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Using a Canadian-American Natural Experiment to Study Relative Efficiencies of Social Welfare Payment Systems[1]

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Résumé : Nous étudions l'impact de la mécanique des paiements d'aide sociale, et en particulier leur concentration dans le temps, sur les prix des denrées alimentaires que se procurent les bénéficiaires de l'aide sociale. Nous présentons tout d'abord un modèle théorique dans lequel les individus ayant des revenus relativement plus faibles s'avèrent être relativement moins mobiles. Il en découle que lorsque leurs consommateurs deviennent plus pauvres (cela se produit lorsque les bénéficiaires de l'aide sociale ont épuisé leur prestation mensuelle), les marchands locaux de denrées alimentaires exercent un plus grand pouvoir de marché, ce qui se traduit par des prix plus élevés. Nous vérifions ce résultat théorique à l'aide d'une expérience naturelle qui nous est offerte grâce à la plus grande concentration dans le temps des paiements d'aide sociale à Montréal (Québec, Canada) qu'à Bangor (Maine, USA). Nous trouvons que : i) Les prix des denrées diminuent de manière significative lors de la semaine pendant laquelle les paiements d'aide sociale sont faits ; ii) Les prix des denrées croissent de manière significative durant les autres semaines du mois. Nous trouvons également que certains facteurs socio-économiques liés à la pauvreté (par exemple le pourcentage de familles monoparentales dans un quartier donné) sont associés à des prix des denrées plus élevés.

Abstract : We study whether social welfare recipients may end up paying more for their grocery if social welfare payments are more concentrated over time. We first present a theoretical model showing that lower incomes in general and a lower lower bound of the income distribution lead to less mobility for poorer consumers. This causes local stores to have more market power and increase their prices when the incomes of poorer people go down and/or when the number of poorer people goes up. Secondly, we verify these theoretical findings by using a natural experiment to study links between food prices and the more restrictive timing of social welfare payments in Montreal, Canada compared to the timing in Bangor, Maine. We find some statistically significant evidence of : i) a negative effect on prices in the week of social welfare check issue ; ii) increasing prices over a month. We also find that some socio-economic factors such as a higher percentage of single-parent families in one area may increase prices charged by grocery stores in that area.

Keywords : Welfare Payments, Grocery Prices, Poverty

JEL Classification : H55, I30, I38

1. INTRODUCTION

Many empirical studies compare the relative costs of food for low-income and high-income households. Those studies tend to show that on average poor people pay more for their grocery items than richer people.

An analysis of the fact that poorer people might pay more than richer people for their groceries was first done by Alcaly and Klevorick (1971). They find that poorer people pay slightly more because: i) the proportion of independent food stores in their neighborhood is higher (prices are higher in these stores[3]) and ii) mobility constraints exist (e.g.: transportation cost) leading low income individuals to go more to closer stores than do higher income people.[4] Kunreuther (1973) confirms those findings and shows that income and storage constraint lead lower income consumers to buy smaller product sizes and to go more to smaller stores located near their home. Doti and Sharir (1981) show that because the value of shopping time increases with income, higher income people buy larger sizes and spend less time shopping for grocery products. Therefore, low-income households often pay more given that a larger size product has a lower cost per unit and that buying larger sizes means less visits to stores. Blaylock (1989) obtains similar results.

More recent studies show mixed evidence on the fact that poorer people may pay more. MacDonald and Nelson (1991) don't provide statistically significant evidence that low-income consumers pay higher prices for food than higher-income consumers. Chung and Myers (1999) find that poor people pay more since there is a disproportionate distribution of non-chain stores in poor neighborhoods. Therefore, they are more likely to shop in smaller grocery stores and convenience stores which sell at higher prices than chain stores. Hayes (2000) denies that poor people pay more based on the fact that preceding studies used bias samples.

In the present paper we look at a new aspect of why some poor consumers may end up paying more, that is: Does the timing of the social welfare payments lead grocery stores to charge higher or lower prices? Do social welfare recipients pay more for their groceries independently of the size of the products or of the costs of going to stores? Related to that hypothesis is a paper by Wilde and Ranney (2000) in which they show that the average expenditure by social welfare beneficiaries (receiving food stamps or money)

[3] See Tanguay *et al*. (1995).

reaches a peak 3 days after the reception of the stamps or money. Because these households adjust their spending on the receipt of the welfare payments, we can think that economic agents informed of when they receive their stamps or money might try to take advantage of that information. For example, if social welfare recipients all receive some money at the same date, there would be a sudden increase in the demand for food and the grocery stores knowing that might react by adjusting their prices.

To answer these questions, we first present a theoretical model inspired by Hotelling's spatial-monopoly model. It emphasizes the existence of mobility constraints which lead to local food stores having some market power. We show that lower incomes in general and especially a lower lower bound of the income distribution, lead to more consumers having no choice but to go to the local store. This causes local monopoly prices to increase when the incomes of poorer people go down and/or when the number of poorer people goes up.

Hence, if one examines the income distribution on a weekly basis (weekly available money) and views the money available to social welfare recipients as the lower bound of the income distribution, is it true that prices are higher when social welfare recipients have just received their checks (as claimed by some welfare defense groups[5])? Or is it rather that prices are higher a few weeks later when welfare recipients have spent part of their monthly benefit and are then relatively poorer? Second, is it the case that local stores in "lower income" neighborhoods sell at higher prices?

To test how social welfare effects price levels, we proceed using a *natural experiment* that involves two independent regions with different social welfare systems: Montreal, Quebec, Canada and Bangor, Maine, USA. The differences between these regions allow us to isolate the effects that the frequency of social welfare payments might have on the pricing of grocery stores. An econometric analysis is done to explain variations in weekly prices prevailing in 11 grocery stores (7 for Montreal, 4 for Bangor) for 60 products (31 for Montreal 29 for Bangor), for 26 weeks.

Results support the presented theoretical model. We find some statistically significant evidence of: i) a negative effect on prices in the week of social welfare check issue; ii) increasing prices over a month.

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[4] On that subject see also Holly and Wheeler (1971).

[5] In Quebec, the « Association coopérative d'économie familiale (ACEF) », a consumer association, studied that possibility in a 3 year study for 94 products. Their results indeed confirm that major grocery stores offer less rebates and lower rebates in the weeks welfare payments are made. On the other hand, their methodology is flawed because they don't control for the costs and the nature of the products, seasonal factors and the size of stores.

We also find that some socio-economic factors may have an impact on the pricing by grocery stores. For instance, we find that a higher percentage of one-parent families in a neighborhood may lead to higher prices, *ceteris paribus*.[6] Our results are related to those of Benson and Faminow (1984) who show that less mobile consumers are more vulnerable to the rent-seeking behavior of food stores. The novelty of the present paper is to show that the timing of social welfare payments may alter social welfare recipients' mobility and therefore the prices they pay for food.

These results imply that the timing of social welfare payments may have a negative effect on the efficiency of the mechanisms used to achieve society's redistibutive objectives. It could be desirable to redesign those mechanisms taking into account their impact on grocery prices in poor neighborhoods.[7]

The rest of the paper is as follows. In section 2 we present a theoretical model explaining both grocery-shopping decision and pricing by stores. In section 3 we turn to the empirical evidence, we analyze the results and discuss some of the implications. We conclude in section 4.

2. THEORETICAL MODEL

2.1 THE GENERAL FRAMEWORK

Consider a world consisting of a linear neighborhood with N consumers uniformly distributed over the segment [-1, 1]. A local store with market power is located at point 0 and we denote a consumer's location or distance to that store by d. Hence, $d \sim U$ [-1, 1]. Consumers are also heterogeneous in income $y > 0$, with $y \sim U$ $[y_L, y_H]$ for the N consumers. For simplicity, we assume that $y_H - y_L = 1$. We also assume that the d and y distributions are independent. Any consumer can be identified by his characteristics (d, y).

[6] Sexton (1973) also shows that mobility constraints measured by proportion of single parent families may make comparison shopping more costly and therefore lead poorer people paying more.

2.2 THE CONSUMERS' PROBLEM

Consumers derive utility from the consumption of three goods: food, f, car, c, and some composite good, x.[8] For simplicity, we assume that food and cars can only be consumed in discrete quantities: $f \in \{0,1\}$ and $c \in \{0,1\}$. As for the composite good, it can be consumed in any non-negative amount, $x \geq 0$.
All consumers have the same utility function given by:

$$(1) \qquad U(f,c,x) = \begin{cases} \gamma + w(c) + ln(x) & \text{if } f = 1 \\ -\infty & \text{if } f = 0 \end{cases}$$

Thus, it is assumed that food cannot be dispensed with. All individuals will be consuming food so the variations in the utility level they will achieve will depend on their consumption of c and x. In particular, they will have to choose whether to buy a car or not. Assuming that $w(c) = w$, a consumer will have $U(1, 0, x) = \gamma + ln(x)$ if he does not buy a car and $U(1, 1, x) = \gamma + w + ln(x)$ if he does.

When buying food f, consumers have two choices. They may prefer to not buy a car (which sells at price q), and to go to the local store where they will pay a price p for their unit of food, this price p including a premium for market power. Assuming the marginal cost of food is constant and equal to m, they would then pay $p \geq m$. While going to the local store can be achieved without a car, it is nevertheless costly to get there. We assume that going to the local store involves a traveling cost t by unit of distance d so that total traveling costs are $t*d$.

The other option for buying food is to use a car, bought at price q, and to travel at no cost to a competitive store located outside the neighborhood. (We could assume that the price q includes the cost of the car plus the cost of driving to the competitive store.) Once at the competitive store, they can buy food at a price equal to the marginal cost m.

As mentioned earlier, assuming that consumers have to buy food the decision they face is then to incur the cost of a car or not. A consumer buying a car (C) faces a budget constraint given by:

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[7] This potential temporal adjustment by governments contrasts with the spatial indexation of transfer payments. On this last topic see Glaeser (1998).

[8] We can see *car* as any transportation mode or as a rental price for transportation. Note that an alternative interpretation of our model would be to view the price q as the cost of gathering information on prices prevailing at more than one store.

(2) $m + q + x = y$

The utility of this consumer is then:

(3) $U_C = \gamma + w + ln(y - m - q)$

As for not buying a car (*NC*), it implies the following budget constraint:

(4) $p + td + x = y$

And the utility of the consumer in this case is:

(5) $U_{NC} = \gamma + ln(y - p - td)$

Hence, $U_C \geq U_{NC}$ leads to using a car and shopping at the competitive store. We assume equality leads to owning a car because of an infinitesimal advantage. Using (3) and (5), we obtain that a consumer should use a car if:

(6) $w + ln(y - m - q) \geq ln(y - p - td)$

Simplifying (6) using log rules and $z = e^w$ leads to the conclusion that a consumer with characteristics *(d, y)* will buy a car and shop for food at the competitive store if:

(7) $y \geq y^*(d) = \alpha - \beta p - \delta d$

where $\alpha = z(m + q) / (z-1) > 0$; $\beta = 1 / (z - 1) > 0$ and $\delta = t / (z - 1) > 0$.

Therefore consumers with characteristics *(d, y)* such that $y \geq y^*(d)$ use a car and shop at the competitive store while consumers with characteristics *(d, y)* such that $y < y^*(d)$ buy from the local monopoly.

From eq. (7) we obtain: $\partial y^* / \partial d < 0$; $\partial y^* / \partial q > 0$; $\partial y^* / \partial m > 0$; $\partial y^* / \partial p < 0$; $\partial y^* / \partial t < 0$.

Thus, the critical level of income, y^*, above which one buys a car is smaller the further one is located from the local store. Also, the critical level of income and the number of consumers shopping at the local monopoly both increase (decrease) whenever costs of shopping locally decrease (increase) and/or costs of shopping at the outside competitive store increase. A similar and opposite statement can be made for the outside competitive store. Obviously, any shopper that stops shopping locally will shop at the competitive store (and vice-versa).

2.3 THE DEMAND FOR THE LOCAL MONOPOLY

Using distributions on y and d and y^* as given by eq. (7), the numbers of consumers going to the local monopoly and the competitive store can be computed.

Figure 1 illustrates that over the segment [0, 1]. The proportion of consumers not using cars, $\lambda(p)$, and shopping locally is given by the area under y^* and over y_L. Since all consumers are located on [1,-1] it is sufficient to double the obtained proportion to have the total proportion of consumers not buying cars. Moreover, we normalize $N = 1$ so that that proportion is then the number of consumers shopping locally. We have:

(8) $$\lambda(p) = \alpha - \beta p - y_L - \delta / 2$$

This represents the total number of consumers shopping locally over the segment [0, 1].

By symmetry, the total number of consumers not using a car and buying one unit of food from the local store is:

(9) $$D(p) = 2\,\lambda(p) = 2\,(\alpha - y_L - 2\,\beta p) - \delta$$

Eq. (9) is the demand facing the local monopoly. We now proceed to the local store's profit maximizing problem.

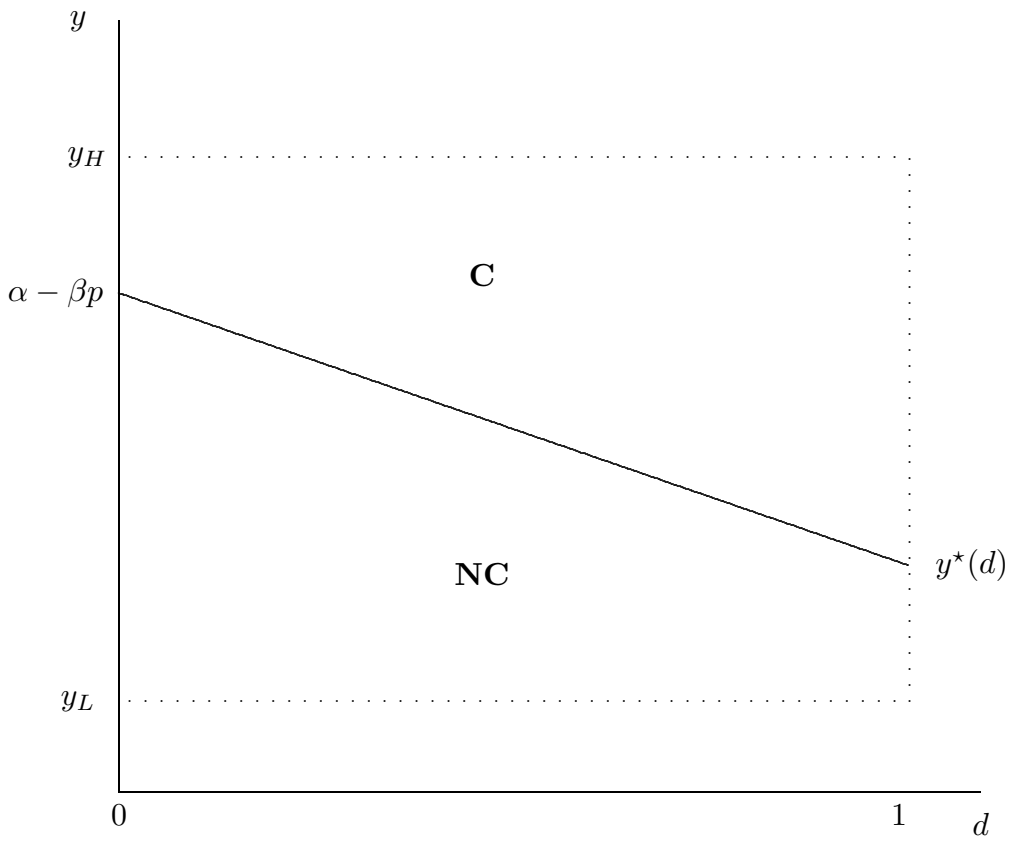

Figure 1

2.4 THE LOCAL MONOPOLY'S PROBLEM

The problem faced by the local monopoly is:

(10) $\underset{p}{Max}\ \pi = (p-m)\, D(p)$

The first order condition is:

(11) $D(p) + (p-m)\, D'(p) = 0$

Using the demand given by eq. (9) one obtains:

(12) $p^* = (\alpha - \delta / 2 - y_L) * (1 / 2\beta) + m / 2$

Replacing for the defined values of α, β, and δ we get[9]:

(13) $p^* = 1 / 4 * [\, 2 (z + 1)\, m + 2zc - 2(z-1)\, y_L - t]$

Interesting results can be derived from eq.(13). First, as should be expected the price is increasing in the marginal cost m. Second, if the cost of using a car (transportation) increases, consumers shop more locally and this leads to a higher local price. Third, as the value of a unit of distance (t) to the store increases, the local store should decrease its price to compensate that additional cost. Finally, and most interestingly, the local price is decreasing in the lower income level y_L. Therefore, if the distribution of y shifts to the right from $[y_L, y_H]$ to $[y_L + \varepsilon, y_H + \varepsilon]$ then local price should decrease as more consumers go to the competitive store. The explanation within the presented model is that lower incomes lead to fewer transportation choices and create lock-in effects.

We will test this last result in two ways. First, if one examines the income distribution on a weekly basis (weekly available money) and views the money available to social welfare recipients as the lower bound

[9] A sufficient condition for $p^* > m$ is $m < c - t / 2$.We assume this is the case.

of the distribution, is it true that prices are higher when social welfare recipients have just received their checks (as claimed by some welfare defense groups), or is it rather that prices are higher a few weeks later when welfare recipients have spent part of their monthly benefit and are then relatively poorer (as predicted by our model)? Second, is it the case that local stores in "low income" neighborhoods sell at higher prices? Or "technically" speaking, are areas with income distributions more to the left facing higher local prices? We now turn to the empirical study of these questions.

3. ECONOMETRICS AND EMPIRICAL RESULTS

3.1 DATA

3.1.1 PRICES AND COSTS[10]

Observations on prices for 31 products were collected at seven grocery stores in the Montreal area over a period of 26 consecutive weeks from November 6, 2000, through May 6, 2001. Observations on a similar set of 29 products were collected at four grocery stores in the Bangor, Maine area over 26 consecutive weeks from November 10, 2001 through May 5, 2002.[11] Therefore, the Canadian observational structure represents a pooling of 26 time series observations for each of 217 product-store cross-sectional units (5 642 observations) while the American structure represents a pooling of 26 time series observations for each of 116 product-store cross-sectional units (3 016 observations).

Corresponding observations on product cost were collected based on wholesale prices in Montreal and in Bangor. These costs were collected to account for the fact that prices variations may simply reflect lower or higher costs (due for example to seasonal factors).[12] Moreover, costs should reflect the average price of a product across stores which can explain why the prices change given the entire market situation and not only based on one particular store situation. Price and cost data for each product was expressed in terms of a common base unit (e.g.: ounce, gram, pound, kilogram). Table 1 (in appendix) lists the products and their corresponding product type category for the Canadian and the American samples.

[10] The list of visited stores for regular and wholesale prices is available upon request.
[11] Days of the week are not important because prices are constant throughout the week.
[12] See Macdonald (2000) for a study on seasonal price variations.

The grocery stores were chosen following predetermined criteria. The most popular stores were chosen in order to: 1) represent well each group of retailers; 2) cover the entire market; 3) obtain a diversity in the type of clientele (welfare recipients or not).

The choice of products was done according to the criteria used by Glazer (1981), Lanoie *et al.* (1994) and Tanguay *et al.* (1995). First, each product was available to consumers throughout the evaluation period. Second, each product is the object of large sales volumes permitting therefore a sufficiently high frequency to justify an analysis of price fluctuations. Third, changes in prices could be made at low cost for the retailer. Prices being easily changed week by week, there is little constraint on their fluctuations. Fourth, publicity was taken into account for each product. To do so we added a criterion of "normal publicity" which should minimize differences between the products due to the fact that some benefit from more publicity than others. Fifth, we controlled for homogeneity of the products across time, variety and quality.

Finally, the time period of six months was chosen to capture the short-term effects more than the changes in the structure of the industry and to minimize the seasonal effects due to harvesting.

3.1.2 SOCIAL WELFARE PAYMENTS AND FOOD ASSISTANCE IN QUEBEC AND IN MAINE

Social welfare checks in Montreal and in the province of Quebec are issued on the first day of the month unless this day falls on a weekend or holiday, in which case the checks are issued on the last non-holiday weekday preceding the first day of the month. The recipients are unrestricted in the expenditures they can make with these funds. These social security benefits are the major source of revenue for people on social welfare.

The prevailing system of food assistance in the Bangor region (and in Maine in general) is different in many regards. First, a food stamp system helps people purchase items at food stores. These stamps are available if you work or not, as long as you can prove that your income and assets are sufficiently low. Also, these stamps are not given to beneficiaries all at the same time. Beneficiaries are divided into five groups: each of these groups receiving their stamps at different dates in a period of 5 to 7 days that may overlap two weeks. Finally, each beneficiary receives stamps at different dates each month (eg: August 12th, September 14th, October 17th, etc.). Second, social welfare given in the form of money is established on a case-by-case basis and amounts are paid depending on some socio-economics

characteristic (like being handicapped, being a single mother, etc…). The payments are usually made at the beginning of each month but not necessarily all at the same time. Finally, social security payments in the United States are distributed over several weeks of each month.[13] Hence, this relatively diffuse timing pattern contrasts strongly with the relatively concentrated timing pattern in Montreal and therefore provides a natural experimental setting in which to estimate any price effects associated with the timing pattern of social welfare check issue in Montreal.

To capture any timing effects, the 26 time series observations in both samples were assigned to a week of the month as follows. If the calendar date on which an observation was collected was 1-7, then the observation was assigned to the first week of the month. If the calendar date was 8-14, then the observation was assigned to the second week of the month. Calendar dates of 15-21 were assigned the three week of the month; and dates of 22-28 were assigned the fourth week of the month. Dates of 29-31 were assigned the fifth week of the month. We code five week-of-month (0, 1) dummy variables to reflect this timing pattern. We create a "week-of-check" (0,1) dummy variable for the Montreal sample that takes on a value of unity if the timing of an observation falls within the week of check issue and zero otherwise. This dummy variable has a value of unity in the first, or the fifth, week of the month. This pattern has a nice feature in that it permits us to estimate a week-of-check effect that is separate from a more general week-of-month effect. If we were to find these more general effects also exist in the Bangor sample, then this result would reinforce the conclusion that they are not related to the timing of social welfare check issuance in the Montreal sample. Conversely, any estimated week-of-check effect is likely to reflect purely an effect from the timing concentration of social welfare check issuance in Montreal.

3.1.3 OTHER CONTROL VARIABLES

In addition to the price and cost observations and the (0, 1) dummy variables created to represent week-of-month and week-of-check effects, we have collected observations on other relevant variables and placed them within our time series cross-section data structure. These include: (1) a measure of each store's size (building plus parking lot); (2) a set of (0,1) dummy variables for product types (meat, fruits and vegetables, dairy products, cereal products, cleaning products, paper products, and other products (see Table 1 for details); and (3) a set of socio-economic variables. Given our theoretical model, the socio-economic variables were chosen to account for mobility constraints and poverty. For the seven

[13] See http://www.ssa.gov/pubs/2002calendar.htm

Montreal stores, the socio-economic variables include measures of percentage of single-parent families, percentage of the population that has less than nine years of schooling population. These data are taken from the last census of the City of Montreal electorate districts done in 1996 for **each** of the seven stores' areas. For the four Bangor area stores, the socio-economic variables include measures of percentage of single-parent families and percentage of households that own their unit.[14] These data are taken from the 2000 U.S. decennial census for the towns/cites in which each store is located. Because two of the four stores are located in the same town, the variation observed for these socio-economic factors is relatively limited in the American data. Table 2 provides definitions for all variables. Table 3 presents the corresponding summary statistics for the Canadian and the American samples. Both tables are in the Appendix.

3.2 ECONOMETRIC CONSIDERATIONS

Our data structure is a time series cross-sectional one with T=26 consecutive weekly time series observations on each of 217 product-store cross-sections for Montreal and 116 product-store cross-sections for Bangor. In both the Canadian and American cases, we have $T < N$. This structure limits the statistical models that are available to us. In general, for a time series cross-section data structure, there are a number of models that can be considered including Ordinary Least Squares (OLS) with cross-section fixed effects; Feasible Generalized Least Squares (FGLS) with random effects, and various other FGLS with cross-section heterogeneity, autocorrelation, and inter-cross-section error correlation.

The model with inter-cross-section error correlation is not feasible with our data structure because $T < N$, as is well-known.[15] We specify instead a model with cross-sectional heteroskedasticity, common autocorrelation, and fixed effects.[16] Given the large number of product-store cross-sections in both data

[14] In all regressions, average household income was not used because it was available only for the year 1990 for the American data. Moreover, Canadian average income by store was highly correlated with the percentage of single-parent families and the percentage of the population that has less than nine years of schooling. Given that only the percentage of single-parent families was also available for the U.S. for year 2000 we chose to go with that common variable. Other socio-economic variables were chosen to eliminate strong multicollinearity which could have led to singular matrix problems and failed estimations. For instance this is why a population variable is not included in the American regressions.

[15] See Greene (2000, p. 608) and Beck, et al. (1993).

[16] We chose to estimate a fixed effects model structure rather than a random effects structure because we wish to make inferences conditional on precisely the product categories delineated in our samples. If we were to repeat our analysis for a subsequent set of 26 weeks, we would sample precisely the same products (e.g., ground beef, whole chicken, bananas, onions, etc.) and assign them to precisely the same product categories (e.g., meat, fruits and vegetables, etc.). The products and product type categories are fixed and do not represent random draws, in repeated samples, from a population of products and product types [Hsiao (1986, pp. 41-43)]. Results from OLS and FGLS model estimates with cross-sectional heteroskedasticity are available on request from the authors.

sets, we estimate fixed effects for the following product type categories: meat, fruits and vegetables, dairy products, cereal products, cleaning products, and paper products. The reference group for these main effects is the others products category. Although fixed effects defined for each product-store combination can be feasibly implemented with our data sets, we are also interested in estimating interaction effects for week-of-check and product. If we define the fixed effects as product-store combinations rather than as product types, we leave ourselves with 36 observations (or less in the autocorrelation models) with which to estimate these important interaction effects. In order to expand the observational base for the estimation of these interaction effects, we have chosen to specify fixed effects based on product types. It should also be recognized that store-specific effects related to store size are controlled for in all of our models. In addition, the socio-economic variables take on values that are store specific; and this feature of our data structure and models also involves store-wise observational variation. For these reasons, we believe that our decision to specify fixed effects across product types is reasonable.

We used this product type fixed effects model to explore a number of specifications involving various sets of right hand side variables. For each specification, we modeled the continuous variables (r.g., price, cost, store-size, population) in natural units and in natural logarithm units. The final Canadian and American models presented in Table 4 represent specifications selected on the basis of the significance of variables conditional on the presence of week-of-month, and in the Canadian case, week-of-check main effects and important interaction effects.

3.3 RESULTS AND ANALYSIS

3.3.1 CANADIAN RESULTS

Table 4 presents the estimates of the linear and logarithmic specifications for the Canadian and American samples. The statistically significant estimated positive effect of cost and the magnitude of the estimates across all four specifications seem reasonable. The statistically significant estimated negative effect of storesize suggests that economies of scale at the store level exist. The estimated fixed effects by product type are all statistically significant vis-à-vis the reference group: other products. The overall fits of all specifications are very good. These results lend support to these statistical models of local grocery prices in Montreal and Bangor and suggest that the specifications are appropriate and can

be relied on to give reasonable estimates of the effects on which this study is focused: week-of-month and week-of-check effects.

The statistically significant estimated week-of-month main effects in the linear specification for the Canadian sample indicate that the average price is between three and fourteen cents higher in the first, third, fourth, and fifth weeks of the month in contrast to the second week. Moreover, there is a statistically significant main effect on price in the week of social welfare check issue which is negative. Because the week-of-check is typically the first week-of-month, this negative effect offsets the positive main effect associated with the first week-of-month main effect. A Wald test for the restriction that the sum of these two effects is zero produces a chi-square test statistic value of 2.35 with a corresponding p-value of 0.13. We conclude that in most of our first week-of-month observations, there is no statistically significant price effect relative to the price in the second week-of-month. When the week-of-check coincides with the fifth week-of-month, the positive week-of-month main effect is offset as well. A Wald test for the restriction that the sum of these two effects is zero produces a chi-square test statistic value of 1.39 with a corresponding p-value of 0.24. However, given the limited number of coincidences in our sample of week-of-check and fifth week-of-month, the positive and significant fifth week-of-month main effect usually is present.[17]

The estimates of the logarithmic specification for the Canadian sample are also presented in Table 4 and generally confirm the linear model results. Our preferred model is once again FGLS-HA for the same reasons as given above for the linear model. As with the linear model, the overall fit is very good as evidenced by an R-square of 0.996. In this logarithmic model, the statistically significant estimated positive effect of cost on price, the magnitude of the estimate and the statistically significant estimated negative effect of Storesize (suggesting economies of scale) all seem reasonable. The estimated fixed effects by product type are all statistically significant. These suggest that the specification is appropriate for our purposes.

The statistically significant estimated week-of-month main effects indicate that the average price is 0.7 percent higher in the third week of the month and 2.3 percent higher in the fifth week, in contrast to the second week. This is a similar finding to that in the linear model; however, there is no statistically significant main effect on price in the week of social welfare check issue in the logarithmic model.

[17] The correlation coefficient between the first (fifth) week-of-month dummy variable and the week-of-check dummy variable is 0.57 (0.53) indicating that no severe collinearity exists for this group of variables that would substantially reduce the precision of the corresponding estimates.

Considering this difference, we can conclude that both models suggest that prices tend to rise later in the month in Montreal and that week-of-check issue is associated with lower prices. The only evidence against this general statement in our sample is the statistically significant estimated positive interaction effect for week-of-check and dairy products in the logarithmic model. Other than this, week-of-check effects on price are negative or zero. These additional findings that week-of-check has negative main effects is evidence for the hypothesis that market power plays a role in higher prices in our sample.

We conclude that the typical pattern over the month in Montreal is for prices generally to rise. We also conclude that prices are lower at the time checks are issued. Moreover, there are two statistically significant and negative week-of-check interaction effects with product type (meat and fruits/vegetables).

These results validate the theoretical findings of our model. Local stores' market power increases over a given month because: i) mobility is decreasing in income levels and ii) available weekly funds are lower later in a month for welfare recipients. Therefore, prices increase with lower mobility caused by lower available incomes.[18]

The results for the socio-economic factors are all statistically significant. Population has a negative effect on average price; and more interesting given the objective of this study, both the incidence of single-parent families and of households with less than nine years of schooling is positive and statistically significant. This may imply that poorer households face higher average prices; or there may be a common correlation with other factors that are present in such lower-income neighbourhoods. That result may be caused by higher operating costs for stores in poorer areas.

[18] If mobility would be constant in incomes, then market power would not play a role in higher prices in our sample. Another potential explanation for the obtained empirical results could then be based on operating costs. Because we don't expect service costs to increase later in the month and there is no evidence on higher operating costs in poorer neighbourhoods, this casts serious doubts on that explanation.

3.3.2 AMERICAN RESULTS AND COMPARISONS

The corresponding estimates based on the American sample are presented in Table 4 as well. The main reason for including American observations (on four stores in the Bangor, Maine area) is to provide a natural experiment with respect to week-of-month effects. Since social welfare payments (e.g., social security, income maintenance, and food stamps) are distributed over several weeks in a month in the U.S., any week-of-month pattern could be compared with any pattern found in the Montreal data and netted out to leave a pattern that could be induced by the particular timing pattern of social welfare payments in Canada. The models have very good overall fits with R-squares of 0.983 (linear specification) and 0.996 (logarithmic specification). The estimates of the linear specification indicate no week-of-month main effects. The estimates of the logarithmic specification exhibit only a negative and statistically significant main effect for week four.

Since the issuance of social welfare checks in the U.S. is spread over a number of weeks each month, in contrast to the primarily first-week-of-the-month issuance pattern in Montreal, the relatively limited week-of-month price variation in Bangor compared to Montreal suggests that there are different factors operating in Montreal that induce intra-monthly price variation that are not present in Bangor. Overall, we believe that the American results reinforce our conclusions based on the Canadian data regarding the evidence for price effects induced by the focused timing of Canadian social welfare payments. Hence, the evidence in our samples supports some social welfare payment induced price effects in Montreal. The typical pattern over the month in Montreal is for prices generally to rise and for prices to be lower at the time of check issuance.

Finally, like in the Canadian case, estimates of both the linear and logarithmic specifications with American data indicate main effects that are positive and statistically significant for incidence of single-parent families. However, the positive incidence of homeownership on prices may cast some doubt on the interpretation of the Canadian results concerning higher average prices for neighbourhoods with higher percentages of single-parent families (or lesser schooled households).[19] Nevertheless, Sexton (1973) also showed that a higher proportion of single parent families may make comparison shopping more costly and therefore lead to less mobility.

[19]On the other hand, they may reflect the impact of higher rents on operating costs and therefore prices. Recall that the cost variable used in the models is wholesale cost of goods, and as such, does not reflect operating costs.

Table 4: FGLSHA Estimates for Montreal, Quebec and Bangor, Maine

	Linear Model, Montreal		Log Model, Montreal		Linear Model, Bangor		Log Model, Bangor	
Variable	**Coefficient**	**t-Stat**	**Coefficient**	**t-Stat**	**Coefficient**	**t-Stat**	**Coefficient**	**t-Stat**
CONSTANT	**0.18**	2.13	**5.62**	18.35	-0.07	-0.80	**1.24**	33.91
Store-specific variables								
COST	**1.18**	237.87	**0.71**	310.42	**1.12**	211.40	**0.93**	246.78
STORESIZE	**0.00**	-2.33	**-0.02**	-3.87	**-0.00**	-9.37	**-0.09**	-20.76
WOM/WOC main effects								
WOMS1	**0.09**	5.89	0.01	1.38	0.10	1.02	0.03	0.73
WOMS3	**0.03**	3.22	0.00	1.38	-0.01	-0.68	-0.01	-1.89
WOMS4	**0.03**	3.01	**0.01**	2.38	-0.00	-0.06	**-0.01**	-3.61
WOMS5	**0.13**	5.99	**0.01**	2.08	-0.00	-0.23	-0.00	-1.05
WOC	**-0.30**	-2.19	-0.09	-0.87				
Socio-economic variables								
POP	**0.00**	-14.50	**-0.60**	-13.65				
POWN					**1.02**	8.91		
LPOWN							**.032**	13.79
P1PFAM	**0.02**	13.50	**0.13**	2.24	**1.45**	7.99	**0.25**	23.68
PLT9	**0.03**	12.00	**0.15**	5.21				
Product type main effects								
MEAT	**1.58**	53.91	**0.40**	55.40	**-0.54**	-30.13	**-0.18**	-23.21
FRVEG	**0.36**	32.42	**0.12**	14.47	**-0.34**	-19.19	**-0.03**	-4.17
DAIRY	**0.16**	8.19	**0.15**	22.29	**-0.54**	-25.76	**-0.19**	-18.55
CEREAL	**-0.30**	-12.96	**0.03**	3.73	**0.97**	43.69	**0.61**	105.40
CLEANPROD	**-0.04**	-2.61	**0.04**	4.25	**-0.66**	-35.86	**-0.21**	-55.26
PAPERPROD	**-0.34**	-9.31	**-0.02**	-5.01	**-0.54**	-30.14	**-0.22**	-35.55
Interaction effects								
WOC?* P1PFAM	0.00	1.84	-0.02	0.76	-0.03	-0.26	0.02	1.23
WOC?*PLT9	0.01	1.91	0.00	0.28	-0.17	-1.13	0.02	0.42
WOC?*MEAT	**-0.19**	-2.99	-0.01	-0.78	-0.00	-0.19	-0.00	-0.17
WOC?*FRVEG	**-0.07**	-3.13	0.01	0.72	0.01	0.37	0.02	1.16
WOC?*DAIRY	0.02	0.55	**0.04**	2.68	0.00	0.10	0.00	0.11
WOC?*CEREAL	0.04	0.71	0.03	1.74	-0.02	-0.40	-0.00	-0.10
WOC?*CLEANPROD	-0.04	-1.26	0.02	0.71	-0.03	-0.88	0.01	0.10
WOC?*PAPERPROD	-0.10	-1.20	0.01	1.38	0.01	0.18	0.01	0.10
Rho-1							Rho-1 = **0.45**	20.26
Rho-2			Rho-1 = **0.41**	32.09			Rho-2 = **0.12**	7.29
Rho-3	Rho-1 = **0.56**	51.33	Rho-2 = **0.34**	22.18	Rho-1 = **0.44**	21.58	Rho-3 = **0.06**	5.56
Weighted Statistics								
R-squared		0.956		0.996		0.983		0.996
Durbin-Watson		2.094		2.139		1.946		2.161

Notes: Bolded values indicate statistical significance at the five percent level for a two-tail test against a null hypothesis of zero.

4. CONCLUSION

We presented an analysis of the evolution of pricing of grocery stores in relation to the sequence of monetary flows given to welfare recipients. We obtained two main results. First, we showed that a more concentrated timing of welfare payments may lead to rising prices over a month. Second, prices are lower at the time of check issuance. We believe these results are caused by social welfare recipients having progressively more limited transportation choices over a month (or when they have less money) and therefore being more captive of local grocery stores. In other words, poorer persons pay higher prices for food because of the exploitation of market power in the face of relatively low mobility. This effect is independent of any price changes which may be due to potentially higher costs of operation in poorer neighborhoods (which are neither ruled out or proven to exist).

Therefore, some potential efficiency losses may exist given the more restrictive timing of social welfare payments in Canada compared to the timing prevailing in the United States. The frequency at which the social welfare payments are made could have a negative effect on the attainment of the redistributive objectives. Given that one of the concerns of governments is the fair redistribution of wealth to poorer individuals and the attainment of this in an efficient manner, these results could justify reforming the way social welfare payments are given in order to minimize the negative effects grocery store pricing have on the redistribution of wealth. This constitutes important and relevant information for governments in countries in which welfare payments are concentrated through time. Governments should make sure that their policy timing does not permit some economic agents, such as grocery stores, to interfere with the goal of the social policies they implement.

For instance the Quebec's government pays all welfare benefits in one day. It might consider revising that method if it causes some unvoluntary harm to poor people's well-being. Because we have shown that grocery stores indeed have opportunistic behaviors, the government can for example spread the payments of welfare benefits throughout the month. Nevertheless, the present research doesn't constitute a sufficient condition to change the way the system works. What would be required for sufficiency would be a complete evaluation of the costs and benefits of all alternative policies of distributing the money to social welfare recipients.

Appendix

Table 1: Canadian and American Products and Corresponding Product Types

Product in Montreal, Quebec, Canada	OPPr Products in Bangor, Maine, USA
Meats	**Meats**
Beef Ground Chuck 80%	Beef Ground Chuck 80%
Chicken Drumsticks	Chicken Drumsticks
Whole Chicken cat. A	Whole Chicken grade A
Fresh Atlantic Salmon	Fresh Atlantic Salmon
Canned tuna	Canned tuna
Fruits and vegetables	**Fruits and vegetables**
Bananas	Bananas
White mushrooms	White Mushrooms
Vegetable juice	
Apple juice	Apple Juice
Iceberg lettuce	Iceberg lettuce
Yellow onions	Yellow Onions
Macintosh apples	
Others	**Others**
Peanut butter	Peanut Butter
Soft drink	Soft Drink
Instant coffee	Instant coffee
Sparkling Water	Spring Water
Spring water	
Ketchup	Ketchup
Dairies	**Dairies**
Cream cheese	Cream cheese
Cheese slices	Cheese slices
Large white eggs	Large White Eggs
Cereals	**Cereals**
Spaghetti 1	Spaghetti 1
Spaghetti 2	Spaghetti 2
Spaghetti 3	
White rice	White rice
Cleaning products	**Cleaning products**
Powder detergent (clothing)	Powder Detergent(95 loads, 80 loads)
	" (120 loads)
Bleach (1 gal.)	Bleach (/gal)
"	" (174oz)
Paper products	**Paper products**
Toilet paper: 8 and 12 rolls	Toilet paper: 6 rolls and 12 rolls
Kleenex	Kleenex

Source: Authors

Table 2: Variable Names and Definitions

Variable Name	Variable Definition
A. Common to Canadian and American Data Sets	
PRICE	Product price ($/unit)
COST	Product wholesale cost ($/unit)
STORESIZE	Size of store and parking lot in square feet (Montreal) / in thousand square feet (Bangor)
WOMS1	Equals unity if observation taken during first seven days (1-7) of month and zero otherwise
WOMS2	Equals unity if observation taken during second seven days (8-14) of month and zero otherwise
WOMS3	Equals unity if observation taken during third seven days (15-21) of month and zero otherwise
WOMS4	Equals unity if observation taken during fourth seven days (22-28) of month and zero otherwise
WOMS5	Equals unity if observation taken during days 29-31of month and zero otherwise
POP	Population in store area (Montreal) / Population in town in which store is located (Bangor)
P1PFAM	Percentage of one-parent households
MEAT	Equals unity if product type is "meat" and zero otherwise
FRVEG	Equals unity if product type is "fruits and vegetables" and zero otherwise
DAIRY	Equals unity if product type is "dairy" and zero otherwise
CEREAL	Equals unity if product type is "cereal" and zero otherwise
CLEANPROD	Equals unity if product type is "cleaning products" and zero otherwise
PAPERPROD	Equals unity if product type is "paper products" and zero otherwise
LPRICE	Natural logarithm of PRICE
LCOST	Natural logarithm of COST
LSTORESIZE	Natural logarithm of STORESIZE
LPOP	Natural logarithm of POPULATION
LP1PFAM	Natural logarithm of P1PFAM
B. Unique to Canadian Data	
WOC	Equals unity if observation taken during seven day period in which social welfare checks were issued
PLT9	Percentage of householders in store area with less than nine years of schooling
LPLT9	Natural logarithm of PLT9
C. Unique to American Data	
POWN	Proportion of householders in town in which store is located who own their home
LPOWN	Natural logarithm of POWN
Source: Authors	

Table 3: Statistics

Variable	Canadian Sample				American Sample			
	Mean	**Std. Dev.**	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
PRICE	3.114	2.912	0.250	19.990	2.290	2.747	0.330	24.990
COST	2.424	1.926	0.263	7.960	1.787	2.444	0.330	17.790
STORESIZE	92473.0	93105.7	7620	268128	69.2	38	9	107
WOMS1	0.231	0.421	0.000	1.000	0.234	0.424	0.000	1.000
WOMS2	0.231	0.421	0.000	1.000	0.228	0.420	0.000	1.000
WOMS3	0.231	0.421	0.000	1.000	0.233	0.423	0.000	1.000
WOMS4	0.231	0.421	0.000	1.000	0.230	0.421	0.000	1.000
WOMS5	0.077	0.267	0.000	1.000	0.075	0.264	0.000	1.000
WOC	0.231	0.421	0.000	1.000				
POP	26862.3	2158.2	23887	29880	14838.8	10087.4	8130	31473
P1PFAM	40.571	8.396	31.000	57.000	0.325	0.033	0.291	0.376
PLT9	23.588	7.044	12.000	33.000				
POWN					0.511	0.055	0.475	0.599
MEAT	0.181	0.385	0.000	1.000	0.213	0.409	0.000	1.000
FRVEG	0.254	0.435	0.000	1.000	0.239	0.427	0.000	1.000
DAIRY	0.073	0.259	0.000	1.000	0.151	0.358	0.000	1.000
CEREAL	0.104	0.305	0.000	1.000	0.027	0.162	0.000	1.000
CLEANPROD	0.104	0.305	0.000	1.000	0.079	0.270	0.000	1.000
PAPERPROD	0.067	0.250	0.000	1.000	0.064	0.245	0.000	1.000
OTHER			0.000	1.000			0.000	1.000
LPRICE	0.852	0.718	-1.386	2.995	0.497	0.731	-1.109	3.218
LCOST	0.564	0.829	-1.338	2.074	0.216	0.733	-1.109	2.879
LSTORESIZE	10.696	1.339	8.939	12.499	3.949	0.906	2.197	4.673
LPOP	10.195	0.080	10.081	10.305	9.418	0.571	9.003	10.357
LP1PFAM	3.683	0.200	3.434	4.043	-1.130	0.098	-1.234	-0.978
LPLT9	3.110	0.328	2.485	3.497				
LPOWN					-0.676	0.103	-0.744	-0.512
Number of Observations		5016				1978		

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