Canadian Studies Grant Programs

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Canadian Embassy/Ambassade du Canada
Washington, D.C.
1997

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January, 1997

Domestic Price, (Expected) Foreign Price, and Travel Spending by Canadians in the United States*

by

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Abstract: This paper develops and tests a model to explain travel expenditures in the United States by Canadians. The model examines a consumer's choice problem where income is allocated between domestic and foreign consumption. Consumers do not know the foreign price level and base their spending in part on expected foreign price. In addition to expected foreign price, domestic price, exchange rates, income, and foreign price uncertainty influence travel spending. Empirically, each determinant is statistically significant. The contribution of each determinant, however, is not the same: expected U.S. price and exchange rates are the primary factors influencing Canadian travel spending.

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* We thank Mark Frascatore and participants at the 1996 Eastern Economic Association meeting for comments on an earlier version. The Canadian Embassy provided financial support for this project. The usual disclaimer applies.

Domestic Price, (Expected) Foreign Price, and Travel Spending by Canadians in the United States

1. Introduction

The pace of Canadian travel spending in the United States has increased substantially. In 1980, Canadian citizens spent approximately 35$ (CN) each day while in the United States. By 1994, travel spending rose almost three-fold to more than 90$ (CN) per day.[1] This spending is vital to many border communities, affecting retail sales, employment, and tax receipts.[2] For example, declining retail sales in Canada during the early 1990s was in large part attributed to increased cross-border shopping by Canadians in the United States (Kemp 1992). Consequently, many U.S. border communities enjoyed the benefits of increased Canadian travel spending during the same time period. In this paper, we develop and estimate a model of spending by Canadians in the United States.[3]

Although numerous studies have examined the factors that influence total Canadian import demand, only a handful of studies have been directed at international travel spending

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[1] Travel spending is included in the balance of payments, and these "hidden imports" have accounted for as much as 10 percent of total Canadian merchandise imports from the United States (*Touriscope: International Travel*, 1994).

[2] While crossings occur at a large number of points along the border, major crossing points are concentrated in the northern New York-Montreal/Ottawa, Buffalo-Toronto, Detroit-Windsor, and Seattle-Vancouver regions.

[3] Canadian spending in foreign countries other than the United States represents less than 10% of total Canadian travel spending.

patterns.[4] Rhomberg and Boissonneault (1964) identify income as the primary determinant of spending abroad. Gray (1966) and Kwack (1972) extend this work to include relative prices between domestic and foreign goods. These authors report that relative prices and income are the principal factors explaining movements in travel spending. In a recent paper, Di Matteo (1993) develops a consumer choice model where Canadian consumers base their travel spending decisions on domestic price, foreign price, and income. If consumers possess full price information, then travel spending is determined primarily by the real exchange rate.[5]

We also present a model of the consumer choice problem, but we do not assume that consumers know foreign prices with certainty. Instead, travel spending is in part determined by expected foreign prices. By eliminating a full information setting, a potential role for uncertainty is introduced. In addition to foreign price uncertainty, the model also identifies income, expected foreign prices, domestic prices, and the nominal exchange rate as the determinants of Canadian spending in the United States.

Our empirical findings suggest that travel spending is significantly linked to the set of determinants identified by the model. We find, however, that the estimated effects of each determinant on travel spending differs substantially. Specifically, consumers do not respond in the same manner following changes in domestic prices and changes in foreign prices. In other words, travel spending is not homogeneous in prices, a finding that is consistent with numerous

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[4] Although numerous studies have been commissioned, Di Matteo (1993) notes that debate surrounding the effects of cross-border spending on the Canadian economy has relied primarily on anecdotal evidence rather than statistical evidence.

[5] Di Matteo (1993) finds that the real exchange rate and income are the key factors that influence cross-border spending over the period 1979-1991.

studies examining Canadian import demand (see, e.g. Deyak, Sawyer, and Sprinkle 1993). Overall, expected foreign prices and the exchange rate exert the greatest influence on travel spending. The effect of domestic prices on travel spending, in contrast, is modest.

2. The Model

Canadian travel spending statistics are categorized according to the length of stay in the United States.[6] Total travel spending is separated into two categories depending on whether spending occurs for same-day travel or travel that involves at least a one night stay in the United States. Expenditures are measured as the amount spent in the United States for accommodations, local transportation, food, entertainment, and goods and services, less fares. Canadian spending per day, measured in Canadian dollars, is shown in Figure 1. Total spending exhibits a general upward trend over the 1980-1994 time period, but the pace of this spending appears to have accelerated in 1990. Spending for each type of trip has increased but the portion attributed to same-day travel has grown more quickly, especially during the early 1990s.

In this section, we present a model of Canadian spending in the United States where consumers allocate income between domestic goods and goods purchased abroad. The consumer maximizes a utility function where utility is derived from domestic and foreign goods

[6] Canadian travel spending data is from *Touriscope: International Travel, 1994*, prepared by Statistics Canada. Customs officers at border crossing points distribute a questionnaire to returning Canadian travelers which asks each traveler for detailed information about the length of their stay and how much they spent while outside the country.

consumption. The utility function is given by

$$u(c,c^*) \tag{1}$$

where c is the quantity of domestic goods consumed and c^* is the quantity of foreign goods consumed. We assume that $u(\cdot)$ is twice continuously differentiable, increasing, and strictly concave in its arguments.

The consumer's budget constraint is

$$pc+E[p^*|I]ec^*\leq y \tag{2}$$

where p is the domestic price, p^* is the foreign price measured in units of foreign currency, e is the nominal exchange rate measured as the amount of domestic currency that can be purchased with one unit of foreign currency, and y is income. The quantity $E[p^*|I]$ is the expected foreign price level conditioned on the information set I.

To close the model, we need to specify the information set available to consumers and how foreign price expectations are formed. We make the following assumptions:

1. Consumers know (with certainty) past foreign prices. Past price information defines a prior distribution that is normally distributed with mean $\bar{p}$ and variance γ^2.

2. Consumers know the value of p and e. According to purchasing power parity, expected foreign price is p/e. Deviations from the actual value of foreign prices and p/e are normally distributed with zero mean and variance α^2.

Expected foreign price, by Bayes Rule, is then

$$E[p^*|I]=\theta\bar{p}+(1-\theta)\frac{p}{e} \tag{3}$$

which is simply a weighted average of $\bar{p}$ and p/e. The weight, θ, depends on uncertainty surrounding $\bar{p}$ and p/e:

$$\theta=\frac{\gamma^2+\alpha^2}{\gamma^2} \quad . \tag{4}$$

In forming foreign price expectations, consumers possess two pieces of information, each of which enables them to compute a forecast of foreign price. Expected foreign price is found by combining the two forecasts where the weight depends on the degree of uncertainty surrounding each forecast. For example, if consumers are less confident regarding the accuracy of the forecast based on purchasing power parity (due to an increase in α^2), then consumers attach greater weight to $\bar{p}$. In this case, the value of θ rises, which according to expression (3), suggests that consumers rely more on $\bar{p}$ rather then p/e in calculating $E[p^*]$. If, in contrast, consumers are relatively less confident with the accuracy of the forecast $\bar{p}$, then greater weight is attached to p/e in forming foreign price expectations.

The consumer's planning problem involves maximizing (1) subject to (2), (3), and (4). The first order conditions are

$$u_{c^*}(\cdot)=\lambda e\left[\theta\bar{p}+(1-\theta)\frac{p}{e}\right] \tag{5}$$

$$u_c(\cdot)=\lambda p \tag{6}$$

and the budget constraint (2), where λ is the Lagrange multiplier.

The solution is given by the continuous functions $c=c(\bar{p},p,e,y,\theta)$ and $c^*=c^*(\bar{p},p,e,y,\theta)$. The relationship between domestic and foreign travel spending is described in the following proposition:[7]

Proposition 1. There exists a continuous function $g(c/c^*) \equiv c(\cdot)/c^*(\cdot)$ *such that*

a. $g(\cdot)$ *is increasing in* $E(p^*)e$ *and*

b. $g(\cdot)$ *is decreasing in p*

where $c(\cdot)$ *and* $c^*(\cdot)$ *satisfy (2), (5), and (6) for a given value of* θ.

Proposition 1 notes that higher anticipated foreign prices lead consumers to expand domestic spending while travel spending falls. Here, there is a shift from foreign consumption to domestic consumption because consumers believe that foreign prices have risen. An increase in the domestic price level, in contrast, favors foreign consumption. In this case, foreign goods become more attractive to consumers because foreign goods are relatively less expensive.

Uncertainty encompasses the consumer's confidence in the forecasts of foreign price through the forecast error variances α^2 and γ^2. The influence of uncertainty on the consumer's choice problem stems from the effects of uncertainty on the expected value of foreign price. In general, a change in uncertainty alters $E(p^*)$ -- via equations (3) and (4) -- which in turns affects the value of domestic and foreign consumption. There is, however, a special case where a change in either α^2 or γ^2 has no effect on $c(\cdot)$ or $c^*(\cdot)$:

Proposition 2. $g(c/c^*)$ *is independent of* θ *if* $\bar{p}=p/e$.

[7] Proofs of propositions are included in the appendix.

Proposition 2 notes that if the two forecasts suggest the same value for anticipated foreign price, then the consumer's problem is unaffected by changes in uncertainty. In this case, changes in uncertainty (via θ) do not affect the expected foreign price level, and hence $c(\cdot)$ and $c^*(\cdot)$. Put different, uncertainty has no effect when $\bar{p}=p/e$.[8]

In general, however, the influence of uncertainty cannot be ignored.

Proposition 3. An increase in γ^2 causes

a. an increase in $g(c/c^*)$ if $\bar{p}<p/e$

b. a decrease in $g(c/c^*)$ if $\bar{p}>p/e$.

Proposition 3 focuses on uncertainty surrounding the forecast of foreign price based on past foreign prices. The influence of γ^2, however, has differential effects depending on the relationship between the magnitudes of the two forecasts. That is, whether higher uncertainty increases or decreases foreign travel spending depends on the relationship between $\bar{p}$ and p/e. To see this result, consider an increase in γ^2. This increase unambiguously reduces the value of θ which means that consumers rely relatively more on p/e rather then $\bar{p}$. If p/e is greater than $\bar{p}$, then consumers revise $E(p^*)$ upward. In this case, the increase in uncertainty favors domestic spending rather than spending abroad. If, on the other hand, p/e is less than $\bar{p}$, then expected foreign price is revised downward, causing consumers to increase travel spending and reduce domestic spending.

Uncertainty surrounding the forecast based on purchasing power parity also has

[8] In a statistical sense, the probability that $\bar{p}=p/e$ is nil.

differential effects.

Proposition 4. An increase in α^2 *causes*

a. a decrease in $g(c/c^*)$ *if* $\bar{p}<p/e$

b. an increase in $g(c/c^*)$ *if* $\bar{p}>p/e$.

Less confidence with the forecast based on purchasing power parity leads consumers to place greater weight on $\bar{p}$ to calculate expected foreign price. If $\bar{p}<p/e$, then consumers anticipate that foreign prices will fall, leading consumers to increase purchases of foreign goods while domestic consumption falls. If $\bar{p}>p/e$, then consumers believe foreign prices will rise which favors domestic consumption rather than foreign consumption.

The results of propositions (1)-(4) are summarized in Figure 2, which illustrates how the consumer allocates income between goods purchased in the domestic market and abroad, for given values of p, y, and θ. The function $g(\cdot)$ is increasing which suggests that higher forecasted foreign price leads to greater domestic consumption. A change in uncertainty causes the curve to rotate around point A where $\bar{p}=p/e$. An increase in the value of θ (either due to a decrease in γ^2 or an increase in α^2) causes the curve to rotate clockwise as indicated by the dotted line. In this case, consumers rely more heavily on $\bar{p}$ in forming expectations of foreign price. If $\bar{p}>p/e$ then consumers anticipate higher prices abroad and reduce foreign expenditures. But if $\bar{p}<p/e$, the change in uncertainty leads consumers to believe that foreign prices have fallen which favors increased travel spending. Only when $\bar{p}=p/e$ is the consumer's choice unaffected by uncertainty.

4. Estimates of the Model

In this section, we empirically examine the predictions of the model developed in the previous section, focusing on the contribution of the identified determinants. This section is divided into two parts. The first part constructs estimates of $\bar{p}$ and p/e and the accompanying measures of uncertainty. The second part estimates a linear version of the model.

4.1 Estimates of Uncertainty and Expected Foreign Prices

The forecast of the foreign price level based on past values is generated by a univariate autoregressive model (AR). Foreign price is represented by the U.S. CPI which is sampled monthly.[9] According to the Baynesian Information Criteria, four lagged terms are included. The monthly predicted values generated by the AR(4) model are (arithmetically) averaged to arrive at annual estimates of $\bar{p}$. Temporal aggregation is used because the travel spending data are recorded annually and this data is the sum of spending that occurs during the calendar year. The variance of the monthly disturbance terms provides an annual estimate of the forecast variance γ^2.[10]

The second forecast of U.S. prices is based on purchasing power parity. In this case, the forecast is computed using observed data. The temporal aggregate of the monthly values

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[9] All data, with the exception of travel spending data, are from CANSIM (Statistics Canada).

[10] We also estimated ARCH models and temporally aggregated estimates of the conditional variance to compute values for γ^2. In the empirical work to follow, the results are qualitatively unchanged.

represents p/e. If purchasing power parity offers an accurate portrayal of relative prices, then p/e is an unbiased estimate of p^*.[11] Deviations are then normally distributed with zero mean. Estimates of α^2 correspond to the variance of the monthly deviations.

Over the period 1980-1994, the value of p/e is biased downward. This finding suggests that prices in the United States (adjusted for currency value) are greater than Canadian prices. In other words, travel spending by Canadians would be relatively more expensive than goods purchased domestically. We also find that $\bar{p}$ is a more accurate forecast and that $\bar{p}$ is consistently above p/e. Consequently, consumers should rely more heavily on $\bar{p}$ rather than p/e in forming foreign price expectations. That is, the behavior of the measures of uncertainty associated with the two forecasts are such that consumers should attach greater weight to $\bar{p}$ in constructing expected values of U.S. prices.

4.2 Estimates of the Model

In this section, we estimate a linear model to determine the influence of the

[11] Whether nominal exchange rates adjust to equate prices across countries is highly debated (see, e.g. Rogoff 1996). Overall, the law of one price appears better suited to explain long-run exchange rate movements. In the short run, deviations from the law of one price are well documented and may be attributed to such factors such as the goods are not the same (Richardson 1978), transportation costs, trade barriers, and pricing-to-market behavior (Knetter 1993).

Recent work for Canada and the United States offers evidence that borders do matter, contrary to the law of one price. McCallum (1995) and Engel and Rogers (1996) find significant effects of the Canadian-U.S. border on regional trade patterns and commodity prices.

determinants identified by the theoretical model. The empirical model is given by[12]

$$\log\left(\frac{s}{p}\right)=\beta_0+\beta_1\log(p)+\beta_2\log(E[p^*])+\beta_3\log(e)+\beta_4\log\left(\frac{y}{p}\right)+\beta_5\gamma^2+\beta_6\alpha^2+\beta_7 FTA+\varepsilon \qquad (7)$$

where s is spending by Canadians in the United States and ε is a disturbance term. All data is sampled annually over the period 1980-1994 time period.[13]

The variable FTA is a dummy variable which captures the influence of the Canada-U.S Free Trade Agreement. The variable assumes a value of one for the period 1987-1994, and a value of zero otherwise. The Canada-U.S. Free Trade Agreement was signed in mid-1987 and was the focal point of much debate in Canada, leading to a Canadian federal election in 1988. The Free Trade Agreement did not have an immediate effect on retail prices and did not apply to important consumer goods such as gasoline, tobacco, and dairy products.[14] Nonetheless, the Agreement may have caused greater awareness of cross-border travel expenditure opportunities, particularly in communities close to the border.[15]

Three features of the empirical model warrant discussion. First, Proposition 1 maintains that $\beta_1>0$, $\beta_2<0$, and $\beta_3<0$. In other words, higher domestic prices support increased travel spending. Higher expected prices in the United States, in contrast, depress travel spending, as

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[12] The model is estimated in (log) level form. Deyak, Sawyer, and Sprinkle (1993) use a similar model for Canadian import demand and find that the appropriate specification includes data expressed in levels based on unit root and cointegration tests.

[13] We also attempted to include a dummy variable corresponding to the introduction of the goods and services tax (GST) in 1991. This variable was not statistically significant at conventional levels.

[14] Furthermore, restrictions on the quantity of goods that could be brought back by travelers remained unchanged under the Free Trade Agreement.

[15] Engel and Rogers (1996) find little empirical evidence that the Free Trade Agreement influenced the effects of the Canadian-U.S. border on commodity prices.

does the exchange rate. Second, the (expected) real exchange rate is not used to measure relative prices. Instead, the real exchange rate is decomposed into its components and each component enters the model separately. This specification is motivated by empirical results for Canadian import demand. Deyak, Sawyer, and Sprinkle (1993), among others, find little support for the assumption that Canadian import demand is homogeneous in prices. Instead, consumers respond differently to changes in domestic prices and foreign prices. In any event, the homogeneity postulate imposes a restriction on the model that can be assessed statistically. Third, uncertainty does not have differential effects over the sample period under examination. That is, we find $\bar{p}>p/e$ over the entire sample. Propositions 3 and 4 then suggest that $\beta_5>0$ and $\beta_6<0$.

Parameter estimates of equation (7) for same-day and over-night Canadian spending in the United States are estimated using seemingly unrelated regression. The first column examines same-day travel spending, and the second column corresponds to over-night travel spending. These types of spending are differentiated -- rather than aggregated into total travel spending -- because same-day travel is motivated primarily by cross-border shopping[16] while over-night travel is mainly associated with recreation or pleasure travel. Thus, is it unlikely that the influence of the determinants would be the same for each type of travel spending.

Beginning with same-day travel spending, coefficient estimates for expected foreign prices, domestic prices, the nominal exchange rate, income, uncertainty, and the Free Trade Agreement variable are of the expected sign and statistically significant at the 1-percent level.

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[16] Although cross-border shopping is not one of the categories used to classify the purpose of travel by Statistics Canada, same-day travel figures are often used to measure the extent of cross-border shopping (Di Matteo 1993).

The χ^2 statistic reported in Table 1 examines the hypothesis H_0: $-\beta_1=\beta_2=\beta_3$. That is, the χ^2 statistic examines the validity of the homogeneity postulate. For same-day travel spending, homogeneity is rejected which indicates consumers do respond differently to movements in the components of the real exchange rate. Put differently, the real exchange rate is not an appropriate measure of relative prices.

The estimated elasticity of same-day travel spending with respect to expected U.S. price suggests that Canadian travel spending is extremely sensitive to movements in expected foreign prices. The effect of the nominal exchange rate is also large in magnitude. The influence of Canadian prices, however, is slight in comparison. Tests for the equality of the estimated coefficients for expected foreign prices and domestic prices, and the exchange rate and domestic prices reject equivalence at the 1-percent level.[17] Overall, the effects of expected foreign prices together with the nominal exchange rate exert the greatest influence on same-day travel spending.

Both uncertainty terms are statistically significant determinants of same-day travel spending. The coefficient estimates suggests that Canadians are more responsive to uncertainty surrounding the forecast based on past U.S. price rather than purchasing power parity. Specifically, we reject the hypothesis H_0:$\beta_5=-\beta_6$ at the 1-percent level (not shown). This most likely traces to the finding that the forecast generated from past prices is more accurate. That is, consumers rely more heavily on this forecast, and changes in uncertainty have a more profound effect. In contrast, consumers attach little credence to the forecast based on purchasing power parity. As a result, greater uncertainty associated with this forecast has less

[17] The χ^2 statistic is 77.01 and 50.23, respectively.

effect on travel spending.

For over-night travel spending, expected foreign prices, domestic prices, exchange rates, income, uncertainty, and the Free Trade Agreement term are statistically significant at the 5-percent level. Homogeneity in prices is also rejected for over-night travel spending, suggesting that consumers respond differently to changes in the components of relative prices. Although domestic prices are a significant determinant, their contribution is slight. That is, the magnitude of the coefficient associated with Canadian price is significantly smaller than that associated with either expected foreign price or the exchange rate.[18] In other words, expected price in the United States and the nominal exchange rate are the primary price factors that explain over-night travel spending. As is the case with same-day travel spending, uncertainty surrounding the forecast based on past U.S. prices appears more important than is uncertainty associated with purchasing power parity.

There are also important differences regarding the contribution of each determinant for the different type of travel spending. In general, we find that over-night spending is less responsive to changes in domestic prices, expected U.S. prices and the exchange rate than is same-day travel spending (restrictions on the estimated model confirm this conjecture statistically). This also holds for income and foreign price uncertainty. Overall, the influence of the set of identified determinants differs, depending on whether travel is same-day or over-night.

[18] The χ^2 statistic is 28.89 and 16.10, respectively.

5. Conclusion

This paper presents a simple consumer choice model designed to identify the main determinants of Canadian spending in the United States. The model focuses on a representative consumer who allocates income between spending on goods purchased in domestic markets and goods purchased abroad. The central feature of the model is that the consumer does not possess full information about foreign prices. Instead, the consumer's spending behavior is based in part on prices expected to prevail in the United States. By eliminating a full-information setting, the model identifies uncertainty as an important determinant of travel spending. In addition, domestic price, expected foreign price, nominal exchange rates, and income also help explain Canadian travel spending in the United States.

Empirical estimates confirm the main predictions of the model over the period 1980-1994. Higher prices in Canada are associated with greater Canadian travel expenditures in the United States. In contrast, an increase in anticipated foreign prices and the cost of foreign currency discourage travel expenditures by Canadians. In addition, foreign price uncertainty, income, and the Free Trade Agreement influence travel spending. The contribution of each identified determinant, however, is not equivalent. In particular, Canadian spending in the United States appears most responsive to expected foreign price and the exchange rate. Domestic price, while a significant determinant, has a more modest impact on Canadian travel spending.

With the move to fewer international trade restrictions, Canadian shoppers are likely to become more sensitive to relative prices. The importance of travel spending is evident by the widespread opposition to recent U.S. proposals to impose a tax on border crossings. Travel purchases already represent a viable alternative to shopping in local markets, and the results of this paper suggest that U.S. retailers are able to exert a substantial influence on the pace of this spending.

Appendix

Proof of Proposition 1. Because $u(\cdot)$ is continuous, twice differentiable, and concave and the budget constraint is linear in c and c^*, there exists continuous functions $c(p,e,\bar{p},\theta,y)$ and $c^*(p,e,\bar{p},\theta,y)$ that satisfy (2), (5) and (6). Furthermore,

$$\frac{\partial c(\cdot)}{\partial p}<0,\ \frac{\partial c(\cdot)}{\partial[E(p^*)e]}>0\quad and\quad \frac{\partial c^*(\cdot)}{\partial p}>0,\ \frac{\partial c^*(\cdot)}{\partial[E(p^*)e]}<0\ .$$

If $g(c/c^*)\equiv c(\cdot)/c^*(\cdot)$, then

$$\frac{\partial g(\cdot)}{\partial[E(p^*)e]}=\frac{\left[\frac{\partial c(\cdot)}{\partial[E(p^*)e]}c^*(\cdot)\right]-\left[\frac{\partial c^*(\cdot)}{\partial[E(p^*)e]}c(\cdot)\right]}{\left[\frac{\partial c^*(\cdot)}{\partial[E(p^*)e]}\right]^2}>0\ .$$

Thus, $g(\cdot)$ is increasing in $E(p^*)e$ as maintained in part a.

Differentiating $g(\cdot)$ with respect to p yields

$$\frac{\partial g(\cdot)}{\partial p}=\frac{\left[\frac{\partial c(\cdot)}{\partial p}c^*(\cdot)\right]-\left[\frac{\partial c^*(\cdot)}{\partial p}c(\cdot)\right]}{\left[\frac{\partial c^*(\cdot)}{\partial p}\right]^2}<0\ .$$

Therefore, $g(\cdot)$ is decreasing in p as maintained in part b.

Proof of Proposition 2. Uncertainty influences $c(\cdot)$ and $c^*(\cdot)$ by its effects on $E(p^*)$. Specifically,

$$\frac{\partial c(\cdot)}{\partial j}=\frac{\partial c(\cdot)}{\partial E(p^*)}\frac{\partial E(p^*)}{\partial\theta}\frac{\partial\theta}{\partial j}$$

and

$$\frac{\partial c^*(\cdot)}{\partial j}=\frac{\partial c^*(\cdot)}{\partial E(p^*)}\frac{\partial E(p^*)}{\partial \theta}\frac{\partial \theta}{\partial j}$$

for $j=\gamma^2,\alpha^2$. Differentiating (3) with respect to θ yields

$$\frac{\partial E(p^*)}{\partial \theta}=\bar{p}-\frac{p}{e}$$

which vanishes if $\bar{p}=p/e$. Thus, $\partial c(\cdot)/\partial j=\partial c^*(\cdot)/\partial j=0$ which suggests that $\partial g(\cdot)/\partial \theta=0$. Therefore, $g(\cdot)$ is independent of θ and the consumer's choice problem doesn't depend on uncertainty if $\bar{p}=p/e$.

Proof of Proposition 3. From Proposition 1, it follows that $\partial g(\cdot)/\partial E(p^*)>0$. Differentiating (3) and (4) and combining expressions yields

$$\frac{\partial E(p^*)}{\partial \gamma^2}=\frac{\partial E(p^*)}{\partial \theta}\frac{\partial \theta}{\partial \gamma^2}=\left[\bar{p}-\frac{p}{e}\right]\left[-\frac{\alpha^2}{(\gamma^2)^2}\right]$$

where the second bracketed term is unambiguously negative. If $\bar{p}<p/e$, then $\partial E(p^*)/\partial \gamma^2>0$ which implies that $\partial g(\cdot)/\partial E(p^*)>0$. Therefore, an increase in γ^2 causes an increase in $g(\cdot)$ if $\bar{p}<p/e$ as shown in part a.

If, on the other hand, $\bar{p}>p/e$ then $\partial E(p^*)/\partial \gamma^2<0$. In this case, $\partial g(\cdot)/\partial E(p^*)<0$. Therefore, an increase in γ^2 causes a decrease in $g(\cdot)$ when $\bar{p}>p/e$ as maintained in part b.

Proof of Proposition 4. Differentiating (3) and (4) yields

$$\frac{\partial E(p^*)}{\partial \alpha^2}=\frac{\partial E(p^*)}{\partial \theta}\frac{\partial \theta}{\partial \alpha^2}=\left[\bar{p}-\frac{p}{e}\right]\left[\frac{1}{\alpha^2}\right].$$

Because $1/\alpha^2>0$, $\partial E(p^*)/\partial \alpha^2<0$ if $\bar{p}<p/e$. An increase in α^2 then lowers $E(p^*)$, which by Proposition 1, leads to a decline in $g(\cdot)$ as maintained in part a.

If $\bar{p}>p/e$, then $\partial E(p^*)/\partial\alpha^2>0$. In this case, an increase in α^2 produces a decline in $g(\cdot)$ as maintained in part b.

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Table 1. Regression Results

Determinant	Dependent Variable: Same-Day Travel Spending	Dependent Variable: Over-Night Travel Spending
Constant	61.41* (6.57)	20.37* (3.15)
p	0.23* (0.02)	0.07* (0.01)
$E(p^{*})$	-18.69* (2.12)	-5.48* (1.02)
e	-7.49* (0.62)	-2.45* (0.30)
y/p	2.42* (.83)	0.91** (0.40)
γ^2	0.27* (0.04)	0.07* (0.02)
α^2	-0.12* (0.02)	-0.04* (0.01)
FTA	0.91* (0.12)	0.20* (0.06)
$\chi^2(1)$	91.11*	37.65*
$Q(2)$	3.74	5.41
$\bar{R}^2$	0.98	0.98

Notes: Coefficients are estimated by seemingly unrelated regression. Standard errors are in parentheses. The $\chi^2(1)$ statistic corresponds to the null hypothesis that travel spending is homogeneous in prices and has one degree of freedom. The statistic $Q(2)$ is a Box-Ljung portmanteau test for second order autocorrelation of the regression residuals. A '*' and a "**' indicates significance at the 1-percent and 5-percent level, respectively.

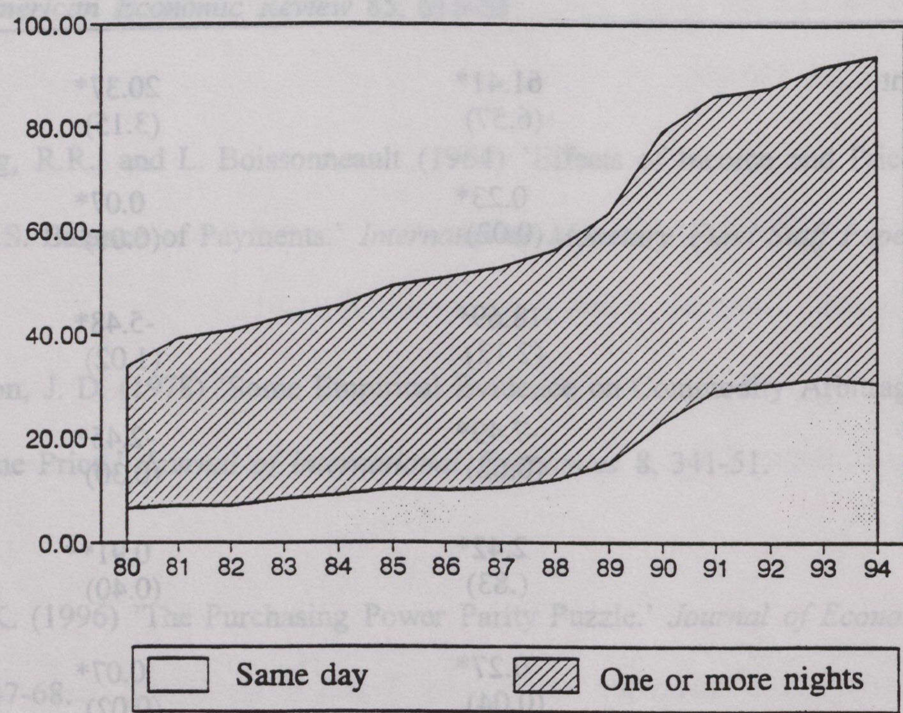

Figure 1. Travel spending per day, 1980-1994.

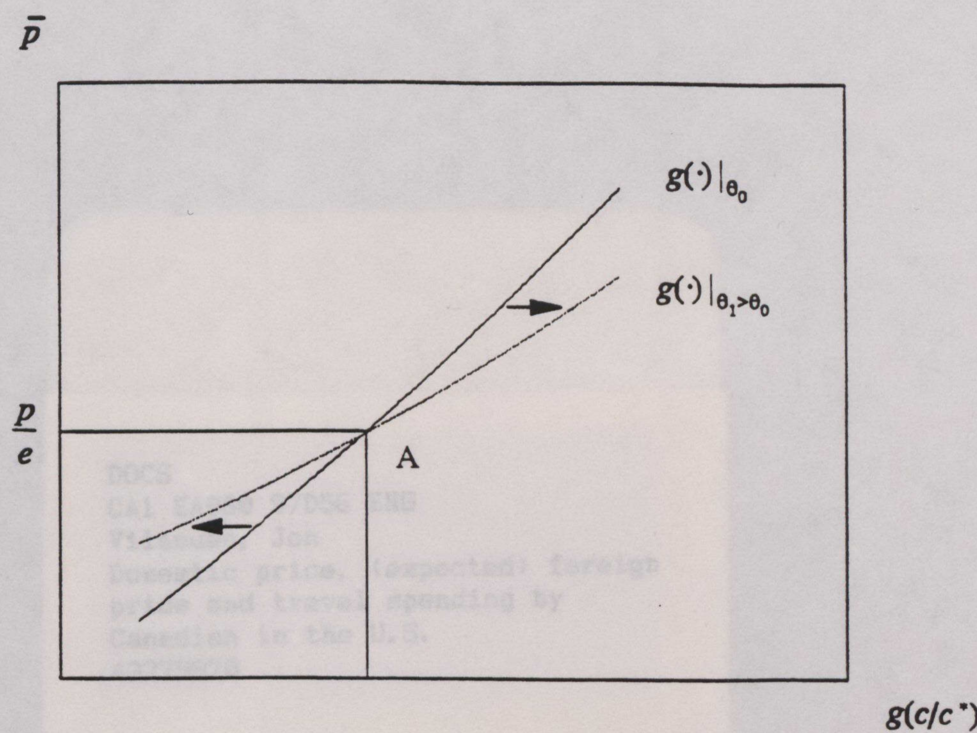

Figure 2. The effects of uncertainty on the consumer's choice problem

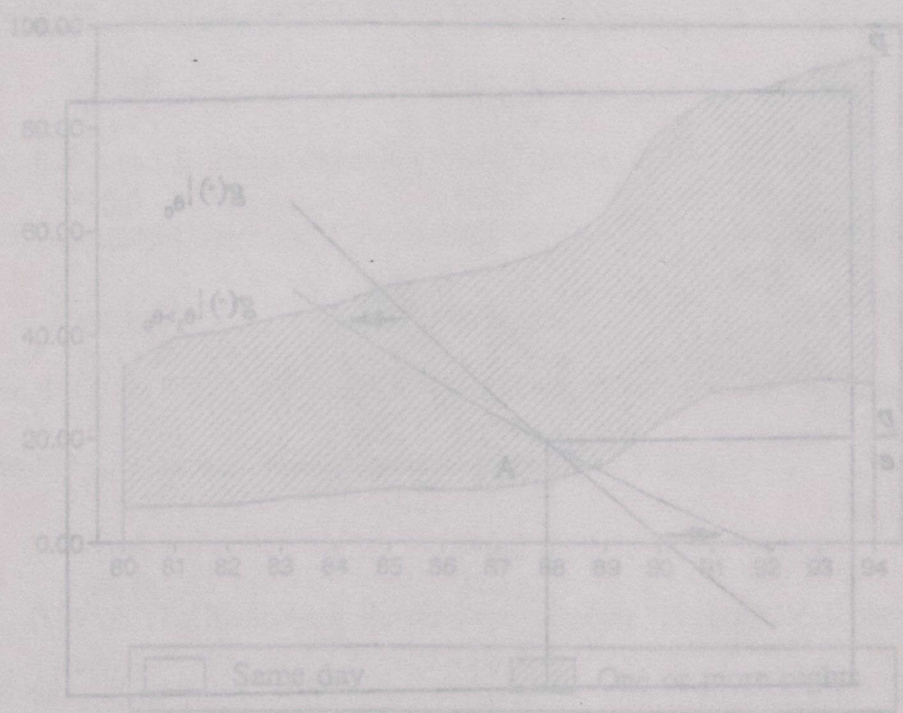

Figure 1. Travel spending per day, 1980-1994.