Estimating the Price Impact of a Development Project on a Regional Market*

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Introduction

In an attempt to reduce regional disparities in income and employment, it is common policy in Canada for both federal and provincial governments to offer private firms incentives (e.g., location grants, subsidies, tax advantages) to induce investments in less developed regions. It is commonly accepted that such publicly assisted investment projects will increase regional employment and income levels. These projects, however, are not independent of the market environment in which investment has occurred, and net regional benefits will frequently depend, among other things, on the relative size of the project compared to existing production facilities and on the characteristics of market demand. Especially in the case of large-scale enterprises in small regional markets, output price may be endogenous, and such developments may have negative consequences for exisiting operations. An understanding of the economic environment and market impact of such publicly sponsored projects is important for *ex-ante* assesments of the economic benefits resulting from the investment. Nevertheless, in the Canadian experience, it is not difficult to find regional development projects that were initiated without regard to these basic economic tenets. The chairman of the Economic Council of

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Canada, Judith Maxwell, has cited "faulty market studies" as one cause of the low success record of location grants (Maxwell 1988).

The purpose of this paper is to undertake a market demand analysis useful in assessing the economic impact of a large-scale publicly assisted investment project in a small regional market. Such an analysis can be used to delineate regional market linkages and to characterize price determination, as well as to provide information on the impact of a development project on output price, on existing operations, and on potential net regional benefits. If output price is exogenous to the regional market, a development project will not affect the price level or impact negatively on existing firms in the region. On the other hand, an endogenous price implies that increased supplies will clear the market only at a lower price. The important question involves the extent of the price drop required to clear the market. This will depend on how sensitive price is to changes in consumer purchases, on the volume of new supplies entering the market, and on how rapidly market demand is increasing. Even with price endogenous, a rapidly increasing demand will allow new supplies to enter the market with minimal price impact on existing firms and ensure good growth potential for existing firms as well as for the government-supported project. Our objective is to show that with some basic information on how markets work and on the characteristics of market demand, public agencies can make better informed decisions regarding the benefits and costs of investment in regional development projects.

The empirical analysis will examine the greenhouse vegetable complex recently developed in Newfoundland.[1] This project was undertaken and has been sustained with substantial public assistance. Because of its large industrial scale, the potential impact on the existing greenhouse vegetable markets in the Maritime Provinces is significant. Moreover, the net regional benefits resulting from the project are not clear and will depend, among other things, on the extent of the price drop resulting from increased supplies and on the tradeoff between increased employment and income levels in Newfoundland compared with the decreased employment and income levels in other sectors of the regional market.

[1]Large-scale greenhouse units have an apparent appeal to agencies promoting regional development. The attractive features of greenhouse production may include: i) the traditional labour intensiveness of production; ii) the minimum natural resource requirements; iii) the effectiveness of capital subsidies for inducing such investment; iv) the presence and observed viability of small scale production in most regions; v) the import replacement and food self-sufficiency aspects of these developments; and, vi) the productivity claims of promoters with new technology/productive systems.

In the next section, we briefly survey greenhouse vegetable markets in Canada, with particular emphasis on product flows and price determination, in order to define the relevant market for greenhouse vegetables. Following this, a transformed variables model of market demand is specified and estimated using monthly data for the 1982-86 period for the Eastern Canadian greenhouse cucumber and tomato markets. This analysis provides summary statistics that characterize demand conditions in these markets and that facilitate assessment of the price impact of the Newfoundland project.

The Market for Greenhouse Vegetables

Greenhouse vegetable production in Canada is a significant agricultural sector. In 1986, 430 operations with a combined production area of 51 million square feet reported product sales totalling $55 million, principally from the sale of tomatoes (20,000 tonnes) and cucumbers (25,000 tonnes). In the last decade, the introduction of hydroponics, new varieties of cucumbers, and temperature tolerant tomatoes has resulted in lower costs and increased productivity. Heating costs are the major factor influencing the cost and location of production.

Ontario is the principal greenhouse production region in Canada, accounting for 65 percent of total Canadian tomato production and 68 percent of total cucumber production. A survey of production figures by province for greenhouse cucumbers and tomatoes for 1986 is reported in Table 1.

Table 1

GREENHOUSE CUCUMBER AND TOMATO PRODUCTION BY PROVINCE, 1986

	Reported Production* (MT)	
	Cucumber	Tomato
Ontario	18,068	14,818
British Columbia	3,677	5,675
Alberta	3,493	466
Quebec	946	1,111
N.S.-N.B.-P.E.I.-Nfld.	42	568
Man.-Sask.	7	29
Canada	26,633	22,667

* Statistics Canada, *Greenhouse Industry 1985* and 1986, Cat. No. 22-202, Annual.

The cost of producing greenhouse vegetables is higher than for competing field products. Greenhouse tomatoes and cucumbers, however, have distinct quality characteristics and normally return higher prices. The quality advantage of these products is derived from freshness (they are grown closer to markets and are picked ripe) and from the highly controlled conditions under which they are produced. In the case of the distinctive long English or "seedless" cucumbers, these can only be grown in controlled environments.[2] While there is some production in all months of the year, almost two-thirds of cucumbers and three-quarters of tomatoes are marketed in the April to July period. Production is minimal in the December to February period and very light in the months of November and March.[3]

The harvest season for local field cucumbers and tomatoes has a substantial impact upon the market for greenhouse vegetables. Local field vegetables are picked ripe and have high quality characteristics similar to the greenhouse product yet sell for significantly lower prices. Consequently, production of garden tomatoes and cucumbers is a major element reducing the demand for greenhouse products, especially during the months of August and September. The impact of local vegetable production on the demand for greenhouse products will be accounted for in the econometric model.

Outside the local field vegetable season, the major competitive product for greenhouse production is field-grown imports, which account for a large proportion of total supplies within the domestic greenhouse vegetable marketing season (Anderson 1985). In 1986, 147,000 tonnes of tomatoes and 40,000 tonnes of cucumbers were imported from the U.S. and Mexico (Statistics Canada).

Some imports of greenhouse vegetables occur in the off-season, principally from Europe and the U.S., but the volume involved is small. Reported unloads of domestic and imported greenhouse and field tomatoes and cucumbers are shown in Table 2 for all of 1986 and for the April-July sub-period. Table 2 indicates that for all of 1986 greenhouse production accounted for approximately 12 percent of total tomato unloads and 32 percent of total cucumber unloads. However,

[2]Smith (1986) conducted consumer test panels to evaluate the acceptability of greenhouse compared with imported field tomatoes and reported that greenhouse tomatoes received significantly higher consumer evaluations for colour, size, firmness, texture, flavour and general acceptability.

[3]See Inmarint International Marketing and Investment Ltd. "Report on the Economics of the Canadian Greenhouse Industry", prepared for Agriculture Canada, Ottawa, April 1983; and Arcus Consulting Limited and Inmarint International Marketing and Investment Ltd, "An Analysis of the Medium and Long Term Markets for the Canadian Greenhouse Vegetable Industry", prepared for Agriculture Canada, February, 1984.

for the April to July sub-period the corresponding numbers increased to 21 percent for greenhouse tomatoes and 47 percent for greenhouse cucumbers.

In undertaking a demand analysis, the first task is to define the relevant market boundaries. We do this for greenhouse tomatoes and cucumbers by examining product shipments from one region to another, and define a market according to a geographic region within which normal product shipments occur.

Table 2

REPORTED UNLOADS OF DOMESTIC AND IMPORTED GREENHOUSE AND FIELD TOMATOES AND CUCUMBERS AT TWELVE CANADIAN MARKETS, 1986

	Tomatoes		Cucumbers	
	MT	%	MT	%
		1986 Annual		
Domestic Product				
Greenhouse	17,086	12.1	18,814	31.5
Field	6,022	4.3	10,448	17.5
Imported Product				
Greenhouse	2,636	1.9	1,401	2.3
Field	115,116	81.7	29,064	48.7
Total	140,860	100.0	59,727	100.0
		April-July Period		
Domestic Product				
Greenhouse	12,694	21.3	11,402	46.9
Field	2,664	4.5	1,834	7.5
Imported Product				
Greenhouse	167	0.3	64	0.3
Field	44,145	74.0	11,029	45.3
Total	59,670	100.0	24,329	100.0

Source: Agriculture Canada, *Annual Unload Report Fresh Fruit and Vegetables, 1986.*

Following this definition, Canadian greenhouse vegetable production can be defined on an east/west basis, with B.C. and Alberta the major suppliers in the west and Ontario the major supplier in the east. This is illustrated in Table 3, which shows product shipments of tomatoes and cucumbers to 12 Canadian cities from province of origin. Shipments to Western Canadian cities originate primarily from production points in the western provinces, although some small-volume

Table 3

REPORTED UNLOADS OF GREENHOUSE TOMATOES AND CUCUMBERS
IN TWELVE CANADIAN CITIES BY PLACE OF ORIGIN, 1986
('000 lbs)

City	Tomatoes								Cucumbers							
	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Halifax	19	-	4	7	-	-	-	-	57	-	19	131	-	-	-	-
Saint John	17	12	-	8	-	-	-	-	20	5	2	31	-	-	-	-
Quebec City	-	-	27	1,470	0	0	0	111	-	-	13	488	-	-	-	11
Montreal	-	-	442	5,711	-	-	-	93	-	-	637	2,968	-	-	30	25
Ottawa	-	-	-	678	-	-	-	-	-	-	5	1,228	-	-	2	-
Toronto	-	-	-	2,203	-	-	-	-	-	-	-	5,345	-	-	-	-
Winnipeg	-	-	-	221	-	-	5	90	-	-	-	471	12	4	98	253
Regina	-	-	-	-	-	18	-	58	-	-	-	41	-	26	322	-
Saskatoon	-	-	-	9	-	15	-	83	-	-	-	68	-	24	533	29
Edmonton	-	-	-	49	-	-	132	528	-	-	-	22	-	-	1,284	28
Calgary	-	-	-	35	-	-	329	726	-	-	-	-	-	-	1,218	-
Vancouver	-	-	-	-	-	-	-	3,987	-	-	-	17	-	-	5	3,331
Total unloads	36	12	473	10,390	0	33	466	5,675	77	5	677	10,817	12	54	3,493	3,677

Source: Agriculture Canada, *Annual Unload Report, Fresh Fruits and Vegetables*, 1986.

shipments do originate from Ontario. On the other hand, the eastern Canadian market is dominated by Ontario, which ships product to all major points in Eastern Canada. In addition, greenhouse prices in this market tend to increase with distance away from this production source.[4] In large part, the separation of markets is maintained by high transportation costs and increased product spoilage due to long-distance shipping.

Product price differences across Canada reflect provincial production levels and regional linkages embodied by trade patterns. The price/disappearance relationships for greenhouse cucumbers and tomatoes are shown in Figure 1 and Figure 2 respectively. In the west, for both greenhouse cucumbers and tomatoes, price tends to increase and disappearance levels decrease with distance away from B.C. In the east, for greenhouse cucumbers, per capita disappearance varies, as would be expected, with comparative price levels, with price increasing and per capita disappearance levels decreasing with distance from the Ontario production region. The price/disappearance relationship for eastern greenhouse tomatoes is also as expected, except for the Quebec region, which represents an anomaly with higher prices and

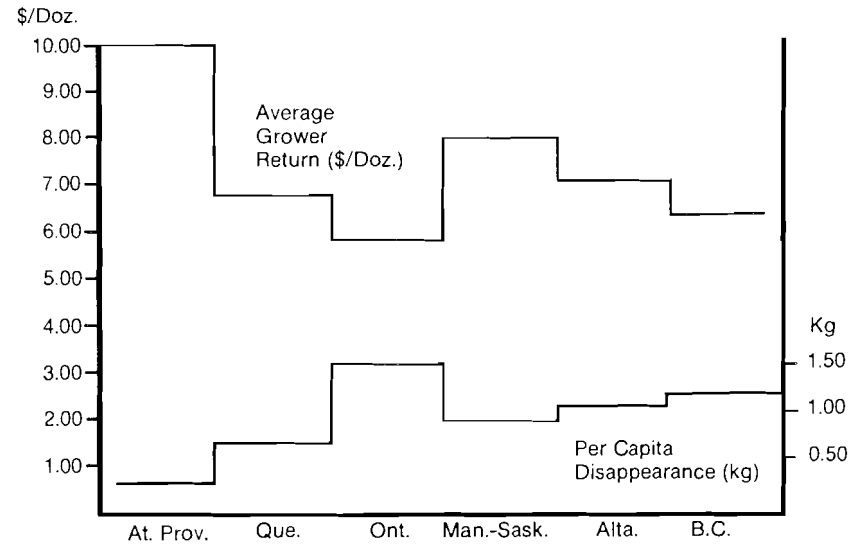

Figure 1

AVERAGE GROWER RETURNS AND PER CAPITA DISAPPEARANCE BY REGION, GFREENHOUSE CUCUMBERS, 1986

[4]The higher prices in the Maritime region reflect not only transportation costs but also higher costs of production due to higher heating costs compared to Ontario producers (Gordon, Robinson and Trott 1986).

higher disappearance levels compared with Ontario. This situation is caused by Quebec consumers having strong preferences for greenhouse tomatoes.[5]

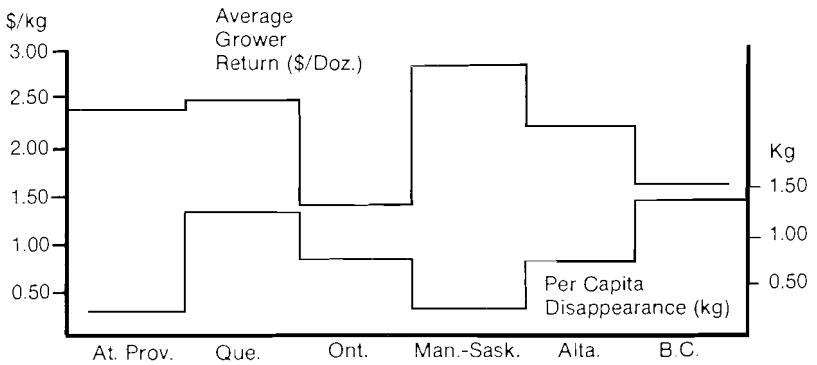

Figure 2

AVERAGE GROWER RETURNS AND PER CAPITA DISAPPEARANCE BY REGION, GREENHOUSE TOMATOES, 1986

Thus, the Maritime greenhouse region is a small segment of the larger Eastern Canada market, where product price is endogenous and depends on production levels within the total market region. An examination of demand conditions for greenhouse vegetable production in the Maritimes and the consequent impact of a greenhouse development project in Newfoundland must be embedded in a larger analysis of greenhouse vegetable markets in eastern Canada. It is to this task that we now turn.

A Transformed Variables Model of Market Demand

Consumer demand theory allows for the derivation of complete systems of demand equations within broad commodity bundles (Phlips 1974). This analysis, which is based on the assumption of separability, allows for the full richness of economic theory to be used in specifying demand systems. The assumption of separability, however, is too strong when applied to individual commodities. An alternative and pragmatic approach is to specify directly the quantity demand for each commodity as a function of own price, the price of substitute goods, and personal disposable income (Sun 1987; Nuckton 1980). Generally,

[5]Despite lower levels of consumer income and higher greenhouse tomato prices in Quebec, per capita consumption of greenhouse tomatoes is at least 60 percent above the Ontario level.

a linear or linear in logs functional form is chosen to represent the demand relationship. However, a transformed variables model can be used to statistically differentiate between the linear and log-linear forms and determine an appropriate, non-linear functional form specification of the demand equation (Box and Cox 1964).[6] From our discussion in the previous section, we are interested in determining the parameters of the inverse demand function (i.e., those factors that influence the determination of prices) for the eastern Canadian greenhouse cucumber and tomato markets.[7] A transformed variables model for the inverse demand function can be written as:

$$\frac{P_i^{\lambda} - 1}{\lambda} = \beta_o + \beta_Q \frac{(Q_i^{\lambda} - 1)}{\lambda} + \beta_{pF} \frac{(P_{Fi}^{\lambda} - 1)}{\lambda} + \beta_I \frac{(I^{\lambda} - 1)}{\lambda} + e_i \quad i=C,T \quad (1)$$

where C is cucumber, T is tomato, P is the price of the greenhouse product, Q is marketed quantity, P_F is the price of the field substitute, I is disposable income, and e is a random error term.

In general, this transformation is not consistent with the standard normality assumption of the error terms (Maddala 1977, 315; Fomby, Hill and Johnson 1984, 425). Rather, the transformation implies that the error structure is truncated. We proceed, following Judge, *et al.* (1988, 557), by assuming that the truncation effect is negligible.[8] Consequently, the e_i are assumed approximately normally distributed with zero mean and constant variance.

The functional form specification of Equation (1) depends on the parameter λ. For $\lambda = 0$, $\frac{P_i - 1}{\lambda} = \log P_i$ (and similarly for the remaining variables) and Equation (1) is transformed into a function linear in logs:

$$\log P_i = B_o + B_Q \log Q_i + B_{pf} \log P_{fi} + B_I \log I + e_i \quad i=C,T \quad (2)$$

On the other hand, for $\lambda = 1$, Equation (1) is transformed into a linear function:

$$P_i = B_o + B_Q Q_i + B_{pf} P_{fi} + B_I I + e_i \quad i=C,T \quad (3)$$

[6]Some examples of the use of the transformed variables model are Chang (1977) and Hassan and Johnson (1979).

[7]The quantity variable used here is influenced by greenhouse prices in the preceding year and can be used as an independent variable in the current period price equation without introducing serious simultaneity problems (Chang 1977).

[8]The truncation problem results because the log-likelihood function contains values of the log of the dependent variable, which cannot be negative. However, the normality of the error term allows the dependent variable to assume any value. In our case, the dependent variable is output price, which is not consistent with negative values. Consequently, we assume that the truncation problem for our purposes is not serious.

Different values of λ will lead to different functional form specifications of the estimating equations.

Because Equation (1) is non-linear in the parameters, a maximum likelihood procedure is used in estimation. Moreover, an iterative search routine is used to determine which λ maximizes the value of the likelihood function. Standard errors are obtained from the information matrix.

A likelihood ratio test (ϕ) is used to test a null hypothesis of a linear functional specification against a non-linear alternative hypothesis or:

$$\phi = -2\ [L(\lambda=1) - L(\hat{\lambda})]$$

where $L(\lambda=1)$ is the value of the likelihood function for $\lambda=1$ and $\hat{\lambda}$ is the estimated value of λ. ϕ is distributed as chi-squared with 1 degree of freedom.

After estimation, standard elasticity measurements (flexibilities) can be calculated at the mean of the data using the formula:

$$\eta_{pki} = \beta_{ki}(\bar{K}_i/\bar{P})^{\lambda} \qquad (4)$$

where k = Q, P_t, I, i = C,T and where the bar overhead indicates mean values. These summary measures will provide a convenient statistical characterization of the demand conditions for greenhouse cucumbers and tomatoes.

The data used in estimation represents monthly observations for the marketing period 1982-1986 for the Eastern Canadian cucumber and tomato markets. The own price variable is defined as the monthly average wholesale-to-retail price quotation at six urban centres; the quantity variable is defined as the volume of shipments from the Ontario Marketing Board plus reported unloads of Quebec, New Brunswick, Nova Scotia and Prince Edward Island supplies; the field price is defined as the consumer price index for the field-grown product; and income is defined as Eastern Canadian personal disposable income. Where appropriate, the variables (market supply and income) are defined in per capita values and prices and income variables are normalized to 1981 dollars. A seasonal dummy variable (Seasonal) is included in each equation to account for the effect of local field-grown supplies. In addition, the influence of varying product grades and the spatial nature of the market across Eastern Canada on the greenhouse price is also accounted for using dummy variables. For cucumbers, the data allows identification by region and product grade; however, for tomatoes these two factors are measured jointly.

Summary statistics of the search routine for both the cucumber and tomato equations are presented in Table 4. For both equations, the null hypothesis of either a linear (λ = 1) or a linear in logs (λ = 0) specification is rejected at the 95 percent confidence level, (χ^2_1 = 3.841) and a non-linear functional form is chosen: λ = .34 for cucumbers and λ = .16 for tomatoes.

Table 4

SUMMARY STATISTICS OF THE MAXIMUM LIKELIHOOD REGRESSION MODELS

	λ	Log L-F*	R^2	SEE	X^2
Cucumber	0	1200.91	.8495	2.632	5.96
	1	1192.49	.8483	.0137	22.80
	.34	1203.89	.8520	.4249	
Tomato	0	1070.40	.8076	3.229	4.38
	1	1046.12	.7613	.00026	52.94
	.16	1072.59	.8085	.6973	

* Value of the log of the likelihood function.

The maximum likelihood regression parameters of the cucumber and tomato equations are reported in Table 5. The data appear to fit the models reasonably well with adjusted R^2 values of 84 percent for cucumbers and 79 percent for tomatoes, and all major parameters, except income in the tomato equation, have the correct sign *a priori* and are statistically significant at the 95 percent confidence level.

The seasonal dummy variables show, as expected, a statistically strong negative effect on prices during the local field supply season. Moreover, the regional/grade dummy variables[9] indicate that the greater the distance from Toronto and the higher the product grade, the higher the price. This result is more easily seen for the cucumber equation using the regional variables (Dum 1 - Dum 5), which show (with Toronto as the base region) that price increases by the index value of: .043, Ottawa; .042, Montreal; .081, Quebec City; .174, Saint John; and .164, Halifax.

[9]The dummy variables are as follows. For cucumbers, Dum 1 to Dum 5 are grade classifications defined as: maritime, small, medium, large, and extra-large respectively; Dum 6 to Dum 10 are city classifications defined as: Halifax, Saint John, Quebec City, Montreal, and Toronto respectively; the base classification is large/medium in Ottawa. For tomatoes, dummy variables are defined for city/grade classifications; Dum 1 is Halifax/NS, Dum 2 is Saint John/NB-NS-Ont, Dum 3 is Quebec City/#1 Ont, Dum 4 is Quebec City/#2 Ont, Dum 5 is Montreal/#1 Ont, Dum 6 is Montreal/#2 Ont, Dum 7 is Montreal/Que, Dum 8 is Ottawa/Ont, Dum 9 is Toronto/large Ont, and Dum 10 is Toronto/medium Ont; the base classification is Toronto/extra-large Ont.

Table 5

MAXIMUM LIKELIHOOD REGRESSION ESTIMATES: TRANSFORMED INVERSE DEMAND FUNCTIONS†

	Cucumber Coefficients	Tomato Coefficients
Output	-.182	-.157
	(-9.73)*	(-11.31)*
Field Price	.245	.274
	(21.5)*	(8.41)*
Disposable Income	.601	-.59
	(4.35)*	(-.313)
Seasonal	-.064	-.2154
	(-10.72)*	-(15.8)*
Dum 1	.164	.114
	(13.4)*	(5.03)*
Dum 2	.174	.127
	(14.9)*	(5.38)*
Dum 3	.081	.008
	(11.9)*	(.382)
Dum 4	.042	-.141
	(7.2)*	(-6.97)*
Dum 5	.043	-.027
	(5.5)*	(-1.35)
Dum 6	-.061	-.181
	(-4.48)*	(-8.80)*
Dum 7	-.176	.002
	(-8.50)*	(.094)
Dum 8	-.069	-.046
	(-8.87)*	-(2.25)*
Dum 9	-.033	-.095
	-.033	-.095
Dum 10	-.061	-.187
	(-3.38)*	(-7.78)*
Constant	-1.11	-3.77
	(-4.89)*	(-10.04)*
R^2	.8454	.7937
N	329.	196.
λ	.34	.16

† t-statistics are in parenthesis.

* Significant at 0.05 level.

Additional interpretation of our results is described in terms of elasticity measurements. The elasticites, reported in Table 6, are first calculated at the mean of the data for all years including, for purposes of comparison, the elasticities derived from the linear and the log-linear functional form equations; second, these values are recalculated

at the mean of the data for each year. This will allow us to determine the stability of our results over time.

In comparing different functional forms, for the quantity and income variables in both the cucumber and tomato equations a linear specification would have overestimated the values of the elasticities, whereas a log-linear specification would have underestimated these values. The bias is reversed for the field price variable.

Table 6

ELASTICITIES OF DEMAND: EASTERN CANADIAN CUCUMBERS AND TOMATO MARKETS, 1982-1986

		Price Elasticity with Respect to		
	Year	Quantity	Field Price	Income
Cucumber				
log-linear	All*	-.146	.627	.641
linear	Years	-.177	.543	.697
λ = .34		-.155	.598	.664
	1982**	-.161	.604	.667
	1983	-.152	.607	.647
	1984	-.162	.604	.682
	1985	-.147	.586	.664
	1986	-.156	.591	.662
Tomato				
log-linear	All*	-.179	.598	0
linear	Years	-.314	.592	0
λ = .16		-.213	.587	0
	1982**	-.211	.590	0
	1983	-.213	.587	0
	1984	-.214	.586	0
	1985	-.204	.582	0
	1986	-.220	.588	0

* Calculated at the mean of the data for all years.

** Calculated at the mean of the data for each year, λ = .34 for cucumbers and λ= .16 for tomatoes.

In each year of the data, an inelastic response of price to changes in quantity is measured for both the cucumber and tomato markets. This indicates that an increase in market supply will cause less than a proportional decrease in price, and implies that even though output price is endogenous, increased sales of both products can be achieved with less than a proportional decrease in price required to clear the

market. The inelastic response is the result of a strong substitute relationship between greenhouse and field products, as measured by a large positive cross price elasticity in each year of the data. In other words, as expected, changes in the field price will have a direct and significant effect on greenhouse product price.

The measured response of price to changes in market supply warrants additional comment. Although increased greenhouse supplies will lower industry price, our results imply that it will also increase total industry revenue. At first thought, such an outcome would be a positive benefit resulting from, say, a government-supported development project. In terms of regional impact, however, the increased revenue will be captured by the government project, whereas price and revenue to existing firms will decrease.

A measure of the rate at which demand is increasing is provided by the income elasticity of demand. This is an important statistic because if it is significant new supplies can enter the market with only a minor impact on price and existing operations. However, in the case at hand, this summary statistic is calculated to be less than one for cucumbers and statistically insignificant from zero for tomatoes. Consequently, we expect a less than proportional change in per capita demand for cucumbers and no significant change in per capita demand for tomatoes due to changes in income level. This implies that the demand curves for these products are not increasing sufficiently to absorb new market supplies without price effects.

In sum, the structure of the Eastern Canadian greenhouse markets indicates that increased greenhouse supplies resulting from, say, a government-supported development project cannot be absorbed by these markets without disrupting price levels and existing operations. However, increased supplies can be marketed with less than a proportional drop required in price. Consequently, the extent of the price drop and the negative regional impact will depend on the volume of new supplies entering the market.

In the next section, based on the econometric results presented here, a detailed market study of the regional price impact of the Newfoundland greenhouse project is presented.

Market Impact

The government of Newfoundland has provided substantial amounts of public money[10] to support the establishment of a large-scale greenhouse complex. The production volumes expected from this 8-acre

[10]Public assistance given to this development has been reported as $3.5 million "in cash", $0.9 million in tax deferrals, a $3 million lease-purchase arrangement for growing lights, and $9.6 million in loan guarantees (*The Globe and Mail*, July 15, 1988).

operation are large relative to the size of the regional market. Based upon the lowest quoted yields, and assuming equal area allocations for the two products, annual outputs would be 1,700 tonnes of cucumbers and 1,900 tonnes of tomatoes. If consumer purchases of tomatoes and cucumbers in Newfoundland increased to 150 percent of previous levels, annual shipments to the mainland of 1,500 tonnes of cucumbers and 1,125 tonnes of tomatoes are indicated.

With a completely aseasonal pattern of production (the least disruptive for existing producers) 630 tonnes of cucumbers and 470 tonnes of tomatoes would be available for market during the April to August period. If such volumes were located or moved entirely to Ontario, price decreases of less than 1 percent would be indicated based on the estimated price flexibilities and total eastern production levels during this period. Under this scenario the price impact of the development project is minimal.

However, if the product is shipped into the nearby Maritime region higher returns would be realized due to higher prices and lower transportation costs. One would expect that supplies from Newfoundland would enter the Maritime region until marginal returns drop below their best alternative rate (in this case, the Quebec price) less incremental transportation costs. Prior to this cut-off point and despite a strong price inelastic response, the volume of shipments involved, assuming the current levels of Maritime production are maintained, would indicate significant price reductions occuring.

After displacing current Ontario greenhouse shipments into the region (i.e., approximately 23 tonnes of tomatoes and 272 tonnes of cucumbers for the April to August period) product sales would have to increase by approximately 62 percent for greenhouse cucumbers and by 100 percent for greenhouse tomatoes to absorb these new supplies. Historic price-quantity relationships imply that such large increases could be induced with wholesale price decreases of 10 percent for cucumbers and 22 percent for tomatoes.[11]

The yields and the areas allocated to the two crops could vary substantially from those used in this illustration. The effect on price of a range of shipment volumes into the Maritime region is shown in Table 7. At the top end of the range for tomatoes, with shipments of 900 tonnes, a 40 percent decrease in price is expected and will result in Maritime prices and per capita disappearance levels comparable with Toronto. In the case of cucumbers, with shipments of 900 tonnes, a price drop of 17 percent is expected and will cause about half of the difference in Maritime/Ontario wholesale prices and about a third of the difference in per capita disappearance levels being removed.

[11]These wholesale price changes correspond with proportionally larger grower price changes of over 15 percent and 30 percent respectively.

Table 7

ESTIMATED WHOLESALE PRICE CHANGES FOR GREENHOUSE TOMATOES AND CUCUMBERS AT VARYING LEVELS OF SHIPMENTS INTO THE MARITIME MARKET*

Shipments to Maritime Market	Wholesale Price Changes	
	Tomatoes**	Cucumbers
- MT -	%	
227	-10	-0.5†
340	-15	-2
454	-21	-5
567	-26	-8
680	-32	-11
794	-37	-14
907	-42	-17

* April to August period.

** Calculated on the basis of initial total consumption of 575 tonnes of greenhouse tomatoes for the April to August period.

† This value is the estimated change in eastern wholesale price due to the displacement of 227 tonnes of Ontario cucumber shipments. All other changes are calculated for Maritime wholesale prices.

Based on current price levels in Quebec, or alternatively the U.S. northeast, it is not expected that these more distant markets would be as financially attractive to the Newfoundland project as the Maritime region until mainland shipments surpassed levels equating 450 tonnes for tomatoes and over 900 tonnes for cucumbers over the April to August period. At this point, price reductions of approximately 20 percent for greenhouse tomatoes and 17 percent for greenhouse cucumbers will occur in the Maritime region.

Conclusion

The Maritime region imports substantial quantities of field and greenhouse tomatoes and cucumbers relative to local greenhouse production. Small increases in local production, by displacing Ontario greenhouse vegetables, will not affect Maritime prices and will have only negligible impact on Eastern Canada markets. Increased supplies above the Ontario import level must displace imported field products in the consumer's market basket, and this requires a reduction in the regional greenhouse price level. However, because of the strong substitute relationship between the field and greenhouse varieties, the resulting

price decreases are less than proportional to the percentage increase in new supplies. In the case under consideration here, the problem is that the magnitude of the project's planned production relative to the regional market is found to involve significant negative price changes. Assuming the Newfoundland project attempts to maximize returns, it is expected that the Maritime region would experience greenhouse price reductions of at least 20 percent for tomatoes and 10 percent for cucumbers. Moreover, because of high production costs, the Maritime region would also experience a reduction in income and employment as price levels fall and existing firms leave the market. Clearly, assistance for greenhouse development in Newfoundland on a scale consistent with the regional market would have been more appropriate.

There are many examples in Canada[12] of public assistance being given to businesses with inadequate advance market and price analysis concerning the economic consequences of the investment. Such analysis is essential in order for government policy makers to be aware not only of the local benefits resulting from a development project but also the costs imposed on other actors in the regional market.

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[12] A recent example involved both federal and provincial assistance given to a new hog processing plant in PEI, which has been estimated to have had significant negative impacts for the slaughtering and processing industries in New Brunswick and Nova Scotia (Martin and others 1986).

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