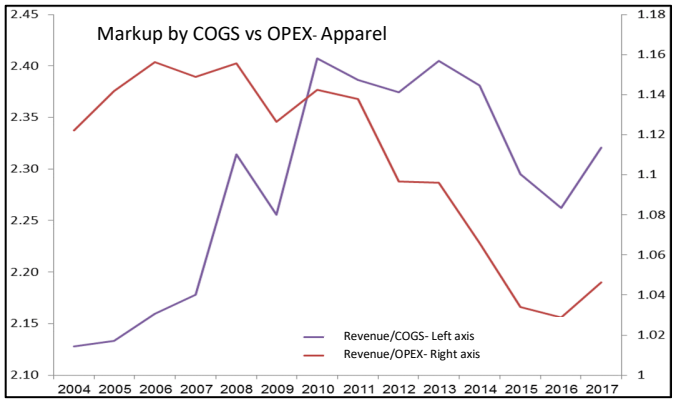
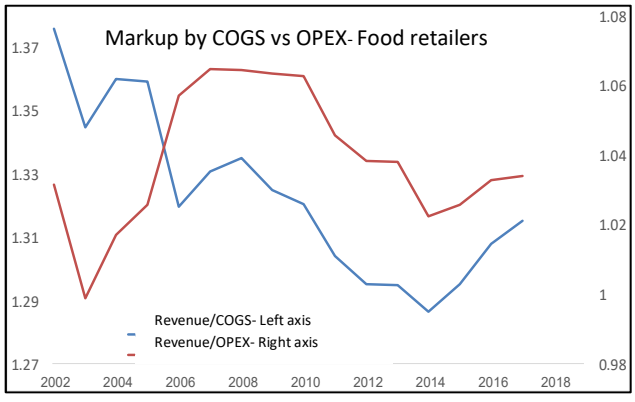


Figure 2.2



Note: COGS is defined as "cost of goods sold". OPEX is defined as operational expenses which is the sum of COGS and SG&A (selling, general & administrative expenses).

2.2. Expenses ratio

We use an alternative variable to measure competition which focuses exclusively on selling and marketing expenses as a ratio of sales. This index is similar in structure to the variable introduced by Bain (1956), known as the "intensity of advertising", which is defined as the ratio between advertising expenses to sales as an indication of product differentiation. Bain assumes that the relationship between this variable and the profit rate is positive, since its purpose is to prevent the entry of competitors. Miller (1969) examined the sign of this relationship in a sample of 106 industrial companies in the USA at the end of the 1950s. The results of the regression showed a positive relationship.

Competition variable "expenses ratio"

(5)

$$Expenses\ Ratio = \frac{Selling\ \&\ Marketing\ Expenses}{Sales}$$

Unlike Bain, who included only advertising expenses in the numerator of his index, we will use the whole selling and marketing expenses incurred by the company until the product reaches the end customer. For example, rent and payroll expenses in the branches, given that these components are also an entry barrier and a way of promoting sales. Furthermore, it is important to add that data on advertising expenses alone cannot be separated from other selling and marketing expenses at a quarterly frequency from firm financial statements in Israel, but only annually.

The direction of the relationship between the "expenses ratio" and the profit ratio will depend on the source of the competition in the industry under study. In other words, since competition develops endogenously within profitable sectors that attract new players and so as to prevent the entry of competitors, the existing companies in the sector invest resources in entry barriers such as selling and marketing expenses; then according to Bain we should consistently observe a positive direction in the relationship between the variables. However, under large exogenous shock to competition in certain sectors of the Israeli economy that requires an increase in selling and marketing expenses relative to sales, which corresponds with increasing competition and declining profitability, we would expect to obtain a negative relationship between the two variables.

Two sectors can be identified in which competition increased as a result of an exogenous shock: i) apparel and ii) communication. In the former, the exogenous shock to competition is reflected in the entry of foreign players offering products at a lower price. In response, the local firms whose livelihood is threatened are then forced to promote their products to the customers to preserve their market share. They therefore increase their expenses to ensure that the product reaches the customer whether by increasing advertising expenses,

increasing the number of branches, opening alternative channels such as the Internet, offering an option for free home deliveries, opening logistics centers, etc. All this with the purpose of creating customer loyalty to ensure that he will prefer to purchase from a familiar, local retailer than from a foreign player who has only recently entered the market. Regarding the communication sector, the exogenous shock to competition was determined by regulations aimed at increasing competition. Thus, from the end of 2011 and during the course of 2012, new players entered the market by offering preferential products (e.g. unlimited calls) at a reduced price. Consequently, incumbent firms saw their profitability eroded and used methods aimed at coping with higher competition, like increasing selling and marketing expenses relative to sales.

We define the expenses ratio index as a proxy for competition only in sectors that experienced a large exogenous shock to competition as is the case of apparel and communications.

Ratio vs absolute value - When looking at selling and marketing expenses, an increase in the absolute value of the variable in parallel to the raise in the "expenses ratio" when an exogenous shock to competition affects the sector, strengthens our assumptions, as it happened in the apparel sector (Figure 2.3). However, when an exogenous shock to competition occurs in a services sector as is the case of communications, and taking into account that sales turnover highly decreased as a consequences of the regulatory reform that affected the competition structure, we will accept the fact that the absolute value of selling and marketing expenses went up only around the period the reform was set up, in parallel to the increase in the expenses ratio, and not during an extended period of time (figure 2.4).

Figure 2.3

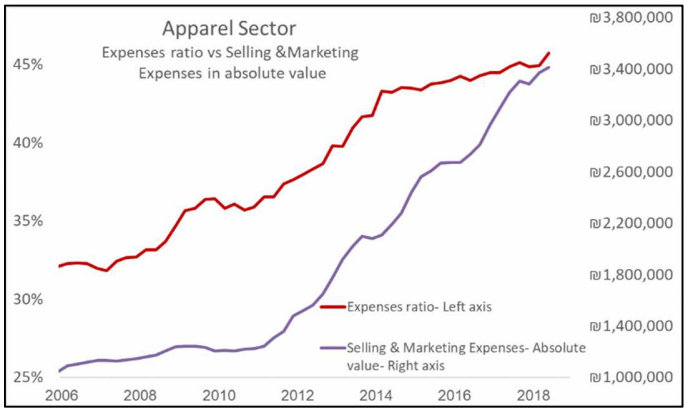
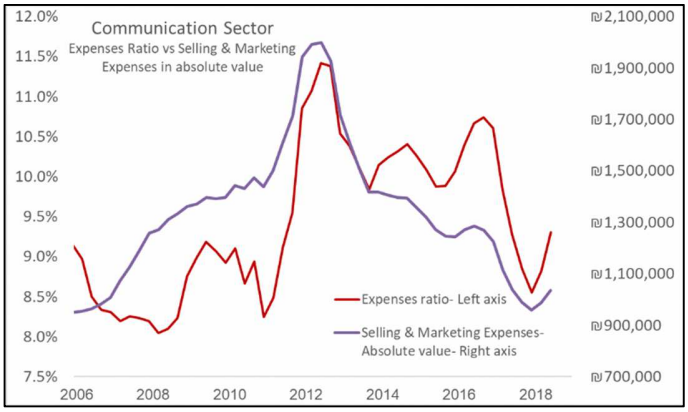


Figure 2.4



3. Modeling, data and estimation methods

3.1. Introduction

We will estimate a sector-based Phillips curve for Israel using the econometric approach of Gordon (2011), which is empirical and it is not subject to structural assumptions, in contrast with the Neo-Keynesian approach of structural modeling of inflation. The Neo-Keynesian approach assumes a certain rigidity in price adjustment. However, evidence of a high degree of flexibility in price setting in some sectors in Israel reduces the plausibility of assumed price rigidity in a sectoral analysis[6]. This price flexibility justifies modeling based on Gordon's empirical approach, in contrast with the Neo-Keynesian structural approach.

The Gordon Triangle consists of three elements that define his version of the Phillips curve: (a) inertia, (b) demand and (c) supply. Thus, using Gordon's approach, the rate of inflation in period *t* in sector *j* is a function of three factors: the sectoral inflation with one or more lags $\Pi_{j,t-1}$, a demand variable $D_{j,t-1}$ and supply factors $S_{j,t}$. Among the supply factors, we could name import prices and the foreign exchange rate, and as noted above we will add a variable that represents the level of competition in the sector.

$$\Pi_{t,j} = \alpha_{0j} + \alpha_j(L)\Pi_{j,t-1} + \beta_j(L)D_{j,t} + \gamma_j(L)s_{j,t} + \varepsilon_{j,t} \tag{6}$$

We present a specification of equation (6) for each sector. To maintain a homogenous structure of the Phillips curve across sectors, we will present uniform elements that will appear in every specification (lagged sectoral inflation, a sectoral output variable and general supply-side components). But taking into account the heterogeneity that exists between sectors, we will add specific elements such as dummy variables for regulation (food law, the Ministry of Finance program "*Neto Hozalot*"[7], communications sector reform), or for periods of national security-related conflicts. For the output variable, there are two possible alternatives depending on the sector (i) percentage change or (ii) deviation from the trend (gap) – where the choice depends on the level of price rigidity in the sector. This is due to the fact that assuming that the frequency of price updates in a particular sector is high enough (such as apparel), we cannot assume that in this sector output deviates

[6] S.Ribon and D.Sayag's research (2013), examines the frequency of price updates by sectors based on Israel's Consumer Price Index categories. The study shows that after Transportation (which is known to be particularly volatile due to changing gasoline prices), the Clothing and Footwear sector shows the most frequent price updates. The sectors in which prices are updated less frequently are Health, Home Maintenance and Culture, Entertainment and Leisure.

[7] From Hebrew, "*Net Reductions*", a Ministry of Finance plan aimed at reducing import taxes on a wide variety of consumer good: cosmetics, electric appliances, clothing and shoes.

from the potential level since a high degree of flexibility in price setting is compatible with product at the potential level. Ribon and Sayag's (2013) present the frequency of price updates in the sectors that comprise Israel's CPI[8]. Based on their findings, we will decide whether the price update frequency is high enough so as to choose for the most suitable output variable (percentage change or gap). Furthermore, among the sectors under study in our paper, we include two non-tradable sectors (communications and tours and recreation) both of which use the output gap of the economy as a demand variable. This is because we did not find a more suitable output variable for them.

We will estimate a Phillips curve for each sector separately by using the OLS method with quarterly data from 2002 through 2018, a period that is relevant for analyzing the effect of competition on prices. Moreover, the choice of the period was also influenced by the availability of high quality data on the companies' profits, taken from the financial statements published on the TASE website. This is why in certain sectors the sample period was shortened.

The selection of the appropriate specification was made by using significance test at a confidence level of 90% and by using the Schwarz Criterion to choose the optimal number of explanatory variables according to the lowest value of the indicator. Certain specifications among the sectors under study resulted non statistically significant and we discarded them. The combination of both criteria together with economic considerations determined the final choice. It must be said that there may be some endogeneity in the competition variables as firms' revenue (sales) is a function of prices. We tried to solve this problem by using lagged competition variables. We choose the appropriate lag for the competition variables in a statistical way by the level of significance. A robustness check appears in appendix B.

Since our results are based exclusively on publicly traded companies, they provide only a partial picture of the effect of competition on inflation. Although the number of companies in the samples for the different sectors is relatively small, these are some of the largest firms in the economy in their sector, and thus they are representative of the general trend.

What results do we expect to obtain? The increased competition is reflected in a decline in **markup** (4) due to the loss of market power. The loss of market power is reflected in a drop in prices as companies have difficulty charging prices that are above the competitive level. Thus, we would expect a positive sign for the regression coefficient that describes the relationship between markup and sectoral inflation rate. Regarding the **expenses ratio** (5), stronger competition is reflected in an increase in selling and marketing expenses relative to sales, as long as the major driver of variation in competition is an exogenous shock and it takes place against the backdrop of falling prices and declining profitability. In this case, we would expect to obtain a negative direction in the relationship between this

[8] See footnote nº 4.

variable and the rate of inflation. In cases where competition is not driven by a large, exogenous shock, predicting the sign is difficult. In this case, a negative sign will be consistent with increased competition driving down inflation, however other factors could explain the results.

It should be noted that both competition variables (the markup and expenses ratios) were calculated as a weighted average of markup and expenses ratio respectively, for companies in the sector, where the weight is based on the company's sales turnover.

3.2. Apparel sector

The weight of apparel in the CPI is about 2.5%. Apart from specific periods of time, inflation in the clothing sector has been negative since the end of the 1990s (Figure 3.1), mainly after the Chinese economy opened up to international trade. The difference today is that in contrast with the early 2000s, when all the trade in this sector was performed by firms, today the end customer does her own importing and trading. Figure 3.2 shows the development of the competition indicators in Israel's clothing sector from the early 2000s to the present time, using data from the financial statements published by five public companies. We can see a turning point at the beginning of the 2010' decade. The markup ratio (blue line) declines gradually reaching a low point in 2016, while the expenses ratio (red line) rises between 2011 and 2018 from 36% to 46%. This may be explained by the burgeoning competition in the market as local consumers enjoy greater access to foreign players via the Internet and greater exposure to overseas sources.

Figure 3.1

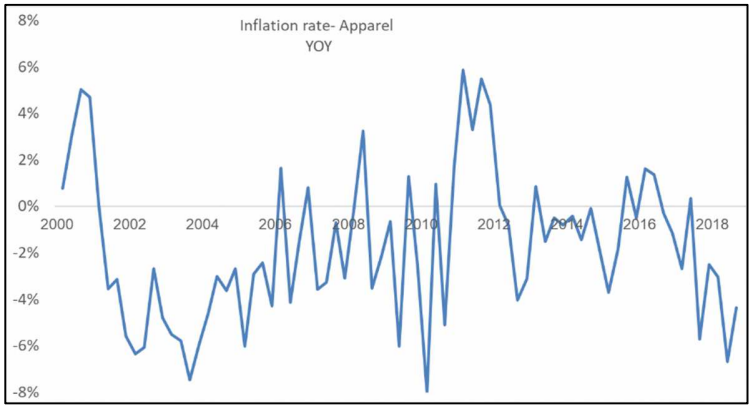
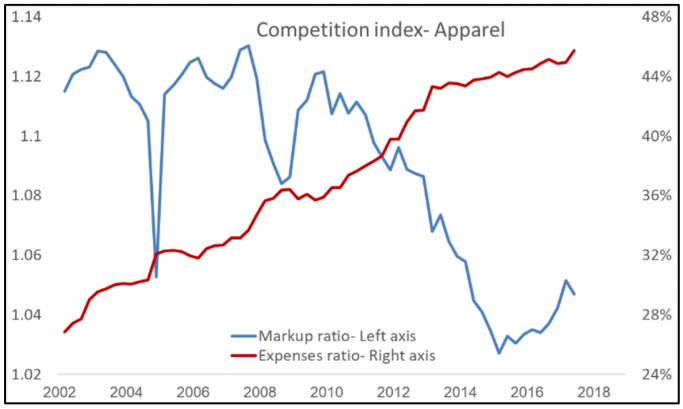


Figure 3.2



We will estimate a Phillips curve for the apparel sector using quarterly data between Q2:2003 and Q2:2018.

(7)

$$\pi_{t\_apparel} = \alpha_0 + \sum_{1}^{2} \alpha_i \pi_{t-i\_apparel} + \beta Y_{t-1\_apparel} qoq + \mu \Delta Z_{t-2} + \sum_{1}^{2} \varphi_i E\%^{US}{}_{t-1} + \gamma \pi *_{t-1\_apparel} + \rho D\_neto\_hozalot_t + \theta min\_wage_t\_qoq + \varepsilon_t$$

Where $\pi_{t-i\_apparel}$ is the lagged sectoral inflation rate at quarterly frequency (seasonally adjusted), $Y_{t-1\_apparel} qoq$ is the quarterly change in the quantity sold by fashion retailers (seasonally adjusted) based on Central Bureau of Statistics (CBS) data, $\Delta Z_{t-i\_apparel}$ is the competition index (with two alternatives: change in markup ratio or change in the expenses ratio) according to data from financial statements published on the website of the Israel Securities Authority, $E\%^{US}{}_{t-1}$ is the percentage quarterly change in the shekel / dollar exchange rate, $\pi *_{t-1\_apparel}$ is the percentage quarterly change in imported clothing prices (Paasche Index, CBS). $D\_neto\ hozalot_t$ is a dummy variable that indicates the *Neto Hozalot* plan launched by the Ministry of Finance[9]. This variable equals to 1 in Q4:2017 and Q1:2018 (when the plan was announced and entered into force). Additionally, we added a variable for the quarterly rate of change in the minimum wage which characterizes the wage earned by most of the workers in this sector.

3.2.1. Results of the estimation

Table 1 shows the results of the estimation for the three regressions – one specification without a competition variable, and two others with a different competition variable each. Regarding the markup variable estimates (table 1, column 2), the findings are consistent with the existence of a positive relationship between the markup ratio and the sectoral inflation rate. In other words, an increase in markup of 1%, which reflects a decline in competition and an increase in the companies' market power, corresponds with an increase of 0.32 percentage points in the sectoral rate of inflation, with a two-period lag. Furthermore, a negative relationship was found between the increase in the level of competition measured by a quarterly increase in the expenses ratio (table 1, column 3), and the sectoral rate of inflation, with a four-quarter lag. An increase of 1% in the expenses ratio, would therefore lead to a decline of 1.1 percentage points in the sectoral rate of

[9] See footnote 7.

inflation. Additionally, the implementation of the *Neto Hozalot* plan has a negative effect on the rate of inflation and the plan's contribution to the sectoral rate of inflation is -3%.

According to the statistic *adjusted* R^2 for the regression, the specification that includes the expenses ratio shows the best fit and it improves the goodness of the estimation compared with the specification that does not include it *(adjusted* $R^2 = 0.58$*)*. However, this is not a significant improvement since the value of the statistic without using a competition variable equals 0.53.

Table 1: Results of the Estimation – Apparel sector [10]

Sector: Apparel Dependent variable: Apparel inflation t qoq Sample period: 2003Q2:2018Q2 | 61 observations	Competition variables: based on 5 clothing retailers 1	2	3
Δ Expenses ratio $_{t-4}$			-1.15** (0.456)
Δ Markup $_{t-2}$		0.32* (0.164)	
Dummy "neto hozalot"	-2.99** (1.168)	-3.17*** (1.142)	-3.28*** (1.119)
Control variables	√	√	√
Adjusted R^2	0.53	0.56	0.58

3.3. Food sector

The weight of food category in the CPI is about 14%. The annual rates of change for this item were positive in recent decades up to the second quarter of 2012, when food prices dropped for the first time while the trend was particularly marked between 2014 and 2017 (Figure 4.1). In part of this period, world food prices fell sharply after rising steeply in the preceding years. In this context we must emphasize the close relationship between domestic food prices and international prices. Thus, the maneuverability of price setting is affected by the fact that raw materials in the food industry are commodities and that domestic food prices are affected by prices worldwide. In 2016, world food prices began to recover, in contrast with trends in Israel. It is possible that regulation favoring competition in this sector, together with consumer awareness that prevents price increases, have contributed to this phenomenon.

[10] For an extensive table of results, which provides a detailed list of the estimation coefficients for all the variables, see Appendix A.

Figure 4.1

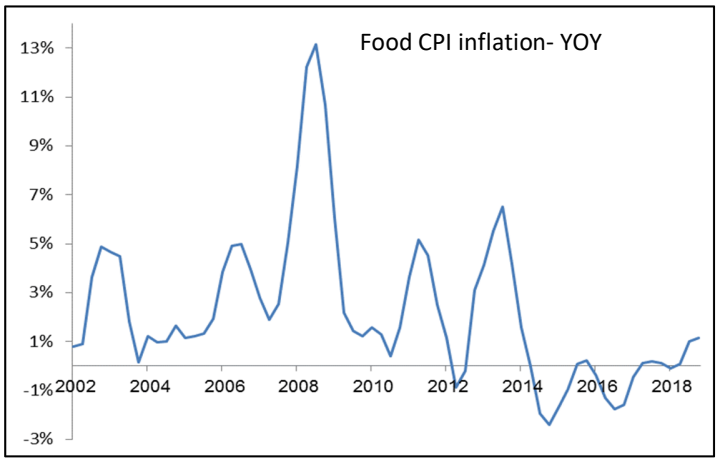
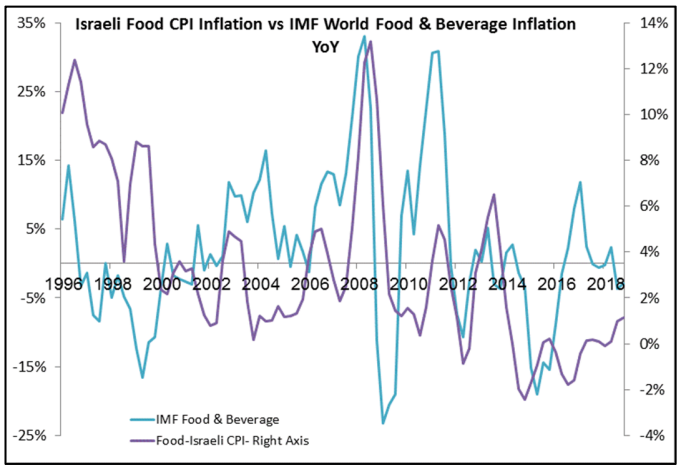


Figure 4.2



In contrast with the key factor associated with the increasing competition in the apparel sector – online purchases from abroad - in the food sector this threat is less relevant. In the past few years, two laws have been enacted to encourage competition: The Food Law, designed to reduce market concentration, which was passed in 2014 and took effect in the first quarter of 2015, and about a year and a half later, the Protection of Public Health Law (commonly known as the "Cornflakes Reform"), which allows the parallel import of dry food and entered into force at the end of September 2016. At the same time, food retail chains began to introduce products at lower prices under their own private labels and websites were launched for online purchases, together with the development of applications that offer discounts and special offers, activity which was inspired by the Walmart success story. Furthermore, it is also possible that since the social unrest of the summer of 2011, consumer awareness has changed, affecting consumer behavior vis-à-vis manufacturers and food retailers. At the same time, the atmosphere of competitiveness created in the different sectors may have spilled over into other sectors.

To estimate regression (6) for the food sector, and due to the fact that the supply chain comprises two categories of companies – manufacturers/importers and retailers – which, due to their different specifications, cannot be mixed together to create a single competition index, we will divide the companies into two categories and formulate different competition indicators, one for manufacturing /importing firms and one for the food retailers.

To estimate the regressions, we will use data for the period Q1:2002 – Q4:2018, although for one of the specifications the sample will begin in Q1:2007.

(8)

$$\pi_{t\_food} = \alpha_0 + \alpha_1 \pi_{t-1\_food} + \beta \hat{Y}_{t-1\_food} + \sum_{0}^{2} \varphi_i E\%^{US}{}_{t-1} + \sum_{0}^{1} \gamma_i \pi *_{\_food}{}_{t-i} + \mu_t \Delta Z_{t-i\_food} + \theta D\_food\_law_t + \varepsilon_t$$

Where $\pi_{t-i_{food}}$ is the sectoral lagged rate of inflation at a quarterly frequency, $\hat{Y}_{t-1\_food}$ is the trend deviation of the seasonally adjusted retail trade index for the food sector[11], ΔZ_{t-i_food} is the quarterly change in the annual competition index (two alternative indexes for manufacturing /import companies as well as two options for retail food chains). $E\%^{US}{}_{t-1}$ is the quarterly rate of change in the shekel-dollar exchange rate, $\pi *_{t-1\_food}$ is the quarterly rate of change in imported food's raw materials (Paasche Index, CBS). $D\_food\_law_t$ is a dummy variable equal to 1 from the fourth quarter of 2014, when food legislation became applicable. The effect of this legislation is a continuous process that cannot be quantified and may still be in process. Furthermore, the timing of both laws overlap one another and they also overlap with a continuous process that began after the social unrest of the summer of 2011, when consumer awareness seems to have changed.

Figure 5.1

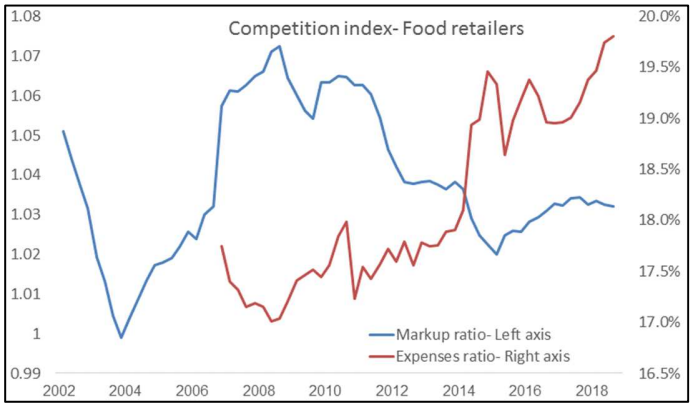
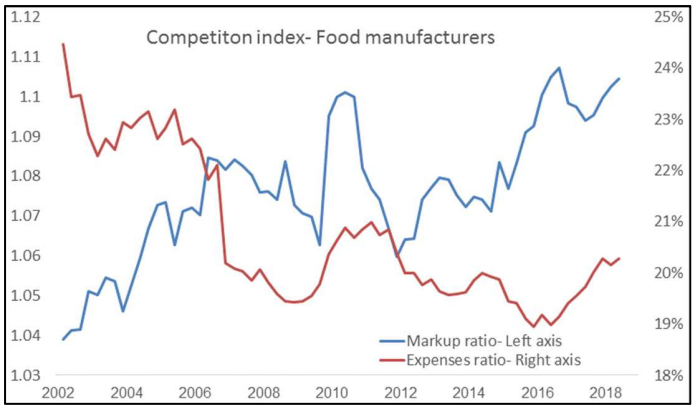


Figure 5.2



The sample in the retail food chains comprises three significant players. Over the last ten years, markup ratio has declined considerably (see Figure 5.1), reaching a low point in 2015, while expenses ratio has increased from 17% to around 20%.

The food manufacturers sample comprises 10 companies in the food and beverage sector. In the last 16 years, the markup ratio has increased from 1.04 to 1.1 (Figure 5.2).

[11] In the specification under a shortened sample (from 2007), an output variable based on the CBS retail sales index for the food sector exclusively does not demonstrate good statistical compatibility. Therefore, we used a variable with a broader aggregation, the deviation from the trend of the aggregate retail sales index.

Additionally, since the early 2000s, expenses ratio has dropped from 24% to a current level of 20%, although from a shorter-term perspective, there has actually been an increase from a 19% level in 2016.

3.3.1. Results of the estimation

Table 2: Results of the estimation – food retailers[12]

Sector: Food Retailers Dependent variable: Food inflation t qoq Competition variables: based on 3 food retail firms	Sample period: 2002Q1:2018Q4 68 observations		Sample period: 2007Q1:2018Q4 48 observations	
	1	2	3	4
Δ Expenses ratio $_{(t-4)}$				0.529*
				(0.262)
Δ Markup $_{(t-1)}$		0.309*		
		(0.187)		
Dummy food law	-0.241	-0.272	-0.349	-0.426*
	(0.220)	(0.218)	(0.241)	(0.235)
Control variables	√	√	√	√
Adjusted R^2	0.53	0.54	0.64	0.66

Table 3: Results of the estimation – food manufacturers / importers[13]

Sector: Food manufacturers Dependent variable: Food inflation t qoq Sample period: 2002Q1:2018Q4 | 68 observations	Competition variables: based on 10 food producers and importers firm		
	1	2	3
ΔExpenses ratio $_{(t-4)}$		-0.110	
		(0.218)	
Δ Markup $_{(t-3)}$			0.134
			(0.090)
Dummy food law	-0.241	-0.261	-0.289
	(0.220)	(0.213)	(0.213)
Control variables	√	√	√
Adjusted R^2	0.53	0.52	0.54

According to the results (Tables 2 and 3), the markup ratio variable presents a positive coefficient but it is only significant when based on retail companies and not on manufacturing companies. In this case, a 1% increase in the markup ratio is consistent with a 0.3% increase in the rate of inflation in the food sector within one quarter.

It is important to add that the food sector is tightly regulated and controlled so that profitability among the manufacturers is affected by a number of factors. The manufacturing and supply chain consists of several stages and a variety of players. Some

[12] See a wide table which includes results of the estimation with all the variables in Appendix A.
[13] See footnote 8.

of them are capable of making a profit which will be at the expense of another supplier or player in the chain. Thus, profitability results are therefore not necessarily reflected in the final price in the sector. We should therefore expect noise in the results of the analysis based on manufacturing /importing firms. Nevertheless, in our results, as noted above, the markup ratio shows a positive coefficient, indicating that an increase in market power reflected in higher profit is accompanied by an increase in prices.

The expenses ratio variable based on retail companies, presents a positive, significant coefficient (Table 2, column 4). This is because an increase in these expenses as a method of differentiation and entry barrier allows the companies to grow their profitability, by preventing competitors from entry and this leads to lower competition allowing higher prices to be charged. However, as explained in section 2, the expenses ratio is not defined as a proxy for competition in the food sector since no large exogenous shock that could affect its structure was identify under the scope of this work. Where this index is based on food manufacturers/importers, the coefficient presents a negative sign and it is not significant (Table 3, column 2). Regulations and large number of players in the supply chain generate noise in the results. Likewise, competition from imported food products or private supermarket brands[14] so that local manufacturers struggle to keep their products in a good location on the supermarket shelves, may also explain these findings.

With respect to new regulations governing competition in the food market, the dummy variable indicating the period of the legislation presents a negative direction, i.e. the average rate of inflation since 2014 is lower by [0.2-0.4] percentage points. The variable is significant in only one specification (Table 2, column 4). It is important to add that it is doubtful that this dummy variable can be used to accurately reflect the effect of the legislation given that other factors may also have pushed prices down during this period. It is possible that consumer awareness changed after the social unrest of the summer of 2011. It is a process that takes place in a continuous manner rather than being an isolated incident at a given time, and the dummy variable of legislation catches also this effect.

We note that there is an improvement in the goodness of fit of the regression after the addition of the markup ratio competition variable according to *adjusted* R^2, but it is not of significant magnitude. This leads us to conclude that competition is not a significant factor in determining food prices, but rather that other factors are responsible for setting the prices.

3.4. The communications sector – telephone services

The communications sector in Israel is subject to significant regulation that affects the pricing of services. Among the regulatory processes introduced in the last two decades, it

[14] According to Shufersal's financial statements, more than 20% of their sales are from the chain's private brand.

could be named the Gronau Committee to regulate Bezeq tariffs, and at the beginning of the 2010' decade, the reform designed to allow new players to enter the market. Figure 6.1 shows the sharp decline in telephony service prices from the beginning of the 2010' decade, immediately after the implementation of the reform from the end of 2011. Figure 6.2. shows the erosion in firms' profitability that came together with the reform. To strengthen the evidence of firms' profitability erosion and the raise in competition after the reform, we added figure (6.3) which shows Cellcom's competition indices[15]. It could be seen that since the reform was set up, the markup ratio has been decreasing gradually up to levels that are below than those prevailing before the reform.

Figure 6.1

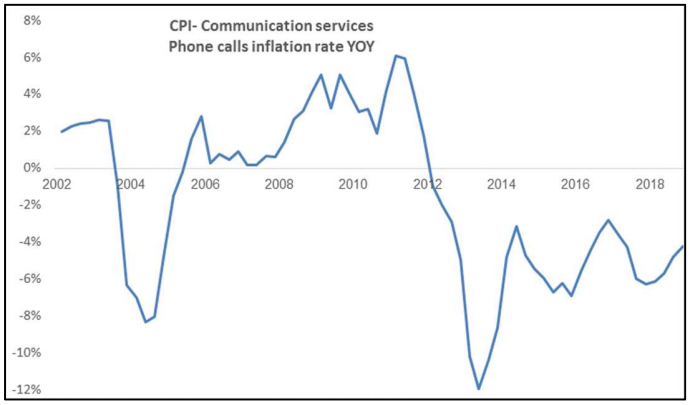


Figure 6.2

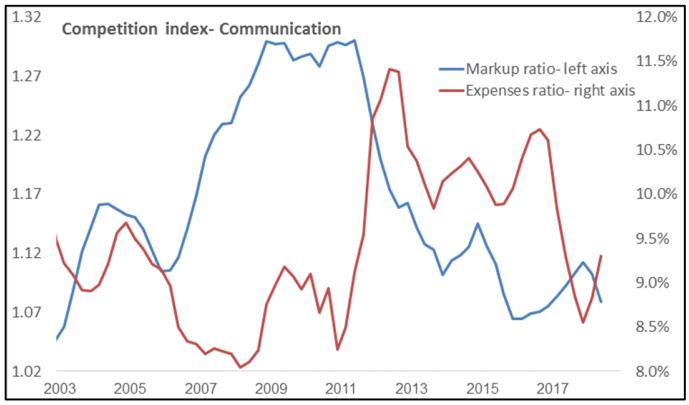
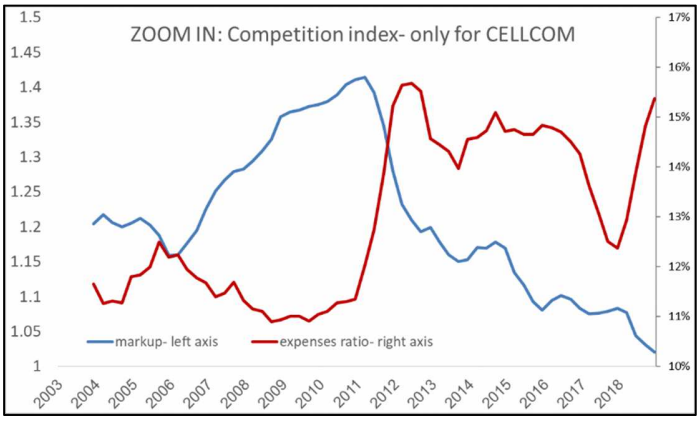


Figure 6.3



We will estimate a Phillips curve to the communications sector- telephony services in particular (2.5% of the CPI)- and we will compile competition variables based on data for

[15] Cellcom is one of the three companies that make up the sectoral indices of figure 6.2. As a particular case, Cellcom specific indices are shown in figure 6.3.

three leading companies in Israel's communication sector. To estimate a sector-based Phillips curve, we will use quarterly data for the period *Q1:2003 – Q4:2018*.

(9)

$$\pi_{t\_comm} = \alpha_0 + \alpha_1 \pi_{t-1\_comm} + \beta \hat{Y}_{t-1} + \varphi_i E\%^{NEER}{}_{t-1} + \gamma_i \pi_{\_headline}{}_{t-1} + \mu_t \Delta Z_{t-i\_comm} + \theta D_{reform} + \varepsilon_t$$

Where π_{t-i_comm} is the lagged sectoral rate of inflation at a quarterly frequency; $\hat{Y}_{t-1}$ is the output gap for the Israeli economy – the reason we chose to use it as an output variable lies in the fact that this is a non-tradable sector and specifically one that operates in the utilities industry and is correlated with the development of macroeconomic factors; $\pi_{\_headline}{}_{t-1}$ is the general rate of inflation in the economy in annual terms- according to the 2003 Communications Regulations there is an annual indexation; ΔZ_{t-i_comm} is the quarterly change in the annual competition index in two alternatives as explained in Section 2. Particularly in the case of the expenses ratio variable, we will multiply it by the dummy variable D_{reform} which indicates the implementation of the communications reform of 2011-2012 and is equal to 1 from the fourth quarter of 2011. This is because under our assumptions, the features of this variable were subject to change as a result of an exogenous shock that came from a new regulation, that intensified the level of competition in the sector. In addition to that, we will add the product of expenses ratio multiplied by (1-D_{reform}) to control for the effect of competition on prices before the reform was set up. $E\%^{NEER}{}_{t-1}$ is the quarterly rate of change in the nominal effective exchange rate of the shekel.

3.4.1. Results of the estimation[16]

Table 4: Results of the estimation – Communications sector

Sector: Communication Dependent variable: Communication inflation t qoq Sample period: 2003Q1:2018Q4 | 64 observations	1	2	3
(1–Dummy_Reform)∗ΔExpenses ratio $_{(t-3)}$			1.297*
			(0.697)
(Dummy_Reform)∗ΔExpenses ratio $_{(t-3)}$			-0.847*
			(0.526)
Δ Markup $_{(t-3)}$		0.165*	
		(0.099)	
Dummy "reform"			-1.053***
			(0.366)
Control variables	√	√	√
Adjusted R^2	0.33	0.35	0.44

[16] A table including all the estimation results appears in Appendix A.

According to the results of the estimation, the markup ratio presents a positive and significant coefficient (Table 4, column 2) so that a 1% increase in the markup ratio matches a 0.2% increase in sectoral inflation within three quarters. The second variable, the expenses ratio, which was multiplied by the dummy variable, presents a positive and significant coefficient until the beginning of the reform, that becomes negative and significant after the implementation of the reform (Table 4, column 3). Thus, after the onset of the reform, an increase of 1% in expenses ratio corresponds to a decrease of 0.8 percentage points in the sectoral inflation rate within three quarters. This is in line with the assumption of stronger competition that is exogenously originated, which leads the existing companies to allocate resources to promote their products so that customers will choose them rather than the new competitors offering more attractive prices. The dummy variable for the communications reform presents a negative and significant coefficient so that on average, the price of telephone services is 1% lower than in the period preceding the reform. This specification improves the goodness of fit of the regression given that the *adjusted* R^2 statistic increases significantly.

3.5. Miscellaneous sector – Toiletries and cosmetics

From the second half of the 2000' decade, the annual rate of inflation in the toiletries and cosmetics subsector, which is part of the miscellaneous sector, shows a decline and in most of the 2010' decade the rate of inflation is also negative (Figure 7.1). Numerous factors could explain this trend but we will focus on competition. Therefore, we will estimate a sector-based Phillips curve and formulate a competition variable using four companies that market personal care products and cosmetics.

Figure 7.1

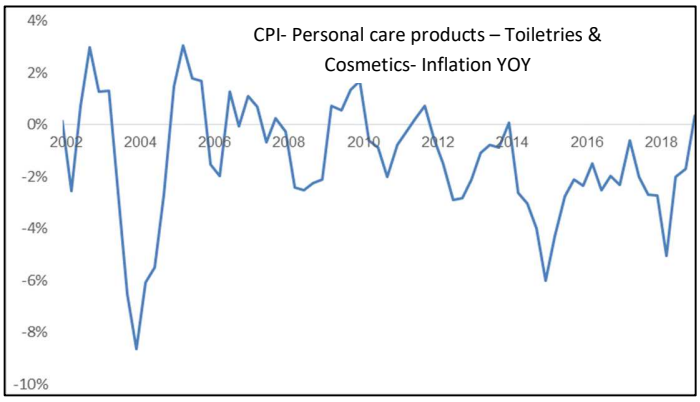
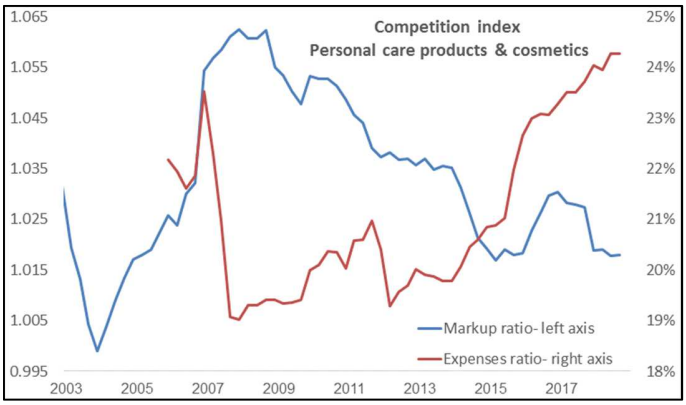


Figure 7.2



We used data for the period Q1:2002-Q4:2018 as well as a shortened sample for the period Q3:2006-Q4:2018 due to the absence of a longer sample for the variable expenses ratio.

(10)

$$\pi_{t\_personal\_care} = \alpha_0 + \alpha_1 \pi_{t-1\_personal\_care} + \beta \hat{Y}_{t-1\_miscellaneous} + \mu \Delta Z_{t-2} + \sum_{0}^{1} \varphi_i E\%^{US}{}_{t-1} + \gamma \pi *_{t\_personal\_care} + \rho\, D\_neto\_hozalot_t + \varepsilon_t$$

Where $\pi_{t-i\_personal\_care}$ is the quarterly lagged sectoral inflation rate (seasonally adjusted); $\hat{Y}_{t-1\_miscellaneous}$ is the deviation from the trend in the seasonally adjusted retail trade index in the miscellaneous sector; $\Delta Z_{t-2\_personal\_care}$ is the quarterly change in the annual competition index in the two alternatives as defined in Section 2 ; $E\%^{US}{}_{t-1}$ is the quarterly rate of change in the shekel−dollar exchange rate; $\pi *_{t-1\_personal\_care}$ is the quarterly rate of change in the prices of imported personal care products (Paasche Index, from the CBS); $D\_neto\ hozalot_t$ is a dummy variable which equals 1 in Q4:2017 and in Q1:2018 (as well as in apparel sector). This given the fact that the Ministry of Finance *"Neto Hozalot"* plan eliminated the 12% customs duty on cosmetics.

3.5.1. Results of the estimation[17]

Table 5: Results of the Estimation - toiletries and cosmetics

Sector: Personal care products	Sample period: 2002Q1:2018Q4		Sample period: 2006Q3:2018Q4	
Dependent variable: Toiletries and Cosmestics inflation	68 observations		50 observations	
Competition variables: based on 4 firms	1	2	3	4
ΔExpenses ratio (t-2)				0.377*
				(0.213)
Δ Markup (t-2)		0.573*		
		(0.286)		
Dummy "neto hozalot"	-1.051	-1.074	-1.16*	-1.211**
	(0.753)	(0.735)	(0.611)	(0.597)
Control variables	√	√	√	√
Adjusted R^2	0.22	0.26	0.13	0.18

According to the results of the estimation, the competition variable markup ratio shows a positive and significant coefficient, so that a 1% increase in the markup ratio corresponds to an increase of 0.6 percentage points in the sectoral rate of inflation within two quarters (Table 5, Column 2). The expenses ratio variable also presents a positive and significant coefficient. (Table 5, Column 4). Although this sector is exposed to external competition

[17] A broad table of results which includes all the regression variables appears in Appendix A.

(as well as the clothing sector), the intensity of the threat here is more moderate and we therefore cannot say that an exogenous entry of competitors occurred in this sector, as it was assumed in the apparel sector.

The dummy variable specifying the implementation of the *Neto Hozalot* plan presents a negative and significant coefficient in the shortened sample. According to the estimation, the plan's contribution to the sectoral rate of inflation is -1%.

The goodness of fit of the regression improves when adding a competition variable to the specification, according to the *adjusted* R^2 statistic.

3.6. Culture, entertainment and leisure – tours and recreation

For most of the last decade and a half, prices in the internal tourism sector have seen a positive rate of change (Figure 8.1). We will examine which factors affected pricing in the sector, particularly competition. In the past few years, pricing in this sector has become more dynamic due to the development of means of purchase of vacation packages through websites and mobile applications. Likewise, pressure on prices is felt in the light of the preference for vacation packages abroad as airline ticket prices fall combined with the knowledge that hotel services abroad are attractive. Additionally, the tense security situation tends to push local prices down. Furthermore, the global economic situation also affects incoming tourism and prices of tourism packages.

Figure 8.1

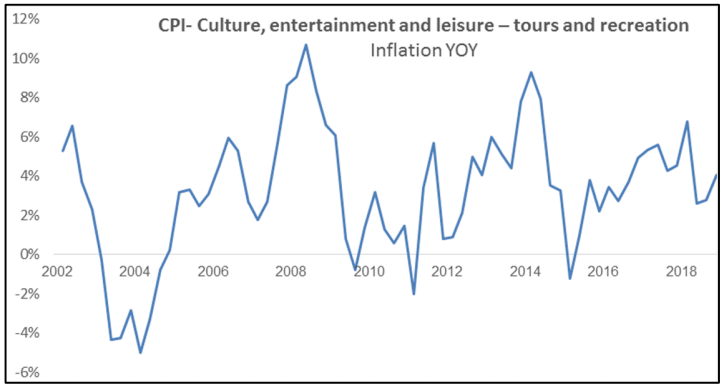
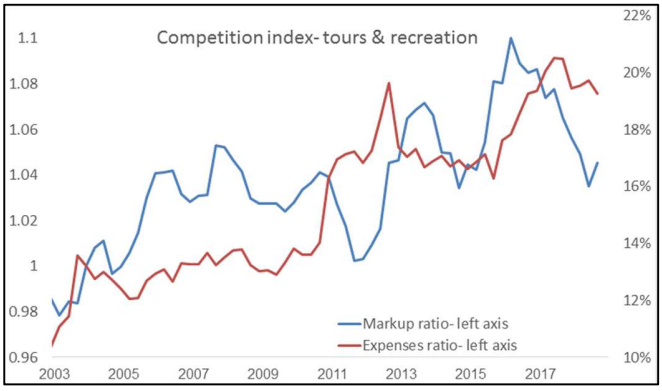


Figure 8.2



We will estimate a sector-based Phillips curve for the period: Q3:2003-Q4-2018

(11)

$$\pi_{t\_tourism} = \alpha_0 + \sum_{1}^{2} \alpha_i \pi_{t-i\_tourism} + \beta \hat{Y}_{t-1} + \sum_{0}^{2} \varphi_i E\%^{US}{}_{t-1} + \mu_t \Delta Z_{t-i\_tourism} + \theta D_{war} + \varepsilon_t$$

Where $\pi_{t-i\_tourism}$ is the lagged quarterly sectoral rate of inflation; $\hat{Y}_{t-1}$ is the output gap for the Israel economy according to our choice of using it as the output variable for the regression in non-tradable sectors; $E\%^{US}{}_{t-1}$ is the rate of change in the shekel/dollar exchange rate; $\Delta Z_{t-i\_tourism}$ is the quarterly change in the annual competition index in its two alternatives as explained in Section 2; D_{war} is a dummy variable that indicates the periods in which there were defensive operations or wars.

3.6.1. Results of the estimation[18]

Table 6: Results of the estimation – tours and recreation

Sector: Tours and recreation Dependent variable: Tours and recreation inflation Sample period: 2003Q1:2018Q4 | 64 observations	Competition variables: based on 2 firms 1	2	3
Δ Expenses ratio $_{(t-2)}$		-0.430 (0.285)	
Δ Markup $_{(t-2)}$			0.419** (0.183)
Dummy "War"	-1.312* (0.706)	-1.285* (0.699)	-1.148* (0.685)
Control variables	√	√	√
Adjusted R^2	0.21	0.23	0.27

According to the results of the estimation, the markup ratio presents a significant and positive coefficient as expected (Table 6, column 3), and the goodness of fit of the regression improves when we include the variable in the specification, according to the *adjusted* R^2 statistic. An increase of 1% in the markup ratio is associated with an increase of 0.4 percentage points in the sectoral rate of inflation within two quarters. The expenses ratio, which in the case of the tours & recreation sector, is not defined as a proxy for competition, presents a negative coefficient and it is not significant (Table 6, column 2).

The dummy variable for security escalation periods presents a negative and significant coefficient. In means that on average, vacation prices drop by more than 1% in these periods.

[18] A broad table that includes the results of all the regression variables appears in Appendix A

3.7. The contribution of competition to inflation – summary table

To illustrate the ability of the competition variables to explain inflation, we present a calculation of their contribution to sectoral and general inflation rates in the period 2012−2017 (Tables 7 and 8). We do this by using the results of the estimation presented above. We chose a period from the sample in which there is significant expression of the increased competition.

Column (1) in tables 7 and 8 presents the contribution of the competition variable to sectoral inflation. Column (2) presents the sectoral inflation rate during this period. Column (3) calculates the contribution of the competition variable to the general inflation rate in line with the weight of the item in the general index (which appears in parentheses), and column (4) presents the improvement in the goodness of fit of the regression with the addition of the competition variable.

The results show that the increase of competition in the apparel sector explains a significant part of the sectoral inflation changes in this period. During the period, the rate of inflation in the sector was -11.2%, while 2.5 percentage points are explained by the decline in competition measured by the markup ratio (Table 7, column 1)[19].

Regarding the expenses ratio variable, the increase in competition measured by this ratio explains 8 percentage points from the reduction of 11.2% in apparel prices (Table 8, column 1)[20]. With respect to communication, although the contribution of competition to sectoral inflation seems to be minor, but since the direction of the change fits our theory, it could be the case of a measurement error and thus the actual contribution could be in fact higher than estimated. We remind that in sectors other than apparel and communication, the expenses ratio was not defined as a proxy for competition. Thus only in those two sectors the quantitative analysis presented in table 8 is justified.

[19] For illustration purpose we present the way we calculated table 7 for the apparel sector. The competition contribution to sectoral inflation measured by markup (table 7, column 1) is calculated as the product of the markup regression coefficient (equal to 0.32, see section 3, table 1) and the change (delta) in markup during 2012-2017 which equals to -7.4%. Thus 0.32*(-7.4%)=-2.5% is the competition contribution to sectoral inflation. Colum 3 describes the contribution of sectoral competition to headline inflation which is calculated as the product of the contribution to sectoral inflation (table 7, column 1) which equals (-2.5%) multiplied by apparel weight in inflation (2.5% as it appears in parentheses). Thus, -2.5%*0.025= -0.06%. Regarding column 4 in table 7, it presents the difference between adjusted R^2 in column 2 and column 1 from table 1 in section 3, which equals 0.56-0.53=0.03.

[20] We present the way we calculated table 8 for the apparel sector. The competition contribution to sectoral inflation measured by markup (table 8, column 1) is calculated as the product of the expenses ratio regression coefficient (equal to -1.15, see section 3, table 1) and the change (delta) in expenses ratio during 2012-2017 which equals to 7.2%. Thus -1.15*7.2%=-8.3% is the competition contribution to sectoral inflation. Colum 3 describes the contribution of sectoral competition to headline inflation which is calculated as the product of the contribution to sectoral inflation (table 8, column 1) which equals (-8.3%) multiplied by apparel weight in inflation (2.5% as it appears in parentheses). Thus, -8.3%*0.025= -0.21%. Regarding column 4 in table 8, it presents the difference between adjusted R^2 in column 3 and column 1 from table 1 in section 3, which equals 0.58-0.53=0.05.

It is important to note that in the results of the regressions along this work, it may be a downward bias in the coefficient size of the competition estimates due to a measurement error which weakens the values obtained in the industries surveyed (attenuation bias). Therefore, a more in-depth examination at the sector and firm level is required.

Table 7: Contribution of competition (measured by markup) to inflation

Competition index: Markup ratio	(1) Competition contribution to sectoral inflation 2012-2017	(2) Sectorial inflation 2012-2017	(3) Comptetition contribution to headline inflation 2012-2017	(4) Regression improvement by Adjusted R^2 2002-2012
Apparel (2.5%)	-2.5 %	-11.20%	-0.063 %	3%
Food- retail (13.7%)	-5.31 %	3.51%	-0.727 %	1%
Communication (2.5%)	-3.5 %	-30.30%	-0.088 %	2%
Personal Care (1.5%)	-0.93 %	-14.70%	- 0.014 %	4%
Tours & Recreation (0.8%)	2.51 %	29.75%	0.020 %	6%

Table 8: Contribution of competition (measured by expenses ratio) to inflation

Competition index: Expenses ratio	(1) Competition contribution to sectoral inflation 2012-2017	(2) Sectorial inflation 2012-2017	(3) Competition contribution to headline inflation 2012-2017	(4) Regression improvement by Adjusted R^2 2002-2018
Apparel (2.5%)	-8.3 %	-11.20%	-0.21 %	5%
Food- retail (13.7%)	0.9 %	3.51%	0.12 %	2%
Communication (2.5%)	-1.14 %	-30.30%	-0.03 %	4%
Personal Care (1.5%)	1.1 %	-14.70%	0.02 %	5%
Tours & Recreation (0.8%)	-1.45 %	29.75%	-0.01 %	2%

We conducted a robustness test for the competition variables in every specification for the five sectors under study. The purpose of the check is to validate the choice of the lag of the competition variable that has been selected in each specification, which has been made under statistic criterions (significance level). The alternative variable used to test robustness is the moving average of the competition variable that appears in the relevant

specification together with its adjacent lags[21]. The results show that the estimated coefficients stay stable when replacing the selected lag for the competition variable by the alternative mentioned above. In other words, in most of the cases under study, the results are still significant and maintain the sign and the size of the coefficient.

4. Summary and conclusions

In this paper, we presented a sectoral-based Phillips Curve which describes the effects of demand and supply side factors on the rate of inflation in five sectors in the Israeli economy, in an attempt to identify the effect of changes in competition. In the period under study, we found that an increase in competition measured by a conventional index (markup) is consistent with a decline in the rate of inflation in the sector. We also used an alternative index, the expenses ratio as a proxy for an exogenous change in competition. In sectors in which large exogenous shocks to competition were occurred the results are consistent with the assumptions. In other words, an increase in expenses ratio which indicates an increase in competition, corresponds with a decline in the sectoral rate of inflation in the following quarters. This is the case in the apparel sector and in the communication sector after the reform of end 2011. In sectors in which competition is the outcome of the inherent market dynamic and no large competition shocks were experienced, it was demonstrated that our variable is not relevant.

Additionally, based on the results obtained from the regressions, it appears that the negative relationship between the level of competition and the rate of inflation is mostly present in the apparel sector.

It is important to note that a great part of the variation in prices in the sectors under study, was not explained in the analysis of this work. Hence, more detailed firm-level research is needed, that will allow a more accurate estimation of competition variables, and thus improve the accuracy of the causal relationship.

[21] See Appendix B

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Appendix A: Results of the estimation

Table A.1: Apparel sector

Sector: Apparel Dependent variable: Apparel inflation t qoq Sample period: 2003Q2:2018Q2 | 61 observations	Competition variables: based on 5 clothing retaillers 1	2	3
Constant	-1.19*** (0.240)	-1.2*** (0.234)	-0.86*** (0.263)
Sectoral inflation t-1 qoq	-0.64*** (0.105)	-0.66*** (0.103)	-0.69*** (0.102)
Sectoral inflation t-2 qoq	-0.24** (0.113)	-0.23** (0.110)	-0.27*** (0.108)
Sectoral imported inflation * t-1 qoq	0.53*** (0.134)	0.57*** (0.132)	0.52*** (0.128)
ILSUSD t-1 qoq	0.02 (0.023)	0.03 (0.023)	0.03 (0.023)
ILSUSD t-2 qoq	0.09*** (0.023)	0.097*** (0.023)	0.09*** (0.022)
Quantity growth t-1 qoq	0.12** (0.052)	0.14*** (0.051)	0.13** (0.049)
Dummy "neto hozalot"	-2.99** (1.168)	-3.17*** (1.142)	-3.28*** (1.119)
Minimum wage	0.37*** (0.116)	0.412*** (0.115)	0.33*** (0.112)
Δ Expenses Ratio $_{(t-4)}$			-1.15** (0.456)
Δ Markup $_{(t-2)}$		0.32* (0.164)	
Adjusted R^2	0.53	0.56	0.58

Table A.2: Food sector (retail companies)

Sector: Food Retailers Dependent variable: Food inflation t qoq Competition variables: based on 3 food retail firms	Sample period: 2002Q1:2018Q3 68 observations 1	 2	Sample period: 2007Q1:2018Q4 48 observations 3	 4	 5
Constant	0.261* (0.140)	0.295** (0.140)	0.311* (0.173)	0.331* (0.176)	0.365** (0.169)
Sectoral inflation t-1 qoq	0.489*** (0.107)	0.466*** (0.106)	0.589*** (0.114)	0.569*** (0.116)	0.582*** (0.110)
ILSUSD t qoq	0.01 (0.009)	0.012 (0.009)			
ILSUSD t-1 qoq	0.02** (0.008)	0.024*** (0.009)	0.017 (0.011)	0.020* (0.011)	0.019* (0.011)
ILSUSD t-2 qoq			0.021* (0.011)	0.022* (0.011)	0.021** (0.010)
Food raw materials imported inflation t qoq	0.066*** (0.023)	0.065*** (0.022)	0.072*** (0.020)	0.067*** (0.021)	0.077*** (0.020)
Food raw materials imported inflation t-1 qoq	0.047** (0.023)	0.046** (0.023)			
Food quantity gap t-1	0.098* (0.059)	0.124** (0.060)			
Retail quantity gap t-1			0.129** (0.056)	0.128** (0.056)	0.156*** (0.055)
Dummy food law	-0.241 (0.220)	-0.272 (0.218)	-0.349 (0.241)	-0.373 (0.244)	-0.426* (0.235)
Δ Expenses ratio $_{(t-4)}$					0.529* (0.262)
Δ Markup $_{(t-1)}$		0.309* (0.187)		0.181 (0.225)	
Adjusted R^2	0.53	0.54	0.64	0.63	0.66

Table A.3: Food sector (manufacturing / import companies)

Sector: Food Manufacturers Dependent variable: Food inflation t qoq Sample period: 2002Q1:2018Q4 | 68 observations	Competition variables: based on 10 food producers and importers firms					
	1	2	3	4	5	6
Constant	0.156 (0.103)	0.184 (0.102)	0.15 (0.105)	0.261* (0.140)	0.301** (0.135)	0.299** (0.133)
Sectoral inflation t-1 qoq	0.542*** (0.096)	0.504*** (0.096)	0.56*** (0.097)	0.489*** (0.107)	0.447*** (0.104)	0.46*** (0.103)
ILSUSD t qoq	0.011 (0.008)	0.02** (0.008)	0.012 (0.008)	0.01 (0.009)	0.019** (0.008)	0.019** (0.008)
ILSUSD t-1 qoq	0.021** (0.008)	0.01 (0.008)	0.021** (0.008)	0.02** (0.008)	0.01 (0.008)	0.01 (0.008)
Food raw materials imported inflation t qoq	0.072*** (0.022)	0.053** (0.022)	0.066*** (0.022)	0.066*** 0.023***	0.048** (0.022)	0.043* (0.022)
Food raw materials imported inflation t-1 qoq	0.046* (0.023)	0.058** (0.026)	0.051** (0.024)	0.047** (0.023)	0.06** (0.025)	0.065** (0.025)
Food quantity gap t-1	0.103* (0.059)	0.112* (0.060)	0.134** (0.063)	0.098* (0.059)	0.105* (0.060)	0.132** (0.062)
Dummy food law				-0.241 (0.220)	-0.283 (0.217)	-0.289 (0.213)
Δ Expenses Ratio $_{(t-4)}$		-0.125 (0.219)			-0.110 (0.218)	
Δ Markup $_{(t-3)}$			0.13 (0.092)			0.134 (0.090)
Adjusted R^2	0.53	0.52	0.54	0.53	0.52	0.54

Table A.4: Communication sector

Sector: Communication Dependent variable: Communication inflation t qoq Sample period: 2003Q1:2018Q4 | 64 observations	1	2	3	4	5
Constant	-0.473* (0.244)	-0.570** (0.248)	-0.034 (0.283)	-0.083 (0.335)	0.006 (0.276)
Sectoral inflation t-1 qoq	0.359*** 0.122	0.332*** (0.122)	0.200 (0.130)	0.206 (0.133)	0.199 (0.128)
NEER t-1 qoq	0.133** (0.066)	0.112* (0.067)	0.117* (0.063)	0.114* (0.064)	0.114* (0.062)
Headline inflation yoy t-1	0.176* (0.096)	0.209** (0.097)	0.136 (0.093)	0.145 (0.099)	0.167* (0.091)
Output gap t-1	0.206* 0.115	0.189* (0.114)	0.252** (0.111)	0.245** (0.114)	0.221** (0.108)
Dummy "reforma"			-0.995*** (0.367)	-0.926** (0.443)	-1.053*** (0.366)
$(1-\text{Dummy_Reform}) * \Delta$Expenses Ratio $_{(t-3)}$					1.297* (0.697)
(Dummy_Reform)Δ Expenses Ratio $_{(t-3)}$					-0.847* (0.526)
Δ Markup $_{(t-3)}$		0.165* (0.099)		0.032 (0.115)	
Adjusted R^2	0.33	0.35	0.40	0.39	0.44

Table A.5: Miscellaneous – Toiletries and Cosmetics

Sector: Personal care products Dependent variable: Toiletries and Cosmestics inflation Competition variables: based on 4 firms	Sample period: 2002Q1:2018Q4 68 observations 1	 2	Sample period: 2006Q3:2018Q4 50 observations 3	 4
Constant	-0.323** (0.134)	-0.308** (0.131)	-0.307** (0.124)	-0.330*** (0.122)
Sectoral inflation t-1 qoq	-0.050 (0.113)	-0.082 (0.111)	-0.172 (0.131)	-0.189 (0.128)
Personal care imported prices t qoq	0.179*** (0.052)	0.174*** (0.051)	0.127** (0.058)	0.138** (0.057)
ILSUSD t qoq	0.037*** (0.012)	0.036*** (0.011)	0.013 (0.014)	(0.013) (0.013)
ILSUSD t-1 qoq	0.025** (0.011)	0.025** (0.011)	0.024* (0.012)	0.023** (0.012)
Miscellaneous quantity gap t-1	0.111** (0.049)	(0.079) (0.050)	0.026 (0.059)	(0.032) (0.058)
Dummy "neto hozalot"	-1.051 (0.753)	-1.074 (0.735)	-1.16* (0.611)	-1.211** (0.597)
Δ Expenses ratio $_{(t-2)}$				0.377* (0.213)
Δ Markup $_{(t-2)}$		0.573* (0.286)		
Adjusted R^2	0.22	0.26	0.13	0.18

Table A.6: Tours and Recreation

Sector: Tours and recreation Dependent variable: Tours and recreation inflation Sample period: 2003Q1:2018Q4 | 64 observations	Competition variables: based on 2 firms 1	2	3
Constant	1.479*** (0.258)	1.549*** (0.259)	1.487 (0.249)
Sectoral inflation t-1 qoq	-0.110 (0.122)	-0.129 (0.121)	-0.099 (0.117)
Sectoral inflation t-2 qoq	-0.347*** (0.126)	-0.340*** (0.124)	-0.405*** (0.124)
Output gap	0.545*** (0.153)	0.541*** (0.152)	0.579*** (0.149)
ILSUSD t qoq	0.008 (0.023)	0.007 (0.023)	0.013 (0.022)
ILSUSD t-1 qoq	-0.001 (0.022)	-0.005 (0.022)	0.003 (0.022)
ILSUSD t-2 qoq	-0.037* (0.021)	-0.041* (0.021)	-0.038* (0.020)
Dummy "War"	-1.312* (0.706)	-1.285* (0.699)	-1.148* (0.685)
ΔExpenses ratio $_{(t-2)}$		-0.430 (0.285)	
Δ Markup $_{(t-2)}$			0.419** (0.183)
Adjusted R^2	0.21	0.23	0.27

Appendix B: Robustness check

Table B.1: Apparel sector

Sector: Apparel Dependent variable: Apparel inflation t qoq Sample period: 2003Q2:2018Q2 | 61 observations	**Robustness check** Competition variables: based on 5 clothing retaillers 1	2	3
Constant	-1.19*** (0.240)	-1.14*** (0.253)	-0.90*** (0.282)
Sectoral inflation t-1 qoq	-0.64*** (0.105)	-0.64*** (0.106)	-0.67*** (0.104)
Sectoral inflation t-2 qoq	-0.24** (0.113)	-0.25** (0.114)	-0.23** (0.111)
Sectoral imported inflation * t-1 qoq	0.53*** (0.134)	0.51*** (0.138)	0.55*** (0.132)
ILSUSD t-1 qoq	0.02 (0.023)	0.02 (0.023)	0.03 (0.023)
ILSUSD t-2 qoq	0.09*** (0.023)	0.09*** (0.024)	0.09*** (0.023)
Quantity growth t-1 qoq	0.12** (0.052)	0.12** (0.053)	0.17*** (0.056)
Dummy "neto hozalot"	-2.99** (1.168)	-3.02** (1.177)	-3.32*** (1.156)
Minimum wage	0.37*** (0.116)	0.37*** (0.117)	0.36*** (0.114)
$\frac{1}{3}\sum_{i=2}^{4}\Delta\ Expenses\ Ratio_{\ t\_i}$			-1.35* (0.729)
$\frac{1}{3}\sum_{i=1}^{3}\Delta Markup_{\ t\_i}$		0.21 (0.358)	
Adjusted R^2	0.53	0.53	0.55

Table B.2: Food sector (retail companies)

Sector: Food Retailers Dependent variable: Food inflation t qoq Competition variables: based on 3 food retail firms	Sample period: 2002Q1:2018Q4 68 observations 1	**Robustness check** 2	Sample period: 2007Q1:2018Q4 48 observations 3	**Robustness check** 4
Constant	0.261* (0.140)	0.295** (0.140)	0.311* (0.173)	0.376** (0.173)
Sectoral inflation t-1 qoq	0.489*** (0.107)	0.467*** (0.106)	0.589*** (0.114)	0.615*** (0.112)
ILSUSD t qoq	0.01 (0.009)	0.012 (0.009)		
ILSUSD t-1 qoq	0.02** (0.008)	0.022** (0.008)	0.017 (0.011)	0.018* (0.011)
ILSUSD t-2 qoq			0.021* (0.011)	0.020* (0.010)
Food raw materials imported inflation t qoq	0.066*** (0.023)	0.066*** (0.022)	0.072*** (0.020)	0.073*** (0.020)
Food raw materials imported inflation t-1 qoq	0.047** (0.023)	0.044* (0.023)		
Food quantity gap t-1	0.098* (0.059)	0.116* (0.059)		
Retail quantity gap t-1			0.129** (0.056)	0.156*** (0.056)
Dummy food law	-0.241 (0.220)	-0.269 (0.218)	-0.349 (0.241)	-0.464* (0.243)
$\frac{1}{3}\sum_{i=2}^{4}\Delta Expenses\ Ratio_{t\_i}$				0.933* (0.522)
$\frac{1}{3}\sum_{i=0}^{2}\Delta Markup_{t\_i}$		0.383* (0.231)		
Adjusted R^2	0.53	0.54	0.64	0.66

Table B.3: Communication sector

Sector: Communication Dependent variable: Communication inflation t qoq Sample period: 2003Q1:2018Q4 | 64 observations	Robustness check 1	2	3
Constant	-0.473* (0.244)	-0.582** (0.247)	0.151 (0.274)
Sectoral inflation t-1 qoq	0.359*** 0.122	0.305** (0.124)	0.11 (0.122)
NEER t-1 qoq	0.133** (0.066)	0.119* (0.065)	0.114* (0.058)
Headline inflation yoy t-1	0.176* (0.096)	0.207** (0.096)	0.148* (0.085)
Output gap t-1	0.206* 0.115	0.203* (0.113)	0.201* (0.102)
Dummy "reforma"			-1.328*** (0.358)
(1–Dummy_Reform) $*\frac{1}{3}\sum_{i=3}^{5}\Delta Expenses\ Ratio_{t\_i}$			2.353*** (0.883)
(Dummy_Reform) $*\frac{1}{3}\sum_{i=3}^{5}\Delta Expenses\ Ratio_{t\_i}$			-1.587** (0.624)
$\frac{1}{3}\sum_{i=2}^{4}\Delta Markup_{t\_i}$		0.219* (0.122)	
Adjusted R^2	0.33	0.36	0.5

Table B.4: Toiletries and Cosmestics

Sector: Personal care products Dependent variable: Toiletries and Cosmestics inflation Competition variables: based on 4 firms	Sample period: 2002Q1:2018Q3 Robustness check 68 observations 1	2	Sample period: 2006Q3:2018Q3 Robustness check 50 observations 3	4
Constant	-0.323** (0.134)	-0.309** (0.128)	-0.307** (0.124)	-0.339*** (0.123)
Sectoral inflation t-1 qoq	-0.050 (0.113)	-0.129 (0.111)	-0.172 (0.131)	-0.184 (0.128)
Personal care imported prices t qoq	0.179*** (0.052)	0.175*** (0.049)	0.127** (0.058)	0.157** (0.059)
ILSUSD t qoq	0.037*** (0.012)	0.037*** (0.011)	0.013 (0.014)	(0.013) (0.013)
ILSUSD t-1 qoq	0.025** (0.011)	0.029*** (0.011)	0.024* (0.012)	0.023* (0.011)
Miscellaneous quantity gap t-1	0.111** (0.049)	(0.057) (0.050)	0.026 (0.059)	(0.034) (0.058)
Dummy "neto hozalot"	-1.051 (0.753)	-0.926 (0.716)	-1.16* (0.611)	-1.281** (0.600)
$\frac{1}{3}\sum_{i=1}^{3}\Delta Expenses\ Ratio_{t\_i}$				0.602* (0.336)
$\frac{1}{3}\sum_{i=1}^{3}\Delta Markup_{t\_i}$		1.06*** (0.384)		
Adjusted R^2	0.22	0.3	0.13	0.18

Table B.5: Tours and Recreation sector

Sector: Tours and recreation Dependent variable: Tours and recreation inflation Sample period: 2003Q1:2018Q4 | 64 observations	**Robustness check** Competition variables: based on 2 firms 1	2	3
Constant	1.479*** (0.258)	1.549*** (0.259)	1.493*** (0.253)
Sectoral inflation t-1 qoq	-0.110 (0.122)	-0.129 (0.121)	-0.146 (0.121)
Sectoral inflation t-2 qoq	-0.347*** (0.126)	-0.340*** (0.124)	-0.359*** (0.123)
Output gap (-1)	0.545*** (0.153)	0.541*** (0.152)	0.586*** (0.152)
lLSUSD t qoq	0.008 (0.023)	0.007 (0.023)	0.014 (0.023)
lLSUSD t-1 qoq	-0.001 (0.022)	-0.005 (0.022)	0.003 (0.022)
lLSUSD t-2 qoq	-0.037* (0.021)	-0.041* (0.021)	-0.036* (0.020)
Dummy "War"	-1.312* (0.706)	-1.285* (0.699)	-1.25* (0.693)
ΔExpenses Ratio $_{(t-2)}$		-0.430 (0.285)	
$\frac{1}{3}\sum_{i=1}^{3}\Delta Markup_{t\_i}$			0.483* (0.262)
Adjusted R^2	0.21	0.23	0.24