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Prescription Drug Prices in Canada and the United States—Part 1

A Comparative Survey

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Contents

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Executive Summary

This study compares the prices of prescription drugs in Canada and the United States. The measure used is the replacement cost, at Canadian prices, of drugs consumed by the average American pharmacy or consumer. The sample was selected from the drugs consumed in the largest quantities in the United States. This ensures that the study captured non-patented as well as patented drugs. Other studies that compare drug prices across borders use price indices, which overwhelmingly reflect the prices of patented drugs.

The study finds that prescription drug prices are lower in Canada than in the United States. However, there is considerable variance among the price differences. A certain number of drugs are more expensive in Canada than in the United States. In all cases, these drugs are generic drugs. Indeed, if American consumers paid Canadian prices for generic drugs, they would pay higher prices than they do now.

As well, patented drugs have a smaller Canadian discount than branded, non-patented drugs. This is interesting because Canada has a price regulator, the Patented Medicine Prices Review Board, which controls patented drug prices but not non-patented drug prices.

The fact that generic drug prices are often higher in Canada than the United States and that branded non-patented drugs have a greater Canadian discount than patented drugs invites a closer examination of the effects of Canada's drug-price control regime.

Introduction

Public attention in the United States and Canada has recently focused on differences among the prices of prescription drugs in the two countries. Because of these price differences, a number of American residents who live close to the Canadian border have come to Canada to have their prescriptions filled in Quebec, Ontario (CBC television, *The National*, February 18, 2000) and more recently, British Columbia (CTV Vancouver, *The Noon News Hour*, May 3, 2000). To serve this market, at least one group of medical entrepreneurs plans open a clinic just north of the border between the state of Washington and British Columbia (Fong 2000).

Reports from the United States indicate that prescriptions can be purchased at significantly lower costs in Canada than in the United States. In 1998, Representative Bernard Sanders initiated a study that compared prescription drug prices in Vermont to prices in Canada and Mexico (US House of Representatives 1998). The report concluded that it appeared that drug companies were engaged in a form of discriminatory pricing that victimized those who were least able to afford it. In the fall of 1999, the CBS news program, *60 Minutes*, featured this subject and reported that bus-loads of American seniors had traveled to Ontario and Quebec to obtain prescription drugs. President Clinton ordered a study of prescription drug costs in America, which was submitted in April 2000 (US Department of Health and Human Services 2000). Hillary Clinton, campaigning for a seat in the American Senate, promised legislation that would permit New York pharmacists to buy low-cost prescription drugs from Canada (Clinton 2000).

Some American jurisdictions, such as Maine, plan to impose explicit price regulation on pharmaceuticals, for which Canada's Patented Medicines Prices Review Board is to be the model.

The goal of this study is to identify the effects of price regulation in the Canadian and American markets. It looks at wholesale and retail prices for a sample of high-volume prescription drugs sold in the United States and Canada. It seeks to answer the questions:

(1) What would the average American pharmacy pay for drug X if it were to pay the Canadian price?

(2) What would the average American drug consumer pay for drug X if he were to pay the Canadian price?

This survey contributes to the discussion of prescription drug prices by examining a much larger set of data than other recent lists (Clinton 2000; Gorton 2000) and including prescription drugs other than patented drugs.

Given that the Canadian government explicitly regulates prices of patented drugs and the United States government does not, the authors expect that the results of this survey will be an important input for researchers who seek to explain the effects of the different regulatory systems in the two countries. Because the Canadian government regulates the prices of patented drugs only, we have sought especially to identify differences between the prices of patented and of non-patented drugs.

Identifying an objectively selected sample that contains both significant patented and non-

patented drugs is a challenge. For the most part, classical price indexes capture prices of patented drugs, which dominate sales volume. A sample including non-patented drugs permits the authors to observe differences between relative prices for drugs that are subject to price regulation in Canada (patented drugs) and those that are not (non-patented drugs). We believe that the sample that we have collected is the largest since a study using 1992 data to construct a variety of classical price indices (Danzon 1996).

Method

Prices measured

There are three price levels in the distribution chain for prescription drugs: the "gate price" (the price at which the manufacturer sells to the wholesaler), the wholesale price, and the retail price. Criticisms of high drug prices are usually levelled against manufacturers. However, outside researchers have found it extremely difficult to observe actual gate prices. This study compares the next two levels: wholesale and retail prices. The average wholesale mark-up is estimated to be about 2.5 percent in the United States (US Department of Health and Human Services 2000: 98), so wholesale prices are very close to gate prices. However, true wholesale prices are also very difficult to observe. Thus, the authors were forced to adopt key assumptions about wholesale transaction prices at which drugs are sold to pharmacies.

For this reason, the study also compares retail prices. Although retail distribution is well downstream from the factory gate in terms of value added,[1] retail prices have the advantage of being unambiguous. They are relatively easy to collect and require no assumptions as to their accuracy.

Sample

Selecting the Sample

The 60 prescription drugs with the greatest volume of prescriptions written in the United States during the period of January through October 1998, as compiled by Scott-Levin's *Source Prescription Audit*, were selected from the *1999 Drug Topics Red Book* (Medical Economics Company 1999: 150-151). The list is attached as Appendix 1.

Qualifying the sample

There were several criteria for determining whether a drug listed in the *Red Book* could be compared to a product in Canada. All drugs had to be prescription pharmaceuticals that were identical and equivalent in several respects. Brand-name drugs were compared only to brand-name drugs and generic drugs compared only to generic drugs. Products had to be identical with respect to chemical name, dosage or strength, and form. For example, generic *Diazepam* was not compared to branded *Valium*®. If a drug was sold as a tablet on Costco Online in the United States but as a caplet by Costco Canada, it was rejected.

Not all drugs in the sample of 60 fit the criteria. Because the authors wanted to compare both

wholesale and retail prices, four prices were collected: an American wholesale price (*Red Book*), a Canadian wholesale price (Ontario Drug Benefit Program formulary), an American retail price (Costco), and a Canadian retail price (Costco). Fifteen drugs had to be excluded from both the wholesale and the retail comparisons (not the same 15 in each case.) Tables 1 and 2 show the drugs that were excluded from the wholesale and retail samples, respectively, and the reasons that this was necessary.

Two branded drugs were included in the comparisons although they sell under different names in the two countries. *Procardia XL*® (*Nifedipine*), sold by Pfizer in the United States is sold as *Adala*t® by Bayer in Canada. This is due to a licensing agreement between the two companies. SmithKline Beecham sells *Amoxicillin/Clavulanic Acid* in the United States as *Augmentin*®, but as *Clavulin*® in Canada. The authors determined that the two products were comparable in both cases. Thus, 45 drugs out of 60, or 75 percent of the sample, were compared for both the wholesale and retail cases. Canadian prices were translated to American dollars at an exchange rate of 69 cents US to the Canadian dollar.

The number of prescriptions written for the wholesale sample was 629,068,000 and for the retail sample, 609,835,000. It is estimated that the total number of prescriptions written in the United States during the period was 2.4 billion (US Department of Health and Human Services 2000: 113). Thus, the samples capture about 25 percent of the total number of prescriptions written.

Definition of terms

Comparison of wholesale prices

Average Wholesale Price (AWP) has a different meaning in Canada than in the United States, where the *Drug Topics Red Book* lists AWPs for var-

ious distributors of each drug. These AWPs serve as the bases for determining the prices that will be paid by third-party payers, health maintenance organizations, and government departments to pharmacies for the prescriptions dispensed to their clients. For branded drugs, the AWP is set by the manufacturer. The price at which the manufacturer sells to the wholesaler is discounted, on average, by 20 percent off the AWP. The wholesaler sells to the pharmacy at a discount of 18 percent. Thus, the average actual wholesale price is 82 percent of the AWP (US Department of Health and Social Services 2000: 98). The authors realize that this specific discount does not apply to every drug in the sample. Nevertheless, as it is the best approximation available, it was used as the American wholesale price.

For generic drugs, there is no clear relationship between the listed AWP and the actual wholesale price. Each generic drug in the *Red Book* has a number of suppliers, who often charge extremely different prices for the same dose, form, and package of any one drug. In many cases, the highest list price is a multiple of the lowest. The authors do not believe that these prices can realistically be interpreted as true prices at which drugs are sold. The *Red Book* also lists the highest price that the government will pay as a drug benefit for Medicaid clients (the HCFA price, from the Health Care Financing Administration). Since the HCFA price is steeply discounted, the true wholesale transaction price for generics is estimated to be 1.50 times the HCFA price.[2]

In Canada, there is no inexpensive publication similar to the *Drug Topics Red Book*. Therefore, the authors used the Ontario Drug Benefit Formulary's Direct Unit Cost (Ontario Ministry of Health, 1999). When patients insured by one of the Ontario Drug Benefit Programs purchase prescriptions, the Ontario Ministry of Health reimburses the pharmacies an amount calculated

Table 1 Drugs rejected from wholesale price comparison

Product	Status & Rank	Comments
Albuterol Aerosol	G7	Different packaging modalities made comparisons not possible.
Ambien®	B26	In Red Book but not any of other three data sources used.
Claritin®	B7	Sold as Over-the-Counter product in Canada.
Cyclobenzaprine	G25	Not covered by Ontario DBP.
Doxycycline Hyclate	G27	Not covered by Ontario DBP.
Glucotrol XL®	B29	In Red Book but not any of other three data sources used.
Hydrocodone / **APAP**	G1	In Red Book but not any of other three data sources used.
K-Dur 20®	B28	Not covered by Ontario DBP.
Levoxyl®	G22	Not covered by Ontario DBP.
Ortho Tri-Cyclen®	B31	Not covered by Ontario DBP.
Prempro®	B11	In Red Book but not any of other three data sources used.
Prilosec®	B4	Available by name of Losec® (brand). Different packaging modalities rendered comparisons impossible
Propoxyphene-N / **APAP**	G6	In Red Book but not any of other three data sources used.
Trimox	G2	Not covered by Ontario DBP.
Ultram®	B25	In Red Book but not any of other three data sources used.

Table 2 Drugs rejected from retail price comparison

Product	Status & Rank	Comments
Acetamin. w/Cod.#3	G8	Costco Canada dispenses Tylenol® #3 (Brand) as a substitute.
Albuterol Aerosol	G7	Different packaging modalities made comparisons not possible.
Ambien®	B26	In Red Book but not any of other three data sources used.
Amoxicillin	G9	Specific drug not listed in United States on-line retail drug set.
Amoxil®	B30	Amoxil not sold by Costco Canada.
Claritin®	B7	Not included in database. Sold as Over-the-Counter product in Canada.
Glucotrol XL®	B29	In Red Book but not any of other three data sources used.
HCTZ/Triamterene	G12	Costco Canada does not sell generic drug. Issues Dyazide® (Brand) as a substitute.
Hydrocodone / **APAP**	G1	In Red Book but not any of other three data sources used.
Levoxyl	G22	Eltroxin® dispensed by Costco Canada as an equivalent.
Prempro®	B11	In Red Book but not any of other three data sources used.
Propoxyphene-N / **APAP**	G6	In Red Book but not any of other three data sources used.
Trimox	G2	Not included in Canada Costco drug set.
Ultram®	B25	In Red Book but not any of other three data sources used.
Ortho Tri-Cyclen®	B31	Packaging sufficiently different in Canada so as to render price comparison impossible.

Note to tables 1 and 2: Status and Rank (column 2) are taken from the *1999 Drug Topics Red Book* (Medical Economics Company 1999). G indicates a generic drug; B indicates a branded drug; numbers indicate a drug's rank among either generic and branded drugs as determined by the number of prescriptions written.

as the Direct Unit Cost plus 10 percent, plus a dispensing fee. This is intended to cover the cost of the acquisition of the drugs from the manufacturer or wholesaler, the retail margin, and the professional service of the dispensing pharmacist. The Direct Unit Cost is approved by a review committee of the Ontario Drug Benefit Program and is a good approximation for the true wholesale price, averaged over the community of wholesalers. As well, we canvassed one Canadian wholesaler for actual prices, which corresponded very closely to the published Direct Unit Costs. In many cases, they were equal. Therefore, the Direct Unit Cost was used as the Canadian wholesale price.

Comparison of retail prices

The wide range of prices charged by different pharmacies made it difficult to compare the prices of a particular pharmacy in the United States to the prices of a different pharmacy in Canada. Therefore, Costco, which operates in both countries, was chosen as the reference pharmacy. For the United States, data were collected from the Costco On-line Pharmacy where a complete list of drug prices was provided. An American Costco employee informed the authors that on-line prices and in-store prices were equal. Full-scale online pharmacy services do not exist in Canada, so Canadian prices were obtained from pharmaceutical customer representatives at a local Costco outlet. Prices include professional dispensing fees. The data were collected at the beginning of April 2000.[3]

Analysis

Classifying the sample

The drugs were classified in two ways: by pharmacologic-therapeutic classification and by level of intellectual property protection in the United States.

With respect to pharmacologic-therapeutic classification, the drugs fell into eight categories (taken from Ontario Ministry of Health 1999):

(1) Autonomic Agents (AU);

(2) Blood Formation and Coagulation (BL);

(3) Cardiovascular Drugs (CV);

(4) Electrolyte, Caloric, and Water Balance (EL);

(5) Gastrointestinal Drugs (GI);

(6) Hormones and Substitutes (HO);

(7) Anti-Infective Agents (IN); and

(8) Central Nervous System Drugs (NS).

With respect to intellectual property, the drugs were classified as:

(1) *exclusive*: the drug is protected in the United States from competitors selling the same *moiety* (molecular structure of the therapeutically active ingredient) through patents or exclusivity granted by the United States Food and Drug Administration;[4]

(2) *branded only*: the drug is not legally protected from competing products of the same *moiety* but the manufacturer maintains the trademarked name for its version of the drug and invests heavily in order to differentiate its brand from competing substitutes or to dissuade substitutes from entering the market;[5]

(3) *generic*: the drug is a substitute for another drug of the same *moiety* that does not enjoy legal protection from competition, and the generic drug competes almost entirely on

price, making little or no investment in brand differentiation.[6]

The 45 drugs in both the wholesale and retail samples were distributed among these categories in a matrix, as shown in tables 3 and 4.

Examining the sample

Calculations

In order to get as much information from the wholesale and retail samples as possible, the data were examined in several ways.

(1) The Canadian discount or premium was calculated as the difference between the Canadian price and the American price, divided by the American price and expressed as a percentage.

(2) A simple analysis of the median, simple average, range, sample standard deviation, and number of drugs that are more expensive in Canada were calculated for both samples.

(3) A weighted average was calculated by multiplying each drug's Canadian percentage discount by a weighting factor, W_i, and taking the sum of the resulting weighted percentage discounts, where:

$$W_i = N_i / N_T$$
and
$$\sum_{i=1}^{45} W_i = 1$$

Where N_i is the number of prescriptions written during the period for drug i;

and N_T is the total number of prescriptions written for the sample (for the wholesale sample $N_T = 629{,}068{,}000$, and for the retail sample $N_T = 609{,}835{,}000$).

(4) The samples were sorted into subsets by pharmacologic-therapeutic categories and sub-

jected to the same analysis (where the weighting factors were calculated as a proportion of the prescriptions written for the subset).

(5) The samples were sorted into exclusive, branded only, and generic subsets and subjected to the same analysis.

Caveats and assumptions

The goal of the weighted average is to estimate the difference in drug costs that the "average" American retailer or consumer would experience if he paid Canadian prices for his basket of drugs. It does *not* estimate the average cost of the basket of drugs bought by the United States as a whole. Such an estimate would have to be weighted by sales revenue, not by number of prescriptions written. For example, *Epogen®* (*Epoetin Alfa*, recombinant DNA origin), a drug taken by injection only, is a blood formation and coagulation agent prescribed for patients suffering anaemia due to AIDS and other causes. It was the drug with the sixth highest sales in the United States in 1999/2000 (IMS Health 2000), as measured by sales revenue, but is classified as an orphan drug by the United States FDA because it sells very few units. Therefore, it does not appear in the sample used in this study. However, *Epogen®* (as well as *Procrit®*, another manufacturer's version of the drug) costs hundreds of dollars per vial. The drug weighs heavily in the national United States weighted drug basket but clearly does not figure in the drug costs of the "average" American patient.

Two caveats must be understood when considering these weighted averages. First, "prescriptions filled" is used as a proxy for units consumed. The authors do not know the average length of treatment for which any prescription was written. That is, whether a prescription was written for one week's supply or three months' supply is not taken into consideration. This uncertainty about the consumption period of the drugs prescribed

Table 3: Classification Distribution of Wholesale Sample, by numbers of drugs (and percentage)

	AU	BL	CV	EL	GI	HO	IN	NS
45 drugs (100%)	0 drugs (0%)	1 drug (2%)	15 drugs (33%)	3 drugs (7%)	2 drugs (4%)	5 drugs (11%)	8 drugs (18%)'	11 drugs (24%)
Exclusive 18 drugs (40%)			11 (24%)		1 (2%)	2 (4%)	1 (2%)	3 (7%)
Branded only 7 drugs (16%)		1 (2%)	1 (2%)			1 (2%)	4 (9%)	
Generic 20 drugs (44%)			3 (7%)	3 (7%)	1 (2%)	2 (4%)	3 (7%)	8 (18%)

Table 4: Classification Distribution of Retail Sample

	AU	BL	CV	EL	GI	HO	IN	NS
45 drugs (100%)	1 drugs (2%)	1 drug (2%)	15 drugs (33%)	3 drugs (7%)	3 drugs (7%)	5 drugs (11%)	7 drugs (16%)	10 drugs (22%)
Exclusive 20 drugs (46%)			11 (24%)	1 (2%)	2 (4%)	2 (4%)	1 (2%)	3 (7%)
Branded only 6 drugs (14%)		1 (2%)	1 (2%)			1 (2%)	3 (7%)	
Generic 19 drugs (41%)	1 (2%)		3 (7%)	2 (4%)	1 (2%)	2 (4%)	3 (7%)	7 (16%)

Note to tables 3 and 4: AU = autonomic agent; BL = blood formation and coagulation; CV = cardiovascular; EL = electrolyte, caloric, and water balance; GI = gastrointestinal; HO = hormones and substitutes; IN = anti-infective; NS = central nervous system. Percentages may not add up due to rounding.

is not a serious weakness, however, because the goal of the study is to estimate the replacement costs of the sampled drugs at Canadian prices, whatever the consumption period.

Second, the prices used are prices for one dose, form, and package of each sampled drug. Each price was carefully chosen because the same dose, form, and package exists in both countries. However, actual prescriptions filled for each drug include a variety of doses, forms, and packages. Thus, the weighting method assumes that the quantity of the dose, form, and package whose price is used, as a proportion of all doses, forms, and packages of that drug, is constant for all drugs. Furthermore, it assumes that the price

of the selected dose, form, and package has a constant relationship to all other doses, forms, and packages of that drug, and that the relationship is constant for all drugs in the samples. As well, it assumes that these relationships hold for the Canadian drugs.

For example, take two drugs, *A* and *B*. Each drug sells in two doses of tablets: 5mg and 10mg. Suppose 50 percent of the units of drug *A* are sold as 5mg tablets and 50 percent as 10mg tablets. Quantities sold of drug *B* must conform to the same proportions for the weighting formula to be accurate. Furthermore, if the 5mg tablet of drug *A* is half the price of the 10mg tablet, this price relationship must be the same for drug *B*.

When using Canadian prices to determine the replacement cost of the drugs, the price relationship for the Canadian doses must be the same as for the American doses. Clearly, these assumptions are not true. However, we did not have more specific information about the composition of doses, forms, and packages for the prescriptions filled for each drug and believe that we have minimized the error resulting from the use of these assumptions by selecting the most common dose, form, and package of the drug, so long as it was identical in the two countries.

Findings

Overall findings

The results of the simple analysis for each drug are attached as Appendix 2 (wholesale) and Appendix 3 (retail), ranked by the percentage Canadian discount or premium. The calculation of the weighted average for each sample is shown in Appendix 4 (wholesale) and Appendix 5 (retail), where the samples are ranked according to their contribution to the weighted average. The findings are summarized in table 5.

The findings confirm that prescription drugs are cheaper in Canada than the United States. However, the most striking finding from this simple analysis is that there is a wide range of differences between the price of drugs in Canada and that in the United States. As well, we see that a number of drugs are more expensive in Canada than the United States, especially at the retail level.

Findings by Pharmacologic-Therapeutic Classification

Table 6 (wholesale) and table 7 (retail) categorize the observations with respect to pharmacologic-therapeutic classification.

All pharmacologic-therapeutic classes (except the cardiovascular drugs) have lower prices in Canada than the United States at the wholesale level. Except for hormones and substitutes, all classes demonstrate large ranges of price differences at both wholesale and retail levels. However, the sample sizes for many of the classes is very small, so statistical measures must not be considered definitive. At retail prices, the cardiovascular, gastrointestinal, anti-infective, and central nervous system subsets had at least one member whose Canadian price was higher. As well, the lone autonomic agent had a higher retail price in Canada. The results for the cardiovascular drugs are skewed because of one heavily weighted drug, *Atenolol*, which is vastly more expensive in Canada than in the United States.

Generic Drugs versus Brand-Name Drugs

As shown in table 5, two drugs had higher wholesale prices in Canada than the United States, and seven had higher retail prices. All of these drugs were generic drugs. Indeed, these drugs comprise over one-third of the generics in the retail set.

Table 8 (wholesale) and table 9 (retail) show the simple statistical analysis of the samples, broken down by intellectual property classification.

All subsets but one are cheaper in Canada. Generic drugs, however, appear to be more

Table 5: Analysis of Canadian (Discount) or Premium

	Median	Simple Average	Weighted Average	Range	Standard Deviation	Number of drugs more expensive in Canada
Wholesale	(45%)	(43%)	(42%)	(98%) to 350%	68%	2
Retail	(46%)	(24%)	(28%)	(95%) to 238%	76%	7

Table 6: Canadian (Discount) or Premium by Pharmacologic-Therapeutic Classification (Wholesale)

45 drugs	AU 0 drugs	BL 1 drug	CV 15 drugs	EL 3 drugs	GI 2 drugs	HO 5 drugs	IN 8 drugs	NS 11 drugs
Median	N/A	(68%)	(27%)	(92%)	(61%)	(81%)	(41%)	(49%)
Simple Average	N/A	N/A	(4%)	(91%)	(61%)	(82%)	(51%)	(54%)
Weighted Average	N/A	N/A	16%	(19%)	(61%)	(82%)	(50%)	(62%)
Range	N/A	N/A	(64%) to 350%	(95%) to (85%)	(68%) to (53%)	(94%) to (73%)	(98%) to (28%)	(96%) to 58%
Standard Dev.	N/A	N/A	99%	5%	10%	8%	24%	45%
Number of drugs priced higher in Canada	0	0	1	0	0	0	0	1

Table 7: Canadian (Discount) Premium by Pharmacologic-Therapeutic Classification (Retail)

45 drugs	AU 1 drug	BL 1 drug	CV 15 drugs	EL 3 drugs	GI 3 drugs	HO 5 drugs	IN 7 drugs	NS 10 drugs
Median	109%	(58%)	(30%)	(61%)	(56%)	(74%)	(53%)	(47%)
Simple Average	N/A	N/A	(1%)	(63%)	0%	(73%)	(17%)	(43%)
Weighted Average	N/A	N/A	9%	(64%)	(4%)	(75%)	(28%)	(43%)
Range	N/A	N/A	(51%) to 238%	(66%) to (60%)	(59%) to 115%	(80%) to (60%)	(95%) to 212%	(84%) to 20%
Standard Dev.	N/A	N/A	87%	3%	100%	6%	105%	34%
Number of drugs priced higher in Canada	1	0	2	0	1	0	1	2

Note to tables 5, 6, and 7: Figures in parentheses indicate Canadian discount; figures without parentheses indicate Canadian premium.

expensive on average at the retail level. For both wholesale and retail prices, there are significant differences between subsets. The subset with the largest average discount is the branded-only subset. Canadian exclusive drugs enjoy less of a discount and generic drugs perhaps not at all. However, the range of generic price differences is much larger than it is for the other subsets. This wide dispersion of generic price differences is noteworthy, especially since the patented and branded-only subsets show almost the same, much smaller, variances in price differences. This difference in results between the wholesale and retail findings for generics is not easily explained. As noted above, retail prices are less prone to error from the collection of data, so the different findings may be due to inaccuracy in the wholesale prices.

Table 8: Canadian (Discount) or Premium by Intellectual Property Classification (Wholesale)

45 drugs	Exclusive 18 drugs	Branded only 7 drugs	Generic 20 drugs
Median	(39%)	(62%)	(74%)
Simple Average	(40%)	(56%)	(41%)
Weighted Average	(45%)	(63%)	(33%)
Range	(79%) to (2%)	(85%) to (28%)	(98%) to 350%
Standard Deviation	21%	20%	100%
Number of drugs priced higher in Canada	0	0	2

Table 9: Canadian (Discount) or Premium by Intellectual Property Classification (Retail)

45 drugs	Exclusive 20 drugs	Branded only 6 drugs	Generic 19 drugs
Median	(47%)	(64%)	(41%)
Simple Average	(46%)	(61%)	11%
Weighted Average	(35%)	(65%)	7%
Range	(79%) to (16%)	(80%) to (40%)	(95%) to 238%
Standard Deviation	17%	16%	106%
Number of drugs priced higher in Canada	0	0	7

Note to tables 8 and 9: Figures in parentheses indicate Canadian discount; figures without parentheses indicate Canadian premium.

Conclusion

(1) The comparison of international prices of pharmaceuticals is a challenging task. In our sample, 25 percent of the data had to be excluded from analysis because comparable products could not be found in both countries. This confirms that, as indicated earlier, such studies are prone to pitfalls and potential abuse (Danzon 1996).

(2) Significant and risky assumptions have to be made about wholesale prices, especially in the United States. The finding that generic drugs in Canada are more expensive at the retail level but not so at the wholesale level indicates that the wholesale prices estimated may be inaccurate. Although the the mark-ups for generic drugs by American pharmacies are believed to be higher than for branded drugs (US Department of Health and Human Services 2000: 114), the authors are not aware of any differences in regulation or market structure at this point in the distribution chain that would give Canadian pharmacies more leverage than their American counterparts in marking up generic prices.

(3) Generally, prescription drugs are cheaper in Canada at both the wholesale and the retail level. These averages disguise the fact that subsets of the sample demonstrate very different results and wide variance.

(4) Brand-name drugs are significantly cheaper in Canada than the United States at both the wholesale and retail level. Non-patented brand name drugs, however, have larger Canadian discounts than patented drugs.

(5) the average American would spend more on generic drugs if he were paying Canadian prices rather than current American prices.

However, this finding is tempered by the observation that cross-border price differences for generics are widely dispersed, with some being vastly cheaper in Canada and some very much more expensive.

Future research

These findings invite further research in both method and policy.

(1) Superior measurements of wholesale prices are sorely needed to develop accurate and robust findings to support policy proposals.

(2) *Why* are prescription drug prices lower in Canada than in the United States? Is this the effect of regulation, or other causes?

(3) Even more interesting is the difference between the prices of patented, branded-only, and generic drugs. Why are generic price differences so much more widely dispersed than prices for branded drugs? Are there different public policies in the two countries that lead to differences in the Canadian discount or premium for each of these three subsets?

The authors anticipate that significant insight into policy will result from an understanding of the dynamics of the pricing of prescription drugs in the two countries and another paper in the Fraser Institute's series, Public Policy Sources, discusses these issues (Graham 2000). The authors hope that other researchers in both Canada and the United States will find this survey useful as they study drug prices and pharmaceutical policy in the two countries.

Notes

1   In the United States, the average retail price is estimated to be 1.27 times the true average wholesale price (US Department of Health and Human Services 2000: 98).

2   Discounts for generic drugs to payers such as Medicaid vary widely. About 75 percent of generics offer maximum discounts of 40 percent to 50 percent. About 25 percent of generics offer maximum discounts of 13 to 15 percent. Thus, the weighted average discount is about 45 percent (US Department of Health and Human Services 2000: 104, 108). The study assumes that the average pharmacy receives a discount of about 18 percent (as for branded drugs). Thus, the true wholesale price to a pharmacy is approximately the HCFA price times 0.82/0.55, or about 1.50.

3   The authors realise that there is a 16 month delay from the end of the period for which quantities were sampled and the collection of retail price data but we believe that retail prices did not change significantly over the period in either the United States or Canada. However, this was not confirmed.

4   Drugs are usually protected from competition solely by patents. In the United States, however, the Food and Drug Administration can also grant exclusivity to a drug for other reasons. For example, orphan drugs (those with small potential markets) or drugs for paediatric use are granted exclusivity, notwithstanding their patent status.

5   Although a branded drug may not have patents or exclusivity preventing competitors from selling imitators, it does not always follow that competitors will always enter the market. Some drugs do not enjoy legal protection from competition but market factors alone prevent the entry of substitute products.

6   Classification according to generic or branded was done according to the lists in the Red Book. The branded subset was further segregated into exclusive and branded-only subsets through querying the United States FDA Center for Drug Evaluation and Research's Orange Book at the FDA website.

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Appendix 1

Red Book Top 60 Prescription Drugs

Rank determined by number of prescriptions written in the United States,
January to October 1998; Drugs sorted alphabetically

Product	Prescriptions Written (000s)	Rank	Product	Prescriptions Written (000s)	Rank
Accupril	7,640	53	Lorazepam	13,246	28
Acetamin. w/Cod.#3	19,375	12	Lotensin	7,056	59
Albuterol Aerosol	19,812	10	Metoprolol Tartrate	10,167	39
Alprazolam	18,235	14	Naproxen	10,058	41
Ambien	8,272	51	Norvasc	17,310	17
Amitriptyline	12,729	33	Ortho Tri-Cyclen	7,245	57
Amoxicillin	18,563	13	Paxil	14,598	22
Amoxil	7,340	56	Pravachol	9,534	42
Atenolol	22,262	6	Prednisone Oral	13,134	30
Augmentin (Clavulin)	13,016	32	Premarin tabs	34,362	2
Biaxin	8,945	45	Prempro	14,059	23
Cardizem CD	10,144	40	Prevacid	8,830	46
Cephalexin	20,809	7	Prilosec	19,596	11
Cipro	10,429	37	Prinivil	6,905	60
Claritin	17,111	18	Procardia XL (Nifedipine)	9,091	44
Coumadin Tabs	12,140	34	Propoxyphene-N/APAP	19,816	9
Cyclobenzaprine	8,377	50	Prozac	19,818	8
Diazepam	8,542	49	Ranitidine HCL	10,399	38
Doxycycline	7,098	58	Septra	13,807	25
Furosemide Oral	22,516	5	Synthroid	28,845	3
Glucophage	13,069	31	Trazodone HCL	7,684	52
Glucotrol XL	7,474	55	Triamterene w/HCTZ	16,576	20
Glyburide	10,840	36	Trimox	25,485	4
Hydrochlorothiazide	14,014	24	Ultram	8,727	47
Hydrocodone/APAP	42,382	1	Vasotec	13,556	27
Ibuprofen	18,034	15	Verapamil SR	8,597	48
K-Dur 20	7,550	54	Zestril	13,708	26
Lanoxin	16,637	19	Zithromax	11,550	35
Levoxyl	9,326	43	Zocor	13,183	29
Lipitor	17,955	16	Zoloft	15,922	21

Appendix 2

Differences between Canadian and American Wholesale Prices

Drugs sorted by Canadian (discount) or premium (column 7)

Product	Patent Protection[1]	Class[2]	(1) Estimated US Wholesale Price per Tablet or Capsule (US$)[3]	(2) Ontario Drug Benefit Program Direct Unit Cost (US$)	Difference: Price 2 minus Price 1 (US$)	Canadian (discount) or premium[4]
Trimeth/Sulfa (Septra)	G	IN	1.54	0.03	(1.50)	(98%)
Lorazepam	G	NS	0.76	0.03	(0.73)	(96%)
Amitriptyline	G	NS	0.09	0.00	(0.09)	(96%)
Hydrochlorothiazide	G	EL	0.09	0.00	(0.08)	(95%)
Glyburide	G	HO	0.80	0.05	(0.76)	(94%)
Diazepam	G	NS	0.07	0.00	(0.07)	(94%)
Naproxen	G	NS	0.97	0.07	(0.89)	(92%)
HCTZ/Triamterene	G	EL	0.40	0.03	(0.37)	(92%)
Synthroid	B	HO	0.23	0.04	(0.20)	(85%)
Furosemide Oral	G	EL	0.03	0.00	(0.03)	(85%)
Prednisone Oral	G	HO	0.03	0.01	(0.03)	(81%)
Premarin tabs	E	HO	0.40	0.08	(0.32)	(79%)
Glucophage	E	HO	0.50	0.13	(0.36)	(73%)
Zoloft	E	NS	1.80	0.55	(1.25)	(69%)
Coumadin Tabs	B	BL	0.52	0.17	(0.36)	(68%)
Augmentin (Clavulin)	B	IN	1.89	0.60	(1.29)	(68%)
Ranitidine HCL	G	GI	1.67	0.54	(1.13)	(68%)
Lanoxin	E	CV	0.17	0.06	(0.11)	(64%)
Biaxin	B	IN	2.67	1.02	(1.65)	(62%)
Prevacid	E	GI	2.95	1.38	(1.57)	(53%)
Ibuprofen	G	NS	0.05	0.03	(0.03)	(49%)
Prozac	E	NS	2.12	1.11	(1.02)	(48%)
Cipro	E	IN	2.80	1.53	(1.27)	(45%)
Procardia XL (Adalat XL)	B	CV	1.13	0.64	(0.49)	(43%)
Paxil	E	NS	1.83	1.10	(0.73)	(40%)
Pravachol	E	CV	1.73	1.04	(0.69)	(40%)
Vasotec	E	CV	1.29	0.80	(0.49)	(38%)
Zithromax	B	IN	5.37	3.40	(1.97)	(37%)
Amoxicillin	G	IN	0.11	0.07	(0.04)	(35%)

Product	Patent Protection[1]	Class[2]	(1) Estimated US Wholesale Price per Tablet or Capsule (US$)[3]	(2) Ontario Drug Benefit Program Direct Unit Cost (US$)	Difference: Price 2 minus Price 1 (US$)	Canadian (discount) or premium[4]
Alprazolam	G	NS	0.10	0.06	(0.03)	(34%)
Acetamin. w/Cod.#3	G	NS	0.05	0.03	(0.02)	(34%)
Verapamil SR	G	CV	0.92	0.60	(0.31)	(34%)
Cephalexin	G	IN	0.30	0.21	(0.10)	(32%)
Amoxil	B	IN	0.18	0.13	(0.05)	(28%)
Lipitor	E	CV	1.54	1.10	(0.44)	(28%)
Lotensin	E	CV	0.65	0.47	(0.18)	(28%)
Accupril	E	CV	0.78	0.57	(0.21)	(27%)
Zestril	E	CV	0.75	0.56	(0.19)	(25%)
Prinivil	E	CV	0.74	0.56	(0.18)	(24%)
Zocor	E	CV	1.87	1.52	(0.35)	(19%)
Norvasc	E	CV	1.09	0.88	(0.20)	(19%)
Metoprolol Tartrate	G	CV	0.10	0.08	(0.01)	(13%)
Cardizem CD	E	CV	1.19	1.17	(0.02)	(2%)
Trazodone HCL	G	NS	0.10	0.15	0.06	58%
Atenolol	G	CV	0.09	0.40	0.31	350%
					Avg:	(43%)
					Std Dev:	68%
					Median:	(45%)

1 B = branded only; E = exclusive; G= generic.

2 BL = blood formation and coagulation; CV = cardiovascular; EL = electrolyte, caloric, and water balance; GI = gastrointestinal; HO = hormones and substitutes; IN = antiinfective; NS = central nervous system.

3 See discussion at page 10.

4 Difference (column 6) divided by the US wholesale price (column 4). Figures in parentheses indicate Canadian discount; figures without parentheses indicate Canadian premium.

Appendix 3

Differences between Canadian and American Retail Prices

Drugs sorted by Canadian (discount) or premium (column 7)

Product	Patent Protection[1]	Class[2]	(1) US Unit Price at Costco Online (US$)	(2) Canadian Unit Price at Costco Retail Pharmacy (US$)	Difference: Price 2 minus Price 1 (US$)	Canadian (discount) or premium[3]
Trimeth/Sulfa (Septra)	G	IN	1.00	0.05	(0.95)	(95%)
Lorazepam	G	NS	0.29	0.05	(0.24)	(84%)
Synthroid	B	HO	0.28	0.06	(0.23)	(80%)
Premarin tabs	E	HO	0.46	0.10	(0.36)	(79%)
Glucophage	E	HO	0.60	0.16	(0.44)	(74%)
Augmentin (Clavulin)	B	IN	2.31	0.63	(1.68)	(73%)
Glyburide	G	HO	0.20	0.06	(0.14)	(70%)
Biaxin	B	IN	3.38	1.03	(2.35)	(69%)
Zoloft	E	NS	1.89	0.59	(1.30)	(69%)
Amitriptyline	G	NS	0.05	0.02	(0.04)	(66%)
Furosemide Oral	G	EL	0.05	0.02	(0.04)	(66%)
Diazepam	G	NS	0.05	0.02	(0.03)	(64%)
Hydrochlorothiazide	G	EL	0.05	0.02	(0.03)	(61%)
Prednisone Oral	G	HO	0.05	0.02	(0.03)	(60%)
K(Dur 20	E	EL	0.49	0.20	(0.30)	(60%)
Prevacid	E	GI	3.39	1.39	(2.00)	(59%)
Coumadin Tabs	B	BL	0.62	0.26	(0.36)	(58%)
Prilosec	E	GI	3.48	1.53	(1.95)	(56%)
Cipro	E	IN	3.28	1.55	(1.73)	(53%)
Zocor	E	CV	3.16	1.53	(1.63)	(51%)
Lanoxin	E	CV	0.14	0.07	(0.07)	(50%)
Prozac	E	NS	2.30	1.20	(1.10)	(48%)
Procardia XL (Adalat XL)	B	CV	1.22	0.66	(0.56)	(46%)
Ibuprofen	G	NS	0.07	0.04	(0.03)	(46%)
Pravachol	E	CV	1.95	1.06	(0.90)	(46%)
Paxil	E	NS	2.03	1.19	(0.84)	(42%)
Vasotec	E	CV	1.38	0.81	(0.57)	(41%)
Naproxen	G	NS	0.15	0.09	(0.06)	(41%)
Zithromax	B	IN	5.69	3.42	(2.27)	(40%)

Product	Patent Protection[1]	Class[2]	(1) US Unit Price at Costco Online (US$)	(2) Canadian Unit Price at Costco Retail Pharmacy (US$)	Difference: Price 2 minus Price 1 (US$)	Canadian (discount) or premium[3]
Lotensin	E	CV	0.79	0.52	(0.28)	(35%)
Prinivil	E	CV	0.82	0.57	(0.25)	(31%)
Accupril	E	CV	0.88	0.62	(0.26)	(30%)
Zestril	E	CV	0.81	0.57	(0.24)	(29%)
Lipitor	E	CV	1.64	1.19	(0.44)	(27%)
Cardizem CD	E	CV	1.19	0.90	(0.28)	(24%)
Norvasc	E	CV	1.06	0.90	(0.17)	(16%)
Metoprolol Tartrate	G	CV	0.11	0.10	(0.01)	(13%)
Cephalexin	G	IN	0.22	0.22	0.00	(1%)
Alprazolam	G	NS	0.07	0.08	0.01	12%
Trazodone HCL	G	NS	0.14	0.17	0.03	20%
Cyclobenzaprine	G	AU	0.13	0.27	0.14	109%
Ranitidine HCL	G	GI	0.14	0.29	0.16	115%
Verapamil SR	G	CV	0.22	0.62	0.40	180%
Doxycycline Hyclate	G	IN	0.13	0.42	0.28	212%
Atenolol	G	CV	0.12	0.41	0.29	238%
					Avg:	(24%)
					Std Dev:	76%
					Median:	(46%)

1 B = branded only ; E = exclusive; G= generic.

2 AU = autonomic agent; BL = blood formation and coagulation; CV = cardiovascular; EL = electrolyte, caloric, and water balance; GI = gastrointestinal; HO = hormones and substitutes; IN = antiinfective; NS = central nervous system.

3 Difference (column 6) divided by the US retail price (column 4). Figures in parentheses indicate Canadian discount; figures without parentheses indicate Canadian premium.

Appendix 4

Weighted Average Canadian Wholesale (Discount) or Premium
Canadian prices divided by American prices
Drugs sorted by contribution to weighted average (column 5)

Product	Units (000s)	(1) Weighting Factor[1]	(2) Percentage Price Difference (Canada/US)	Contribution to Weighted Average (Discount) or Premium (column 1 * column 2)
Premarin tabs	34,362	0.0546	(79%)	(4%)
Synthroid	26,845	0.0427	(85%)	(4%)
Furosemide Oral	22,516	0.0358	(85%)	(3%)
Acetamin. w/Cod.#3	19,375	0.0308	(85%)	(3%)
HCTZ/Triamterene	16,576	0.0264	(92%)	(2%)
Trimeth/Sulfa (Septra)	13,807	0.0219	(98%)	(2%)
Hydrochlorothiazide	14,014	0.0223	(95%)	(2%)
Lorazepam	13,246	0.0211	(96%)	(2%)
Amitriptyline	12,729	0.0202	(96%)	(2%)
Zoloft	15,922	0.0253	(69%)	(2%)
Prednisone Oral	13,134	0.0209	(83%)	(2%)
Lanoxin	16,637	0.0264	(64%)	(2%)
Glyburide	10,840	0.0172	(94%)	(2%)
Glucophage	13,069	0.0208	(73%)	(2%)
Prozac	19,818	0.0315	(48%)	(2%)
Ibuprofen	18,034	0.0287	(49%)	(1%)
Augmentin (Clavulin)	13,016	0.0207	(68%)	(1%)
Coumadin Tabs	12,140	0.0193	(68%)	(1%)
Diazepam	8,542	0.0136	(94%)	(1%)
Ranitidine HCL	10,399	0.0165	(68%)	(1%)
Cephalexin	20,809	0.0331	(32%)	(1%)
Amoxicillin	18,563	0.0295	(35%)	(1%)
Alprazolam	18,235	0.0290	(34%)	(1%)
Naproxen	10,058	0.0160	(60%)	(1%)
Paxil	14,598	0.0232	(40%)	(1%)
Biaxin	8,845	0.0141	(62%)	(1%)
Vasotec	13,556	0.0215	(38%)	(1%)
Lipitor	17,955	0.0285	(28%)	(1%)
Cipro	10,429	0.0166	(45%)	(1%)

Product	Units (000s)	(1) Weighting Factor[1]	(2) Percentage Price Difference (Canada/US)	Contribution to Weighted Average (Discount) or Premium (column 1 * column 2)
Prevacid	8,830	0.0140	(53%)	(1%)
Zithromax	11,550	0.0184	(37%)	(1%)
Procardia XL (Adalat XL)	9,091	0.0145	(43%)	(1%)
Pravachol	9,534	0.0152	(40%)	(1%)
Zestril	13,706	0.0218	(25%)	(1%)
Norvasc	17,310	0.0275	(19%)	(1%)
Verapamil SR	8,597	0.0137	(34%)	0%
Zocor	13,183	0.0210	(19%)	0%
Amoxil	7,340	0.0117	(28%)	0%
Accupril	7,640	0.0121	(27%)	0%
Lotensin	7,056	0.0112	(28%)	0%
Prinivil	6,905	0.0110	(24%)	0%
Metoprolol Tartrate	10,167	0.0162	(13%)	0%
Cardizem CD	10,144	0.0161	(2%)	0%
Trazodone HCL	7,684	0.0122	58%	1%
Atenonolol	22,262	0.0354	350%	12%
Total	629,068	1.0000	Weighted Av. Discount:	(42%)

1   A weighted average was calculated by multiplying each drug's Canadian percentage discount by a weighting factor, W_i, and taking the sum of the resulting weighted percentage discounts, where:

$W_i = N_i / N_T$

and

$$\sum_{i=1}^{45} W_i = 1$$

Where N_i is the number of prescriptions written during the period for drug i;

and N_T is the total number of prescriptions written for the sample (for the wholesale sample $N_T = 629,068,000$, and for the retail sample $N_T = 609,835,000$).

Appendix 5

Weighted Average Canadian Retail (Discount) or Premium

Canadian prices divided by American prices

Drugs sorted by contribution to weighted average (column 5)

Product	Units (000s)	(1) Weighting Factor[1]	(2) Percentage Price Difference (Canada/US)	Contribution to Weighted Average (Discount) or Premium (column 1 * column 2)
Premarin tabs	34,362	0.0563	(79%)	(4%)
Synthroid	26,845	0.0440	(80%)	(4%)
Furosemide Oral	22,516	0.0369	(66%)	(2%)
Trimethoprim/Sulfa (Septra)	13,807	0.0226	(95%)	(2%)
Lorazepam	13,246	0.0217	(84%)	(2%)
Prilosec	19,596	0.0321	(56%)	(2%)
Zoloft	15,922	0.0261	(69%)	(2%)
Glucophage	13,069	0.0214	(74%)	(2%)
Prozac	19,818	0.0325	(48%)	(2%)
Augmentin (Clavulin)	13,016	0.0213	(73%)	(2%)
Hydrochlorothiazide	14,014	0.0230	(61%)	(1%)
Amitriptyline	12,729	0.0209	(66%)	(1%)
Ibuprofen	18,034	0.0296	(46%)	(1%)
Lanoxin	16,637	0.0273	(50%)	(1%)
Prednisone Oral	13,134	0.0215	(60%)	(1%)
Glyburide	10,840	0.0178	(70%)	(1%)
Coumadin Tabs	12,140	0.0199	(58%)	(1%)
Zocor	13,183	0.0216	(51%)	(1%)
Biaxin	8,845	0.0145	(69%)	(1%)
Paxil	14,598	0.0239	(42%)	(1%)
Vasotec	13,556	0.0222	(41%)	(1%)
Cipro	10,429	0.0171	(53%)	(1%)
Diazepam	8,542	0.0140	(64%)	(1%)
Prevacid	8,830	0.0145	(59%)	(1%)
Lipitor	17,955	0.0294	(27%)	(1%)
Zithromax*	11,550	0.0189	(40%)	(1%)
K-Dur 20	7,550	0.0124	(60%)	(1%)
Pravachol	9,534	0.0156	(46%)	(1%)
Procardia XL (Nifedipine)	9,091	0.0149	(46%)	(1%)

Product	Units (000s)	(1) Weighting Factor[1]	(2) Percentage Price Difference (Canada/US)	Contribution to Weighted Average (Discount) or Premium (column 1 * column 2)
Naproxen	10,058	0.0165	(41%)	(1%)
Zestril	13,706	0.0225	(29%)	(1%)
Norvasc	17,310	0.0284	(16%)	0%
Lotensin	7,056	0.0116	(35%)	0%
Cardizem CD	10,144	0.0166	(24%)	0%
Accupril	7,640	0.0125	(30%)	0%
Prinivil	6,905	0.0113	(31%)	0%
Metoprolol Tartrate	10,167	0.0167	(13%)	0%
Cephalexin	20,809	0.0341	(1%)	0%
Trazodone HCL	7,684	0.0126	20%	0%
Alprazolam	18,235	0.0299	12%	0%
Cyclobenzaprine	8,377	0.0137	109%	1%
Ranitidine HCL	10,399	0.0171	115%	2%
Doxycycline Hyclate	7,098	0.0116	212%	2%
Verapamil SR	8,597	0.0141	180%	3%
Atenolol	22,262	0.0365	238%	9%
Total	609,835	1.0000	Weighted Av. Discount:	(28%)

1   A weighted average was calculated by multiplying each drug's Canadian percentage discount by a weighting factor, W_i, and taking the sum of the resulting weighted percentage discounts, where:

$$W_i = N_i / N_T$$

and

$$\sum_{i=1}^{45} W_i = 1$$

Where N_i is the number of prescriptions written during the period for drug i;

and N_T is the total number of prescriptions written for the sample (for the wholesale sample $N_T = 629,068,000$, and for the retail sample $N_T = 609,835,000$).

Acknowledgments

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