International Prices And Availability Of Pharmaceuticals In 2005

Drug spending differences reflect availability and use, not just prices.

by Patricia M. Danzon and Michael F. Furukawa

ABSTRACT: This paper compares pharmaceutical spending, availability, use, and prices in twelve countries in 2005. Drug spending per capita was higher in the United States than in other countries. The United States had relatively high use of new drugs and high-strength formulations; other countries used more of older drugs and weaker formulations. Thus, whether U.S. overall volume of use is lower or higher depends on the measure of volume and type of product. Comprehensive price indexes show foreign prices to be 20–40 percent lower than U.S. manufacturer prices, but only 10–30 percent lower than U.S. public prices. Generics are cheaper in the United States than in other countries. [*Health Affairs* 27, no. 1 (2008): 221–233; 10.1377/hlthaff.27.1.221]

Health care spending per capita is consistently higher in the United States than in other industrialized countries, and pharmaceutical spending is no exception. In 2005, the United States spent $1,141 per capita on pharmaceuticals, roughly twice the per capita drug spending in Germany, Canada, and the United Kingdom and more than ten times the per capita drug spending in Mexico. This paper examines how quantity of services, mix of compounds, prices, and other factors contribute to these spending differences. Specifically, using the United States as the base, we compare the availability, use, and prices of originator and generic drugs in the United States with eleven other countries: France, Germany, Italy, Spain, the United Kingdom, Canada, Australia, Japan, Brazil, Chile, and Mexico. Our spending data are from the universe of pharmaceutical sales, including outpatient and inpatient channels, using the IMS Health MIDAS database for 2005.[1] Our spending decomposition focuses on retail/outpatient sales, because hospital data are unavailable for the Latin American countries and hospital price data are unreliably reported for many other countries.

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Spending And Quantity Per Capita

■ **Spending.** Estimates of pharmaceutical spending and prices differ greatly, depending on whether measured at manufacturer prices or at public prices, which include wholesaler and retail pharmacy distribution margins and any value-added taxes.[2] Measured at public prices, total drug spending per capita in 2005, including inpatient and outpatient sales, ranged from $1,141 in the United States to $400 in Australia and $49 in Brazil (Exhibit 1). Measured at manufacturer prices, per capita drug spending ranged from $836 in the United States to $31 in Brazil. Thus, distribution margins and taxes absorb a sizable share of total drug spending, ranging from 18 percent in Japan to 43.5 percent in Italy. Excluding inpatient sales, outpatient per capita drug spending at manufacturer prices ranged from $534 in the United States to $20 in Brazil. This includes prescription and over-the-counter (OTC) sales of single-molecule products but excludes combination drugs, which are too heterogeneous across countries to permit valid comparison.[3] These outpatient sales are the focus of the remainder of our analysis, except that for Japan, we include both outpatient and hospital sales, because hospital outpatient departments deliver a sizable share of outpatient care in Japan.

■ **Quantity.** Although the United States leads in aggregate per capita spending, it ranks second to lowest among the high-income countries in number of doses per capita, as measured by IMS standard units (Exhibit 2).[4] Japan has unit volume at 160

EXHIBIT 1
Pharmaceutical Spending, Aggregate And Per Capita, At Public And Manufacturer Prices, 2005

	All channels				Outpatient only[a]		
	Total spending (millions of U.S. dollars)		Spending per capita (U.S. dollars)		Spending per capita (U.S. dollars)		
Country	Public[b]	Manuf.[c]	Public[b]	Manuf.[c]	Public[b]	Manuf.[c]	Distribution margin[d]
U.S.	336,727	246,762	1,141	836	729	534	26.7%
Canada	16,852	12,683	525	395	403	295	26.7
France	45,436	30,251	750	500	494	294	40.5
Germany	48,502	31,464	588	381	387	237	38.8
Italy	35,393	19,365	615	337	354	200	43.5
Spain	23,675	14,838	550	345	334	210	37.3
U.K.	30,838	20,288	514	338	335	220	34.2
Japan	73,215	60,037	573	470	471	386	18.0
Australia	8,085	6,166	400	305	275	198	28.0
Brazil	9,162	5,807	49	31	31	20	36.6
Chile	1,159	737	72	45	43	28	36.4
Mexico	9,812	6,903	96	67	59	42	29.6

SOURCE: Authors' calculations based on data from IMS Health MIDAS database, 2005.

[a] Retail channel; single molecule products only, excluding combinations.

[b] At public prices.

[c] At manufacturer prices.

[d] Distribution margin for outpatient only; includes wholesaler and retail pharmacy distribution margins and value-added taxes (VAT), if applicable.

EXHIBIT 2
Pharmaceutical Usage Per Capita, Relative To U.S. Usage (U.S. = 100), Overall, By Global Age, And Over-The-Counter (OTC) Products, 2005

	Overall			By global age[a]					OTC
Country	No. of doses per capita	Avg. strength per dose	No. of grams per capita	5 years or less	6–10 years	11–20 years	21–30 years	31+ years	Doses per capita
U.S.	100	100	100	100	100	100	100	100	100
Canada	123	119	146	46	89	101	72	141	66
France	139	123	171	65	78	111	173	151	38
Germany	104	82	85	45	52	76	86	121	161
Italy	74	74	55	58	54	97	109	68	58
Spain	110	134	147	43	85	113	173	107	73
U.K.	112	84	94	40	61	92	91	128	102
Japan	160	35	56	40	117	189	313	144	6
Australia	104	78	81	48	88	64	72	120	111
Brazil	17	58	10	4	5	8	17	20	7
Chile	32	77	25	8	10	18	36	38	49
Mexico	18	85	16	6	5	8	13	23	28

SOURCE: Authors' calculations based on data from IMS Health MIDAS database, 2005.
NOTES: Retail channel, single molecule products; excludes combinations; therapeutic classes for hospital solutions, diagnostic agents, and various; and formulations for nonhuman use or unknown applications.
[a] Global age defined as years since first molecule launch in any country.

percent of the U.S. level; France, Canada, the United Kingdom, Spain, Germany, and Australia range from 139 to 104 percent of the U.S. level; and Brazil, Chile, and Mexico are only 17–32 percent of the U.S. level. Thus, a simple decomposition of pharmaceutical spending into price and volume, with price estimated as a residual, might conclude that "it's the prices, stupid."[5] But such an inference would ignore differences in formulations, product mix, and use of generics, which interact with prices to yield the overall spending differences.

Strength, Formulations, And Therapeutic Mix

Countries differ in their mix of formulations and in average strength (milligrams of active ingredient) per dose. Some comparison countries use more liquids, parenterals, ophthalmics, and dermatological formulations, which typically have lower strength per unit than oral solids (tablets and capsules), the predominant form in most countries and particularly in the United States.[6] The United States also tends to use more long-acting formulations, which substitute "quality" for quantity of doses, leading to lower aggregate unit volume—and perhaps better patient compliance. Long-acting forms are almost 8 percent of all units in the United States, compared with 1–7 percent in the other countries (Exhibit 3).

■ **Formulations and usage.** Overall, countries that use stronger formulations tend to use fewer doses. Thus, although the United States uses fewer doses, average strength per dose is higher in the United States than in all countries except Spain, France, and Canada. Consequently, measuring volume as grams of active ingredient

EXHIBIT 3
Market Structure And Availability Of Generics And Over-The-Counter (OTC) Products, 2005

	Percent of unit volume			Percent of off-patent[b] molecules, with		Percent of total molecules, with	
Country	Combination products[a]	Long-acting formulations	OTC products	Any generic	Unbranded generic	OTC only	Rx and OTC
U.S.	24.7%	7.9%	28.0%	73.7%	49.0%	17.1%	10.0%
Canada	25.9	5.0	15.0	64.1	35.3	3.7	5.4
France	31.1	4.7	7.7	44.1	18.9	17.1	10.9
Germany	23.4	7.0	43.2	60.7	29.3	30.6	7.4
Italy	24.2	4.2	21.7	57.2	14.0	11.4	8.9
Spain	20.0	3.9	18.7	60.9	25.5	10.3	7.0
U.K.	26.0	4.3	25.5	54.8	34.6	20.8	8.9
Japan	19.2	3.2	1.0	57.1	14.3	2.2	6.1
Australia	28.1	3.9	30.0	63.2	20.1	25.6	10.7
Brazil	48.8	2.5	11.8	73.1	41.3	3.4	10.4
Chile	29.5	1.1	42.3	69.6	30.4	29.2	9.8
Mexico	47.9	1.4	43.0	67.4	24.6	7.1	9.3

SOURCE: Authors' calculations based on data from IMS Health MIDAS database, 2005.

[a] Denominator is total unit volume in retail channel.

[b] Off-patent molecules defined as molecules with at least twelve years since country-specific launch and first global launch within prior thirty years.

per capita, the United States has higher volume than all other countries except these three. Compared to the United States, Japan has 60 percent more doses per capita, but because Japan uses weaker dosing, it uses 44 percent fewer grams of active ingredient per capita than the United States uses.

■ **Therapeutic mix of drug use.** Countries also differ greatly in the therapeutic mix of their drug use.[7] Relative to the United States, alimentary use is particularly high in Japan, Canada, and France; cardiovascular use is relatively high in Japan, Germany, France, and the United Kingdom; only France and Canada have higher central nervous system use than the United States; and respiratory use is relatively high in the United Kingdom, France, Australia, Spain, and Germany. How far these differences in formulations and therapeutic mix reflect epidemiologic factors, medical norms, reimbursement incentives, or industrial policy differences is an important subject for future research.

New Versus Older Compounds

Much of the higher pharmaceutical use in other countries is for older molecules (Exhibit 2). In fact, total use in other countries is higher compared to the United States only for molecules eleven years old or older, many of which are off-patent; in Germany, Australia, and the United Kingdom, the higher use is exclusively for molecules over thirty years old.[8] U.S. per capita use is higher than in all other countries for molecules within ten years of global launch, particularly for the newest molecules within five years of global launch.[9] Greater U.S. use of new com-

pounds reflects earlier launch and relatively rapid diffusion, conditional on launch.

■ **Launch lags.** Several recent studies have shown that countries with strict price regulation tend to experience launch lags or nonlaunch of new drugs.[10] These studies are based on restricted samples; hence, results differ, and conclusions are not fully generalizable. Our estimates, based on the full universe of drugs sold in these twelve major markets, show that for drugs launched in 1995–2005, the United States has the shortest average launch lag and the highest percentage of new drugs available, followed by Germany (Exhibit 4). One key contributing factor is that these are the only two high-income countries where drugs can be launched and reimbursed without requiring government approval of the price or reimbursement.[11] The United Kingdom, which also does not require price approval of new drugs, ranks third in availability of new molecules and fast launch over the past decade. Availability of the newest drugs is much lower in France, Spain, Italy, Japan, and Australia, all of which require price approval prior to reimbursement.

■ **Diffusion.** Once a drug is launched, diffusion (measured as average units per 1,000 population within three years of the drug's country-specific launch) is most rapid in France, Japan, Australia, and Spain, partially offsetting these countries' relatively long launch lags.[12] By contrast, diffusion is slowest in Germany and the United Kingdom, despite early launch there. The United States ranks roughly at the median in speed of diffusion. Thus, the high U.S. use of new drugs reflects very prompt launch combined with median speed of diffusion.

EXHIBIT 4
New Molecule Launch Lag And Availability, By Global Age, 2005

	New molecule launch lag[a] (months) with global age			Percent of new molecules[b] with global age		
Country	5 years or less	6–10 years	11–20 years	5 years or less	6–10 years	11–20 years
U.S.	4.4	7.6	42.9	63.8	66.5	46.2
Canada	17.9	18.1	46.7	28.3	48.3	35.7
France	12.0	18.6	42.3	27.0	40.4	41.1
Germany	8.7	13.9	38.6	52.0	59.1	49.8
Italy	19.0	24.9	47.0	23.0	38.9	48.3
Spain	16.4	24.2	61.9	26.3	41.4	42.3
U.K.	9.7	13.7	34.9	34.2	53.2	40.5
Japan	11.7	28.3	27.5	31.6	47.8	66.4
Australia	17.4	23.4	54.5	28.3	45.8	34.2
Brazil	11.8	20.2	63.4	26.3	45.8	42.6
Chile	19.0	28.7	66.1	19.7	36.9	30.9
Mexico	11.4	25.3	59.3	30.3	50.2	42.0

SOURCE: Authors' calculations based on data from IMS Health MIDAS database, 2005.

[a] New molecule launch lag is defined as months since first molecule launch in any country, conditional on launch in country.

[b] New molecules defined as molecules launched in any of twelve study countries; global age defined as years since first molecule launch in any country.

Originator Versus Generic Market Shares

All study countries nominally recognize patents; hence, in principle, new originator compounds should enjoy roughly twelve years of effective patent life, during which they can charge prices above marginal cost to recoup research and development (R&D) costs. Once patents expire, payers can realize major savings if generic entry and uptake occur promptly after patent expiry and at low prices.

■ **Availability of generics.** To provide evidence on the postpatent entry of generics, Exhibit 3 reports the percentage of molecules aged at least twelve years since their country-specific launch that have at least one generic available. By this measure, the United States leads all other countries with generic availability for almost 74 percent of these potentially off-patent molecules. Slower generic entry abroad reflects both regulatory obstacles and weaker economic incentives.

■ **Unbranded versus branded generics.** The United States also has a relatively high percentage of unbranded versus branded generics, which is important for price competitiveness. "Unbranded generics" are usually marketed by molecule name and compete primarily on price; they predominate in countries where generic markets are pharmacy driven. "Branded generics" compete on brand rather than price; they predominate in countries where physicians determine whether to use generics and which generic to use. In countries that adopted patents late (primarily the Latin American countries), branded generics also include "copy" versions of originator products that were grandfathered when these countries adopted World Trade Organization (WTO)–compliant patent regimes.

In the United States, unbranded generics account for 53 percent of unit volume and 9.8 percent of sales, whereas branded generics are 18.2 percent of volume and 9.6 percent of sales (Exhibit 5). Unbranded generics' larger share of volume than sales reflects their low prices. Off-patent brands with at least one generic competitor (multisource originator products) account for only 8 percent of U.S. volume, reflecting the rapid generic erosion of originator sales after patent expiry. By contrast, in countries with strict price regulation, such as Italy, Spain, France, and Japan, unbranded generic shares make up only 11–17 percent of sales, and the majority of generics are branded generics. Generic shares of sales are higher than in the United States because of relatively high generic prices. Off-patent brands also have a larger share (16–27 percent) of volume in regulated markets, reflecting slow postpatent generic penetration.

■ **On-patent brands.** On-patent brands (single-source originator) account for less than one-fourth of unit volume in all countries: 2–7 percent in the Latin American countries, 20 percent in the United States, and almost 24 percent in Italy (Exhibit 5). But these on-patent brands account for a larger share of dollar sales than of unit volume, reflecting their relatively high prices: 70 percent of U.S. sales versus 43–56 percent in the other high-income countries. The relatively large U.S. sales share of on-patent brands reflects both the greater use of newer, relatively high-price drugs and formulations discussed earlier and higher prices for comparable drugs.

EXHIBIT 5
Originator Versus Generic Market Shares For Drugs, 2005

	Share of unit volume				Share of sales			
	Originator		Generic		Originator		Generic	
Country	Single-source	Multi-source	Branded generic	Unbranded generic	Single-source	Multi-source	Branded generic	Unbranded generic
U.S.	20.2%	8.5%	18.2%	53.1%	70.2%	10.4%	9.6%	9.8%
Canada	16.2	8.4	45.1	30.3	55.5	12.5	24.3	7.8
France	23.0	16.3	44.7	16.0	56.4	14.7	21.1	7.9
Germany	10.0	15.4	43.8	30.8	42.6	14.5	29.3	13.6
Italy	23.7	26.0	39.7	10.5	49.6	20.9	24.9	4.6
Spain	20.6	27.3	35.4	16.7	48.0	23.1	21.4	7.4
U.K.	11.8	19.5	21.3	47.4	47.3	16.0	13.3	23.4
Japan	19.3	25.6	42.3	12.7	50.0	27.1	18.8	4.1
Australia	20.1	20.2	49.5	10.2	55.0	18.0	24.2	2.8
Brazil	4.9	24.6	46.3	24.2	18.4	25.2	37.3	19.2
Chile	1.9	7.5	37.7	52.9	9.2	20.3	49.1	21.3
Mexico	7.5	25.5	51.4	15.6	25.9	38.8	31.4	3.9

SOURCE: Authors' calculations based on data from IMS Health MIDAS database, 2005.

Price Indexes

Thus far, we have documented the cross-national diversity in drug formulations, age mix, and originator versus generic shares. Since price indexes can include only matching drugs, this heterogeneity implies major trade-offs: Requiring precise matching yields more precise comparisons but based on a limited and possibly unrepresentative subset of drugs.

We computed two sets of bilateral price indexes for each country, relative to the United States. The molecule-atc3 indexes compare prices for all products that match on active ingredient (molecule) and indication (IMS three-digit Anatomical Therapeutic Classification, or ATC3), regardless of formulation, strength, brand, or prescription status. These molecule-atc3 indexes represent at least 80 percent of sales in all countries except Japan (64 percent). The molecule-atc3-form-strength indexes compare prices only for products that match on molecule, indication, strength, and formulation (regardless of brand or prescription status); these indexes provide a more apples-to-apples comparison, but they represent less than 50 percent of sales in all countries except Canada, Australia, and the United Kingdom and even lower shares of unit volume, ranging from 17 percent in Japan to 68 percent in Canada.[13]

Since this study adopts a U.S. focus, all price indexes are weighted by U.S. volume weights—that is, they show the cost of the U.S. market basket at foreign prices. Future work will report comparisons based on other countries' market baskets, which will be more relevant for policy decisions in those countries. Unless otherwise noted, all prices are per dose, at manufacturer price levels, and are converted into U.S. dollars using exchange rates as reported by IMS Health. U.S.

prices are adjusted for estimated off-invoice discounts, and German prices are adjusted for the mandatory rebate on products exempt from reference pricing.[14]

■ **Price comparisons using the ATC3 indexes.** The comprehensive molecule-atc3 indexes for 2005 show most countries' prices to be 20–40 percent lower than U.S. prices (Exhibit 6). The molecule-atc3-form-strength indexes (not shown) are similar, generally differing less than five percentage points, except that Japan drops to 4 percent higher than the United States and Mexico is 11 percent higher than the United States, which implies that Mexican prices are essentially the same as U.S. prices gross of off-invoice discounts.

■ **Comparisons using public versus manufacturer prices.** By contrast, foreign public prices are only 10–30 percent lower than the U.S. prices, compared to 20–40 percent lower for foreign manufacturer prices. For example, when public prices are used in place of manufacturer prices, France's price index increases from 74 to 91, Germany's increases from 75 to 90, and Italy's increases from 67 to 87. These findings confirm that distribution margins absorb a larger share of total pharmaceutical spending in several regulated markets than in the United States. High distribution costs may contribute to pressure on manufacturer prices to keep public prices at po-

EXHIBIT 6
Pharmaceutical Price Indexes, Relative to U.S. Prices (U.S. = 100), 2005

	Comprehensive indexes[a]				Originator versus generic[b,c,d]				
					Originator		Generic	Rx versus OTC[b,c,d]	
Country	Manuf.[d] at exch. rates[c]	Public[e] at exch. rates[c]	Public[e] at GDP PPPs[f]	Manuf.[d] normalized by income[g]	Single-source	Multi-source	Branded and unbranded	Rx	OTC
U.S.	100	100	100	100	100	100	100	100	100
Canada	81	81	79	103	74	60	133	79	189
France	74	91	78	100	64	37	108	69	262
Germany	75	90	95	106	74	65	151	77	192
Italy	67	87	82	94	55	68	150	63	527
Spain	59	69	71	93	62	40	109	57	377
U.K.	72	81	68	93	76	61	131	77	202
Japan	111	99	80	151	81	99	211	101	362
Australia	69	70	66	90	63	62	138	70	195
Brazil	69	80	68	336	62	109	128	64	186
Chile	56	65	119	206	56	55	138	58	312
Mexico	102	107	157	414	90	87	216	110	218

SOURCES: World Development Indicators, 2005; and authors' calculations based on data from IMS Health MIDAS database, 2005.

NOTE: ATC3 is Anatomical Therapeutic Classification.

[a] Bilateral matching with U.S. by molecule-atc3.

[b] Bilateral matching with U.S. by molecule-atc3-form-strength.

[c] Prices converted to U.S. dollars at exchange rates.

[d] Manufacturer prices.

[e] Public prices.

[f] Prices converted to U.S. dollars at gross domestic product (GDP) purchasing power parities (PPPs).

[g] Price index normalized by GDP per capita.

litically acceptable levels. By contrast, Japan appears lower at public prices than at manufacturer prices, which suggests that physician dispensing of drugs does save distribution costs, although it might also distort prescribing incentives.

■ **Comparisons using PPPs rather than exchange rates.** Exhibit 6 also reports the public price indexes using gross domestic product (GDP) purchasing power parities (PPPs) rather than exchange rates to convert foreign currencies to U.S. dollars.[15] Doing so generally decreases the price indexes, modestly for most countries but significantly for some, which suggests that drug prices are lower than prices of other goods and services in most countries compared to the United States. This is particularly true in Japan, where the molecule-atc3 index declines from 99 using exchange rates to 80 using PPPs. Conversely, using PPPs increases the price indexes for Chile and Mexico to, respectively, 19 percent and 57 percent higher than the United States, which implies that drug prices are much higher than prices of other goods and services, especially in Mexico, compared to the United States.

■ **Adjusting for affordability.** Exhibit 6 also reports manufacturer prices normalized by average income (GDP per capita), as a rough measure of the affordability of drugs in different countries. After income is adjusted for, most countries are within ten percentage points of the United States, with the exception of Japan and the Latin American countries. The very high drug prices relative to average per capita income in these Latin American countries may partly reflect their skewed distribution of income and manufacturers' tendency to target prices to the affluent minority. Such prices are unaffordable to most people, which contributes to the low overall per capita use of drugs in these countries.

Originator Versus Generic Prices

Since generics now account for 70 percent of unit volume in the United States and several other countries, any comprehensive comparison of prices must consider generics as well as originator prices. In Exhibit 6 we show molecule-atc3-form-strength indexes for originator and generic products. Single- and multisource originator products are reported separately, because they face different competitive and reimbursement conditions: Single-source products are typically newer and still on patent, whereas multisource originator products are older, face generic competition, and may be subject to reference-price reimbursement.

The price indexes for single-source originator products generally show foreign prices two to ten percentage points lower than the comprehensive indexes, relative to the United States. Italy and Chile appear to have the lowest on-patent brand prices, at 55–56 percent of U.S. prices, while Mexican prices are the highest, at 90 percent of U.S. prices (Exhibit 6). These conclusions are based on the U.S. market basket of products and might be quite different for indexes using the comparison countries' market baskets. Foreign prices appear even lower, relative to the United States, for originator multisource products. The low foreign prices for off-patent brand-name products partly reflect strict regulation in countries such

as France and Spain that disallow postlaunch price increases. By contrast, in the United States, off-patent brands sometimes raise price as a market segmentation strategy, while most consumers switch to cheap generics.[16] However, our U.S. prices for off-patent brands may be biased upward, because we apply the same average discount to all originator products, whereas these off-patent brands sometimes give very large discounts to payers.

These originator single- and multisource price indexes for matching formulations are our closest analogy to other price comparisons that focus exclusively on matching originator products. Such comparisons typically show U.S. prices to be higher, relative to other countries, than our more comprehensive price indexes, which include generics and all formulations. Thus, a comparison of the comprehensive indexes with the originator-only indexes illustrates the upward bias in price comparisons that result from excluding generics.

The overall generic price indexes, which include both branded and unbranded generics, show that all countries have higher generic prices on average than the United States has, ranging from 8–9 percent higher in France and Spain to 111–116 percent higher in Japan and Mexico. The low U.S. generic price indexes reflect the very low U.S. prices of unbranded generics. For unbranded generics, all foreign prices are higher, ranging from 14 percent higher in Chile to threefold higher in Australia and fivefold higher in Canada. For branded generics, prices are highest in Japan, similar in the United States, Germany, and Mexico.

■ **Reasons for low U.S. generic prices.** These low U.S. generic prices reflect several factors that make the U.S. generic sector highly price competitive: (1) The U.S. Food and Drug Administration (FDA) Abbreviated New Drug Application (ANDA) process requires a generic to show bioequivalence to the originator, which provides the basis for substitutability; (2) the default dispensing rule permits pharmacists to substitute a generic for a brand unless the physician requires the brand; (3) pharmacy reimbursement is usually a fixed dispensing fee plus a fixed reimbursement for the drug, such that pharmacies can profit by substituting cheaper generics; (4) consumer copayments are lower on generics than on brands; and (5) the concentrated buying power of pharmacies, through chain pharmacies, mass merchandisers such as Wal-Mart, and group purchasing arrangements for independent pharmacies, forces generic manufacturers to compete on price to capture market share of these large market makers.

■ **Factors that have raised generic prices abroad.** Conversely, factors that have limited uptake and price competitiveness of generics in some other countries include the following: (1) lack of a regulatory requirement for generic bioequivalence, which is the basis for substitutability and consumer/physician confidence in generics; (2) limited authorization for pharmacists to substitute generics; (3) weak pharmacy incentives to seek out inexpensive generics when dispensing fees are proportional to drug price; (4) restrictions on commercial ownership and chain pharmacies; and (5) in some countries, regulation of generic prices that has served as a

floor to generic prices, rather than a ceiling.

In recent years, several European Union (EU) countries, including France, Spain, and Italy, have changed their rules governing generics, to expand pharmacists' authority and incentives to substitute cheaper generics. German sickness funds now bargain directly with generic companies. Such measures may shift generic markets in these countries away from higher-price branded generics that market to physicians and toward price-competitive unbranded generics that market to pharmacies and payers, as in the United States.

■ **Mexico as outlier.** Perhaps the most striking finding from this analysis of originator versus generic prices is that Mexico's generic prices are higher, relative to U.S. prices, than its originator prices. This conclusion is tentative, if the IMS prices overstate true prices because of off-invoice discounting. But taken at face value, these data suggest that high generic prices are a major contributor to Mexico's high overall drug price level. Generic prices are also about 30 percent higher in Brazil and Chile than in the United States, comparable to Canada and lower than Mexico.

OTC Versus Prescription Availability, Use, And Prices

Our measures of aggregate use include both prescription (Rx) and OTC drugs. Availability and use of OTC products reflect regulation, medical norms, patients' and physicians' reimbursement incentives, and the price-competitiveness of retail pharmacy. Consequently, the OTC products available differ, and a given product may be Rx in one country but OTC in another.[17]

The OTC share of total unit volume ranges from 1 percent in Japan to 28 percent in the United States and 43 percent in Mexico (Exhibit 3). The percentage of molecules that are OTC-only ranges from 4 percent in Canada to 31 percent in Germany. By contrast, the percentage of molecules with both Rx and OTC forms is within a 5–11 percent range in all countries. Absolute per capita use of OTCs is higher in the United States than in all countries except Germany, Australia, and the United Kingdom. Japan's very low OTC availability and use may reflect the incentives of Japanese physicians, who dispense and profit from prescribing drugs. The high OTC use in Germany reflects not only its very high number of OTC-only molecules but also its tradition of generous insurance reimbursement of OTC drugs, at least until many were delisted from reimbursement recently. In many countries with comprehensive drug insurance, the patient's copayment on Rx drugs is less than the price of an OTC, so patients prefer Rx drugs, despite higher total cost to the payer. By contrast, U.S. patients face relatively high Rx copays and low OTC prices, which encourages patients to use OTCs if available.

OTC prices are at least 80 percent higher in all countries than in the United States and more than three times higher in Italy, Japan, Spain, and Chile (Exhibit 6). The high OTC use and low OTC prices in the United States are attributable to its highly price-competitive retail pharmacy market, dominated by the large chains, many of which produce their own private-label (generic) OTC products

that compete on price. By contrast, countries that regulate prescription prices also tend to regulate OTC prices directly or via retail price maintenance. Regulations that prohibit chain pharmacies also undermine OTC price competition, because single pharmacies have weak leverage on brand-name OTC prices and are unlikely to produce their own alternatives to brand-name OTCs.

Discussion And Conclusions

A simple analysis of pharmaceutical spending might conclude that because U.S. per capita drug spending is higher but unit volume is lower, "it's the prices, stupid." For example, since Canada's drug spending is 46 percent of U.S. spending but its unit volume is 123 percent of U.S. volume, a simple residual price calculation would conclude that Canadian prices are 37 percent of U.S. prices. But this analysis has shown that differences in types of drugs used confound such simple inferences. In fact, Canadian prices are 81 percent of U.S. prices: The residual estimate of price differences is biased upward because it ignores the U.S. tendency to use more new, expensive products. Whether similar patterns bias estimates of price differences in other sectors is an important issue for future research.

■ **Impact of using older products.** The higher overall per capita volume in other countries compared to the United States is solely attributable to the use of older products, many over twenty years old, whereas U.S. usage is higher than all the comparison countries for molecules launched in the past ten years. The high U.S. use of new drugs primarily reflects shorter launch lags and greater availability of new molecules, in part as a result of the absence of delays associated with price regulation. Lower use of expensive new drugs in other countries clearly contributes to their lower drug spending. Analyzing the contribution of regulation, medical norms, and other factors to these use patterns and their impact on health are important issues for future research and necessary additional inputs to policy conclusions.

■ **Impact of distribution costs.** The foreign-U.S. drug price differential is smaller at public prices (10–30 percent lower than U.S. prices) than at manufacturer prices (20–40 percent lower than U.S. prices), because distribution margins are generally higher abroad, particularly in regulated markets, than in the highly competitive U.S. pharmacy market. Within the overall basket of drugs, U.S. prices for originator products are higher than those of most other countries, but prices for generics and OTC products are lower in the United States than in other countries, reflecting the more price-competitive U.S. generic and retail pharmacy sectors. Thus, the highly competitive U.S. pharmacy market enables the country to allocate less of its total drug spending to distribution and to pay relatively low generic and OTC prices, thus partly offsetting the relatively high use and prices for on-patent brand-name products in the United States.

■ **Price differentials and per capita income.** In general, price differentials remain roughly in line with differences in per capita income, with the exception of the Latin American countries, particularly Mexico. The Mexico-U.S. price differential is

higher for generics than for originator products. This suggests that greater affordability of drugs in these countries will require review of their regulatory structure and lack of price competition among generics, in addition to strategies to prevent any concern of originator manufacturers over U.S. price referencing or drug importation that may contribute to higher originator prices.

Overall, these 2005 price indexes are quite similar to prior findings based on 1999 data, despite the decline in the U.S. dollar relative to other currencies.[18] This and other changes between 1999 and 2005 are the subjects of ongoing research.

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NOTES

1. Data are for the twelve months ending 30 June 2005. We excluded categories classified as "hospital solutions," "diagnostic agents," and "various"; formulations classified as "non-human use and others" and "unknown"; and a small percentage of packs that exceeded outlier screens based on a price relative greater than 25 or less than 0.04.
2. IMS audits wholesaler prices, then estimates manufacturer prices by subtracting wholesale margins, and public prices by adding pharmacy distribution margins and sales taxes. These "public prices" may exceed prices paid by payers because of discounts on dispensing fees or manufacturer prices.
3. These combination products account for 25 percent of U.S. doses; other countries range from 19 percent in Japan to 31 percent in France and 48–49 percent in Mexico and Brazil (Exhibit 3).
4. The IMS standard unit is a proxy for one dose of each formulation—for example, one tablet, one capsule, 5 ml of a liquid, and so forth.
5. For example, see G.F. Anderson et al., "It's the Prices, Stupid: Why the United States Is So Different from Other Countries," *Health Affairs* 23, no. 3 (2003): 89–105, and references cited therein.
6. See online Appendix Exhibit 1, at http://content.healthaffairs.org/cgi/content/full/27/1/221/DC1.
7. See online Appendix Exhibit 2, ibid.
8. We measured a molecule's global age as 2005 minus the year of a molecule's first launch in any of our sample countries.
9. Japan appears to be an exception, but this is misleading because the Japan figures include inpatient use.
10. For example, see P.M. Danzon et al., "The Impact of Price Regulation on the Launch Delay of New Drugs—Evidence from Twenty-five Major Markets in the 1990s," *Health Economics* 14, no. 3 (2005): 269–292; and M.K. Kyle, "Pharmaceutical Price Controls and Entry Strategies," *Review of Economics and Statistics* 89, no. 1 (2007): 88–99.
11. Since 2005, Germany has added new patented drugs to its reference price system. Our data are too early to show the effects of this change on launch delay.
12. See online Appendix Exhibit 3, as in Note 6.
13. See online Appendix Exhibit 4, as in Note 6.
14. Appendices "Estimating Manufacturer Off-Invoice Discounts in the U.S." and "Estimating an Average Discount for the Mandatory Rebates in Germany" are available upon request from the authors. Send e-mail to danzon@wharton.upenn.edu.
15. Since PPPs measure the relative cost of purchasing a comprehensive market basket of goods at retail prices in different countries, we apply PPP conversion to public pharmaceutical prices.
16. For example, see R.G. Frank and D.S. Salkever, "Generic Entry and the Pricing for Pharmaceuticals," *Journal of Economics and Management Strategy* 6, no. 1 (1997): 75–90.
17. IMS classifies products that are sold "behind the counter" (that is, with advice from a pharmacist) as OTC.
18. P.M. Danzon and M.F. Furukawa, "Prices and Availability of Pharmaceuticals: Evidence from Nine Countries," *Health Affairs* 22 (2003): w521–w536 (published online 29 October 2003; 10.1377/hlthaff.w3.521).