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The Department of Agricultural Economics and Management

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Movement Restrictions, Agricultural Trade and Price Transmission between Israel and the West Bank

by

Rico Ihle and Ofir D. Rubin

P.O. Box 12, Rehovot 76100

ת.ד. 12, רחובות 76100

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Rico Ihle
Chair of Agricultural Policy
Department of Agricultural Economics and Rural Development
Georg-August-Universität Göttingen
Germany
rihle@gwdg.de

and

Ofir D. Rubin
Department of Agricultural Economics and Management
The Hebrew University of Jerusalem
Israel
rubino@agri.huji.ac.il

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Abstract: Imposing military security measures as a consequence of violent conflict may lead to depressing economic effects for all parties involved. One implication is the limited ability to conduct trade, which in turn brings about welfare losses to the economic agents involved and may threat livelihoods and food security. This paper focuses on the consequences of the Israeli-Palestinian conflict, as a prominent example, on bilateral agricultural trade and price dynamics. For this purpose, we consider high-frequency wholesale price data and data on movement restrictions (complete closures) which were imposed by the Israeli Defense Forces in the West Bank between May 2007 and December 2008. In particular, we study the price dynamics of cucumbers and apples, two crops which play an important role for bilateral trade. The spatial and temporal price relationships are assessed using a cointegration framework. Specifically, we use a novel multivariate exogenous regime-switching vector error correction model and employ a recently developed extension of Johansen's cointegration estimation method. We find the wholesale markets of cucumbers and apples in Hebron and Tel Aviv to be integrated. For both products, the price differentials between both markets quickly adjust to short run deviations from the long-run price equilibria. The regime-dependent model suggests that the movement restrictions effectively cut off both markets from each other temporarily.

Keywords: Agricultural trade, cointegration, Israel, regime-dependent error correction, price transmission, Palestinian territories.

JEL: C32, Q11, Q13, F14, F15

* The authors are postdoctoral research associates at the Department of Agricultural Economics and Rural Development at the Georg-August-Universität Göttingen, and the Department of Agricultural Economics and Management at the Hebrew University of Jerusalem, respectively. Note: senior authorship not assigned

1. Introduction

A separation wall being built by the state of Israel divides Israeli residents and the Palestinians who live in the West Bank. This physical barrier separates two economies which are at very different stages of development. Nominal GDP per capita for the year 2010 in Israel was estimated at $28,000 while for the Palestinian territories (including Gaza) it was estimated at a stagnant level of around $4,000 between 1999 and 2008 (World Bank, 2008) . Agriculture is one of the main economic activities in the Palestinian territories. In 2010, agriculture accounted for 9.4% and 5.3% of the GDP in Gaza and the West Bank, respectively. The total number of workers in this sector reached 81,000 in 2010, which accounted for 8% and 13% of the total labor force in these regions. In Israel, only 2% of the GDP was attributed to agriculture and 1.2% of the total labor force was employed in the agricultural sector in 2010 (ICBS 2011, PCBS 2011).

The agro-climatic conditions in the Palestinian territories and Israel are relatively similar, but the characteristics of the agricultural sector in each economy are very different. First, there are differences in the supply of production factors. Palestinian agricultural labor is available and relatively inexpensive, while Israeli agriculture is capital intensive and suffers from a shortage of unskilled labor. Secondly, Israeli agriculture profits from developed research carried out by government institutes and universities. Third, Israel enjoys a good reputation among export markets for its high quality and phyto-sanitary standards. Conversely, export of agriculture products from the Palestinian territories to overseas markets is limited and conducted mainly through Israeli export companies. In fact, Israel and Jordan are the main importing countries of Palestinian agricultural products. Under these circumstances one could expect substantial welfare gains from specialization and trade for Israelis and the Palestinians. In practice, military security measures possibly suppress the full achievement of the economic potential of trade. The goal of this paper is to explore the linkage between agricultural markets in Israel and the West Bank under the presence of trade barriers. In particular, we study the implications of such policies in view of the economic wellbeing on both sides of the Israeli-Palestinian border.

2. Agricultural markets and bilateral trade

There are four main agricultural wholesale markets in Israel. Those are located in Haifa, Tel-Aviv (aka Tzrifin[1]), Rehovot and Jerusalem. The wholesale markets jointly account for about 50% of the fruit and vegetables marketed domestically. The remaining amount is supplied by smaller wholesale markets, where there are only a few traders in each. Other marketing channels include logistic centers established by the two largest Israeli supermarket chains. These centers purchase agricultural products directly from growers. Finally, a small amount is delivered directly from growers to retailers.

[1] The Tel Aviv wholesale market has been moved to Tzrifin in 2006.

Within the West Bank, the largest wholesale market is located in Hebron. Other markets are in Jenin, Tulkarem, Qalqelia, Nablus, Ramallah, East Jerusalem, Jericho and Bethlehem. Unfortunately, data on quantities and prices within these markers and other areas in the Palestinian territories is extremely scarce and difficult to obtain due to the geopolitical situation.

Trade between Israel and the West Bank takes place at the border crossings and is governed by the Israeli Civil Administration. In practice, agricultural products are unloaded from one track and loaded to another which then goes to the other side of the border, i.e. the so called Back-to-Back system. Also, at this point quantities are being recorded for data collection and samples are being used on the Israeli side for monitoring health regulations.

In this study we focus on fruit and vegetable crops. Due to sanitary restrictions, Israeli law bans the transfer of animals and animal products from the Palestinian territories to Israel, therefore we do not regard them here. More specifically, we focus on the linkage between the price behaviors of two significant traded products: cucumbers and apples. Israel is a net importer of cucumbers from the West Bank. In 2010, the imported amount of cucumbers for household consumption and processing was 18,778 and 12,859 tons, respectively. This amount jointly accounts for 50% of overall agricultural products transferred from the West Bank to Israel that year[2]. The main horticulture products transferred from Israel to the West Bank are fruits. The overall amount imported during 2010 was 15,885 tons, of which banana is the most important product accounting for 9,083 tons transferred. Second to that is apple with 3,794 tons. Since sufficient records of the daily prices for bananas in the West Bank are unavailable, the authors have chosen to focus on apples.

The period under investigation is post *Al-Aqsa Intifada* (a period of intensified Israeli-Palestinian violence), which can be characterized by a decrease in security measures and movement restrictions. Accordingly, it can be considered a relatively steady period in terms of trade. The situation of the trade volumes is depicted in Figure 1.

3. Data and descriptive statistics

Daily price data was obtained for the two products of the two largest wholesale markets of Israel and the West Bank. Prices from the Tel Aviv wholesale market, which are reported by the Israeli Ministry of Agriculture on a daily basis, are used. The recorded price is the mode of each daily sample, which includes a survey of several wholesale traders.

Data for the Hebron market were collected by the wholesale market administration and includes contracts with specified quantities and prices. The period sampled in Hebron is shorter than in Tel Aviv restricting our focus to May 2007 - Sep 2010.

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[2] Israeli Ministry of Agriculture and Rural Development.

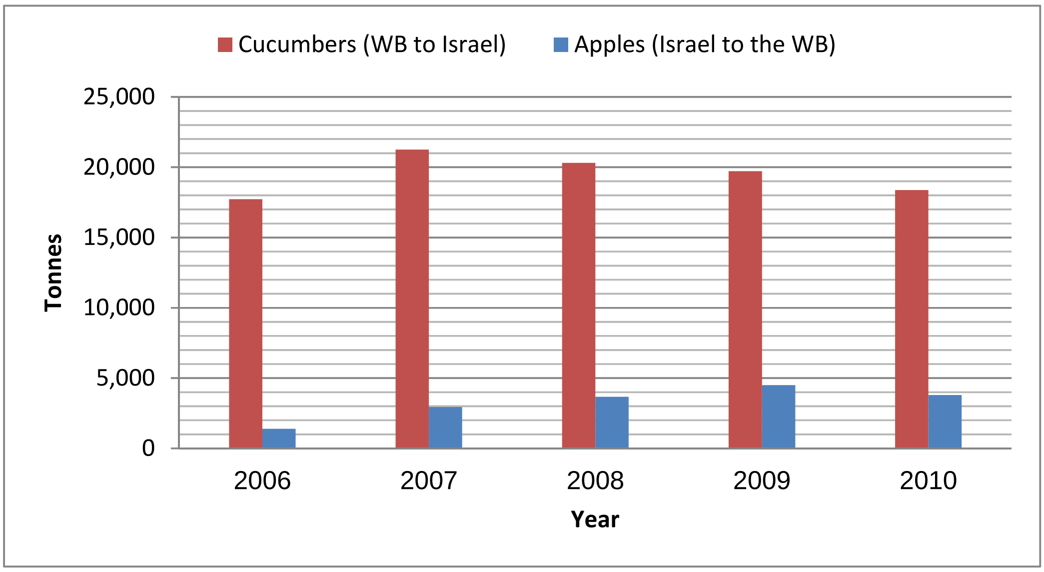

Figure 1: Trade between Israel and the WB (Source: Israeli Ministry of Agriculture and Rural Development)

In Israel, wholesale market trading activities take place during weekdays, which are Sunday – Thursday. Limited trade occurs on Friday mornings as well, while on Saturdays the wholesale markets are closed. In the West Bank markets operate regularly from Saturday to Thursday and trade does not take place on Fridays. Friday prices were not recorded by the Israeli Ministry of Agriculture at all and the Hebron data contains a large number of weekend days without reported trade as well. Since the markets operate only partially and the quantity traded is not significant during weekends, it is appropriate to omit Fridays and Saturdays from our analysis. Other days with no recorded prices in our dataset are national holidays in Israel and the West Bank since trade does not occur then either. Missing values of daily prices (Sunday to Thursday) within this period have been imputed utilizing routines of the R package Amelia II (Honaker et al., 2007) as proposed by King et al. (2001). We adapt these and perform 1000 imputations, for which the mode is estimated as the final imputed value using the method of Parzen (1962) implemented in Poncet (2010).The data is reduced further due to the limited availability of data on daily movement restrictions between Israel and the West Bank. In practice, the Israeli Defense Forces use various physical measures for security purposes. Those include checkpoints, roadblocks, gates and other fixed or temporary measures. With regard to agricultural trade it is almost impossible to determine the impact of each of these on the ability to perform trade. Therefore, in the analysis we only consider data of complete closures, since only at that time can we be sure that bilateral trade does not take place.

Daily data on complete closures is made available by B'tselem, an Israeli organization for human rights. The available data, in accordance with the price dataset, is for the period between May 2007 and December 2008 (Figure 2). During this period we observe 69 days of closure, of which 45 occur on weekdays (i.e. days of trade). Most days of closure take place on Israeli holidays in the West Bank, namely Jewish high holidays and the

Israeli Independence Day. In the respected period we observe 13 days of holidays, of which 11 are weekdays.

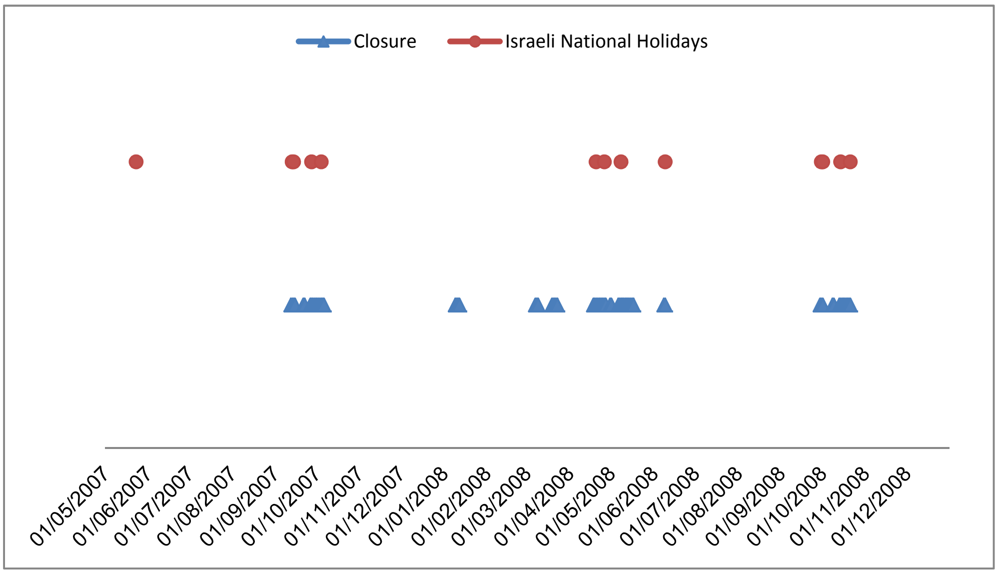

Figure 2: Closures and Israeli high holidays (Source: B'tselem (2011) and authors)

Distributional properties of prices are portrayed in Tables 1 and 2. While only one variety of cucumber is marketed in this region, apple data covers a mixture of varieties which are traded (and sampled) over the year. Since the variety is large and not all apple varieties were sampled every day, we average daily prices of apples and then pool all average prices together in each market. This seems reasonable for several reasons. First, we suppose that consumers' marginal rates of substitutions between different varieties of apples are large. Second, the narrow geographical scope of the region makes it sensible to assume that the same varieties are sold in Tel-Aviv and Hebron at the same time. Therefore, comparing the daily average prices of apples in these markets is appropriate. Lastly, when examining the dataset, we observe that although price differences between some varieties of apples may be statistically significant, the magnitude is negligible.

Table 1: Descriptive statistics of cucumber prices

Wholesale market	Hebron		Tel Aviv	
	Observed	inc. imputed values	Observed	inc. imputed values
Number of obs.	427	437	406	437
Mean	2.28	2.31	2.97	2.99
Median	1.95	1.96	2.50	2.50
Stand.dev.	1.28	1.29	1.68	1.65
Min	0.68	0.68	0.70	0.70

Max	7.81	7.81	9.00	9.00

Source: Authors' calculations.

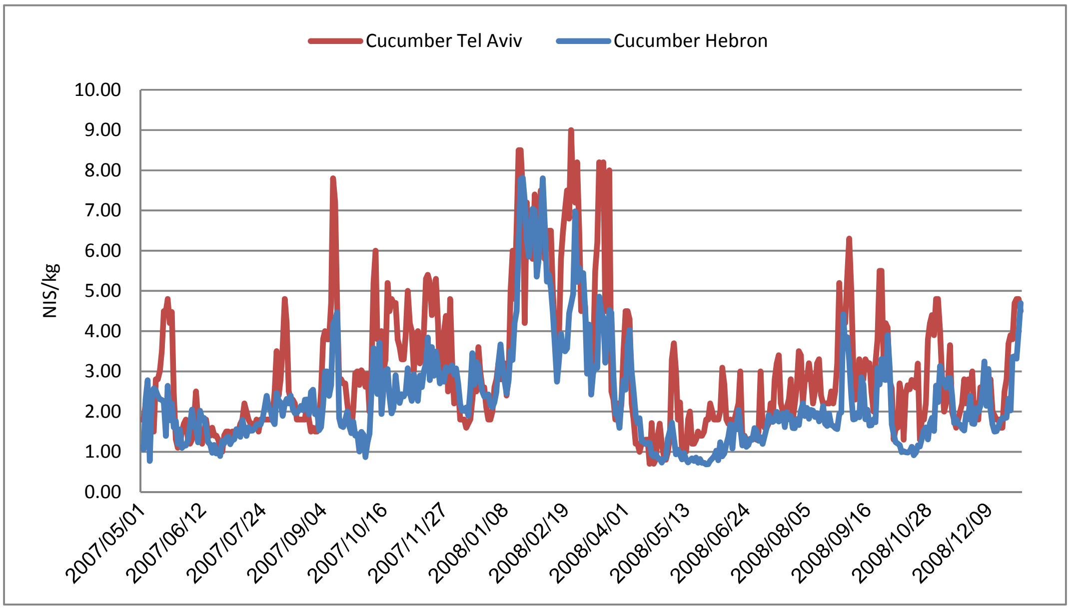

Figure 3:Cucumber prices (Source: Israeli Ministry of Agriculture and Hebron wholesale market)

The Figures 3 and 4 and Tables 1 and 2 suggest that there are spatial differences of the means for the two products. For cucumbers, the daily mean difference is 0.64 NIS/kg with a standard error of 0.05. The difference in apple prices is much more substantial, 3.36 NIS/kg (with a standard error of 0.04). This stands for a 114% average gap between the prices of apples in the West Bank and Israel. Price differences for cucumbers and apples can be identified clearly in Figures 3 and 4, respectively. Price volatilities in Hebron and Tel Aviv are almost identical for cucumbers with a variation coefficient of size at 0.55~0.56. Nevertheless, the coefficient of the daily difference of cucumbers is much higher (1.48). For apples, this coefficient diverges greatly. Hebron prices are much more volatile than the prices in Tel Aviv. We estimate coefficients of 0.24 in Hebron and 0.09 in Tel Aviv. The daily difference has a variation coefficient for size at 0.22.

Table 2: Descriptive statistics of apple prices

Wholesale market	Hebron		Tel Aviv	
	Observed	inc. imputed values	Observed	inc. imputed values
Number of obs.	374	437	402	437
Mean	2.95	2.97	6.33	6.34
Median	2.87	2.91	6.29	6.32
Stand.dev.	0.74	0.72	0.57	0.56
Min	1.00	1.00	4.61	4.61
Max	5.12	5.12	7.76	7.76

Source: Authors' calculations.

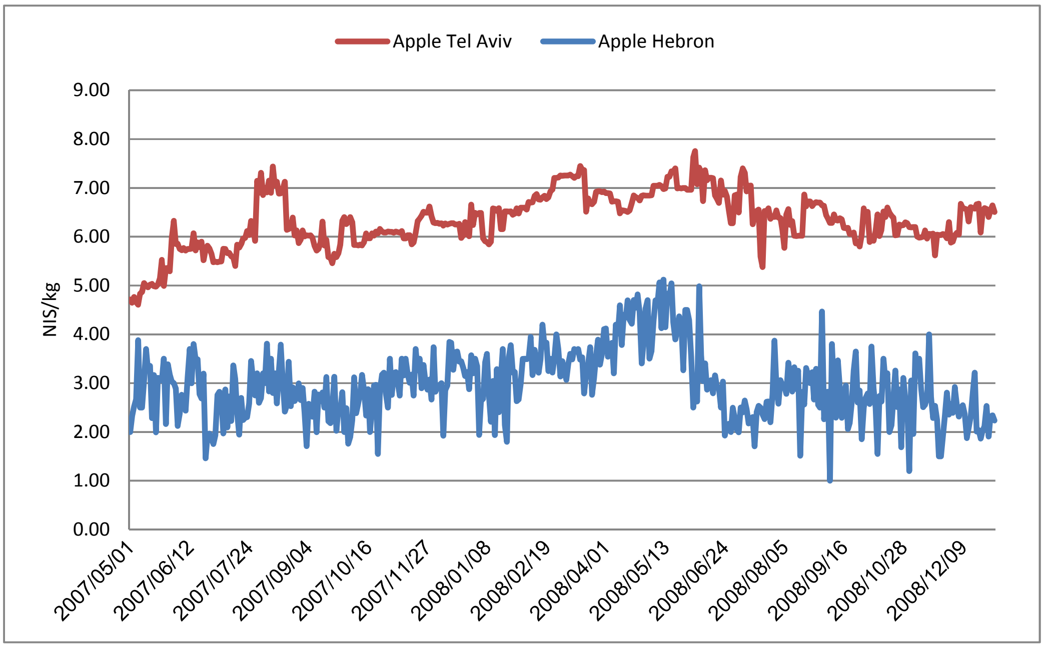

Figure 4: Apple prices (Source: Israeli Ministry of Agriculture, Hebron wholesale market)

4. The Econometric Model

We understand market integration as a dichotomous long run measure. Markets are seen as integrated if the "set of locations share both the same traded commodity and the same long run information" (Gonzalez-Rivera and Helfand, 2001: 576), that is, if v-1 long-run price equilibria among v locations and trade flows between the considered locations exist. We postulate that this is a necessary condition for price transmission. Price transmission, in contrast, is a gradual measure consisting of both a long run and a short run dimension.

We assess the question of price interdependencies empirically using the cointegration framework. In particular, we use a vector error correction model (VECM) for examining the spatial and temporal relationships of each of the price series and between them. The basic model is formulated as:

$$\Delta p_t = \alpha\beta' p_{t-1} + \sum_{i=1}^{k}\Gamma_i \Delta p_{t-i} + \varepsilon_t = \alpha\, eqe_{t-1} + \sum_{i=1}^{k}\Gamma_i \Delta p_{t-i} + \varepsilon_t = \Pi p_{t-1} + \sum_{i=1}^{k}\Gamma_i \Delta p_{t-i} + \varepsilon_t . \quad (1)$$

The vector $p_t = \{p_t^1, \ldots, p_t^v\}'$ is a vector of the price series of the *v* locations and Δ denotes the first difference operator, i.e., $\Delta p_t = p_t - p_{t-1}$. The parameters α and β quantify the partial impact of the past price levels on the current prices changes where β provides an estimate of the long run price equilibria so that $\beta' p_{t-1} = eqe_{t-1}$ contains the deviations from the *r* equilibrium relationships (*equilibrium errors*)[3]. Hence, the $(v \times r)$ *loading matrix* α can be interpreted as a measurement of the partial impact of the past equilibrium errors on the current price movement Δp_t. The $(v \times kv)$ matrix Γ contains the other postulated determinant of the current price movement, that is, the partial impact of past price movements (*short-run parameters*). Finally, ε_t denotes Gaussian white noise errors and *k* denotes the lag length of the regarded periods of past price changes.

However, the given context of two clearly different trade frameworks, that is, whether trade between the West Bank and Israel is or is not subject to closures of the commercial terminals, points to the potential existence of more than one dynamic price relationship and, hence, puts doubt on the assumption of constant model parameters. Ihle (2010) provides an extension of alternative modelling approaches which relax the assumption of parameter constancy and model the evolvement of model parameters over time with differing stochastic processes. Among other approaches, Ihle and Amikuzuno (2010) suggest a novel estimation method for models which are characterized by regime-dependent parameter switching between constant parameter values in regimes exogenously determined based on the context of the market considered.

The given context also strongly suggests two fundamentally differing market regimes: the regime of undisturbed trade between the West Bank and Israel (*noc*) and, secondly, the regime of terminal closures (*c*). Hence, we use an exogenous regime-switching framework for modelling the disequilibrium response of cucumber and apple prices. Hence, we estimate the following model with the extension of Johansen's estimation method (Johansen, 1988, 1991) as suggested by Ihle and Amikuzuno (2010). This approach has an advantage since it uses a modified version of Johansen's reduced rank regression which was shown by Gonzalo (1994) to possess superior statistical properties in comparison to most competing estimation approaches.

The model for the two bivariate vectors of cucumber and apple prices can be formulated as:

[3] Alternatively, these can be interpreted as the common factors which drive the system prices considered.

$$\Delta p_t = \begin{pmatrix}\alpha^{noc} & \alpha^{c}\end{pmatrix}\begin{pmatrix} eqe_{t-1}^{noc} \\ eqe_{t-1}^{c}\end{pmatrix} + \sum_{i=1}^{k}\Gamma_i \Delta p_{t-i} + \varepsilon_t . = \alpha^{noc} eqe_{t-1}^{noc} + \alpha^{c} eqe_{t-1}^{c} + \sum_{i=1}^{k}\Gamma_i \Delta p_{t-i} + \varepsilon_t . (2)$$

The regime-dependent equilibrium errors eqe_t^{noc} and eqe_t^{c} are obtained from the data on the closure incidences as $eqe_t^{c} = \beta' p_t I_t^{c}$ and $eqe_t^{noc} = \beta' p_t (1 - I_t^{c})$ where I_t^{c} is an indicator variable which takes one if there is a closure implemented in period *t* and zero otherwise.

5. Estimation Results

5.1 Time Series Properties

We first assess the time series properties of the data by testing for unit roots and cointegration. Tables 3 and 4 contain the results of the unit root tests for the levels and the first differences of the price series, respectively. We employ a number of tests in order to obtain comprehensive evidence of the existence of unit roots. The first two tests have the null hypothesis of a unit root while the third one assesses the hypothesis of stationarity. The Augmented Dickey-Fuller (ADF, Dickey and Fuller, 1979) test clearly indicates that all series, except for apples in Tel Aviv, possess a unit root at the 5 percent level of significance. The MZ_{α}^{GLS} statistic developed by Ng and Perron (2001) suggests unit roots for all series except cucumbers in Tel Aviv, although the test statistic exceeds the critical values only slightly. However, the test yields counterintuitive results for the apple series regarding first differences[4].

Table 3: Results of the unit root tests of the price levels

Product	Location	ADF		MZ_{α}^{GLS}		KPSS	
		lags[a]	statistic[b]	k[c]	statistic[d]	lags	statistic[e]
Apple	Hebron	7	-2.331	7	-3.414	11	0.471*
	Tel Aviv	2	-3.874*	12	-0.761	11	1.155*
Cucumber	Hebron	8	-2.550	10	-6.391	11	0.345
	Tel Aviv	9	-2.857	9	-9.296*	11	0.270

Source: Authors' calculations.

Notes:

* Significance at the 5 percent level.

[a] Lag length selection according to the Akaike Information Criterion (AIC) and the Hannan-Quinn Model Selection Criterion.

[b] The critical value at the 5 percent significance level is -2.86.

[c] Selection according to the Modified Akaike Information Criterion (MAIC).

[d] The critical value at the 5 percent significance level is -8.100.

[e] The critical value at the 5 percent significance level is 0.463.

[4] We report this test statistic here only. This also holds for the other statistics suggested by Ng and Perron (2001), as their results are not entirely conclusive and contradict each other in some cases.

The KPSS test (Kwiatkowski et al., 1992) does not yield unambiguous results. Although the test statistics for the first difference series strongly indicate stationarity, the statistics for the level data are much larger but not significant for the cucumber series. However, regarding the Tel Aviv apple series, nonstationarity is strongly pointed to while the ADF test suggests the opposite. Hence, the unit root tests yield ambiguous results for the four prices. Hence, we adopt the recommendation of Juselius (2008: 19) who states: "There are many arguments in favor of considering a unit root (a stochastic trend) as a convenient econometric approximation rather than a deep structural parameter" and, due to the partly contradicting evidence, regard it as a unit root series[5].

Table 4: Results of the unit root tests of the first differenced prices

Product	Location	ADF		MZ_{α}^{GLS}		KPSS	
		lags[a]	statistic[b]	k[c]	statistic[d]	lags	statistic[e]
Apple	Hebron	6	-12.601*	16	-0.182	11	0.057
	Tel Aviv	1	-19.121*	16	-1.283	11	0.118
Cucumber	Hebron	7	-9.889*	1	-209.746*	11	0.054
	Tel Aviv	8	-10.852*	0	-211.074*	11	0.029

Source: Authors' calculations.
Notes:
* Significance at the 5 percent level.
[a] Lag length selection according to the Hannan-Quinn Model Selection Criterion.
[b] The critical value at the 5 percent significance level is -1.94.
[c] Selection according to the Modified Akaike Information Criterion (MAIC).
[d] The critical value at the 5 percent significance level is -8.100.
[e] The critical value at the 5 pe cent significance level is 0.463.

Subsequently, we carry out two cointegration tests in order to test whether each of the market pairs share a long run price equilibrium. Table 5 displays the test results. The Saikkonen-Lütkepohl test (Saikkonen and Lütkepohl, 2000a, 2000b) has the advantage that it is, opposite to the Johansen trace test (Johansen, 1991), robust against several parameter instability issues. The results of the two cointegration tests are more consistent. Both tests clearly reject a cointegration rank of zero for three of the four cases at the 5 percent level of significance. The Johansen trace test statistic is just slightly below the critical value for apples only. But since the Saikkonnen-Lütkepohl test is unambiguous in its decision, we conclude for both market pairs that they are cointegrated; that is, that the prices of apples and cucumbers in Hebron and Tel Aviv share a stable long run equilibrium, respectively. Furthermore, since they are also connected by trade flows, we conclude that the two cucumber and apple markets are integrated.

[5] This strategy is also plausible due to the consideration that there are many different unit root tests in existence because of the fact that none of them are free from (statistical) problems when applied to arbitrary time series. This fact becomes very clear when looking at the differing test results in Tables 3 and 4.

Table 5: Results of the cointegration tests

Product	Market pair	Johansen trace[a]		Saikkonen-Lütkepohl[b]	
		lags[c]	statistics	lags[c]	statistics
Apple	Hebron – Tel Aviv	8	20.03/ 5.32	4	21.67/ 0.47
Cucumber	Hebron – Tel Aviv	9	32.29/ 5.71	9	19.60/ 2.31

Source: Authors' calculations.

Notes:

[a] The critical values at the 5 percent significance level for a cointegration rank of zero and one are 20.16 and 9.14, respectively.

[b] The critical values at the 5 percent significance level for a cointegration rank of zero and one are 12.26 and 4.13, respectively.

[c] Lag length selection according to the AIC.

5.2 Model Building

We first estimate linear VECMs in order to impose some over-identifying restrictions in order to test whether the model adequately describes the data. We estimate the model for untransformed price series which implies additive transaction costs, that is, costs for performing trade are postulated to be independent from the price levels, which is a reasonable assumption in the given context.

Model selection criteria yield differing recommendations regarding the optimal lag length k of model (1) (Table 6). Although all lag length choices yield models with more or less problems in the diagnostic residuals tests, we opt for the largest suggested values of k since it removes autocorrelation from the residuals. Hence, for apples we employ a model of seven lags and for cucumbers a model of ten lags.

Table 6: Optimal lag length choices of model selection criteria

Product	AIC	Hannan-Quinn Criterion	Schwarz Criterion
Apple	7	3	1
Cucumber	10	1	0

Source: Authors' calculations.

Tables 7 and 8 display the results of these linear models. Table 7 illustrates that the long run price equilibrium may be restricted to the simple price difference. Hence, the parameter β^0 quantifies the average price differential between the prices of either commodity in the Hebron and Tel Aviv wholesale markets. The average prices of apples and cucumbers at the Hebron market are the average margins to the price level at Tel Aviv, 30 percent and 117 percent, respectively.

Table 7: Estimates of the cointegration relationships

	Product	β^0	β^H	β^{TA}	p-value of Wald test
Unrestricted	Apple	7.579	1	-1.639	-
	Cucumber	-12.052	1	-0.905	-
Restricted	Apple	3.475	1	-1	0.089
	Cucumber	0.677	1	-1	0.206

Source: Authors' calculations.

Note: β^0, β^H and β^{TA} are the constant and the coefficients of the Hebron and the Tel Aviv prices, respectively.

Table 8 indicates that both prices significantly respond to deviations from the average margin. The adjustment reactions are significant at the 5 percent level. For apples, it is the Hebron price which responds stronger, while for cucumbers it is the Tel Aviv price. Moreover, the error correction rates are extraordinarily strong in magnitude ranging to almost one quarter of the equilibrium error. Such high rates seem very plausible since the markets are most likely the two largest wholesale markets in the region, and are also located near to each other.

Table 8: Estimates of the adjustment speeds

	Product	α^H	α^{TA}
Unrestricted	Apple	-0.031 (-0.927)	0.054 (3.751)
	Cucumber	-0.084 (-1.834)	0.280 (3.744)
Restricted	Apple	-0.117 (-2.277)	0.045 (2.033)
	Cucumber	-0.126 (-2.602)	0.230 (2.885)

Source: Authors' calculations.
Notes: t-values in parentheses.

5.3 Switching Model Estimates

However, the question of to what magnitude the movement restrictions imposed due to security reasons exerted a significant impact on the short run adjustments of prices. For assessing this inquiry, we estimate the regime-dependent model (2). Since we did not obtain evidence against imposing the over-identifying restrictions mentioned in Table 7, we also estimate the regime-dependent model with this restriction. Table 9 shows the regime-dependent estimates of the adjustment speeds α.

Both commodities regarded show the same pattern. In the regime of imposed closures, we find no significant error correction. This result implies that prices are not cointegrated in this regime. Hence, the closures are found to have had a maximum impact on price dynamics because they completely cut off the Hebron and the Tel Aviv wholesale markets from each other. By restricting the information set to the periods without closures, it is only the Tel Aviv prices which show significant responses to the disequilibria. Hebron prices, although numerically to the same magnitude, are not significant at the 5 per cent level.

Table 9: Estimates of the regime-dependent loading parameters of the restricted model

Regime	Product	α^{H}	α^{TA}
No closure	Apple	0.068 (1.165)	0.062 (2.620)
	Cucumber	0.335 (1.332)	0.266 (3.405)
Closure	Apple	0.007 (0.053)	-0.096 (-1.720)
	Cucumber	0.040 (0.267)	-0.061 (-1.289)

Source: Authors' calculations.
Notes: t-values in parentheses.

6. Discussion

In politically unstable environments subject to violent conflict, actions of interest groups often determine the political setting and shape the conditions of food production and trade. These actions do in contrast to explicit agricultural and economic policies not aim at peacefully influencing the public decision making process, but follow often the logic of violence. Consequently, not only the welfare of market participants, but also existential issues of food security and their economic livelihoods can be indirectly affected. Between Israel and the Palestinian territories, agricultural trade is one area of fundamental economic importance in terms of both the livelihoods and food security of a large part of the population.

This analysis focuses on the implications of security policies put forward by Israel on the ability of both sides in this conflict to benefit from bilateral trade. Thus, it also provides indications on the intermediate consequences and the welfare implications of the conflict for market participants (producers, traders, consumers). To our knowledge, this study is the first to use quantitative approach to do so. It contributes to the literature by focusing on the economic side effects of security policies on agriculture and trade.

In this context, we study price interdependencies of cucumber and apple prices between the Hebron and Tel Aviv wholesale markets, as both commodities belong to the most important traded goods between the West Bank and Israel. We also regard a time series of comprehensive closures enforced by the Israeli Defense Forces on the West Bank. We examine daily average prices of both commodities between May 2007 and December 2008 by using an exogenous switching vector error correction model defined by the incidences of the closures. For the model estimation we use a recently suggested adaptation of Johansen's cointegration estimation approach.

While prices of cucumbers in Israel are slightly higher than in the West Bank, differences in apple prices are momentous. One reason for the significant gap may be due to quality differences between markets. Another reason might be linked to a non-competitive behavior. Israeli marketers may carry out price discrimination by exporting apples to the

West Bank and, by doing so, cutting off local supply, in turn driving up prices in Israel.. Interestingly, we show that the question of whether markets are competitive or not does not hinder our ability to prove strong price dynamics linkages between these markets.

We employ three unit root tests which approach the issue of unit root testing from various perspectives. We find mixed evidence on the order of integration of the time series. However, since the series are characterized by short periods of extreme price spikes, we suspect that the unit root test may have difficulties with this aspect of the price series. We find the prices to be cointegrated. Based on the suggested definition of market integration, we hence identify the regarded wholesale markets for both commodities as integrated because they share the same long run price information (cointegration) and also the same commodity (vivid trade flows).

We first estimate linear vector error correction models. The cointegration relationships for both commodities can be restricted to be the price differential between both markets. For apples, a commodity which is mainly shipped from Israel to the West Bank, it is the Hebron price which responds more sensitively to price disequilibria. For cucumbers which is the main product shipped from the West Bank to Israel, Tel Aviv prices are found to react more pronounced to price shocks.

The results of the regime-dependent model suggest that the prices of the two wholesale markets are not integrated temporarily during the occurrence of comprehensive closures. Hence, this security measure is found to have the maximum impact possible on the wholesale markets for the commodities looked at which is plausible since the closures significantly reduce or even completely cut off trade on a very short term scale. The welfare implications are complex since the closures are likely to create temporary situations of commodity glut or shortages depending on the wholesale market and the direction of trade. Producers, traders and consumers are correspondingly affected.

This analysis is preliminary and can be extended into several directions. First, it would be desirable to regard more commodities and investigate more than two markets in the network of wholesale markets. However, this can be very challenging due to data availability and data completeness. In the given context, data completeness plays a major role in determining not only the extent of the research concerning the period, markets and products covered, however, in addition, the reliability of the research also comes into question since results become increasingly vague with a growing number of imputed data points. Furthermore, only one variety of some fruits and vegetables exist. However, commodities characterized by high quality and/ or variety differences may pose the question of adequate price aggregation.

Regarding further research, it might be useful to increase the information set considered, for example, by regarding the role and the impact of internal movement restrictions, i.e., closures inside the West Bank, other than the comprehensive closures since they also affect consumer welfare within the West Bank. Naturally, movement restrictions within the West Bank impact trade between the West Bank and Israel as well. In this context, a higher number of observations of comprehensive closures might already be of interest; that is, particularly an extension of the period studied to the time briefly after the outbreak of the Al-Aqsa intifada might yield more robust estimation results for the model parameters of the closure regime.

Second, several extensions and improvements of the modeling framework are also desirable. A basic issue in this context is to obtain consistent evidence of the order of integration of the time series. In addition, regime-dependent cointegration tests might offer an interesting framework for a more comprehensive examination of the time series. The regime-dependence might be extended to parameters other than the loading coefficients. Besides the possibility of testing parameter restrictions, a stochastic modeling of the closure time series might also prove useful for finding worthy information. Certainly, an extended dynamic analysis using impulse response functions or similar measures might contribute to the evidence for the dissemination of price shocks within and across regimes. The identification of common factors and the decomposition of the shocks and the price series into permanent and transitory components might offer detailed information on the market structure and price causalities. Lastly, a more extensive analysis of the redistribution of welfare in these markets due to the closures identified by price dynamics might be of great interest.

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