Prescription drug prices for the elderly

Recent research suggests that there is little difference in the rates of drug price inflation facing older and younger Americans, when age-related patterns of consumption are taken into account

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Over the next few decades, the U.S. population aged 65 and older will grow, both in absolute numbers and as a share of the total population. As people age, they tend to have higher medical care expenses. Thus, an increasingly elderly society can be expected to devote a greater amount of its expenditures toward medical care. The implications of a graying society for future medical care expenditures will depend, of course, both on the price and on the quantity of future medical care for the elderly.

To the extent that they live on fixed incomes, the elderly are particularly vulnerable to price inflation. However, relatively little is known about the extent to which price inflation of the basket of medical care goods and services used by the elderly differs from the price inflation of the set of medical care goods and services used by younger Americans. To address this issue, we focus on elderly-nonelderly price inflation differentials for one component of medical care—namely, prescription pharmaceuticals—from 1990 to 1996.[1]

Background and concepts

Elderly-nonelderly differentials in drug price inflation could reflect brand-generic consumption proportions that vary by age. For treatment of acute conditions, the elderly may be more fragile, and prudent medical practice might suggest prescribing for them the newest generation of drugs having the fewest side effects, the least adverse drug interactions, and the most convenient dosing. Thus, for certain acute conditions, one might expect the elderly to be disproportionate users of newer, branded drugs. To the extent that such drugs increase in price more rapidly than older off-patent and generic drugs, the cost of the elderly's bundle of drugs would be expected to increase *more rapidly* than that of the young.

Although the same considerations would apply for treatment of chronic conditions, the surviving elderly are more likely to be using older drug products, because physicians are hesitant to change medications when an existing drug regimen is working well in treating a chronic condition. With "stickier" usage patterns and by surviving to old age, the elderly would therefore disproportionately use older drugs to treat their chronic conditions, drugs that are more often available as generics. Under this hypothesis, price inflation for the elderly's bundle of drugs would be *less than* that for bundle purchased by the young. We examine both these hypotheses empirically, focusing on three therapeutic classes—antibiotics, antidepressants, and calcium channel blockers.

The systems by which prescription pharmaceuticals are distributed and paid for in the United States are complex and rapidly changing. We assess elderly-nonelderly price differentials at three different points in the distribution chain: (1) the initial point, involving sales from manufacturers

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to wholesalers, retailers, and hospitals; (2) an intermediate point, retail sell-in, at which retail pharmacies acquire prescription drugs from wholesalers and manufacturers; and (3) a final point, retail sell-out, at which retail pharmacies dispense and sell prescription drugs to patients. At the retail sell-out point in the distribution chain, we attempt—to the extent that available data permit—to distinguish consumers' out-of-pocket expenditures for pharmaceuticals from those expenditures involving government funds (medicaid and various public assistance programs), as well as from payments by private third-party insurance sources (fee-for-service insurance plans and various forms of medigap and managed care).

Medical expenditures. Prescription drugs accounted for 6.1 percent of U.S. national health expenditures in 1996. The share of prescription dollar sales occurring at the retail level fell from 64 percent in 1990 to 57 percent in 1996, even as the mail-order share increased from 5 percent to 9 percent.[2] Within the retail sector, the share of new prescriptions paid for with cash fell dramatically, from 59 percent in 1991 to 32 percent in 1996, while that paid for directly by third-party sources other than medicaid doubled from 28 percent to 57 percent.[3] Thus, although prescriptions account for only 6.1 percent of national health expenditures, consumers' direct cash payments are a significant, albeit falling, share of total prescription expenditures.

Data from the 1995 BLS Consumer Expenditure Survey indicate that consumers' out-of-pocket payments (consisting of cash plus copayments and deductibles) for health care constituted 11.9 percent of total expenditures for households in which the reference person was aged 65 or older. This out-of-pocket share for the elderly was much higher than the 5.4-percent average over all households. Total out-of-pocket health care expenditure patterns have been relatively stable since 1990, but in recent years, people of all ages (and especially the elderly) appear to have increasingly substituted payments to health insurance for direct payments for professional medical services, drugs, and medical supplies.[4] For persons under age 65, health insurance as a share of total health-related out-of-pocket payments was 45 percent in 1995, up slightly from 40 percent in 1990. For those 65 and older, however, the increase is much larger, with the health insurance share growing from 45 percent in 1990 to 58 percent in 1995. Expenditures for drugs (prescription plus over-the-counter) as a share of total out-of-pocket health care expenditures have fallen slightly since 1990, but continue to be larger for the elderly; the 1990 and 1995 shares were 17 percent and 16.2 percent, respectively, for all consumers, but were 21.5 percent and 20.6 percent for those 65 and older.

In summary, the expenditure survey data indicate that the composition of out-of-pocket payments has changed considerably since 1990, and in different ways for the elderly and the nonelderly. A dominant trend for people of all ages, however, is away from out-of-pocket direct payments for medical services, drugs, and medical supplies, and toward health insurance. To the extent that this growth in health insurance results in greater buying power by agents of consumers relative to that of providers and suppliers, and to the extent that any resulting reductions in provider-supplier prices are passed on to consumers in the form of lower health insurance premiums, this shift could benefit consumers, particularly the elderly.

Medical prices. Expenditures are, by definition, the product of price times quantity. Disaggregating the growth of health expenditures into price and quantity components involves many conceptual and practical difficulties.[5] BLS publishes an aggregate medical care Consumer Price Index (MCPI), as well as price indexes for various of the MCPI components, such as prescription drugs, professional medical services, and hospital and related services. Each of these price indexes is based on consumers' out-of-pocket expenditures, and thereby excludes payments by governments and third-party insurers.[6]

It is commonly believed that prices paid by consumers for medical care have been increasing more rapidly than those for other items. However, as shown in table 1, this more rapid increase of the MCPI relative to the CPI is not a recent phenomenon. Since 1927, the first year for which MCPI data are available, inflation in the medical component has generally been greater than that for all goods and services.[7] Over the entire 1927–96 period, the MCPI rose at an average annual rate of 4.59 percent, a pace almost half again as fast as the 3.24-percent increase in the overall CPI.

The combination of larger medical-related expenditure weights for the elderly than for the young, and apparent greater price inflation for medical care items than for the overall CPI, has given rise to a conventional wisdom that holds that the

Table 1. Average annual percent change in the overall CPI–U and in the medical CPI, selected periods, 1927–96

Period	CPI–U	Medical CPI	Ratio of medical CPI to CPI–U
1927–46	0.60	1.03	1.72
1946–56	3.38	4.22	1.25
1956–66	1.76	3.36	1.91
1966–76	5.79	7.05	1.22
1976–86	6.78	8.90	1.31
1986–96	3.65	6.46	1.77
1927–96	3.24	4.59	1.42

NOTE: Data for the medical CPI prior to 1935 are from Elizabeth Langford, "Medical Care in the Consumer Price Index, 1935–56," *Monthly Labor Review*, September 1957, table 1, p. 1055.

relatively large price increases involving health care items and services in the last decade have adversely affected the elderly in particular. However, the faster rate of growth of the MCPI than of the CPI dates back at least to 1927. Hence, for the many years when today's elderly were younger, they too benefited from inflation that was less burdensome than that for the elderly of their time. Over the entire life cycle, it is not at all clear whether today's elderly cohort is relatively better or worse off than earlier or future elderly cohorts. With this caveat in mind, we now briefly summarize the existing literature on separate price indexes for the elderly.[8]

Prior to the introduction of medicare in July 1966, the Social Security Administration anticipated that the new program might have an impact on medical care prices. Therefore, in summer 1965, the Administration arranged with BLS to collect supplementary prices for three surgical procedures and two in-hospital medical services that were particularly important to older persons, though not necessarily limited to them. The three surgical procedures were cholecystectomy (removal of gall bladder), prostatectomy (removal of prostate gland), and fractured neck of femur (hip surgery), while the two in-hospital services were acute myocardial infarction (treatment of heart attack) and cerebral hemorrhage (stroke). Among the results of this study, as stated in a report to the President and summarized by Dorothy P. Rice and Loucele A. Horowitz, was the finding that:

> The index of the five in-hospital surgical and medical procedures particularly significant for the aged did not increase as rapidly during 1966 as the combined index for physicians' fees regularly priced for the CPI.[9]

More recently, in response to a mandate contained in the 1987 amendments to the Older Americans Act of 1965, BLS created an experimental price index for elderly consumers (CPI-E). The CPI-E employs differential expenditure weights for the elderly (defined as persons aged 62 and older) and the nonelderly, based on data from the Consumer Expenditure Survey, but assumes that within each category weight, the distribution of prices, the outlets in which consumers buy, the use of coupons, and the availability of discounts, as well as the quality of the items purchased, are the same for the elderly and the nonelderly.[10] From 1982 through 1996, the CPI-E for the elderly grew 67.9 percent, while the CPI rose 62.5 percent, implying that, over the entire 14-year time span, the CPI had an average annual growth rate of 3.53 percent, while the CPI-E for the elderly grew at a slightly faster 3.77 percent per year.[11] The larger health care expenditure weights for the elderly, along with greater measured medical price inflation, account almost entirely for the difference in growth rates between the two series. However, according to the CPI Commission, an advisory body to the U.S. Congress, medical care prices are likely to have overstated inflation by not fully accounting for improvements in quality. If this is correct, then, as Brent R. Moulton and Kenneth J. Stewart note, "A reduced rate of inflation for medical care would mitigate and perhaps eliminate any difference between the CPI-E and the official CPIs."[12]

With this information and brief overview of related literature as background, we now turn to a discussion of our own new research. We begin by focusing on drug prices at the first point in the distribution chain, from producers to wholesalers, hospitals, and retailers.[13] Next, we examine an intermediate point, namely, the acquisition prices paid by retail pharmacies to wholesalers and manufacturers. And then, we assess prices at final points in the distribution chain, from retail pharmacies to patients and payors. Because of data limitations, we do not examine prices received by mail order pharmacies, which account for roughly 9 percent of total prescription dollar sales.

Producer prices for drugs

In reporting on prices at the first point in the distribution chain—from manufacturers to wholesalers and retailers—BLS publishes monthly Producer Price Indexes (PPI's) for almost 50 therapeutic classes of prescription pharmaceuticals. Prices in these various therapeutic classes have increased at different rates. Since 1981, PPI's for anticoagulants, antiarthritics, and systemic anti-infectives, for example, have increased at much lower rates than have those for sedatives, central nervous system stimulants and antiobesity preparations, and psychotherapeutics.[14] Because the elderly are likely to have conditions, diseases, and illnesses that differ from those incurred by the nonelderly, there is no *a priori* reason to expect that the price inflation for the basket of drugs used by the elderly has occurred at the same rate as that for drugs used by the nonelderly.

IMS America, a firm specializing in sales and marketing data for medical and pharmaceutical products, regularly samples the prescribing behavior of office-based physicians; results from this survey are published in the IMS National Disease and Therapeutic Index (NDTI). Based on an extensive sample of new prescriptions written by a panel consisting of about 3,000 physicians, the survey gathers information on such characteristics as the patient's age, diagnosis code, drug therapy prescribed, concomitant diagnoses, and desired actions; these sample NDTI data are then projected by IMS to national totals.[15]

NDTI data thus provide information that permits us to compare the drugs prescribed for use by the elderly with those prescribed for younger patients, including differences involving brands versus generics. Prescriptions written for the elderly constitute 18.7 percent of all new prescriptions, while the nonelderly account for the remaining, and much larger 81.3 percent share.[16] For both the young and old, the leading thera-

Table 2. Producer Price Index weights, percent of prescriptions going to the elderly, and Producer Price Indexes for selected drugs by therapeutic class, 1990–96

Standard Industrial Classification 2834–	Therapeutic class	Producer Price Index weight[1]	Percent of prescriptions going to the elderly[2]	Producer Price Indexes					
				1991	1992	1993	1994	1995	1996
102	Analgesics	11,339	14	106.3	115.7	122.5	128.7	132.1	135.6
105	Antiarthritics	8,049	17	108.6	116.7	123.2	113.1	114.5	121.8
107	Anticonvulsants	2,100	51	112.7	125.9	132.7	136.8	142.1	148.3
109	Systemic antihistamines	9,336	13	111.7	121.3	126.5	131.4	135.7	145.4
111	Systemic anti-infectives	44,412	10	105.9	111.2	115.9	119.9	123.9	125.8
118	Bronchial therapy	11,956	19	111.2	122.5	129.0	139.6	145.8	154.2
119	Cancer therapies	10,079	39	106.0	116.6	120.8	123.4	127.7	132.7
121	Cardiovasculars	35,709	42	108.9	116.2	119.5	123.5	127.2	132.9
125	Cough and cold preparations	2,501	7	111.3	120.8	128.2	135.6	146.9	157.0
126	Dermatological preparations	5,237	7	104.8	111.8	118.8	124.2	133.5	140.5
127	Diabetes therapy	1,479	38	107.8	114.7	120.5	124.6	131.0	134.0
128	Diuretics	2,512	45	107.3	115.1	122.2	130.6	126.3	136.9
135	Hormones	13,047	17	108.7	116.3	122.9	133.5	137.8	137.3
139	Muscle relaxants	2,391	8	106.9	114.4	120.8	118.1	116.7	116.4
141	Nutrients and supplements	427	53	109.2	119.7	129.1	135.5	141.8	147.6
142	Ophthalmic and otic preparations	5,437	31	101.1	106.7	107.4	112.6	119.4	119.2
144	Psychotherapeutics	5,873	11	114.4	123.2	129.8	133.0	138.2	144.7
145	Sedatives	902	16	113.9	125.0	128.4	132.3	138.5	141.6
148	Vitamins	1,000	3	111.2	115.5	108.9	110.6	114.7	122.7
198	Miscellaneous pharmaceuticals	21,511	19	108.0	115.6	123.0	119.3	119.0	120.9

[1] Weights are net output value of shipments.

[2] Drug mentions for elderly as a fraction of elderly plus nonelderly mentions. Drug mentions for age bracket not recorded in the IMS National Disease and Therapeutic Index are ignored.

NOTE: PPI's for SIC 2834-116 (antispasmodic and antisecretory) and SIC 2834-147 (tuberculosis therapy) were not published from 1987 through 1993, and thus are ignored here; their percentages going to the elderly were 23 and 16, respectively, while their 1993 PPI weights were 11,956 and 1,607.

peutic class is broad- and medium-spectrum antibiotics; drugs in this class comprise almost 15.8 percent of new prescriptions written for seniors, but only 7.4 percent of those written for the nonelderly. The most frequent new prescriptions for the young include antidepressants, sex hormones, cough and cold preparations, and oral contraceptives, while those for the elderly include various cardiovasculars (antihypertensives, adrenergic blockers, calcium channel blockers, and diuretics), as well as glaucoma and cancer therapies. Differences between the young and old in the relative utilization of drugs by therapeutic class are considerable. The five therapeutic classes for which elderly-nonelderly usage differences are largest are antibiotics, vaccines, antidepressants, cough and cold preparations, and oral contraceptives, for which use by the younger is more intense in each case.

We now turn to price data. The BLS makes publicly available the fixed quantity weights it employs in aggregating the various therapeutic class-specific price indexes into an overall prescription pharmaceutical PPI. These quantity weights[17] are listed in the third column of table 2, while, in the next column, we list the percent of all new prescriptions written in that therapeutic class that is written for the elderly. In the final five columns of table 2, we list the BLS Producer Price Indexes by therapeutic class, annually from 1991 to 1996, normalized to 100 in 1990.

According to the table, therapeutic classes in which the elderly are particularly important consumers are anticonvulsants (51 percent), cancer therapy products (39 percent), cardiovascular therapy products (42 percent), diabetes therapy (38 percent), diuretics (45 percent), and nutrients and supplements (53 percent), although only for the cancer and cardiovascular therapy products are the PPI weights substantial. Therapeutic classes in which the elderly account for a relatively low fraction of consumption include systemic anti-infectives (10 percent), cough and cold preparations (7 percent), dermatological preparations (7 percent), muscle relaxants (8 percent), and vitamins (3 percent). Therapeutic classes with the largest price increases since 1990 include cough and cold preparations (57 percent), bronchial therapy (54 percent), anticonvulsants (48 percent), systemic antihistamines (45 percent) and psychotherapeutics (45 percent), and, in all cases except anticonvulsants, these are therapeutic classes with disproportionately large to average use by the young, rather than by the elderly. Those therapeutic classes having the smallest price increases since 1990 include muscle relaxants (16 percent), ophthalmic and otic preparations (19 percent), miscellaneous prescription pharmaceuticals (21 percent), antiarthritics (22 percent), and vitamins (23 percent); here, the pattern of relative usage by old and young is more mixed.

To aggregate these various therapeutic class PPI's to overall price indexes, separately for the elderly and the nonelderly, we proceed as follows. First, assuming for the moment that, *within* each of the therapeutic classes, old and young face the same prices (an assumption we relax in the next section), we

multiply the BLS therapeutic class quantity weights by the relative old-versus-young proportions of 1996 new prescriptions, based on NDTI data. We then multiply these therapeutic class-specific elderly and nonelderly quantity weights by the published PPI for the appropriate class, normalized to unity in 1990.[18] Finally, we aggregate over the various therapeutic classes, and thereby obtain separate prescription pharmaceutical PPI's for drugs destined for use by the elderly and the nonelderly. Results from this calculation over the 1990–96 period are summarized in table 3.

The very striking conclusion that emerges from inspection of the table is that, in aggregate, manufacturers' prices for pharmaceutical products destined for use by the elderly change at virtually the same rate as those destined for use by the nonelderly. By 1996, the PPI over all consumers was 1.330, that for the elderly was 1.331, and that for the nonelderly was 1.329.

Hence, despite the fact that the elderly and nonelderly differ substantially in their usage of drugs from various therapeutic classes, and even though manufacturers' price changes since 1990 have varied considerably among the therapeutic classes, there appears to be no price inflation differential by age group at the initial point in the distribution chain from drug manufacturers, at least in the aggregate. PPI's for drugs destined for use by the elderly grew at rates virtually identical to those for the PPI's for drugs destined for use by the nonelderly.

Retail sell-in prices

The PPI calculations presented in the previous section are based on the assumption that, within each therapeutic class, the distribution of prices for products destined for use by the elderly is the same as that for products to be used by the nonelderly. We now relax that assumption.

Based on its electronic computer record survey of about 34,000 retail pharmacies (independents, chains, mass merchandisers, and foodstores), IMS gathers data on brand and generic sales for each chemical compound, as well as on pharmacy acquisition prices and pharmacy selling prices for the best-selling form, strength, and pack of each product. In addition, IMS collects separate retail prices for the best-selling presentation of each product by method of payment—cash, medicaid, and private third-party payor. (These data are reported by IMS in its publications entitled *Retail Perspective* and *Retail Methods of Payment*.[19])

Within each therapeutic class, data are therefore available on what drugs were prescribed; whether they were brand or generic; the best-selling form, strength, and pack of each product; whether the products were destined for use by the elderly or the nonelderly; the "sell-in" price to the pharmacy; and the "sell-out" prices to consumers and other payors. Here, we focus on that point in the distribution chain involving acquisition prices paid by retail pharmacies (what IMS calls sell-in prices), while in the next section, we focus on retail pharmacy sell-out prices to various consumers and payors. Note that BLS does not publish any price indexes at this intermediate point (sell-in to retail stores) in the distribution chain. We now concentrate on three leading therapeutic classes: Broad- and medium-spectrum antibiotics, calcium channel blockers, and antidepressants.

As mentioned earlier, there are at least two possible hypotheses concerning differential elderly-nonelderly drug usage within these therapeutic classes. The first is that, for acute conditions, physicians will prescribe newer drugs for their elderly patients, in order to take advantage of superior adverse interaction and side-effect profiles, and of the more convenient dosing permitted by newer products. These newer products typically command a price premium and experience price inflation that is greater than that for older, off-patent generic drugs.[20] To the extent that these assumptions are valid, therefore, we would hypothesize that for medications used to treat acute conditions, prices faced by the elderly would tend to grow *more* rapidly than do those for the young.

The second hypothesis concerns medications used to treat chronic conditions. In such cases, it is expected that physicians would be hesitant to change medications when a particular drug regimen is working well. The elderly would, therefore, disproportionately use older drugs, which are more often available as generics. If this hypothesis is true, drug prices within certain chronic areas might be growing *less* rapidly for the elderly, because prices of generics are known to have fallen over the last decade, while prices of brands typically have increased.[21]

However, patent protection has expired for only the *very* old drugs. It is well known that, for older but still patent-protected drugs, price increases tend to be larger than for younger drugs.[22] Thus, any price inflation differential between old and young consumers of both acute and chronic medications will depend on the distribution of sales between older drugs with

Table 3. Producer Price Indexes for all pharmaceuticals, for those destined for use by the elderly, and for those destined for use by the nonelderly, 1990–96

[1990 = 100]

Year	All pharmaceuticals	For the elderly	For the nonelderly
1990	1.000	1.000	1.000
1991	1.083	1.083	1.083
1992	1.160	1.163	1.159
1993	1.213	1.211	1.213
1994	1.248	1.247	1.249
1995	1.287	1.284	1.288
1996	1.330	1.331	1.329

SOURCE: See text for details.

and without patent protection. Because such a distribution is an empirical matter that could vary by therapeutic class and change over time, our hypotheses do not have a definitive prediction for any elderly-nonelderly price inflation differential, but must be examined in the context of the distribution of sales between brands and generics in each therapeutic class.

Among the three therapeutic classes we examine here, we expect that the cardiovascular products, such as calcium channel blockers, are used predominantly for treatment of chronic conditions, while the broad- and medium-spectrum antibiotics are used primarily to treat acute conditions. In terms of protracted use, antidepressants are most likely to fall between the antibiotics and the cardiovasculars, because they are used to treat both episodic and more chronic forms of depression. In all three therapeutic classes, however, it is possible that the elderly and nonelderly use drugs for a different set of conditions. In the case of antidepressants, for example, it is well known that physicians frequently prescribe tricyclic antidepressants for "off-label" conditions, such as chronic pain syndromes, that are experienced more frequently by the elderly.

With this as background, we begin by examining retail pharmacy acquisition (sell-in) costs and price indexes for the broad- and medium-spectrum antibiotic class of drugs. As seen in the top panel of table 4, retail acquisitions of these antibiotics almost doubled from 1990 to 1996, growing from $2.1 billion to $3.8 billion. Roughly 90 percent of the retail pharmacy acquisition costs are for antibiotics destined for use by the young. The overall brand and generic shares for antibiotics are somewhat volatile, ranging from 81 percent and 19 percent in 1990 to 90 percent and 10 percent in 1993. Over the entire study period, the brand share for the elderly grew from 82 percent to 91 percent (the generic share fell from 18 percent to 9 percent), while the brand share for the young increased only from 81 percent to 87 percent. The brand share for antibiotics hit its peak in 1992–94 at about 89 to 90 percent (total), and then fell to about 88 percent (total), 87 percent (young), and 91 percent (elderly) in 1996. Thus, particularly since 1992–94, use of branded antibiotic products by the elderly has grown considerably more rapidly, and to greater proportions, than has use of such products by the young. This is, of course, consistent with the acute care hypothesis discussed above. It is also consistent with the notion that newer, branded products having higher efficacy in treating severe or life-threatening infections, such as pneumonia, are increasingly used by the elderly, in part because of the phenomenon of increasing bacterial resistance to older drugs.[23]

We now turn to price indexes, which can be constructed in a number of ways. We chose a technique that mimics the BLS fixed-weight Laspeyres procedure, using 1990 fixed quantity weights, but we also report price indexes based on the Tornquist discrete approximation to the Divisia index calculation, which allows for changing market shares.[24]

In rows labeled "Laspeyres" in the top panel of table 4, we present 1990–96 retail acquisition price indexes for antibiotics over all consumers (Laspeyres index, total), for antibiotics destined for use by the young (Laspeyres, Young) and for those destined for use by the old (Laspeyres, Elderly).[25] The first, somewhat surprising, result we obtain is that, with the Laspeyres index over the entire 1990–96 period, antibiotics used by the elderly increase in price by about 12 percent, whereas the price increase for the nonelderly is somewhat larger at 17 percent. However, if one looks only at estimates for 1992 onwards, the reverse occurs—the elderly price index for antibiotics increases 11 percent, from 1.009 to 1.121, while the index for the nonelderly increases 7 percent, from 1.096 to 1.173.

These findings concerning antibiotics are essentially unaffected when one employs changing share weights and the Divisia index. The bottom three rows of the top panel of table 4 show that, when the Divisia technique is used, the price index for antibiotics destined for use by the elderly is 1.07 by 1996, slightly smaller than the 1.11 for the young. Since 1992, however, the corresponding price index for the young has increased only very slightly (2 percent, from 1.08 in 1992 to 1.11 in 1996), while that for the elderly has increased considerably more (7 percent, from 1.00 to 1.07). In part, this old-young differential reflects a greater increase in use of newer, branded drugs by the old than by the young since 1992, as noted above.

We now turn to retail sell-in prices for antidepressants. According to the top row of the middle panel of table 4, retail sector purchases of these drugs surged by a factor of about 4 between 1990 and 1996 This is considerably more rapid growth than that observed for antibiotics, although, by 1996, total retail acquisition expenditures for the two types of drugs are about equal at $3.73 billion for antidepressants versus $3.77 billion for antibiotics. Antidepressants also are similar to antibiotics in that the retail acquisition dollar share for products destined for use by the young for both classes is about 90 percent, with a very slight upward trend. A distinctive feature of the antidepressant market involves the tremendous growth in sales of the newest generation of these drugs, the selective serotonin reuptake inhibitors such as Prozac, Zoloft, and Paxil. This rapid growth of new, branded products has resulted in a sharply declining generic dollar share of retail sector purchases (from 12 percent in 1990 to 3 percent in 1996), and a corresponding increase in the brand dollar share (88 percent to 97 percent). In each year between 1990 and 1996, the share of retail drug store purchases of generic antidepressants for use by the elderly was larger than that for the young; the 1990 generic shares for old and young were 15 percent and 12 percent, and by 1996, they had fallen to 5 percent and 3 per-

Table 4. Retail pharmacy acquisition (sell-in) costs and price indexes, by therapeutic class, 1990–96

Class or category	1990	1991	1992	1993	1994	1995	1996
Antibiotics, broad- and medium-spectrum							
Total drug costs (thousands of current dollars)	2,094,060	2,527,380	2,839,640	3,274,900	3,422,040	3,791,320	3,767,950
Share going to the young	.891	.890	.888	.889	.885	.881	.875
Share going to the elderly	.109	.110	.112	.111	.115	.119	.125
Share going for brands, total	.814	.846	.892	.897	.894	.833	.879
Share going for generics, total	.186	.154	.108	.103	.106	.167	.121
For the young	.187	.156	.110	.105	.109	.173	.126
For the elderly	.175	.141	.094	.088	.088	.120	.088
Laspeyres index, total	1.000	1.055	1.087	1.125	1.132	1.096	1.167
Young	1.000	1.055	1.096	1.135	1.141	1.103	1.173
Elderly	1.000	1.056	1.009	1.040	1.060	1.043	1.121
Divisia index, total	1.000	1.055	1.073	1.101	1.112	1.117	1.106
Young	1.000	1.055	1.083	1.112	1.121	1.125	1.109
Elderly	1.000	1.055	..995	1.020	1.038	1.056	1.072
Antidepressants							
Total drug costs(thousands of current dollars)	940,460	1,047,720	1,402,000	1,715,030	2,396,310	3,064,150	3,730,927
Share going to the young	.899	.899	.901	.904	.909	.910	.911
Share going to the elderly	.101	.101	.099	.096	.091	.090	.089
Share going for brands, total	.882	.899	.905	.893	.935	.956	.970
Share going for generics, total	.118	.101	.095	.107	.065	.044	.029
For the young	.115	.098	.090	.100	.061	.041	.028
For the elderly	.149	.126	.138	.176	.110	.073	.048
Laspeyres index, total	1.000	1.077	1.176	1.208	1.228	1.267	1.320
Young	1.000	1.077	1.176	1.209	1.230	1.269	1.321
Elderly	1.000	1.074	1.168	1.200	1.209	1.247	1.304
Divisia index, total	1.000	1.077	1.168	1.187	1.190	1.217	1.272
Young	1.000	1.077	1.169	1.189	1.195	1.224	1.279
Elderly	1.000	1.076	1.161	1.172	1.145	1.158	1.201
Calcium channel blockers							
Total drug costs(thousands of current dollars)	1,697,136	2,068,896	2,597,408	2,821,445	3,061,874	3,146,177	3,179,213
Share going to the young	.546	.560	.566	.575	.577	.580	.585
Share going to the elderly	.454	.440	.434	.425	.423	.420	.415
Share going for brands, total	.985	.973	.973	.928	.921	.936	.955
Share going for generics, total	.015	.027	.027	.072	.079	.064	.045
For the young	.015	.034	.032	.072	.077	.062	.046
For the elderly	.014	.018	.021	.072	.082	.068	.045
Laspeyres index, total	1.000	1.072	1.135	1.178	1.197	1.234	1.267
Young	1.000	1.072	1.134	1.175	1.192	1.229	1.261
Elderly	1.000	1.072	1.136	1.181	1.203	1.242	1.273
Divisia index, total	1.000	1.061	1.105	1.132	1.087	1.098	1.105
Young	1.000	1.061	1.103	1.130	1.082	1.093	1.100
Elderly	1.000	1.061	1.108	1.135	1.094	1.105	1.111

NOTE: Laspeyres index employs fixed 1990 weights. SOURCE: See text discussion.

cent. This differential brand-generic pattern could reflect the phenomenon noted above that certain generic tricyclic antidepressants are often prescribed "off-label" to treat chronic pain syndromes that occur more frequently with the elderly.

With respect to price indexes, we first report results based on the fixed-weight Laspeyres procedure. According to results presented in the middle panel of table 4, the antidepressant price inflation differential between old and young appears to be negligible—by 1996, the Laspeyres index for the elderly is 1.30, very slightly less than that for the young at 1.32. For the Divisia index that takes changing shares into account, however, the inflation differential is considerably larger, with the 1996 index standing at 1.20 for the elderly but at 1.28 for the young.

The reason underlying this inflation differential is that the use of off-patent and generic drugs by the elderly is above that of the general population. However, elderly use of some newer and still patent-protected branded drugs is about the same as, or slightly less than, that of the general population. Given these differential brand-generic uses by the elderly and

the young, and with generic prices falling while brand prices are increasing, the basket of antidepressants destined for use by the elderly is growing less rapidly in price than the basket destined for use by the young. Moreover, because it employs changing shares rather than fixed weights, the Divisia index better captures these dynamics. Note that the inflation differential would be even larger if the dollar share of generics had not been falling; by 1996, this share was 5 percent for the elderly and 3 percent for the young, down from 15 percent and 12 percent in 1990.

Next, we turn to the calcium channel blockers, drugs used to treat cardiovascular conditions, and having brand names such as Cardizem, Norvasc, and Procardia XL. As with the antibiotics, retailers have approximately doubled their acquisition costs of blockers from 1990 to 1996, with total acquisition costs of around $3.2 billion in 1996, about 15 percent less than those for antibiotics. The elderly share of of the blockers, however, is much larger than that for either antibiotics or antidepressants. As shown in the bottom panel of table 4, the retail acquisition dollar share of calcium channel blockers for the elderly is over 40 percent, having fallen slightly from 45 percent in 1990 to 42 percent in 1996. The brand-generic market share pattern also is different, nor is it monotonic over time, reflecting, in part, episodic patent expirations and generic entry to the market within the 1990–96 time frame. For the elderly, the generic share increased from 1 percent in 1990 to 8 percent in 1994, and then fell to about 4 percent in 1996; for the young, the respective generic shares are similar at 2 percent, 8 percent, and 4 percent.

Because of the relatively small brand-generic differences by age group, there is only a negligible difference between the elderly and the young in inflation of retail acquisition prices for calcium channel blockers. According to the bottom panel of table 4, the Laspeyres indexes for the young and the elderly are 1.27 and 1.26, while the Divisia indexes are 1.11 and 1.10. In large part, this similarity in elderly-nonelderly price inflation for calcium channel blockers reflects the fact that brand-generic consumption differences between the old and young are much smaller in any given year for calcium channel blockers than they are for either the antidepressants or the antibiotics.

In summary, therefore, over the entire 1990–96 period, retail acquisition price inflation involving antidepressants destined for use by the elderly was *less* than that for the young, reflecting greater use of generic drugs by the elderly. For antibiotics, price inflation has been considerably greater for products going to the elderly since 1992, but the differential is much smaller over the entire 1990–96 period. Moreover, the greater price inflation for antibiotics sold to the elderly since 1992 appears to reflect the more rapid growth in the use of the newest, branded drugs for which adverse interactions with other drugs are fewer, and bacterial resistance is less. For calcium channel blockers, however, the elderly-nonelderly inflation differentials are negligible.

Two other general results are worth noting. First, growth over time in the sell-in prices for all three therapeutic classes, based on the IMS data employed here, is less than inflation as measured by the BLS Producer Price Index, even when the Laspeyres methodology is used; the 1990–96 differences between the two measures are 1.29 percent per year for antibiotics, 1.61 percent for antidepressants, and 0.83 percent for calcium channel blockers.[26] This differential could reflect different pricing for leading (best-selling) presentations of drugs (from IMS data) than for the basket examined by BLS, or the fact that prices move differently at this later point in the pipeline (sell-in to retail) than monitored by the PPI (sales from manufacturers to wholesalers). Moreover, while the PPI prices an actual transaction, the IMS reports average acquisition costs as prices. In addition, the IMS data include drugs manufactured in Puerto Rico, which are out of scope for the PPI. However, the difference could also reflect a bias the BLS has been known to have had in the past in oversampling older branded drugs. Recent changes made to the PPI program are likely to have reduced this bias.[27]

Second, as table 4 shows, in each case the fixed weight Laspeyres price index yields a larger measure of price inflation than does the corresponding Divisia index. Over all consumers, for example, the difference is 0.92 percent per year for antibiotics, 0.65 percent for antidepressants, and 2.34 percent for calcium channel blockers. These differences, while substantial, are consistent with other findings for prescription pharmaceuticals, and highlight the significance of employing changing versus fixed weights in any index measure.[28]

Retail sell-out prices

We now examine price growth in the final point of the distribution chain, that from retail pharmacies to patients and other payors. Our research here must be viewed as preliminary in at least two respects. First, we have not been able to obtain reliable data that distinguish cash, medicaid, and third-party insurance payments separately for the elderly and the nonelderly since 1991.[29] Our inability to obtain reliable national data is unfortunate, for casual empiricism suggests that the elderly's use of third-party payment arrangements to pay for drugs has increased more rapidly in the last few years than has that of the general population, particularly as the retired have moved into medigap managed care arrangements that offer prescription drug benefits. If, in fact, seniors have moved to third-party drug payment more rapidly than the young in recent years, and therefore are increasingly less affected by higher cash prices, then seniors are disproportionately availing themselves of lower managed care prices, resulting in lower drug price inflation (but perhaps still higher-than-average price

Table 5. Divisia retail sell-in and sell-out price indexes for antidepressants for the young and the elderly and for all consumers, 1991–96

Year	Sell-in index			Sell-out[1] index			Gross margin index (sell-out/sell-in)		
	Young	Elderly	Total	Young	Elderly	Total	Young	Elderly	Total
1991	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1992	1.085	1.079	1.084	1.075	1.073	1.075	1.000	1.000	1.000
1993	1.104	1.089	1.102	1.083	1.076	1.082	.981	0.988	0.982
1994	1.110	1.064	1.105	1.081	1.073	1.080	.984	1.008	0.977
1995	1.136	1.076	1.130	1.114	1.096	1.112	.980	1.018	0.984
1996	1.188	1.116	1.181	1.142	1.121	1.140	.962	1.004	0.965

[1]Sell-out is dollars per daily dose of leading presentation, weighted average over channels, using the same channel weights for the elderly and the young.

levels) than that experienced by the nonelderly. Research on this issue must be postponed until appropriate data become available.

Second, the IMS sell-out methods of payments data are based on the best-selling presentation of a particular branded or generic drug. Problems emerge in measuring price and quantity changes consistently when these leading presentations change for brands, and even more so, for specific generic manufactures, over the period under consideration. These problems are particularly evident in our data involving the antibiotics and calcium channel blockers, as are related problems involving products embodying combinations of chemical molecules. In the future, we will be working with IMS to obtain data on additional presentations for branded and generic chemical molecules, as well as information involving the combination products.

For antidepressants, fortuitously, this second problem involving leading presentations turns out essentially not to be an issue. Thus, we limit this section of the discussion of sell-out prices by retail pharmacies to the antidepressant class of prescription drugs. Moreover, because reliable method-of-payments data are not yet available separately for the elderly and the nonelderly, here we simply employ a weighted average of prices among cash, medicaid, and third-party payors, where the weights are assumed to be the same for the elderly and nonelderly.[30]

IMS method of payments data are available only since 1991, whereas the sell-in data analyzed in the previous section go back to 1990. We therefore begin by re-normalizing the antidepressant sell-in data from table 4 so that the Divisia price index for the antidepressant drugs is 1.000 in 1991. Results of that re-normalization appear in the first three columns of table 5. As indicated, from 1991 to 1996, sell-in prices for antidepressant drugs destined for use by the elderly increased 12 percent, while sell-in prices for drugs destined for use by the young increased 19 percent.

In the introductory section of this article, we noted the dramatic change over time in retail methods of payment, away from cash and, instead, toward third-party payors. For retail pharmacies, the growth in third-party payment implies dealing with a more organized and powerful buyer or payor than is the typical cash customer. We therefore expect that, over the study period, sell-out prices (the sum of copayments and third-party reimbursements received by the retail pharmacies) have increased less rapidly than have sell-in prices. One very simple way of highlighting this difference is to compute a "gross margin index," defined as the sell-out price index divided by the sell-in price index, where the former incorporates data on changing methods of payment over time,[31] assumed to be the same for antidepressants as for all drugs.

In the second three columns of table 5, we present the Divisia price index for retail sell-out, normalized to unity in 1991, while in the last three columns, we list the gross margin index, constructed as outlined in the previous paragraph. Several results are particularly interesting.

First, as expected, the increased role of third-party payers since 1991 has put downward pricing pressure on the retail pharmacy sector; while antidepressant prices on a sell-in basis increased 18 percent over all customers from 1991 to 1996, corresponding sell-out prices increased only 14 percent. Thus, gross margins for retail pharmacies selling antidepressant products fell 3.5 percent from 1991 to 1996.

Second, this declining gross margin primarily involved sales of antidepressants to the young. The sell-in retail acquisition prices of these drugs increased 18.8 percent from 1991 to 1996, while sell-out prices increased 14.2 percent, implying a decline of 3.8 percent in gross margins. For the elderly, however, the gross margin actually increased very slightly, by 0.4 percent.

One reason for this last result is that, as noted earlier, the elderly are disproportionately large consumers of generic antidepressant drugs. A number of studies have documented that the retail gross margin on generic drugs is larger, not only in percentage terms, but often also in absolute amounts, than is the retail margin on branded products;[32] that turns out to be the case here as well.[33] One implication of this larger generic retail margin, along with disproportionately great use of generics by the elderly, is that retail pharmacy margins have been

under greater downward pressure from nonelderly customers than from the elderly. It must be emphasized, however, that the calculations underlying table 5 assume that the method–of-payments trends are the same for antidepressants as for all drugs, and the same for the elderly and the young. If, in fact, the elderly are moving into third-party payment arrangements for drugs more rapidly than are the young, these gross margin differentials between young and old will tend to be overstated.

Conclusions

Although BLS publishes an experimental consumer price index for the elderly, that index simply reweights the regular CPI item strata indexes, based on expenditures on the various strata by the elderly. Actual prices faced by the elderly, as well as substrata weights, are assumed to be the same for the elderly and the nonelderly in this experimental price index.

Prescription drugs are likely to be one case in which within-stratum consumption patterns of the elderly differ considerably from those of the nonelderly. Thus, our purpose in this article has been to examine whether prescription drug price inflation in the 1990s has differed between the elderly and the nonelderly, when age-related substrata variations in consumption are taken into account.

We have examined prices at three alternative points in the distribution chain. Our first finding is that, at the initial point in the distribution chain involving manufacturers' sales to wholesalers, retailers, and hospitals (transactions monitored by various pharmaceutical PPI's), there is essentially no age-related aggregate price inflation differential, despite very significant variations in the baskets of drugs destined for use by the elderly and the nonelderly.

A second finding focuses on an intermediate point in the distribution chain, involving acquisition prices of retail pharmacies for purchases primarily from wholesalers; these retail sell-in transactions take place at a theoretical point between the PPI and the CPI, and thus are not monitored by BLS price measurement programs. Here, we find one therapeutic class (antibiotics) in which prices appear to rise more rapidly for the elderly, especially since 1992, one class (antidepressants) in which prices appear to rise less rapidly for the elderly, and one class (calcium channel blockers) in which there is essentially no difference. This suggests that no general age-related pattern of price inflation differentials for prescription pharmaceuticals is likely to emerge. Instead, the empirical significance of brand versus generic consumption, of the use of new versus old drugs, and of age-related quality attributes (once-a-day versus multiple daily dosages, the extent of adverse interactions with other medications, the frequency and seriousness of side effects) must be examined on a class-by-class basis before any general conclusions can be reached. Moreover, because of substantial innovations and rapid market changes in the pharmaceuticals industry, there is no reason why one would expect any such conclusions to be stable over long periods.

A third finding involves sales by retail pharmacies to consumers and other payors. Here, we have data from only the antidepressant therapeutic class, and find that, over all age groups, retail pharmacy sell-out prices have fallen about 3.5 percent since 1991, due in part to the growth of managed care with prescription drug benefits. In terms of retail margins, young patients appear to have enjoyed most of the benefits of this increased power of managed care over time, at the expense of the retail pharmacy sector. For the elderly, prices of antidepressants have risen slightly, reflecting, in part, the fact that the elderly are disproportionately large users of generic drugs, whose retail margins tend to be greater than those of branded products.

A number of caveats are worth noting. First, to the extent that the elderly are enrolling in-third party arrangements with drug benefits (such as HMO medigap programs) at a more rapid rate than are the young, the retail gross margin differential will tend to be overstated, as will growth in sell-out prices for the elderly.

Second, a useful extension of our empirical analysis would involve the introduction of mail order sales into our analysis. Although mail order sales are currently only about 9 percent of all prescription drug dollar sales, mail order is a rapidly growing segment of the pharmaceuticals market, and, in part because of its emphasis on chronic medications, is apparently one in which the elderly are disproportionately represented.[34] We expect that excluding mail order prescription drug sales from our analysis most likely results in our overstating overall price growth for the elderly.

Third, we have made no attempt here to adjust estimated price inflation differentials for variations in the quality of the products used by the elderly and the young, nor have we linked prices of generics at entry with previous prices of their patented antecedents. It is possible, of course, that our findings on differential price inflation for the young and the old in several therapeutic classes could be entirely reversed were quality adjustments taken into account. Adjusting price changes and price differentials for quality changes is therefore an important issue meriting further research.

Finally, an implicit assumption in the present analysis is that the elderly are homogeneous. It is possible, of course, that there are more differences *within* the elderly than there are *between* the elderly and the young. Is income or expenditure inequality greater among the elderly than between the young and elderly? Clearly, the formulation of appropriate public policy involving the elderly depends, in part, on addressing the "within versus between" issue.[35] (In a somewhat different context, involving other products, Robert Michael reports greater variation in expenditures within various de-

mographic groups than between them.[36]) Examining the variability in health expenditures and in price inflation for health-related items within the elderly demographic group is therefore also a topic worthy of further attention.[37] □

Footnotes

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[1] For a discussion of patterns in total acute care health *expenditures* by patient age group from 1953 to 1987, see David M. Cutler and Ellen Meara, "The Medical Cost of the Young and Old: A Forty Year Perspective," Paper presented at the April 1997 National Bureau of Economic Research Conference on Aging, Boulder, CO.

[2] Katharine R. Levit, Helen C. Lazenby, Bradley R. Braden, Cathy A. Cowan, Patricia A. McDonnell, Lekha Sivarajan, Jean M. Stiller, Darleen K. Won, Carolyn S. Donham, Anna M. Long, and Madie W. Stewart, "National Health Expenditures, 1995," *Health Care Financing Review*, Fall 1996, pp. 175–214; and Katharine R. Levit, Helen C. Lazenby, Bradley R. Braden, and the National Health Accounts Team, "National Health Spending Trends in 1996," *Health Affairs*, January/February 1998, pp. 35–51.

[3] IMS 1996 Class of Trade Analysis and Retail Method of Payment Analysis. See *Information Services Manual 1996* (Plymouth Meeting, PA, IMS America, 1996).

[4] In the Consumer Expenditure Survey, consumer out-of-pocket expenditures for health insurance are the sum of employees' pretax contributions at work and direct health insurance premium payments, but employers' health insurance contributions are not included, for those are treated as a business expense.

[5] For an overview discussion, see Jack E. Triplett, "What's Different About Health? Human Repair and Car Repair in National Accounts," Paper presented at the NBER-CRIW Conference on Medical Care Output and Productivity, Bethesda, MD, June 12–13, 1998; Thomas E. Getzen, "Medical Care Price Indexes: Theory, Construction and Empirical Analysis of the US Series 1927–1990," in *Advances in Health Economics and Health Services Research* (JAI Press, 1992), pp. 83–128; and Ernst R. Berndt, David M. Cutler, Richard G. Frank, Zvi Griliches, and Joseph P. Newhouse, "Price Indexes for Medical Care Goods and Services: An Overview," Paper presented at the NBER-CRIW Conference on Medical Care Output and Productivity, Bethesda, MD, June 12–13, 1998.

[6] However, in constructing the BLS Medical Consumer Price Index, the out-of-pocket payments for health insurance are, in turn, distributed into payments by insurers for medical services, medical commodities, and health insurers' retained earnings. See Dennis Fixler, "The Treatment of the Price of Health Insurance in the CPI," unpublished paper (Bureau of Labor Statistics, Aug. 30, 1996; and Ina Kay Ford and Philip Sturm, "CPI revision provides more accuracy in the medical care services component," *Monthly Labor Review*, April 1988, pp. 17–26.

[7] However, for several years within the 1927–46 period, year-to-year changes in the CPI were greater than those for the MCPI. See Getzen, "Medical Care Price Indexes," for a discussion.

[8] For a review of literature on various BLS experimental price indexes, including a separate price index for the poor, both old and young, see Thesia I. Garner, David S. Johnson, and Mary F. Kokoski, "An experimental Consumer Price Index for the poor," *Monthly Labor Review*, September 1996, pp. 32–42; and Brent R. Moulton and Kenneth J. Stewart, "An Overview of Experimental U.S. Consumer Price Indexes," unpublished paper (Bureau of Labor Statistics, March 1997).

[9] See Dorothy P. Rice and Loucele A. Horowitz, "Trends in Medical Care Prices," *Social Security Bulletin*, July 1967, pp. 13–28. The excerpt, which appears on p. 28, is based on *Report to the President on Medical Care Prices* (Washington, U.S. Department of Health, Education and Welfare, 1967). On p. 25 of their work, Rice and Horowitz report that the December 1965–December 1966 price index growth rates ranged from 2.5 percent for cholecystectomy to 6.9 percent for prostatectomy, while the combined index for physicians' fees regularly priced for the CPI increased 7.8 percent.

[10] See Garner and others, "An experimental Consumer Price Index," p. 37; and Moulton and Stewart, "An Overview," p. 18. The time costs of shopping could also differ for the elderly.

[11] See Nathan Amble and Ken Stewart, "Experimental price index for elderly consumers," *Monthly Labor Review*, May 1994, pp. 11–16; Charles C. Mason, "An Analysis of the Rates of Inflation Affecting Older Americans Based on an Experimental Reweighted Consumer Price Index," Report presented to the U.S. Congress, June 1988. The "overall" CPI refers to the CPI-for All Urban Consumers.

[12] See United States Senate Finance Committee, *Final Report from the Advisory Commission to Study the Consumer Price Index* (Washington, U.S. Government Printing Office, Dec. 4, 1996), pp. 58–62; and Moulton and Stewart, "An Overview," p. 21.

[13] In 1995 (1990), 78.9 percent (71.8 percent) of manufacturers' sales were to wholesalers, 12.1 percent (15.8 percent) were to retailers, and 4.8 percent (9.3 percent) were to hospitals. See *1997 Industry Profile* (Washington, Pharmaceutical Research and Manufacturers of America, 1997), fig. 4–12, p. 30.

[14] Indexed to June 1981 = 100, the PPI index values in June 1996 were 145.9, 192.6, and 221.5 for anticoagulants, antiarthritics and systemic antiinfectives, and 730.9, 605.8, and 500.5 for sedatives, CNS stimulants/antiobesity preparations, and psychotherapeutics, respectively. See *Producer Price Indexes* (Bureau of Labor Statistics, June 1996), table 5, p. 61.

[15] For further details, see *Information Services Manual 1996*, ch. 11. A new prescription refers to a new script written by the physician, and is distinguished from continuing therapy.

[16] Additional details on elderly-nonelderly prescription patterns are given in table 5 of Ernst R. Berndt, Iain M. Cockburn, Douglas L. Cocks, Arnold Epstein, and Zvi Griliches, "Is Price Inflation Different for the Elderly? An Empirical Analysis of Prescription Drugs," in Alan Garber, ed., *Frontiers of Health Policy* (Cambridge, MA, National Bureau of Economic Research, forthcoming).

[17] These weights are from the BLS 1993 Cycle C sample.

[18] Notice that, implicitly, we are assuming here that the old-young distribution within each therapeutic class is the same for sales from manufacturers to wholesalers, to hospitals, and to retailers. We relax this assumption in the next section.

[19] For further details, see *Information Services Manual 1996*, chs. 20 and 41.

[20] This is clearly the case for antidepressants, such as the selective sero-

tonin reuptake inhibitors, which have similar efficacy but superior adverse interaction and side effect profiles relative to the older tricyclic antidepressants. See Ernst R. Berndt, Iain Cockburn, and Zvi Griliches, "Pharma-ceutical Innovations and Market Dynamics: Tracking Effects on Price Indexes for Antidepressant Drugs," *Brookings Papers on Economic Activity: Microeconomics 1996* (Washington, The Brookings Institution, 1996) for further discussion.

[21] See, for example, Zvi Griliches and Iain Cockburn, "Generics and New Goods in Pharmaceutical Price Indexes," *American Economic Review*, December 1994, pp. 1213–32; and Berndt and others, "Pharmaceutical Innovations."

[22] See, for example, Ernst R. Berndt, Zvi Griliches, and Joshua G. Rosett, "Auditing the Producer Price Index: Micro Evidence from Prescription Pharmaceutical Preparations," *Journal of Business and Economic Statistics*, July 1993, pp 251–64; Douglas Kanoza, "Supplemental Sampling in the PPI Pharmaceuticals Index," *Producer Price Indexes Detailed Price Report*, January 1996, pp. 8–10; Gregory G. Kelly, "Improving the PPI sample for prescription pharmaceuticals," *Monthly Labor Review*, October 1997, pp. 10–17; and William Ristow, "IMS Presentation to the BLS," mimeo. (Plymouth Meeting, PA, IMS America, July 1996).

[23] Successful brands introduced since 1990 with substantial use by the elderly include Floxin and Lorabid, while sales of other older brands such as Ceftin and Cipro (introduced in 1987) have also grown substantially. Further, Zithromax has once-a-day dosing that facilitates compliance by the elderly.

[24] This fixed-weight procedure is not the same as that employed by BLS in its CPI for prescription drugs for a number of reasons, including the fact that the CPI uses only out-of-pocket weights, whereas weights here include retail acquisition costs for products destined for payment by cash, third-party payors, and medicaid. Moreover, the index here refers to retail acquisition costs, not retail sales to patients and other payors. A description of the BLS method for dealing with prescription drugs in the CPI is found in David L. Cleeton, Valy T. Goepfrich, and Burton A. Weisbrod, "What Does the Consumer Price Index for Prescription Drugs Really Measure?" *Health Care Financing Review*, Spring 1992, pp. 45–51; Paul A. Armknecht, Brent R. Moulton, and Kenneth J. Stewart, "Improvements to the Food at Home, Shelter, and Prescription Drug Indexes in the U.S. Consumer Price Index," CPI Announcement—Version I (Bureau of Labor Statistics, Oct. 20, 1994). Further discussion of both of these indexes and of details regarding their empirical implementation is found in Berndt, Griliches, and Rosett, "Auditing the Producer Price Index."

[25] The elderly-nonelderly split for each drug is based on the average of the 1992, 1994, and 1996 NDTI values.

[26] These differences are computed as growth in the BLS Producer Price Index by therapeutic class (systemic anti-infectives for antibiotics, psychotherapeutics for antidepressants, and cardiovasculars for calcium channel blockers), reported in table 2, minus growth in the "Laspeyres index, total" entries of table 4.

[27] See Kelly, "Improving the PPI sample," for a discussion of the BLS's new sampling procedures and estimates of their impacts.

[28] See, for example, Berndt, Griliches, and Rosett, "Auditing the Producer Price Index"; and Berndt, Cockburn, and Griliches, "Pharmaceutical Innovations."

[29] Data graciously made available to us involving a third-party insurer implied an implausibly huge decline in the elderly's use of cash as a method of payment.

[30] These weights are from Berndt and others, "Is Price Inflation Different for the Elderly?" table 1.

[31] Data are from Berndt and others, "Is Price Inflation Different for the Elderly?" table 1.

[32] See, for example, Alison Masson and Robert L. Steiner, *Generic Substitution and Prescription Prices: The Economic Effects of State Drug Laws* (Washington, Federal Trade Commission, Bureau of Economics, 1985); and Richart E. Caves, Michael D. Whinston, and Mark A. Hurwitz, "Patent Expiration, Entry, and Competition in the U.S. Pharmaceutical Industry," *Brookings Papers on Economic Activity: Microeconomics 1991* (Washington, The Brookings Institution, 1991).

[33] For one well-known branded selective serotonin reuptake inhibitor, for example, the sell-in price in 1996 was $1.71 while the sell-out price, averaged over method of payment channel, was $2.06, implying a $0.35 absolute margin and a 20.5-percent percentage margin [(sell-out/sell-in)–1]. By comparison, for one of the well-known older generation tricyclic antidepressants, the sell-in price was $0.12, and the sell-out price was $0.54, implying a $0.42 absolute margin and a 350-percent percentage gross margin. Note that one would expect the percentage margin to be larger for generics, because a common dispensing fee usually is added to a lower generic acquisition price.

[34] Data made available to us involving one mail-order firm showed that more than half of the prescriptions dispensed were mail ordered to patients 65 years and older.

[35] For an early discussion of this issue in the "Stigler Commission" report, see Eleanore M. Snyder, "Cost of Living Indexes for Special Classes of Consumers," Staff Paper 7, in U.S. Congress, Joint Economic Activity, *Government Price Statistics*, Hearing before the Subcommittee on Economic Statistics of the Joint Economic Committee, Congress of the United States, 87th Congress, 1st Session, Pursuant to Sec. 5(a) of Public Law 304 (79th Congress), Part 1, Jan. 24, 1961, pp. 337–72.

[36] See Robert T. Michael, "Variation Across Households in the Rate of Inflation," *Journal of Money, Credit and Banking*, February 1979, pp. 32–44.

[37] On this, see recent unpublished research findings by David M. Cutler and Elizabeth Richardson, "Inequality in Health," unpublished paper (Cambridge, MA, National Bureau of Economic Research, 1997); and Angus M. Deaton and Christina Paxson, Health, "Income and Inequality Over the Life Cycle," unpublished paper (Princeton, NJ, Princeton University, Department of Economics, 1997).