Markup Pricing in the Context of a Violent Conflict: Differentiated Apples in Hebron Wholesale Market

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Abstract
We investigate whether hostile international relations in the framework of the ongoing Israeli-Palestinian conflict has an effect on pricing and consumption patterns of different varieties of apples marketed in Palestine. For this purpose, we employ a discrete choice equilibrium model with product differentiation. Results suggest that the intensity level of the conflict has a positive (negative) effect on demand (price elasticity and markups). It is plausible that in times of uncertainty transactions are larger as producers have higher incentive to sell their stock and consumers prefer to accumulate food to avoid risk that violence and security measures will impede trade.

Keywords: Consumer animosity, differentiated products, Israel, Palestine, violent conflict

JEL: D74, L11, L13, L66, O5, Q11

1 Introduction

The Palestinian Territories belong to the regions worldwide which have been subject to violent political struggle for decades. They consist of the West Bank and the Gaza Strip where 2.7m and 1.6m Palestinians lived in 2012, respectively (PCBS, 2012a). Economic activity and development has been exposed to strong political pressure resulting from the conflict and suffered depending on the varying degree of its intensity. Besides the two major eruptions of violence between December 1987 and September 1993 known as the First Intifada and between the end of September 2000 until the middle of 2005 known as the Second or the Al-Aqsa Intifada, the political situation has never completely calmed down in recent years but was characterized by occasional more or less grave incidences which impaired personal lives and economic activity nevertheless.

The ongoing challenging political situation has manifold effects on the level and the speed of economic development, household income levels and poverty rates in the Palestinian Territories. The Palestinian Poverty Atlas (PCBS, 2013a) provides a comprehensive inside into the heterogeneous regional distribution of poverty on the municipality level. While the center of the West Bank around Jerusalem and Ramallah has the lowest rates, most of the municipalities with the highest relative shares of poverty as well as the highest absolute numbers of poor individuals are found in the Gaza Strip and in the Hebron Governorate at the Southern end of the West Bank (PCBS, 2013a, p. 35, 37). The Palestinian Expenditure and Consumption Survey 2011estimates poverty rates of 18% and 29% in the West Bank and the Gaza Strip, respectively (PCBS, 2012b). It, moreover, finds that households which have a large number of children, which are female-headed and which depend on agriculture as the main source of income are most vulnerable. Besides the five governorates in the Gaza Strip, Hebron Governorate has by far the largest average household size of 6.4 people in the Palestinian Territories (Table 2.16).

The highest share of the monthly expenditures of an average Palestinian household of 36% was spent on food in 2011 (PCBS, 2012b) which increased by almost 10% per capita since 2009. Engel's Law stating that the lower a household's income is, the higher its share spent on food, is also confirmed in the regional expenditure shares spent on food. While, for example, the average household in Ramallah spent 600 USD on food in 2011, in Rafah in the Gaza Strip 465 USD and in Hebron 484 USD are spent which corresponds to 34%, 47% and 39% of the total monthly cash expenditures, respectively (PCBS, 2012b, T. 2.16). While households of at most three members spend on average 35% of their expenditures on food, this share accounts for more than 43% for households of more than ten members (PCBS, 2012b, T. 2.6). Most important non-food expenditure items are transport, housing and

clothing accounting of 10.6%, 8.4% and 6.3% of total monthly consumption, respectively. Among the important group of food commodities, meat and poultry as well as bread and cereals are the most important items with 8.7% and 5.5%, respectively, fresh vegetables and fruits account together for 7.1% (PCBS, 2012b, T. 2.2). Large households of more than ten members spend on average 8% on these two items while small households of up to three members spend only 6.7%.

This background of extensive poverty in the context of an ongoing political conflict of varying intensity poses a number of questions concerning tangible effects of the conflict for the marketing and demand of basic food products which account for significant amounts of the expenditures of a typical household and play a vital role in its food security. For example, are consumer preferences affected by the current political situation? Do the various symptoms of the conflict affect marketing costs and market competitiveness? What implications for food security does this have? Is there evidence that consumers distinguish between local and foreign produce, especially if local supply heavily depends on imports?

For the analysis of the demand and the pricing behavior, we choose a commodity which plays on the one side a significant role in value terms in inter-regional and local wholesale trade and is, on the other, a fundamental component of the diet and, thus, the food security of the civilian population living subject to the conflict. For this end, we apply New Empirical Industrial Organization methodology to estimate Palestinian consumers' preferences for fresh fruits - since they constitute not only a traditionally important element of the local diet and are essential ingredients of popular local dishes, but are also the relevant source for vitamins and minerals - and pricing rules at the wholesale level. The Israeli-Palestinian conflict is a particularly suitable case for the analysis of economic effects of violent conflict since it has been attracted considerable attention from local, regional and international media, Israeli, Palestinian and international human rights groups and international organizations in the area of economic development. The course of the conflict, the use of violence and the implementation of any conflict-related policy measures and insurgent activities and behaviors of both conflict parties is therefore well monitored and documented which allows measurement of its intensity as a precondition for quantitative economic analysis.

New Empirical Industrial Organization methodology offers models for analyzing aggregate consumer level data in a structural equilibrium model of oligopolistic industry. Starting with a distribution of consumer preferences for a range of differentiated products, these preferences are aggregated into a market share quantities. Oligopolistic pricing equations are added to form the equilibrium model. The impact of product characteristics on supplier costs and consumer preferences are jointly estimated. This approach is particularly useful when trying to understand firm conduct and measuring their markups in actual and simulated scenarios. .

This paper is the first analysis which quantifies the effects of varying intensities of conflict on demand and pricing decisions. It answers this question by estimating a state-of-the-art discrete choice model for demand and pricing of a staple food commodity in a development economics context by combining a unique dataset of prices and quantities with a rich set of variables quantifying political relations on a very disaggregated temporal scale. In doing so, it is also able to question the existence of animosity in light of the hostile day-to-day events due to the conflict. Moreover, the paper contributes to the literature of measuring the intensity of violent conflict (e.g. Seybolt, 2002) by suggesting a range of variables quantifying various aspects of violent political conflict on a local scale. Third, we contribute to the literature one of the rare analyses of micro-economic effects of violent conflict as called for by Blattman and Miguel (2010). Although the underlying dataset is quite far away from the ideal for empirical analysis in the framework of New Empirical Industrial Organization as described in Nevo (2000), its quality is of extraordinary uniqueness for a development context. In the following, we first present the institutional background of this analysis. Details of the model

and the data are presented in sections 3 and 4, respectively. Afterwards, the regression results are presented before we conclude this paper.

2 Institutional Background

The governorate of Hebron is with an estimated population of 650,000, the most populated of the sixteen governorates (PCBS, 2012c, T. 3) as it accounts for 15% of the Arab population in the Palestinian Territories. Hebron - as its capital the home of almost one third of this number - is the traditional commercial center for the Southern part of the West Bank (B'Tselem, 2013c). The region has the highest unemployment rates and the lowest wage rates in the West Bank since years (PCBS, 2013b). The average household size of 6.4 members is markedly above the West Bank average of 5.5 members (PCBS, 2012b). Additionally, households' own food production in the governorate is among the lowest shares in the West Bank. These characteristics and others result in the above-mentioned increased level of poverty and vulnerability against income shocks. In 2009, the governorate had with a number of 174,000 persons the second highest poverty headcount in the Palestinian Territories after Gaza city which corresponds to 40% or the poor in the West Bank or 17% of the 1m Palestinian poor (PCBS, 2013a, p. 22; PCBS, 2013c).[1]

Agricultural production and consumption in the Palestinian Territories are unevenly distributed. While major consumption areas are located in the center of the West Bank, Hebron and Gaza city, production is concentrated around Jenin in the North, Jericho in the Jordan valley and parts of the Gaza Strip. The value of the food produced by the households for own consumption varies between almost zero in the Northern Gaza Strip and almost eight dollars per capita and month in Jericho (PCBS, 2012b, T. 2.17). Trade in fresh produce is carried out via the wholesale markets located in the West Bank governorates. Trade between the West Bank and the Gaza Strip is largely restricted by Israeli authorities since Hamas came into power there. WFP (2009) gives a detailed overview of the marketing structures and further institutional background. Each governorate capital has one mostly centrally located fruits and vegetables wholesale market which consist of a number of separate trader shops and which serve the large numbers of mostly small static, flying or street retail traders in the city as well as in its surroundings.

The Hebron fruits and vegetables wholesale market is the largest in the West Bank. It serves at least 270,000 residents in the city of Hebron and the neighboring towns and villages (PCBS, 2013b). It had to move from its traditional location in the center of the old city outwards into the suburbs a couple of years ago because the traditional area was closed by the Israeli military due to security consideration around the settlement in downtown Hebron (B'Tselem, 2013c). The market hosts some fifty single wholesale trader shops. On average, 195 tons of vegetables and fruits are traded trough 352 transactions in total in this wholesale market. Almost 100 different types of fruits and vegetables are traded there. Cucumbers, tomatoes, zucchinis, cauliflowers, parsley and beans are traded most frequently and make up more than half of the transactions carried out on average. Tomatoes, potatoes, cucumbers, oranges, watermelons and apples account for more than half of the average quantities traded. Main source of vegetables at the Hebron market are Palestinian producers around Jenin and Jericho. Significant shares of the fruits marketed in the Palestinian territories are imported from Israel (for details, see, e.g., Ihle and Rubin, 2013) which also applies to the Hebron wholesale market where, in particular, apples and bananas are imported.

3 Model

We apply an oligopolistic model for the demand for differentiated products. Particularly, we estimate a discrete choice model (logit) based on random utility model of the demand for 12 apple varieties traded from wholesalers to retailers in the wholesale market of Hebron. An

[1] The poverty statistics of the PCBS do not mention the Jerusalem governorate.

observation consists in this case of the aggregate daily transactions per apple variety, that is, aggregate daily sales and the daily average price of apple variety $j = 1, \dots, 12$. The market is in this case defined by the daily apple transactions in the Hebron market.

Modeling setup

We follow Berry (1994) and briefly describe the framework for modeling demand for apples in one wholesale market.[2] For each variety $j \in \{1, \dots, V\}$ a vector z_j of characteristics is observed which affect demand (x_j) and marginal costs (w_j) which are complemented by the unobserved characteristics ξ_j and ω_j, respectively. The discrete choice model is defined in the following way. The utility of wholesaler client $i \in \{1, \dots, N\}$ from purchasing variety j is denoted u_{ij} and depends on the variety characteristics according to the following specification:

$$u_{ij} = x_j\beta - \alpha p_j + \xi_j + \varepsilon_{ij}. \quad (1)$$

The vector x_j quantifies all observed characteristics of a variety j impacting demand. The parameters β and ε_{ij} measure general and consumer-specific taste parameters, which are unobserved by the analyst. The terms ξ_j refer to the mean of consumers' preferences of unobserved variety characteristics. The term ε_{ij} can be interpreted as an error which accounts for stochastic taste parameters. Tchetchik et al. (2008) suggest an alternative understanding of these two unobserved quantities as a variety-specific component and *i*-th clients preferences for a variety j or the variation in consumer tastes as noted by Berry (1994, p. 246). If we further assume that the mean of ε_{ij} is zero, the mean utility level of variety *j* is:

$$\delta_j \equiv x_j\beta - \alpha p_j + \xi_j. \quad (2)$$

A client chooses variety j^* that maximizes her utility u_{ij} which defines a range of utilities and a corresponding set A of unobservable taste parameters ε_{ij} which results the purchase of variety *j*:

$$A_j(\delta) \equiv \{\varepsilon_{ij} | \delta_j + \varepsilon_{ij} > \delta_k + \varepsilon_{ik}, \forall k \neq j\} \quad (3)$$

Notice that this set can be used to define the market shares $s_j(\delta) = \int_A dF(\varepsilon)$ where $F(\varepsilon)$ denotes the cdf of ε_{ij}.

The outside good in this case are the fresh fruits and vegetables except of apples which are traded in Hebron. In particular, we follow Fershtman and Gandal (1998) and use the daily potential market size defined by the recommended amount of fruits and vegetable consumption per capita (USDA, 2013) multiplied by the Palestinian population in the Hebron governorate.[3] Its mean utility is normalized to $\delta_0 = 0$. This suggests that consumers preferring not to buy apples are thought of potentially buying any other fresh fruits and vegetables traded. We follow McFadden (1978) as assume an iid extreme value distribution of the ε_{ij}. Note that for one wholesale market this distribution converges to the traditional logit model for market shares.

The wholesale traders are assumed to be price setters in order to maximize their short-run profits given the prices of other traders in the market. The prices at the wholesale level are assumed to follow a Nash equilibrium in a price game. Marginal costs are modeled as a linear function of product characteristics and input prices. The resulting price vector hence satisfies the usual first-order conditions and enables estimation of the demand system.

Application to Apple Trade in the Hebron Market

[2] In general, one could think of R regionally spread wholesale markets each trading V_{F_r} varieties of Fr fresh fruits and vegetables species each of them serving N potential clients. In the given case, data availability allows us to regard R=1 markets and F=1 fresh fruits which are apples of V=12 varieties.

[3] This is calculated daily based on the average population growth rate of 3.35% and the population estimate of 543,891 for 31 December 2007 (PCBS, 2013d).

Based on the above model the basic empirical specifications of the demand and the pricing equations are:

$$\ln\left(\frac{s_j}{s_0}\right) = x_j\beta - \alpha p_j + \xi_j \qquad (4)$$

and

$$p_j = w_j\gamma + \frac{1}{\alpha(1-s_j)} + \omega_j. \qquad (5)$$

The variables s_j and s_0 denote the market shares of variety j and the outside good, respectively. The term $\frac{1}{\alpha(1-s_j)}$ quantifies the markup oligopolistic traders are able to realize, that is, their profits additionally to their observable and unobservable marginal costs $w_j\,\gamma$ and ω_j, respectively.

We encounter the difficulty that we do not observe retail prices, but wholesale prices instead. Retail fruit trade in the West Bank is characterized by an endless number of micro resellers which are partly flying sellers on self-constructed vehicles or located at small permanent spots along the main market streets and squares which strongly suggests that the fruits and vegetables retail market can plausibly be assumed to be competitive. Hence, marginal cost of retailers equals the wholesale price plus fixed effects, so that

$$mc^r = p_j = p_j^w + c + c_j^v \qquad (6)$$

and

$$\ln\left(\frac{s_j}{s_0}\right) = x_j\beta - \alpha p_j^w - \alpha c + \xi_j. \qquad (4')$$

Additionally, in the context of the political conflict between Israel and the Palestinians another major exogenous factor is likely to affect demand and marginal costs, which is the intensity of the conflict. The waves of fighting which are reiterating temporally inhibit economic activity to a greater or lesser extent because they strongly increase existential uncertainty and threaten the physical integrity of all stakeholders in the marketing chain because of the danger of potential collateral damage for health and life of civilians due to the violence.

Therefore, the usual variety characteristics in x_j such as quality (D_j^q), Israeli origin (D_j^{Is}) (vs. local production), fixed effects of the twelve apple varieties D_j^{va} (following Nevo, 2001) and time effects are complemented by further demand shifters D_l^{sh} such as important Muslim holidays or a set of variables quantifying various aspects of the political conflict (D_m^{conf}).

The demand equation (4') finally estimated becomes therefore:

$$\ln\left(\frac{s_j}{s_0}\right) = c + \sum_{k=j}^{12}\beta_k D_j^{va} + \sum_{l=13}^{18}\beta_l D_l^{sh} + \sum_{m=19}^{30}\beta_m D_m^{conf} + \beta_{31}D_j^{qua} + \beta_{32}D_j^{Isr} - \left(\alpha p_j^w + \alpha^{clo}D^{clo}p_j^w\right) + \xi_j. \qquad (7)$$

We additionally add the term $D^{clo}p_j^w$ in order to obtain empirical evidence on the question whether the demand elasticities changed during more intense periods of the conflict which we proxy here by the incidences of the comprehensive closures of the West Bank Barrier (a wall restricting free movement between the West Bank and Israel) . ξ_j is treated as an error term.

For the pricing equation (8) similar considerations apply. The usual marginal costs characteristics in w_j contain a similar set of variables and additionally a set of four cost variables D^{cost}. As above, the markup term is again interacted with the incidences of the comprehensive closures of the West Bank Barrier.

$$p_j = c + \sum_{k=j}^{12}\gamma_k D_j^{va} + \sum_{i=13}^{18}\gamma_i D_i^{sh} + \sum_{l=19}^{30}\gamma_l D_l^{con} + \gamma_{31}D_{31j}^{q} + \gamma_{32}D_{32j}^{Is} + \sum_{m=33}^{37}\gamma_m D_m^{cost} + (\alpha(1-s_j) + \alpha^{clo}D^{clo}(1-s_j))^{-1} + \omega_j. \qquad (8)$$

We estimate Palestinian consumers' preferences for apple varieties, pricing rules, to consider the question whether there is evidence for consumer animosity and whether the preferences are impacted by the intensity of the coflict. Furthermore, we are interested in assessing the impact of the various aspects of the conflict on marketing costs and competitiveness.

4 Data

We are in the comfortable situation to have access to a unique dataset of transaction data of the Hebron fruits and vegetables wholesale market (HWM, 2011). It consists of data on prices and quantities of all anonymized daily transactions which have been carried out for all traded commodity varieties at the wholesale market. We calculate daily average prices and total traded quantities per variety and day. We focus on apples since it is one of the most important fruits in the Palestinian diet as expenditure statistics suggest (PCBS, 2011c) and it originates from two main sources, which are local Palestinian vs. Israeli production.

The dataset consists in its core of a total number of 4,009 observations of aggregated daily transactions of the trade of 12 apple varieties between May 2007 and the end of September 2010 which corresponds to a period of 1,008 days.[4] During this period, almost 11,000 transactions in apple trade have been carried out in total. The aggregate value of this trade accounted for approximately 37m New Israeli Shekel (NIS) (~10m USD). The average price of the entire set of transactions equals 2.6 NIS/kg and range between 0.5 and 6 NIS. 3.2 tons of apples are traded on average per day. Table 1 shows more descriptive statistics of various characteristics of the observations.

Table 1: Characteristics of the Apple Transactions

	Quantity (kg) per observation	**Price (NIS /kg) per observation**	**Value (NIS) per observation**	**Transactions per observation**
Mean	3,192	2.6	7,980	2.7
Min	14	0.50	24	1
Max	80,552	6	312,508	22
S.D.	4,107	0.85	11,222	2.6
Coef. of var.	1.29	0.33	1.41	0.95

Source: Authors based on HWM (2011).

Conflict indices

Based on two comprehensive and detailed datasets of daily complete closures of the West Bank Barrier (B'Tselem[5], 2013a) and of daily fatalities (B'Tselem, 2013b), we develop a number of indices measuring differing aspects of the conflict between Israelis and Palestinians (Table 2) which are likely to affect either marginal costs, demand or both.

Because the conflict may exert both short-term impacts of up to three days and medium-term impacts of up to one month, we also generate variables which quantify such potentially varying temporal impacts.[6] Variable C1 quantifies the existence of a comprehensive closure on the current day imposed by the Israeli army. In the dataset, 14% of the 4,909 observations were subject to such restrictions. These closures need not to be imposed only during periods of intensive fighting or high number of casualties, they rather represent a perceived existence of a potential security thread and are implemented both for preventive purposes in calm phases of the conflict, e.g., during Israeli holidays, and for control purposes in periods of

[4] Because not each variety is traded on each day, there are considerably less observations available than $12 \cdot 1008 = 12096$.

[5] B'Tselem is an Israeli human rights organization and understands itself as the "The Israeli Information Center for Human Rights in the Occupied Territories".

[6] Although the choices of three and thirty days are ad hoc, we believe it is useful to distinguish between different degrees of the endurance of the effects of aspects of the conflict on economic activity.

intense fighting and many fatalities. In contrast, the variable C2 measures the long-run state of the immediate intensity of the conflict by quantifying whether it is currently in a severe crisis. It equals one if the sum of conflict-related fatalities in Israel and the Palestinian Territories in the 90-days-moving-window before the current date was above the median of the window sum of total fatalities, i.e., 110 fatalities in the last quarter of a year, which was the case in one third of all observations.

Table 2: Descriptive Statistics of the Conflict Variables

Variable	Mean	Min	Max	Std	CV	Source
C1: Comprehensive closure	0.14	0	1	0.35	2.43	B'Tselem (2013a)
C2: Severe crisis	0.33	0	1	0.47	1.42	Authors, B'Tselem (2013b)
C3: Dummy for fatalities in last 3 days	0.49	0	1	0.50	1.02	Authors, B'Tselem (2013b)
C4: Dummy for fatalities in last 30 days	0.93	0	1	0.26	0.28	Authors, B'Tselem (2013b)
C5: Dummy for exceptionally deadly day	0.03	0	1	0.17	5.79	Authors, B'Tselem (2013b)
C6: Frequency of deadly days in last 30 days	0.94	0	23	3.08	3.26	Authors, B'Tselem (2013b)
C7: Peace index	49.98	42.9	57.6	3.54	0.07	IDI (2013)
C8: Share of number of days without fatalities in WB&Israel in last 30 days	89.84	66.67	100	7.52	0.08	Authors, B'Tselem (2013b)

Additionally, we include the two variables C3 and C4 which measure the short- and the medium-run intensities of the conflict, by signaling whether there were any conflict-related fatalities in the last 3 and 30 days, respectively, because even during periods of severe crisis a few days of relaxation may occur which will temporally lessen the pressures towards economic activity exerted by the conflict. These three aspects of conflict intensity are complemented by two variables signaling extreme short-run events during the conflict which might shock economic activity in a particular fashion and two "peace variables" measuring the degree of the temporal relaxation of the conflict and the associated economic hardships. The variable C5 accounts for days during which more fatalities occurred than the 90% quantile of all days with conflict-related fatalities in Israel or the Palestinian Territories, i.e., it takes one if there were more than eight fatalities on a given day. Variable C6 counts the number of such extreme events in the last month. Variable C7 is an index representing the Israeli public opinion regarding the likelihood of ending the conflict[7]. Finally, variable C8 measures the relaxation of the conflict by the share of days without any fatalities in the West Bank and Israel during the last month.

Instruments

Each of the two equations to be estimated contains an endogenous variable, which are the market shares in the pricing equation and the prices in the demand equation. We instrument the markup of the apple varieties traded in Hebron with the quantities of substitutes for apples according to the Palestinian diet traded there, which are bananas, oranges and pears. In the demand equation, we instrument the prices of the apple varieties traded in Hebron by prices of three apple varieties in the fruits and vegetables Israeli wholesale market in TelAviv. Additionally, we included several more variables used as controls in the analysis and are not reported here due to spcae limitations[8].

[7] Source: The Israel Democracy Institute. The Peace Index.
Available at: http://www.peaceindex.org/defaultEng.aspx. Accessed in March 2013. Jerusalem.

[8] The set of cotrol variables includes: years, days of central holidays, weekends, average apple price in Tel-Aviv market and number of daily transactions. Complete descriptive statstics is available from autors upon request.

5 Estimation Results

The system GMM estimation of equations (7) and (8) with the restrictions imposed on α and αclo yields the following results. Table 3 shows the results of selected explanatory variables mentioned in Table 3. The coefficient α is positive – as expected - and significant. This implies that the demand elasticity for apples will be negative and there is a significant markup in the apple wholesale trade in Hebron. In periods when the comprehensive closures of the West Bank Barrier are implemented, this coefficient changes to $\alpha + \alpha^{\mathrm{clo}} = 1.279 + 2.686 = 3.965$ which indicates that conflict constitutes a substantial and negative demand shock significant at the 10% level. For low quality varieties, both prices and demand are significantly smaller. Varieties originating from Israel are, although significantly more expensive by on average 3.2 NIS/kg, also significantly more demanded by consumers in Hebron.

The year dummies do not indicate significant yearly deviations from 2010 concerning the marginal costs and, therefore, prices of apples in Hebron, but suggest that demand in 2008 and 2009 was somewhat higher. The estimated coefficients of the weekend dummy point to that marginal costs rise slightly but significantly on Thursdays, Fridays and Saturdays relatively to the rest of the week, but a strong demand effect is found. While Muslim holidays expect Ramadan do not affect marginal costs and prices, an even stronger demand increase is found which appears to be consistent with the traditional food served by Palestinian Muslims during them. During Ramadan prices increase significantly while and demanded quantities virtually do not change. Four of the five further components of marginal costs in apple trade have – as expected – positive signs and are mostly significant at the 5 percent level, that is, marginal costs and prices increase as these cost components increase.

Table 3: Estimation Results for Selected Explanatory Variables

Variable	Pricing equation		Demand equation	
	Coefficient	p-value	Coefficient	p-value
Constant	-10.217	<0.01	-6.161	<0.01
α (coeff. of markup and price)	1.279	<0.01	1.279	<0.01
α^{clo} (interaction: markup*closure and price*closure)	2.686	0.07	2.686	0.07
Low quality	-0.511	<0.01	-1.378	<0.01
Origin Israel	3.228	<0.01	9.011	<0.01
Year 2007	0104	0.09	-0.070	0.53
Year 2008	-0.113	0.23	0.657	<0.01
Year 2009	-0.013	0.75	0.261	<0.01
Weekend	0.065	<0.01	0.748	<0.01
Muslim holiday	-0.039	0.35	1.894	<0.01
Ramadan	0.202	<0.01	0.017	0.89
Mean apple price at Tel Aviv	0.361	<0.01	-	-
Daily transaction frequency	-0.001	0.87	-	-

Note: "-" means that the variable was not included into the equation.

Table 4 displays the estimates of the coefficients of the variables quantifying various aspects of the conflict and their interactions with the dummy for Israeli origin. The closures or their interaction with the Israeli origin dummies do not matter for marginal costs. However, they induce a strongly positive demand effect which is significant at the 10% level. Similarly, phases of severe crisis do not impact costs, but exert significantly positive immediate effects on apple demand. While a significant short-run increase in marginal costs due to increased conflict intensity measured by the dummy for fatalities during the last three days is found, no significant medium-term effects appear. Confirming the demand effects of the two preceding

variables, consumers again show a significantly raised demand for apples during hot phases of the conflict.

In contrast, the short-run effect of exceptionally deadly days is significantly negative and strong in magnitude. The frequency of such days during the past month does not impact apple prices nor demand in the medium-term. In calmer periods of the conflict, demand for apples significantly increases at a very low magnitude as suggested by the positive estimates of the coefficients of variables C7 and C8 in the demand equation. The effect of phases of severe crisis on costs of Israeli apples in Hebron is significantly positive and appears to by far the largest cost-increasing determinant. This magnitude appears to be plausible given the increased military activity and increased difficulties and costs of shipping apples from Israel to Hebron during such phases. The coefficients of interactions I3 and I4 which quantify the effects of calm conflict phases on costs of and demand for Israeli apples are significant and negative in all cases. This indicates that costs and prices of apples from Israel decrease slightly but significantly during relatively more peaceful phases, which holds also for the demand of such apples.

The own price elasticity of apples in general can be calculated in the following way (Nevo, 2000, p. 522):

$$\bar{\eta}_{jj} = -\alpha \bar{p}(1-\bar{s}_j) = -1.3 * 2.6 * (1-0.023) = -3.3 \qquad (9)$$

where $\bar{p}$ and $\bar{s}_j$ are the average price and market share of apples and single apple transactions, respectively, as shown in Table 2. During periods of conflict measured by the incidences of comprehensive closures of the West Bank Barrier (variable C1 in Table 4), this elasticity changes to

$$\bar{\eta}_{jj}^{clo} = -(\alpha + \alpha^{clo})\bar{p}(1-\bar{s}_j) = -(1.3+2.7) * 2.6 * (1-0.023) = -10.2. \qquad (10)$$

Table 4: Estimation Results for the Conflict Variables

Variable	Pricing equation		Demand equation	
	Coefficient	p-value	Coefficient	p-value
C1: Closure	-0.347	0.10	5.785	0.06
C2: Severe crisis	-0.048	0.17	0.383	<0.01
C3: Fatalities in last 3 days	0.050	0.02	0.156	0.01
C4: Fatalities in last 30 days	0.071	0.13	-0.105	0.28
C5: Exceptionally deadly day	-0.183	<0.01	-0.545	0.02
C6: Freq. of deadly days in last 30 days	-0.004	0.34	0.004	0.68
C7: Peace index	-0.003	0.53	0.027	0.04
C8: Days without fatalities in last 30 days	0.005	0.05	0.026	<0.01
I1: Closure x Israeli origin	0.005	0.92	1.785	0.09
I2: Severe crisis x Israeli origin	0.226	<0.01	0.257	0.06
I3: Peace index x Israeli origin	-0.035	<0.01	-0.090	<0.01
I4: Days without fatalities x Isr. origin	-0.007	0.03	-0.043	<0.01

6 Conclusions

In this study, we investigate whether the intensity of violent political conflict affects pricing and demand of an important food commodity which plays a prominent role in the diet of the population living subject to the political struggle. In particular, we look at the extent and the structure of how the Israeli-Palestinian conflict affects pricing and consumption patterns of apples marketed in the wholesale market of Hebron, the largest and poorest Palestinian governance in the West Bank.

We model the demand-supply system for differentiated apple varieties in the context of an oligopolistic market structure using New Empirical Industrial Organization methodology, namely a structural discrete-choice model which is specified as a logit model. This approach proves to be useful for estimating wholesalers' profit margin and the effect of violent conflict and the resulting restrictive security measures on demand and marginal costs. This assessment provides the first micro-economic analysis by applying such a model to fresh food in a developing economy framework in order to analyse the effects of violent political conflict on food demand. Based on datasets of the Israeli human rights organisation B'Tselem, we develop a range of innovative variables which quantify differing aspects of the conflict. We use these in order to explicitly account for the potential impact of the intensity of the violent conflict on supply and demand behaviour of economic agents in the model by using them as components which directly impact demand, marginal costs and demand elasticities.

We find a significant markup in the Hebron wholesale trade of apples and various significant temporal effects in pricing and demand. While in times of comprehensive closure, price and markups go down, demand also collapses and demand elasticity triples. At the 5% confidence level, there is no direct impact of the closure variable on demand or marginal costs. Marginal costs are found to be mainly impacted by the conflict in the short-term either by incidents of exceptionally many fatalities on the same day or in the last three days. However, demand is much more impacted by medium-term aspects of the conflict, e.g., it rises slightly and significantly if there was a calm-down of the political situation on a monthly basis. It also appears plausible that demand rises in periods of severe crisis because consumers might fear a deterioration of the situation in the near future why they tend immediately to store apples.

We find that the Israeli apples are significantly more demanded than the local Palestinian produce although their prices are on average also by more than 3 NIS/ kg higher while low quality varieties are significantly less demanded although cheaper. Israeli produce tends to be less perishable than the local produce hence to our understanding, it is more demanded during periods of markedly increased uncertainty due to higher conflict intensity. Therefore, there is no evidence for consumer animosity in this context. Although the Israeli apples are marketed in distinctive packages in Hebron market, our results show that Palestinian consumers do not hesitate to purchase them even though their prices are markedly higher. Moreover, we find that the variables indicating positive development (and their interactions) in the conflict have a dampening effect on demand and prices. This finding supports our argument. In times of lower intensity of the conflict, there is less uncertainty in regard the ability to perform trade therefore there is relatively lower urgency to sell, purchase and store fresh food. As more quality data will become available, it will be telling to explore whether the described trend is consistent with other fruits and vegetables traded in Hebron and with respect to their perishability level.

This analysis demonstrates how social science research can substantially profit from the data comprehensive gathering and reporting activities of human rights organizations whose data provide the fundament for quantitative analysis. A few valuable series of raw data allow constructing comprehensive sets of variables which make a multifaceted measurement of conflict intensity feasible. Consumers are found to react considerably more elastic during escalations of the conflict. However, there is barely evidence for medium- or long-term effects of conflict on demand which might suggest that the memory of consumers regarding their purchasing decisions is rather short. Demand increases substantially during phases of conflict escalation although single days of exceptionally high numbers of fatalities yield substantially negative demand shocks. Prices significantly rise during weekends and Ramadan, while demand only increases during weekends and the remaining Muslim holidays. This indicates some evidence for storage before/during holidays because apples are less

perishable than other fruits which might explain the positive demand effect of closures. We find some kind of adverse consumer animosity because Israeli apples much more demanded despite their higher prices. Calm periods are found to have slightly negative effects for prices and the demand of Israeli apples.

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