IS PRICE INFLATION DIFFERENT FOR THE ELDERLY? AN EMPIRICAL ANALYSIS OF PRESCRIPTION DRUGS

Ernst R. Berndt
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Ernst R. Berndt, Iain M. Cockburn,
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ABSTRACT

Using annual IMS data from 1990 to 1996, we examine empirically whether elderly-nonelderly price inflation differentials exist for one medical item, namely, prescription pharmaceuticals. We assess prices for Rx drugs destined for ultimate use by the elderly vs. the nonelderly at three points in the distribution chain: initial sales from manufacturers, intermediate purchases by retail pharmacies, and final sales from retail pharmacies to patients/payors.

We find that at the initial point in the distribution chain, there are no differences in price inflation for the aggregate of drugs destined for use by the elderly vs. the nonelderly. At the intermediate sell-in to pharmacy distribution point, we examine antibiotics (ABs), antidepressants (ADs) and calcium channel blockers (CCBs). For ABs, since 1992 elderly price inflation is somewhat greater than for the young, reflecting in part the elderly's more intensive use of newer branded products having fewer side effects, adverse drug interactions and more convenient dosing -- attributes of particular importance to the elderly. For ADs, elderly price inflation is considerably less than for the young, due in large part to the elderly's greater use of older generic products. For CCBs, elderly-nonelderly differentials are negligible. None of these differentials adjusts for variations in quality.

At the final retail sell-out point, we only examine ADs. We find that since retailers obtain larger gross margins on generic than on branded products, and because the elderly are disproportionately large users of generic ADs, the elderly-nonelderly price inflation differential benefiting the elderly at the intermediate point is reduced considerably at final sale.

Ernst R. Berndt
Alfred P. Sloan School of Management
Massachusetts Institute of Technology
50 Memorial Drive, E52-452
Cambridge, MA 02142
and NBER
eberndt@sloan.mit.edu

Iain M. Cockburn
Faculty of Commerce
University of British Columbia
2053 Main Mall
Vancouver, BC V6T 1Z2
CANADA
and NBER
cockburn@innovation.commerce.ubc.ca

Douglas L. Cocks
Eli Lilly and Company
Lilly Corporate Center
Indianapolis, IN 46285

Arnold Epstein
Harvard Medical School
25 Shattuck Street
Parcel B, 1st Floor
Boston, MA 02115

Zvi Griliches
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
grilic@kuznets.harvard.edu

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I. INTRODUCTION

Over the next few decades, the US population age 65 and older will grow, both in absolute numbers and as a share of the total population. As people age, they tend on average 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 quantitative 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 they live on fixed incomes, the elderly are particularly vulnerable to price inflation. Moreover, medical care price increases are likely to impact the elderly differentially, because medical care is a larger share of their current budgets. Recently there has been substantial controversy concerning the continued automatic adjustment of Social Security payments to the elderly on the basis of changes in the Consumer Price Index (CPI), with a panel of experts estimating that the CPI overstates true cost of living increases by about 1.1% per year.[1]

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. In this paper we focus on elderly-nonelderly price inflation differentials for one component of medical care, namely, prescription pharmaceuticals, from 1990 to 1996.[2]

The systems by which prescription pharmaceuticals are distributed and paid for in the US are complex and rapidly changing. We assess elderly-nonelderly price differentials at three different points in the distribution

chain: (i) the initial point involving sales from manufacturers to wholesalers, retailers and hospitals; (ii) an intermediate point at which retail pharmacies acquire Rx drugs from wholesalers and manufacturers; and (iii) a final point at which retail pharmacies dispense and sell Rx drugs to patients. With respect to payors, at the retail sell-out point in the distribution chain, we 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).

One reason underlying possible elderly-nonelderly drug price inflation differentials is that the brand-generic proportions could vary by age. For treatment of acute conditions, the elderly may be more fragile, and thus prudent medical practice might suggest prescribing for them the newest generation of drugs having fewest side effects, adverse drug interactions, and most convenient dosing. Under this hypothesis, for certain acute conditions one might expect the elderly to be disproportionate users of newer, branded drugs. To the extent newer branded drugs increase in price more rapidly than older off-patent and generic drugs, 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, for physicians are hesitant to change medications when a particular 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 which are more often available as generics. Under this hypothesis, drug price inflation for the elderly's bundle would be *less than*

that for the young. We examine both these hypotheses empirically, focusing on three therapeutic classes -- antibiotics, antidepressants and calcium channel blockers.

We begin in the next section by providing background information on various trends and demographic-related aspects of the US medical care marketplace, and summarize the literature dealing with possible different rates of inflation for the elderly vs. the young. In Sections III, IV and V we focus on prices at an initial, intermediate and final link of the distribution chain, respectively. We document and then examine implications of the fact that the elderly and nonelderly have differential uses of drugs across various therapeutic classes, and varying brand-generic consumption patterns within therapeutic classes. We compute and report on separate elderly-nonelderly price indexes, using a fixed weight Laspeyres index that mimicks procedures currently employed by the BLS, and also employ a changing-share Divisia price index recommended for use by the CPI Commission. We also comment on the important role of differential brand-generic gross margins at retail pharmacies. In Section VI we summarize our findings, offer caveats, and outline important issues for future research.

II. BACKGROUND

A. HEALTH CARE EXPENDITURES

We begin by reviewing recent changes in the components, sources, location and methods of payment for health care items, with a particular focus on pharmaceuticals. In 1994, the last year for which such data are currently available, prescription drugs accounted for 6.2% of the $831.7 billion in total personal health expenditures; non-prescription drugs comprised 3.2%, professional medical services 37.0%, hospital care 40.7%, nursing home care 8.7%, and supplies and other, the remaining 4.2%.[3]

The sources of funds for these various personal health expenditures varied considerably. While consumers' out-of-pocket expenditures provided 26.6% of expenditures for professional medical services, 2.9% of hospital care, and 37.1% of nursing home care, for prescription pharmaceuticals direct consumer expenditures (including copayments and deductibles) are larger, constituting 42.4% of total Rx spending, down from 48.3% in 1990; private third party insurance covered 38.5% of total Rx spending in 1994, up from 34.5% in 1990.[4]

The locus of prescription pharmaceutical sales is also undergoing change. In 1996, for example, about 57% of dollars spent on pharmaceuticals involved retail sales (chain pharmacies, independents, mass merchandisers and foodstores), down from 64% in 1990. While the dollar share involving mail order increased from 5% to 9%, that for hospitals, clinics and nursing homes was relatively constant, 28% in 1990 and 29% in 1996, as was that for staff model health maintenance organizations (HMOs) -- 2% in both years.[5]

Within the retail sector, a very dramatic change involving method of payment has occurred over the last several years. As seen in Table 1, since 1991 the share of new prescriptions paid for by cash has fallen sharply from 59% to 32%, while that paid for directly by third party sources other than Medicaid has doubled, increasing from 28% to 57%. Third party insurance has now become the predominant method of payment for prescription pharmaceuticals sold in retail outlets. The Medicaid share of dollars has varied less, from a high of about 15% in 1993 to about 11% in 1996. (Note that Medicare does not cover outpatient pharmaceutical expenses.) In terms of numbers of new prescriptions, the 1990-96 average annual growth rate (AAGR) for cash customers is -6.6% vs. 20.5% for third party payors.

The above discussion on health expenditures does not distinguish by age group. Through its annual Consumer Expenditure Survey (CES), the US Bureau of

Table 1

RETAIL METHODS OF PAYMENT, 1991-96

	NEW RX'S IN MILLIONS				RX PERCENTAGE DISTRIBUTION		
DATE	CASH	MEDICAID	3RD PARTY	TOTAL	CASH	MEDICAID	3RD PARTY
3Q91	262.4	59.3	122.2	443.9	59.1%	13.4%	27.5%
4Q91	279.2	66.8	136.3	482.3	57.9%	13.9%	28.3%
1Q92	268.6	67.5	140.9	477.0	56.3%	14.2%	29.5%
2Q92	262.5	65.3	140.9	468.7	56.0%	13.9%	30.1%
3Q92	254.0	65.8	137.1	456.9	55.6%	14.4%	30.0%
4Q92	268.2	72.0	151.9	492.1	54.5%	14.6%	30.9%
1Q93	259.1	74.4	165.2	498.7	52.0%	14.9%	33.1%
2Q93	247.0	71.1	164.8	482.9	51.1%	14.7%	34.2%
3Q93	233.5	69.5	164.0	467.0	50.0%	14.9%	35.1%
4Q93	250.1	76.3	186.4	512.8	48.8%	14.9%	36.3%
1Q94	232.4	69.5	201.4	503.3	46.2%	13.8%	40.0%
2Q94	225.2	67.5	205.9	498.6	45.2%	13.5%	41.3%
3Q94	215.5	63.4	205.4	484.3	44.5%	13.1%	42.4%
4Q94	222.2	66.7	229.0	517.9	42.9%	12.9%	44.2%
1Q95	213.9	70.6	251.7	536.2	39.9%	13.2%	46.9%
2Q95	200.5	66.1	252.0	518.6	38.7%	12.7%	48.6%
3Q95	192.7	63.9	251.9	508.5	37.9%	12.6%	49.5%
4Q95	199.8	68.2	282.2	550.2	36.3%	12.4%	51.3%
1Q96	192.8	67.6	291.8	552.2	34.9%	12.2%	52.8%
2Q96	180.0	61.5	294.2	535.7	33.6%	11.5%	54.9%
3Q96	176.6	60.3	296.3	533.2	33.1%	11.3%	55.5%
4Q96	183.6	65.7	325.5	574.8	31.9%	11.4%	56.6%
AAGR	-6.6%	2.0%	20.5%	5.0%			

SOURCE: IMS AMERICA

Labor Statistics collects data on consumers' out-of-pocket expenditures (OOPs) for various budget items, including components of health care. The unit of observation for the CES is the consumer unit ("household"), defined as "the person/group of persons in the household who is/are independent of all other persons in the household for payment of their major expenses".[6] The person in the consumer unit (CU) with major financial responsibility for payment of

major expenses is called the reference person ("head of household") of the consumer unit. CUs are stratified in a number of ways, including one of particular interest to us, namely, by age of the reference person. In Tables 2 and 3 we summarize data from the 1990 and 1995 CES. Five points are particularly worth noting.

Table 2

OUT-OF-POCKET HEALTH CARE EXPENDITURES BY REFERENCE PERSON AGE GROUP
UNITED STATES, 1990 AND 1995

Category	All Consumers	Under 25	25-34	35-44	45-54	55-64	65 and Over	65-74	75 and Over
Total Expenditures Per Consumer Unit:									
1990	28381	16525	28117	35594	37012	29263	18551	20901	15450
1995	32277	18429	31488	38425	42181	32604	22265	25302	18575
Health Care Expenditures Per Consumer Unit:									
1990 $	1480	403	981	1415	1597	1791	2208	2197	2223
1995 $	1732	465	1096	1609	1850	1909	2647	2617	2683
Health Care Share of Total Per Consumer Unit Expenditures:									
1990	5.21%	2.44%	3.49%	3.98%	4.31%	6.12%	11.90%	10.51%	14.39%
1995	5.37%	2.52%	3.48%	4.19%	4.39%	5.86%	11.89%	10.34%	14.44%
Number of Consumer Units (000s):									
1990	96968	7581	21287	21003	14855	12162	20079	11318	8761
1995	103024	7067	19500	23441	18633	12626	21759	11924	9855
Share of Consumer Units by Age of Reference Person:									
1990	100.00%	7.81%	21.95%	21.66%	15.32%	12.54%	20.71%	11.67%	9.03%
1995	100.00%	6.86%	18.93%	22.75%	18.09%	12.26%	21.12%	11.57%	9.57%
Share of National Health OOPs Expenditures by Age of Reference Person:									
1990	100.00%	2.13%	14.55%	20.71%	16.53%	15.18%	30.87%	17.33%	13.57%
1995	100.00%	1.84%	11.98%	21.14%	19.32%	13.51%	32.28%	17.49%	14.82%

Source: United States Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, 1990-91, Table 12 and Consumer Expenditure Survey, 1995, Table 1300.

First, as one would expect, older Americans tend to have larger OOPs on medical care items and services than do the younger. The OOPs per CU health expenditure share generally grows with age, but it increases particularly sharply after age 65. This is seen in the top three panels of Table 2. In 1995, for example, total OOPs health-related expenditures for those under age 25 averaged $465, for those age 55-64 it is $1,909, and for those 75 and over the average is $2,683. While the average health care expenditure share over all consumer units in 1995 is 5.4%, for those under age 25 it is 2.5%, between ages 55-64 it is 5.9%, for those 65 and over it doubles to 11.9%, and for those 75 and over it increases further to 14.4%. Moreover, the data in Table 2 reveal that this age-related total health care expenditure share pattern has been quite stable over the 1990-95 time period.[7]

Second, as the elderly comprise a greater proportion of the population, they account for an increasingly large and disproportionate percentage of the nation's total OOPs health expenditures. As shown in the bottom three panels of Table 2, while those with reference person over age 65 accounted for 20.7% of all consumer units in 1990, their larger per capita OOPs health expenditures implied that the over age 65 CUs constituted 30.9% of OOPs health expenditures over all age groups; by 1995, these numbers increased slightly to 21.1% and 32.3%, respectively.[8] Interestingly, while the proportion of consumer units age 65-74 decreased very slightly between 1990 and 1995 from 11.7% to 11.6%, the percentage of age 75 and over consumer units increased more sharply from 9.0% to 9.6%, resulting in an increase in their OOPs health expenditures share over all age groups from 13.5% to 14.8%.

Third, although total OOPs health care expenditure patterns may be stable, since 1990 people of all ages (and especially the elderly) appear to have significantly substituted payments to health insurance for direct

Table 3

COMPONENTS OF OUT-OF-POCKET HEALTH CARE EXPENDITURES, BY AGE GROUP
UNITED STATES, 1990 AND 1995

Category	All Consumers	Under 25	25-34	35-44	45-54	55-64	65 and Over	65-74	75 and Over
Total Health Care Expenditures Per Consumer Unit:									
1990 $	1480	403	981	1415	1597	1791	2208	2197	2223
1995 $	1732	465	1096	1609	1850	1909	2647	2617	2683
Health Insurance:									
1990 $	581	106	391	485	583	700	990	1014	960
1995 $	860	209	517	726	817	896	1541	1528	1557
1990 %	39.3	26.3	39.9	34.3	36.5	39.1	44.8	46.2	43.2
1995 %	49.6	44.9	47.2	45.1	44.2	46.9	58.2	58.4	58.0
Medical Services:									
1990 $	562	190	391	646	664	654	664	656	674
1995 $	511	157	380	596	664	587	479	471	487
1990 %	37.8	47.2	39.9	45.7	41.6	36.5	30.1	29.9	30.3
1995 %	29.5	33.8	34.7	37.0	35.9	30.8	18.1	18.0	18.2
Drugs (prescription and non-prescription):									
1990 $	252	65	135	183	236	340	475	455	501
1995 $	280	65	139	205	254	344	544	536	555
1990 %	17.0	16.1	13.8	12.9	14.8	19.0	21.5	20.7	22.5
1995 %	16.2	14.0	12.7	12.7	13.7	18.0	20.6	20.5	20.7
Medical Supplies:									
1990 $	85	41	64	100	113	96	80	73	88
1995 $	80	34	60	81	115	83	83	82	84
1990 %	5.7	10.2	6.5	7.1	7.1	5.4	3.6	3.3	4.0
1995 %	4.6	7.3	5.5	5.0	6.2	4.4	3.1	3.1	3.1

Source: See Table 2.

payments to professional medical services, drugs and medical supplies.[9] Note that in the CES, consumer OOPs 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. As is seen in the second panel of Table 3, for all consumers the health insurance share has increased from 39%

to 50% between 1990 and 1995. For those under age 65, the 1995 health insurance share is about 45%, up from slightly under 40% in 1990; for the elderly, however, the increase is even greater, from 45% in 1990 to 58% in 1995. Thus by 1995 more than half of the elderly's OOPs health care budget was devoted to health insurance.

Fourth, a related phenomenon is that the professional medical services component of OOPs expenditures has fallen sharply since 1990, which now is presumably increasingly borne indirectly by insurers. In 1990, for example, the average expenditure on medical services by those age 65 and over was $664, but by 1995 this had fallen 28% to $479. For all consumers, the medical service expenditure share fell from 38% to 30%, but for those 65 and over the drop was even larger, from 30% in 1990 to 18% in 1995.

Fifth, for drugs (the CES data include both prescription and over-the-counter non-prescription drug expenditures), in both 1990 and 1995 expenditures increased with age, and were about twice as large for the elderly relative to all consumers. The level of OOPs expenditures increased about 11% for all consumers from 1990 to 1995 ($252 to $280), but for the elderly the OOPs increase was larger, about 14-15% ($475 to $544). In terms of expenditure shares, the drug component has fallen slightly, from 17% to 16% for all consumers, presumably reflecting a shift to payments by health insurers. For those 75 and over, the drop in the OOPS drug component is slightly larger, from 22.5% in 1990 to 20.7% in 1995.

In summary, the CES data indicate that the composition of OOPs has changed considerably since 1990, and in different ways for the elderly vs. the nonelderly. A dominant trend, however, is away from OOPs direct payments to medical services, drugs and medical supplies, and instead 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 any resulting lower provider-supplier prices are passed on to consumers in the form of lower health insurance premia, this shift could result in benefits to consumers, particularly the elderly.

B. MEDICAL PRICES: ENTIRE US POPULATION

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.[10] 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 all payments by governments and third party insurers.[11]

Recent MCPI data show that prices paid by consumers for medical care have been increasing more rapidly than for other items. Indexed to 100 in 1990, the 1996 MCPI was 140.2, for prescription drugs it was 133.7, for non-prescription drugs and medical supplies 118.7, for physicians' services 134.6, and that for hospital and related services was 151.4, while the CPI for all items was only 120.0.[12] Thus, except for non-prescription drugs, prices of health-related items and services generally appear to have risen more rapidly than the overall CPI. Moreover, as is shown in Table 4, this more rapid increase of the MCPI relative to the CPI is not a recent phenemonon. Since 1927, the first year for which MCPI data are available, medical inflation has has generally been greater than that over all goods and services.[13] Over the entire 1927-96 time period, the MCPI has risen at an AAGR of 4.59%, almost half again as large as the 3.24% for the overall CPI.

In its recent report to the US Senate Finance Committee [1996], however, the CPI Commission concluded that the MCPI was substantially upward biased, stating that "...healthcare inflation is seriously overstated because of the

Table 4

PRICE INFLATION IN THE OVERALL CPI AND IN THE MEDICAL CPI, 1927-96

AVERAGE ANNUAL GROWTH RATES

TIME PERIOD	CPI-URBAN	MEDICAL CPI	RATIO MCPI/CPI
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

Sources: US Department of Labor, Bureau of Labor Statistics. For the MCPI prior to 1935, Elizabeth Langford [1957], Table 1, p. 1055.

substantial uncounted quality change",[14] such as improvements in outcomes.[15] Specifically, the Commission estimated that the upward bias of the MCPI is 3% per year for prescription drugs, for professional medical services, and for hospital and related services, and 1% for non-prescription drugs.[16] Moreover, the Commission recommended major changes in the BLS' treatment of health insurance expenditures.[17] Currently the BLS' procedures for the health insurance component do not take changing coverages into account, but instead simply multiply a medical care price index by an index of health insurance ex post retained earnings, i.e., the ratio of health insurance revenues minus health insurance payments, all divided by health insurance revenues.[18]

The BLS also publishes producer price indexes (PPIs) for various industries, focusing on the initial point in the distribution chain, where it "...measures average changes in selling prices received by domestic producers for their output".[19] Although the BLS has published PPIs for certain health-related industries such as prescription pharmaceuticals for many years,

currently there is no overall medical care PPI. Recently, however, the BLS introduced separate PPIs for offices and clinics of doctors of medicine (12/93), skilled and intermediate care facilities (12/94), general medical and surgical hospitals (12/92), psychiatric hospitals (12/92), and medical laboratories (6/94). A number of recent research studies report that for pharmaceuticals, the PPI overstates price inflation by a considerable amount.[20] Studies by Cutler et al. [1996] on the treatment of heart attacks and by Shapiro and Wilcox [1996] on cataract surgery also suggest substantial upward bias in medical-related PPIs. Cutler et al. point out that apparent price inflation actually involves frequent substitution of more expensive but also more effective inputs.

C. MEDICAL PRICES: FOCUS ON THE ELDERLY

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 relatively large price increases involving health care items and services in the last decade have adversely affected the elderly in particular. Indeed, such considerations played a prominent role in the recent debate concerning a possible downward adjustment of the CPI to index Social Security benefits for the elderly.[21] As noted earlier, however, the greater growth of the MCPI than for the CPI goes 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 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, along with the understanding that growth in the MCPI may be overstated due to overlooked quality improvements, we now briefly summarize the existing literature on separate price indexes for the elderly.[22]

Anticipating that the introduction of Medicare in July 1966 might have an impact on medical care prices, in summer 1965 the Social Security Administration arranged with the 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). In a report to the President, summarized by Rice and Horowitz [1967], it was concluded 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."[23]

More recently, in response to a mandate from 1987 amendments to the Older Americans Act of 1965, the BLS has created an experimental price index for elderly consumers (CPI-E). The CPI-E employs differential expenditure weights for the elderly (defined as age 62 and over) and nonelderly, based on CES data, but assumes that within each category weight, the distribution of prices, the outlets in which consumers buy, the use of coupons and availability of discounts, as well as the quality of the items purchased, are the same for the elderly and the nonelderly.[24] From 1982 through 1996, the CPI-E for the elderly grew 67.9%, while the CPI rose 62.5%, implying that over the entire 14-year time span, the CPI had an AAGR of 3.53%, while the CPI-E for the elderly grew at a slightly larger 3.77% per year.[25] The larger health care expenditure weights for the elderly, along with greater measured medical price inflation, account almost entirely for the difference in AAGRs. As noted by the CPI Commission, however, medical care prices are likely to have

overstated inflation by not fully accounting for improvements in quality. If this is correct, then as is noted by Moulton-Stewart, "A reduced rate of inflation for medical care would mitigate and perhaps eliminate any difference between the CPI-E and the official CPIs."[26]

A related recent study is that by Garner, Johnson and Kokoski [1996], who focus on experimental price indexes for the poor, based on several alternative definitions of "poor". Using CES data for weights, along with CPI prices from 1984 to 1994, they conclude:

> "...we find there to be very little difference between the experimental consumer price indexes produced for the poor and the corresponding CPI for the whole sample."[27]

Similarly, in a study examining real income growth and expenditures on necessities for a variety of demographic groups from 1980 to 1990, Rubin and Koelin [1996] conclude that:

> "...for the population in general, well-being increased over the 1980s, as measured by both real income and discretionary spending. The well-being of elderly households increased relatively more than that of nonelderly households, and the well-being of recipients of cash assistance increased relatively less than that of those who did not receive assistance."[28]

In summarizing their findings concerning differential rates of price growth experienced by diverse groups in the population, the CPI Commission stated:

> "Some have suggested that different groups in the population are likely to have faster or slower growth in their cost of living than recorded by changes in the CPI. We find no compelling evidence of this to date...Further work on this subject remains to be done. In particular, the prices actually paid, not just expenditure shares, may differ."[29]

With this information and brief overview of related literature as background, we now turn to a discussion of our own new research. In Section III we focus on drug prices at the first point in the distribution chain, from producers to wholesalers, hospitals and retailers.[30] In Section IV we examine an intermediate point, namely, the acquisition prices paid by retail

pharmacies to wholesalers and manufacturers. Then in Section V we assess prices at final points in the distribution chain, from retail pharmacies to patients/payors. Because of data limitations, we do not examine prices received by mail order pharmacies, which account for roughly 9% of total Rx dollar sales.

III. PRODUCERS' PRICES FOR DRUGS DESTINED FOR USE BY OLD VS. YOUNG

In reporting on prices at the first point in the distribution chain from manufacturers to wholesalers and retailers, the BLS publishes monthly PPIs for almost fifty therapeutic classes of prescription pharmaceuticals, such as analgesics, broad and medium spectrum antibiotics, cancer therapy products, cardiovascular therapy, antidepressants and vitamins. Prices in these various therapeutic classes have increased at different rates. Since 1981, PPIs for anticoagulants, antiarthritics and systemic anti-infectives, for example, have increased at much lower rates than have those for sedatives, CNS stimulants/ antiobesity preparations and psychotherapeutics.[31] Since the elderly are likely to have conditions, diseases and illnesses that differ from 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 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, information is gathered on, among other matters, the patient's age, physician specialty, physician age, diagnosis code, drug therapy prescribed, concomitant diagnoses, and desired actions; this sample NDTI data is then projected by IMS to national totals.[32]

Table 5

1996 TWENTY LEADING SELLING MARKET CLASSES OF RX DRUGS, BY AGE GROUP

UNDER AGE 65 (81.3% of all mentions)

USC CODE	CLASS NAME	MENTIONS (000s)	PERCENT
15100	Broad & Medium Spectrum Antibiotics	116623	15.79%
02200	Narcotic Analgesics	40955	5.55%
64300	Antidepressants	34623	4.69%
09100	Systemic Antiarthritics	32446	4.39%
52200	Plain Corticoids	28348	3.84%
27100	Biological Vaccines	26593	3.60%
28100	General Bronchodilators	24519	3.32%
52100	Sex Hormones	18831	2.55%
31400	Adrenergic Blockers	16753	2.27%
64600	Antianxiety Agents	16611	2.25%
31100	Antihypertensives	16184	2.19%
02100	Non-narcotic Analgesics	16057	2.17%
34300	Cough/Cold Preparation Prescriptions	16000	2.17%
28400	Respiratory Steroid Inhalants	15000	2.03%
23400	Other Antispasmodics	14925	2.02%
31700	Calcium Channel Blockers	14876	2.01%
37400	Fungicides Alone/Combination	11993	1.62%
34100	Oral Cold Preparation Prescriptions	11432	1.55%
15500	Trimethoprim	11374	1.54%
33200	Oral Contraceptives	11203	1.52%
Sum for Twenty Leading Market Classes, Under Age 65		495346	67.07%

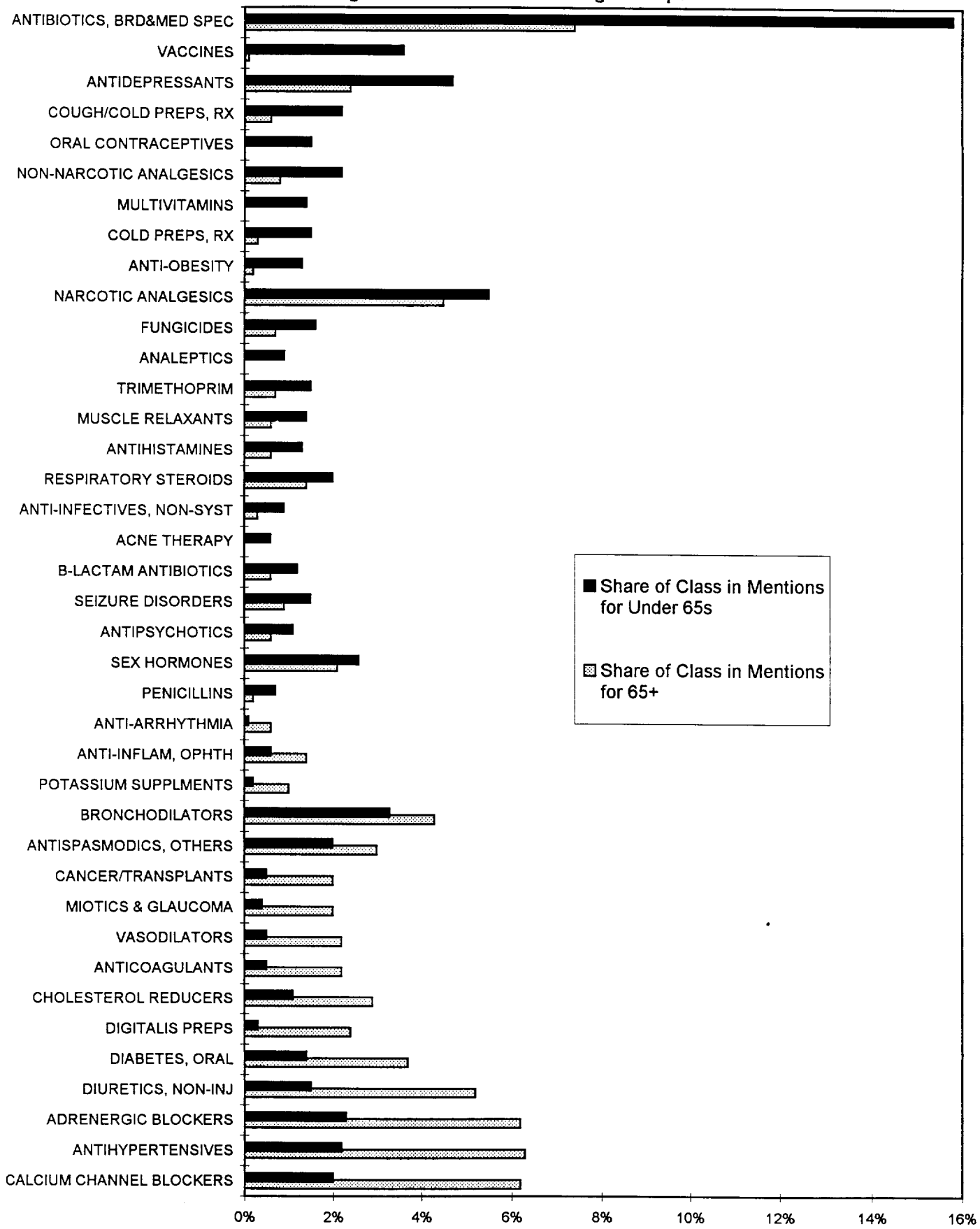
65 OR OVER (18.7% of all mentions)

15100	Broad & Medium Spectrum Antibiotics	12616	7.44%
31100	Antihypertensives	10718	6.32%
31400	Adrenergic Blockers	10565	6.23%
31700	Calcium Channel Blockers	10479	6.18%
41200	Non-injectable Diuretics	8736	5.15%
02200	Narcotic Analgesics	7710	4.55%
28100	General Bronchodilators	7268	4.29%
09100	Systemic Antiarthritics	6874	4.05%
52200	Plain Corticoids	6424	3.79%
39200	Oral Diabetes Therapy	6337	3.74%
23400	Other Antispasmodics	5035	2.97%
32100	Cholesterol Reducers	4918	2.90%
31500	Digitalis Preparations	4037	2.38%
64300	Antidepressants	3987	2.35%
31200	Vasodilators	3694	2.18%
61600	Miotics plus Glaucoma	3433	2.02%
30200	Other Cancer/Transplant Cytotoxics	3381	1.99%
64600	Antianxiety Agents	2969	1.75%
72100	Thyroid Hormones	2430	1.43%
61400	Opthalmic Corticoids	2362	1.39%
Sum for Twenty Leading Market Classes, Over Age 65		123973	73.10%

NDTI data therefore 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 vs. generics. Based on annual NDTI data for 1996, in the top panel of Table 5 we list the twenty leading selling therapeutic classes of drugs for the elderly, while in the bottom panel we list the corresponding leading classes for the nonelderly.[33] Prescriptions written for the elderly constitute 18.7% of all new prescriptions, while the nonelderly account for the remaining and much larger 81.3%. For both the young and old, the leading therapeutic class is broad and medium spectrum antibiotics; drugs in this class comprise almost 15.8% of new prescriptions written for seniors, but only 7.4% for the nonelderly. The most frequent new prescriptions for the young include antidepressants, sex hormones, cough/cold preparations and oral contraceptives, while those for the elderly include various cardiovasculars (antihypertensives, adrenergic blockers, calcium channel blockers, diuretics), as well as glaucoma and cancer therapies. Differences between young and old in the relative utilization of drugs by therapeutic class are considerable; the most substantial of these differences are highlighted in Figure 1. As is shown there, 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 up the various therapeutic class-specific price indexes into an overall prescription pharmaceutical PPI. These quantity weights from the BLS' 1993 Cycle C sample are listed in the third column of Table 6 below, while in the next column we list the percent of all new prescriptions written in that therapeutic class that are written for the

Figure 1
1996 NDTI Drug Mentions By Age Group and Therapeutic Class
Largest Differences Between Age Groups



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elderly. In the final five columns of Table 6 we list the BLS' PPI by therapeutic class, annually from 1991 to 1996, normalized to 100.0 in 1990.

Table 6

BLS WEIGHTS, ELDERLY USAGE OF PRESCRIPTION DRUGS, AND PRODUCER PRICE INDEX BY THERAPEUTIC CLASS, 1990-1996

SIC CODE 2834-	THERAPEUTIC CLASS	PPI WEIGHT	PERCENT ELDERLY	BLS PRODUCER PRICE INDEX (1990=100) 1991	1992	1993	1994	1995	1996
102	Analgesics	11339	14	106.3	115.7	122.5	128.7	132.1	135.6
105	Antiarthritics	8049	17	108.6	116.7	123.2	113.1	114.5	121.8
107	Anticonvulsants	2100	51	112.7	125.9	132.7	136.8	142.1	148.3
109	Systemic antihistamines	9336	13	111.7	121.3	126.5	131.4	135.7	145.4
111	Systemic antiinfectives	44412	10	105.9	111.2	115.9	119.9	123.9	125.8
118	Bronchial therapy	11956	19	111.2	122.5	129.0	139.6	145.8	154.2
119	Cancer therapies	10079	39	106.0	116.6	120.8	123.4	127.7	132.7
121	Cardiovasculars	35709	42	108.9	116.2	119.5	123.5	127.2	132.9
125	Cough and cold preparations	2501	7	111.3	120.8	128.2	135.6	146.9	157.0
126	Dermatological preparations	5237	7	104.8	111.8	118.8	124.2	133.5	140.5
127	Diabetes therapy	1479	38	107.8	114.7	120.5	124.6	131.0	134.0
128	Diuretics	2512	45	107.3	115.1	122.2	130.6	126.3	136.9
135	Hormones	13047	17	108.7	116.3	122.9	133.5	137.8	137.3
139	Muscle relaxants	2391	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	Opthalmic and otic preparations	5437	31	101.1	106.7	107.4	112.6	119.4	119.2
144	Psychotherapeutics	15873	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	1000	3	111.2	115.5	108.9	110.6	114.7	122.7
198	Miscellaneous Rx pharmaceuticals	21511	19	108.0	115.6	123.0	119.3	119.0	120.9

Notes: Percent elderly is drug mentions for elderly as fraction of elderly plus non-elderly mentions. Drug mentions for age bracket not recorded in the NDTI are ignored. BLS PPIs for SIC 2834-116 (antispasmodic/antisecretory) and SIC 2834-147 (tuberculosis therapy) were not published from 1987 through 1993, and thus are ignored here; their elderly weights were 23 and 16, while their 1993 PPI weights were 11956 and 1607, respectively.

As seen in Table 6, therapeutic classes in which the elderly are particularly important consumers are anticonvulsants (51%), cancer therapy

products (39%), cardiovascular therapy products (42%), diabetes therapy (38%), diuretics (45%), and nutrients and supplements (53%), 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 antiinfectives (10%), cough and cold preparations (7%), dermatological preparations (7%), muscle relaxants (8%) and vitamins (3%). Therapeutic classes with the largest price increases since 1990 include cough and cold prepartions (57%), bronchial therapy (54%), anticonvulsants (48%), systemic antihistamines (45%) and psychotherapeutics (45%), 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%), opthalmic and otic preparations (19%), miscellaneous prescription pharmaceuticals (21%), antiarthritics (22%) and vitamins (23%); here the pattern of relative usage by old and young is more mixed.

To aggregate up these various therapeutic class PPIs into 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 Section IV), we multiply these BLS therapeutic class quantity weights by the relative old vs. young proportions of 1996 new prescriptions based on NDTI data. We then multiply these therapeutic class-specific elderly and nonelderly quantity weights times the BLS published PPI for that class, normalized to unity in 1990.[34] Finally, we aggregate up over the various therapeutic classes and thereby obtain separate prescription pharmaceutical PPIs for drugs destined for use by the elderly and the nonelderly. Results from this calculation over the 1990-96 time period are summarized in Table 7 below.

Table 7

PRODUCER PRICE INDEXES FOR ALL PHARMACEUTICALS, THOSE DESTINED FOR USE BY THE ELDERLY, AND THOSE DESTINED FOR USE BY THE NONELDERLY

YEAR	OVERALL PRICE INDEX	ELDERLY PRICE INDEX	NONELDERLY PRICE INDEX
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.

The very striking conclusion that emerges from inspection of Table 7 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, while 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, in the aggregate at the initial point in the distribution chain from drug manufacturers, there appears to be no price inflation differential by age group, at least according to the official BLS price statistics.

IV. RETAIL SELL-IN PRICES: ELDERLY VS. NONELDERLY

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 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 leading form/strength/pack of each product. In addition, IMS collects separate retail prices for the leading presentation of each product by method of payment -- cash, Medicaid and private third party. These data are reported by IMS in its products called Retail Perspective and Retail Methods of Payment.[35]

Within each of these three therapeutic classes, data are therefore available on what drugs were prescribed, whether brand or generic, the leading form/strength/pack of each product, whether destined for use by the elderly or the nonelderly, selling-in price to pharmacy, and sell-out prices to consumers/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 Section V we focus on retail pharmacy sell-out prices to various consumers/payors. We now concentrate on three leading therapeutic classes; these classes are broad and medium spectrum antibiotics (ABs), calcium channel blockers (CCBs), and antidepressants (ADs).

A priori, two possible hypotheses come to mind concerning differential elderly-nonelderly drug usage within these therapeutic classes. The first concerns medications used to treat acute conditions. It is plausible to assume that the health of seniors is more fragile than that of the nonelderly, and that as a result, prudent medical practice would advise prescribing for the elderly those products that, given similar efficacy, had the fewest adverse interactions with other drugs, and the least amount of side effects.[36] Among recent new drug introductions, it is not uncommon that efficacy is similar to that of older products, but that the adverse interaction and side effect profiles of the newer products are superior. More convenient dosing of

newer products, such as once-a-day "sustained release" versions, also facilitate patient compliance, particularly for the elderly who are more likely to have memory lapses. These newer products typically command a price premium, and experience price inflation that is greater than that for older off-patent generic drugs.[37] To the extent 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 those for the young.[38]

A second hypothesis concerns medications used to treat chronic conditions. Here the same basic factors are at work as noted above for acute conditions. In addition, however, for chronic conditions, the old might be expected to have selectively used older drug products, for physicians are hesitant to change medications when a particular existing drug regimen is working well.[39] With stickier consumption patterns and by surviving to old age, the elderly would therefore disproportionally use older drugs which are more often available as generics. If this hypothesis were true, drug prices within certain chronic areas might be likely to grow *less* rapidly for the elderly vs. the nonelderly, since generic prices are known to be falling in the last decade while prices of brands typically increased.[40]

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.[41] 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 and without patent protection. Since 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 be in between the antibiotics and the cardiovasculars, since 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 (AB) class of drugs. As seen in the top panel of Table 8, retail acquisitions of ABs have almost doubled from 1990 to 1996, growing from $2.1 to $3.8 billion. Roughly 90% of the retail pharmacy acquisition costs are for ABs destined for use by the young. The overall brand/generic shares for ABs are somewhat volatile, ranging from 81%/19% in 1990 to 90%/10% in 1993. Over the entire time period, for the elderly brand share has grown from 82% to 91% (generic share has fallen from 18% to 9%), while for the young the brand share has increased only from 81% to 87%. The AB brand share hit its peak in 1992-94 at about 89-90% (for all), and then fell to about 88% (all), 87% (young) and 91% (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 branded antibiotics for use by the

Table 8

RETAIL PHARMACY ACQUISITION (SELL-IN) COSTS AND PRICE INDEXES BY THERAPEUTIC CLASS, 1990-1996

CLASS/CATEGORY	1990	1991	1992	1993	1994	1995	1996
ANTIBIOTICS - BROAD AND MEDIUM SPECTRUM							
Total Drug Costs	2094060	2527380	2839640	3274900	3422040	3791320	3767950
Share Young	.891	.890	.888	.889	.885	.881	.875
Share Elderly	.109	.110	.112	.111	.115	.119	.125
Share Brand - All	.814	.846	.892	.897	.894	.833	.879
Share Generic - All	.186	.154	.108	.103	.106	.167	.121
For Young	.187	.156	.110	.105	.109	.173	.126
For Elderly	.175	.141	.094	.088	.088	.120	.088
Laspeyres Index All	1.000	1.055	1.087	1.125	1.132	1.096	1.167
Laspeyres Young	1.000	1.055	1.096	1.135	1.141	1.103	1.173
Laspeyres Elderly	1.000	1.056	1.009	1.040	1.060	1.043	1.121
Divisia Index All	1.000	1.055	1.073	1.101	1.112	1.117	1.106
Divisia Young	1.000	1.055	1.083	1.112	1.121	1.125	1.109
Divisia Elderly	1.000	1.055	0.995	1.020	1.038	1.056	1.072
ANTIDEPRESSANTS							
Total Drug Costs	940460	1047720	1402000	1715030	2396310	3064150	3730927
Share Young	.899	.899	.901	.904	.909	.910	.911
Share Elderly	.101	.101	.099	.096	.091	.090	.089
Share Brand - All	.882	.899	.905	.893	.935	.956	.970
Share Generic - All	.118	.101	.095	.107	.065	.044	.029
For Young	.115	.098	.090	.100	.061	.041	.028
For Elderly	.149	.126	.138	.176	.110	.073	.048
Laspeyres Index All	1.000	1.077	1.176	1.208	1.228	1.267	1.320
Laspeyres Young	1.000	1.077	1.176	1.209	1.230	1.269	1.321
Laspeyres Elderly	1.000	1.074	1.168	1.200	1.209	1.247	1.304
Divisia Index All	1.000	1.077	1.168	1.187	1.190	1.217	1.272
Divisia Young	1.000	1.077	1.169	1.189	1.195	1.224	1.279
Divisia Elderly	1.000	1.076	1.161	1.172	1.145	1.158	1.201
CALCIUM CHANNEL BLOCKERS							
Total Drug Costs	1697136	2068896	2597408	2821445	3061874	3146177	3179213
Share Young	.546	.560	.566	.575	.577	.580	.585
Share Elderly	.454	.440	.434	.425	.423	.420	.415
Share Brand - All	.985	.973	.973	.928	.921	.936	.955
Share Generic - All	.015	.027	.027	.072	.079	.064	.045
For Young	.015	.034	.032	.072	.077	.062	.046
For Elderly	.014	.018	.021	.072	.082	.068	.045
Laspeyres Index All	1.000	1.072	1.135	1.178	1.197	1.234	1.267
Laspeyres Young	1.000	1.072	1.134	1.175	1.192	1.229	1.261
Laspeyres Elderly	1.000	1.072	1.136	1.181	1.203	1.242	1.273
Divisia Index All	1.000	1.061	1.105	1.132	1.087	1.098	1.105
Divisia Young	1.000	1.061	1.103	1.130	1.082	1.093	1.100
Divisia Elderly	1.000	1.061	1.108	1.135	1.094	1.105	1.111

Notes: Drug costs are in thousands of current dollars. Laspeyres index employs fixed 1990 weights. Sources: see text discussion.

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.[42]

We now turn to price indexes, which can be constructed in a number of ways. The BLS employs a fixed weight procedure known as the Laspeyres price index that keeps weights of the various items in the index fixed over time. The CPI Commission has criticized this fixed weight procedure, and has recommended that a chain-weighted index be used instead, with changing weights that reflect evolving market shares of items over time.[43] The most common version of such a chained index is the (Tornqvist discrete approximation to the) Divisia index.[44] We therefore construct price indexes mimicking the BLS fixed weight procedure, using 1990 fixed quantity weights, but also report price indexes with the more preferred Divisia index calculation that allows for changing market shares.[45]

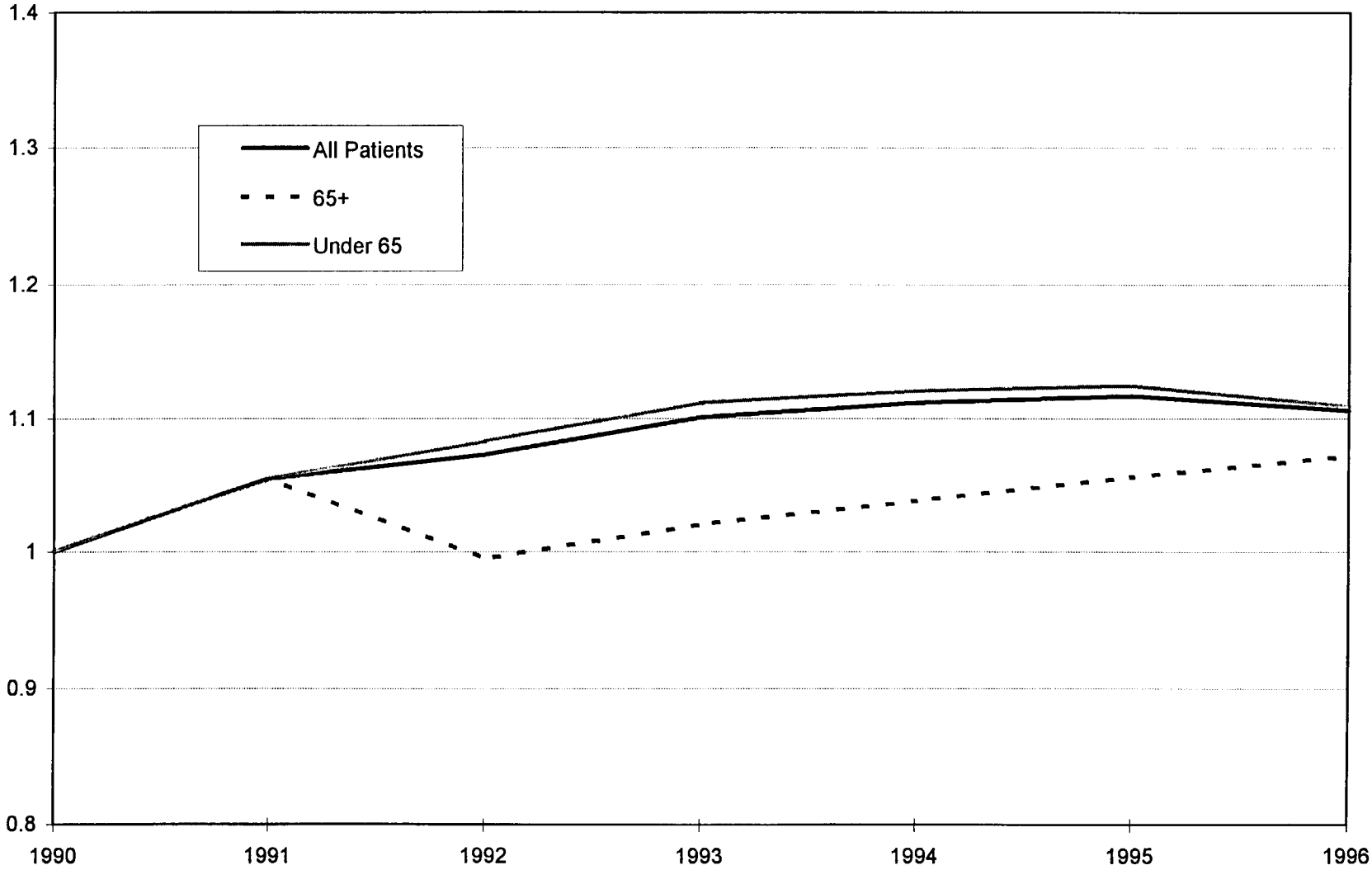
In rows labeled "Laspeyres" in the top panel of Table 8, we present 1990-96 retail acquisition price indexes for antibiotics (ABs) over all consumers (Laspeyres Index All), for ABs destined for use by the young (Laspeyres Young) and for ABs destined for use by the old (Laspeyres Elderly).[46] The first somewhat surprising result we obtain is that with the Laspeyres index over the entire 1990-96 time period, ABs used by the elderly increase in price about 12%, whereas for the nonelderly the price increase is somewhat larger at 17%. However, if one looks only from 1992 onwards, the reverse occurs -- the elderly AB price index increases 11% from 1.009 to 1.121, while that for the nonelderly increases 7% from 1.096 to 1.173.

These AB findings are essentially unaffected when one employs changing share weights and the preferable Divisia index.[47] As seen in the bottom three

rows of the top panel of Table 8, and graphically in Figure 2, with the Divisia by 1996 the price index for ABs destined for use by the elderly is 1.07, slightly smaller than the 1.11 for the young. Since 1992, however, the AB price index has increased only very slightly for the young (2% from 1.08 in 1992 to 1.11 in 1996), while for the elderly it has increased considerably more (7%, 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. To see this in greater detail, in Figure 3 we present 1996 elderly utilization for each AB molecule, and distinguish brands (light bars) from multi-source (dark bars) drugs. The dotted vertical line in Figure 3 represents the elderly average percent over all ABs (9.8%). The differential use of brands and generics by the elderly can be seen by noting that for the vast majority of drugs involving relatively intense use by the elderly, the molecule in question is a branded, single source (light bar) drug.

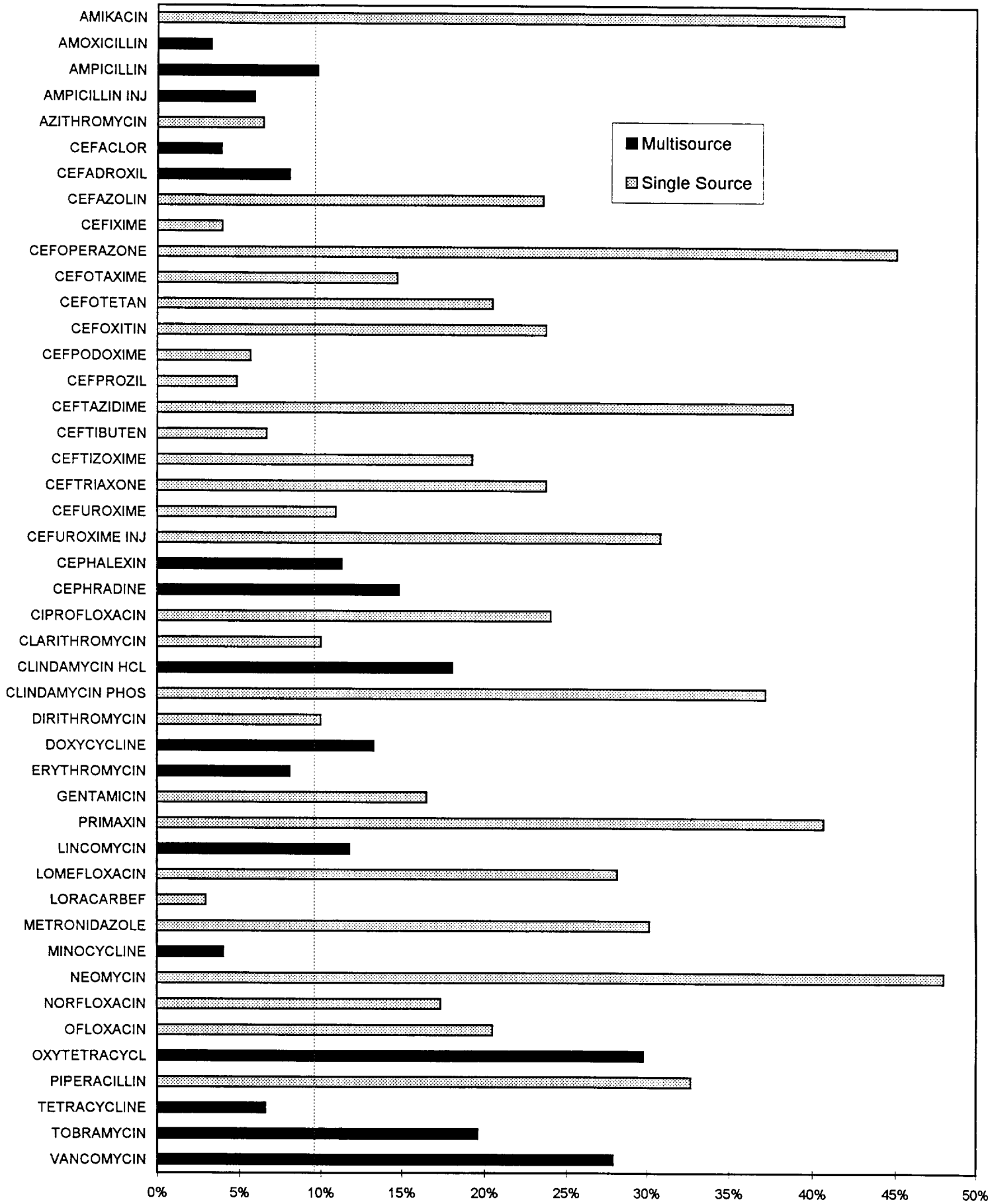
We now turn to retail sell-in prices for antidepressants (ADs). As seen in the top row of the middle panel of Table 8, retail sector purchases of ADs have surged by a factor of about four between 1990 and 1996, thereby growing considerably more rapidly than the ABs, although by 1996 total retail acquisition expenditures for the two are about equal at $3.73 billion for ADs vs. $3.77 for ABs. ADs are also similar to ABs in that the retail acquisition dollar share for products destined for use by the young for both classes is about 90%, with a very slight upward trend. A distinctive feature of the AD market involves the tremendous growth in sales of the newest generation of ADs, the selective serotonin reuptake inhibitors (SSRIs) such as Prozac, Zoloft, Paxil, Luvox and Serzone. This high growth of new branded products has resulted in a sharply declining generic dollar share of retail sector purchases (from 12% in 1990 to 3% in 1996), and a corresponding increase in

Figure 2
Divisia Price Indexes for Antibiotics
"Sell In" Prices to Retail Pharmacies



Source: IMS *Retail Audit*, IMS *NDTI*, authors' calculations

Figure 3
Share of 1996 NDTI Mentions for Age 65+ Patients: Antibiotics



Source: IMS *NDTI* and authors' calculations

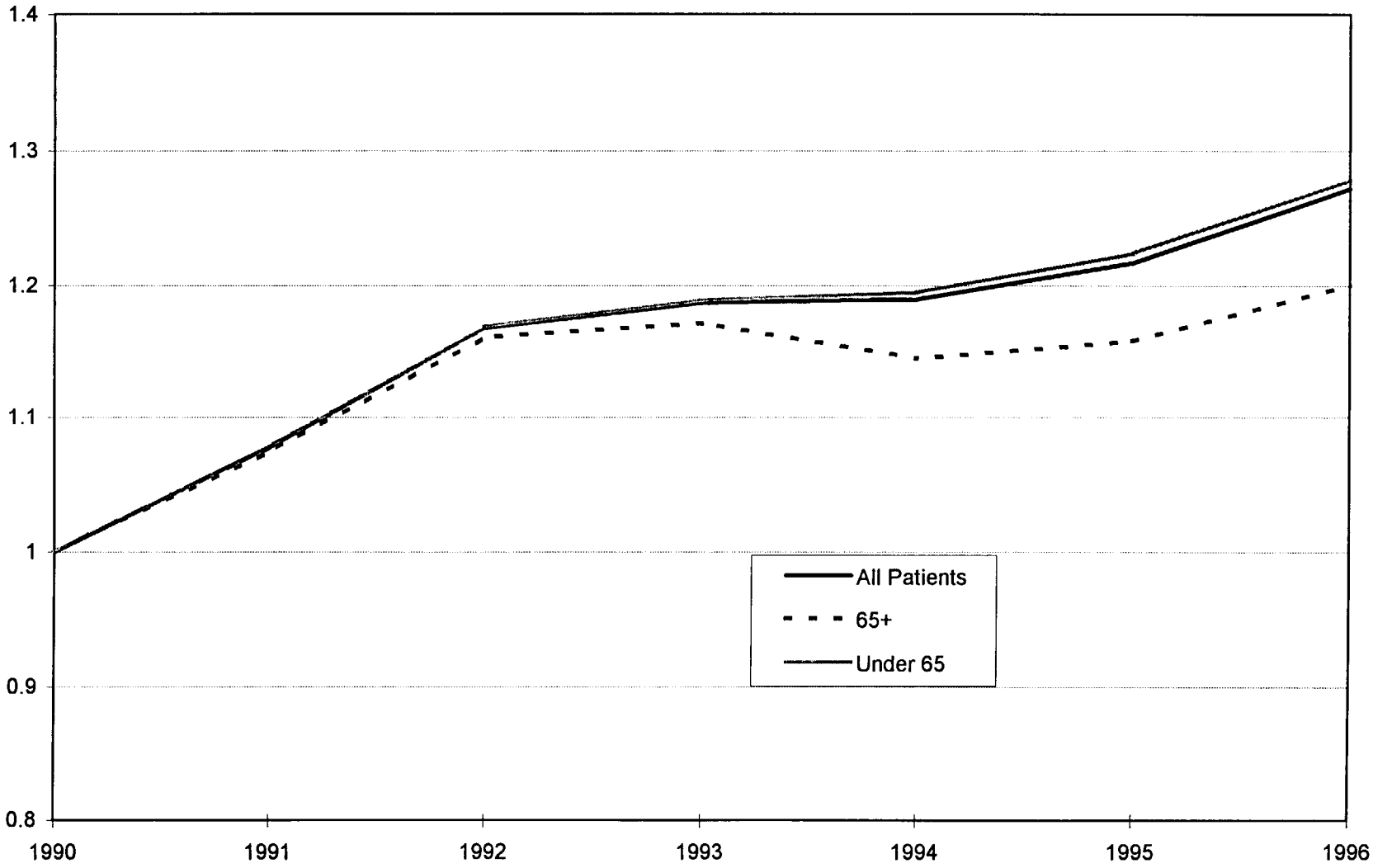
the brand dollar share (88% to 97%). In each year between 1990 and 1996, the share of retail drug store purchases of generic ADs for use by the elderly was larger than that for the young; the 1990 generic shares for old and young were 15% and 12%, and by 1996 they had fallen to 5% and 3%. This differential 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. As seen in the middle panel of Table 8, the AD price inflation differential between old and young appears to be negligible -- by 1996 the elderly Laspeyres index is 1.30, very slightly less than that for the young at 1.32.

For the more appropriate Divisia index that takes changing shares into account, however, the inflation differential is considerably larger, with the 1996 index being 1.20 for the elderly but 1.28 for the young.[48] In Figure 4 below we plot these Divisia AD price indexes for the entire population, for the elderly and for the young. As is seen there, for ADs there is an appreciable difference in retail acquisition price inflation for products destined for use by old vs. those for use by the young. Price inflation for retail acquisitions of ADs destined for use by the elderly has been less than that for ADs destined for use by the young.

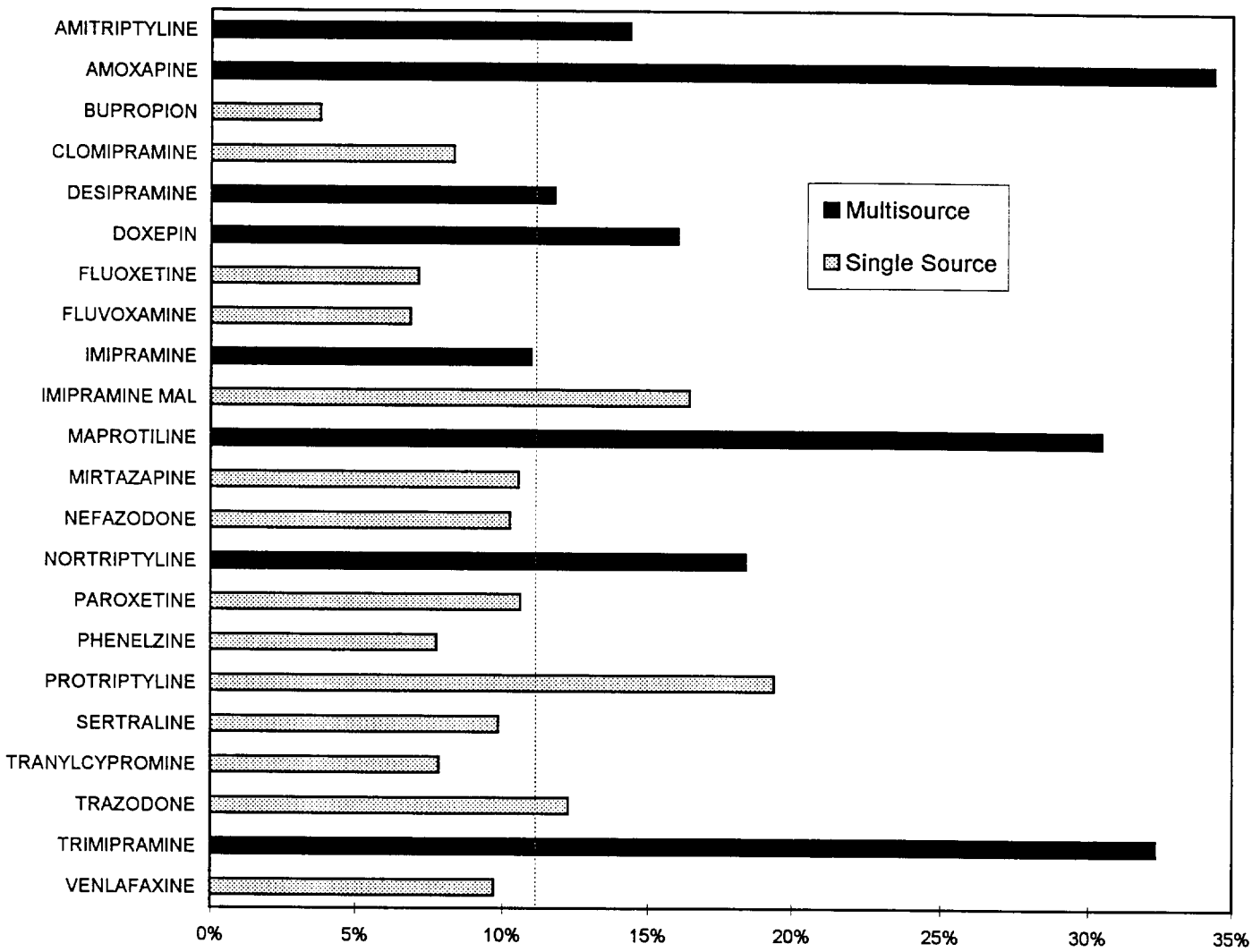
To understand the reason underlying this inflation differential, in Figure 5 we plot the elderly share for each AD chemical molecule, where again the patent-protected drugs are marked with light bars, and generic or multisource drugs are marked with dark bars; over all AD molecules, the elderly average share is 10.3%, represented by the dotted vertical line. As is seen in Figure 5, the elderly's use of off-patent and generic drugs such as trimipramine, protriptyline, nortriptyline, maprotiline, imipramine, doxepin,

Figure 4
Divisia Price Indexes for Antidepressants
"Sell In" Prices to Retail Pharmacies



Source: IMS *Retail Audit*, IMS *NDTI*, authors' calculations

Figure 5
Share of 1996 NDTI Mentions for Age 65+ Patients: Antidepressants

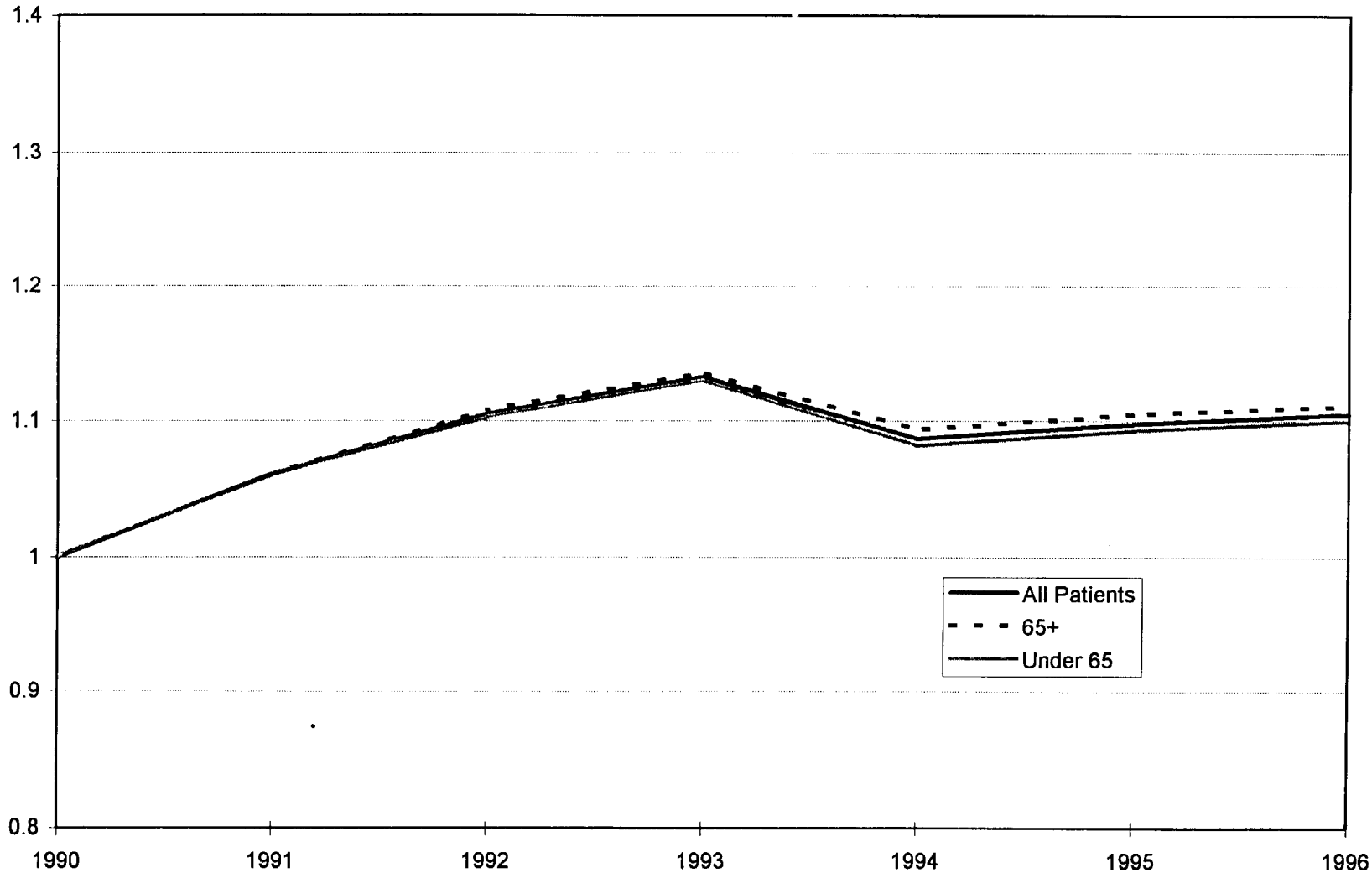


Source: IMS *NDTI* and authors' calculations

amoxapine and amitriptyline is above that of the general population. However, elderly use of some newer and still patent-protected branded drugs such as venlaxafine (brand name Effexor), sertraline (Zoloft), paroxetine (Paxil), and nefazodone (Serzone) is about the same as that of the general population, but elderly use of other patent-protected ADs such as fluvoxamine (Luvox), fluoxetine (Prozac) and buproprion (Wellbutrin) is less than that by the general population. Given these differential brand-generic uses by the elderly vs. the young, and with generic prices falling while brand prices are increasing, the basket of ADs destined for use by the elderly is growing less rapidly in price than the basket of ADs destined for use by the young. Because it employs changing share 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, but by 1996 these shares were 5% for the elderly and 3% for the young, down from 15% and 12% in 1990.

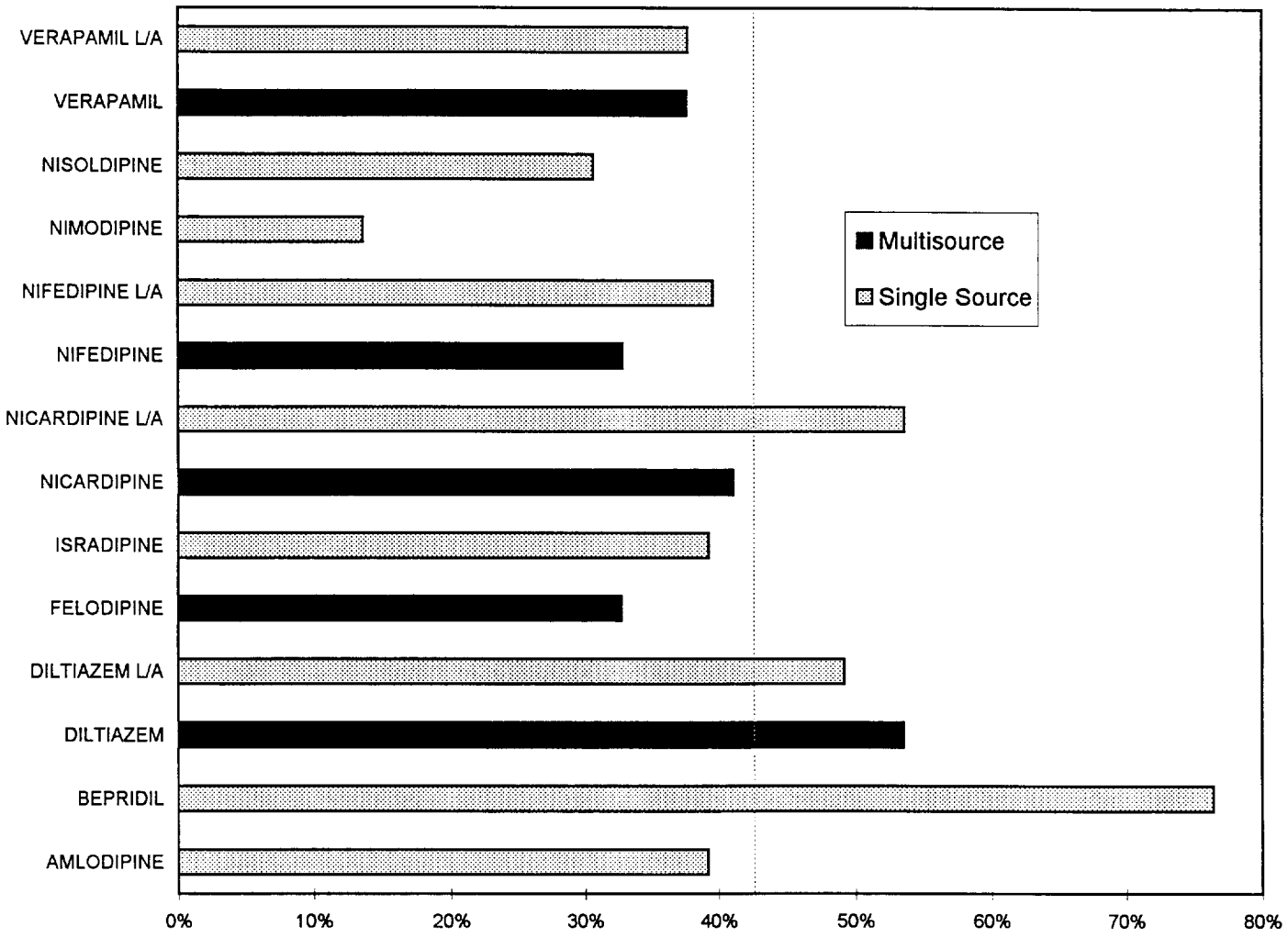
Next we turn to the calcium channel blockers (CCBs), drugs used to treat cardiovascular conditions, and having brand names such as Cardizem, Norvasc and Procardia XL. As with the ABs, retailers have approximately doubled their acquisition costs of CCBs from 1990 to 1996, with total acquisition costs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

Figure 6
Divisia Price Indexes for Calcium Channel Blockers
"Sell In" Prices to Retail Pharmacies



Source: IMS *Retail Audit*, IMS *NDTI*, authors' calculations

Figure 7
Share of 1996 NDTI Mentions for Age 65+ Patients: Calcium Channel Blockers



Source: IMS *NDTI* and authors' calculations

In terms of price indexes, because of the relatively small brand-generic differences by age group, there is only a negligible difference between CCB retail acquisition price inflation for products destined for use by the elderly vs. those for the young. Specifically, as seen in the bottom panel of Table 8 and graphically in Figure 6, the old-young Laspeyres indexes are 1.27 vs. 1.26, while for the Divisia they are 1.11 vs. 1.10. In large part, this similarity in elderly-nonelderly price inflation for the CCBs reflects the fact that brand-generic differences between the old and young are much smaller in any given year for the CCBs than they are for the ADs and ABs. This more modest relative variability is also displayed in Figure 7, for each of the CCB chemical molecules. Other than for bepridil (brand name Vascor) and nimodipine (Nimotop), variations in elderly-nonelderly differences are modest.

In summary, therefore, for antidepressants there appears to be a significant retail acquisition price differential for products destined for use by the old vs. those destined for use by the young over the entire 1990-96 time period, and here the elderly inflation has been *less* than that for the young, reflecting greater use of generics by the elderly. For antibiotics, price inflation has been considerably greater for the elderly's products since 1992, but the differential is much smaller over the entire 1990-96 time period. Moreover, for antibiotics the greater elderly price inflation since 1992 appears to reflect the more rapid growth in elderly use of the newest, branded drugs for which 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 the inflation as measured by the BLS' producer price index, even when employing the Laspeyres procedure; the 1990-96

differences here are 1.29% per year for ABs, 1.61% for ADs, and 0.83% for CCBs.[49] This differential could reflect different pricing for leading presentations of drugs (the IMS data) than for the basket examined by the BLS, but it could also reflect a bias the BLS has been known to have had in oversampling older branded drugs.[50]

Secondly, as seen in Table 8, 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% per year for ABs, 0.65% for ADs, and 2.34% for CCBs. If one sums these two differentials, the differences in average annual growth rates between the BLS' PPI and the Divisia for retail acquisition prices is 2.21% for ABs, 2.26% for ADs and 3.17% for CCBs. These results are therefore quite consistent with other findings reported by the CPI Commission, and underline the importance of the recommendations they made, particularly those involving use of changing vs. fixed weights.

V. RETAIL SELL-OUT PRICES: ELDERLY VS. NON-ELDERLY

We now examine price growth in the final point of the distribution chain, that from retail pharmacies to patients/payors. Our research here must be viewed as preliminary in at least two respects. First, we have not been able to obtain reliable method of payment data that distinguishes cash, Medicaid and third party insurance payment separately for the elderly and the nonelderly since 1991. 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. Our inability to obtain reliable national data is unfortunate, for casual empiricism suggests to us that the elderly's use of third party payment arrangements to pay for drugs has increased more rapidly in the last few years than that of the general population, particularly as the retired have moved into medigap managed care arrangements that offer

prescription drug benefits. If in fact in recent years seniors have moved to third party drug payment more rapidly than the young (consistent with the OOPs data in Table 2), and therefore increasingly are 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 average price 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 leading presentation of a particular branded or generic drug. Problems emerge in measuring price and quantity changes consistently over time when these leading presentations change for brands, and even more so, for specific generic manufacturers, over the time 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 report here our preliminary findings on sell-out prices by retail pharmacies, only for the antidepressant (AD) class of prescription drugs. Moreover, since reliable method of payments data among cash, Medicaid and third party are not yet available separately for the elderly and the nonelderly, here we simply employ a weighted average of prices amongst the three payment methods, where the weights in Table 1 are assumed to be the same for the elderly and nonelderly.

IMS methods of payment 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 AD sell-in data from Table 8 so that the Divisia price index for the AD drugs is 1.000 in 1991. Results of that re-normalization appear in the upper left panel of Table 9. As is seen there, from 1991 to 1996, sell-in prices for AD drugs destined for use by the elderly increased 12%, while sell-in prices for AD drugs destined for use by the young increased 19%.

In the introductory section of this paper we noted the dramatic change over time in retail methods of payment, away from cash and instead toward third party payor. For retail pharmacies, the growth in third party payment implies dealing with a more organized and powerful buyer/payor than is the typical cash customer. We therefore expect that over this time period, sell-out prices by 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 from Table 1 on changing methods of payment over time, assumed to be the same for ADs as for all drugs.

In the top right panel of Table 9, we present the Divisia price index for retail sell-out, normalized to unity in 1991, while in the bottom panel 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 payors since 1991 has put downward pricing pressures on the retail pharmacy sector; while AD prices on a sell-in basis increased 18% over all customers from 1991 to 1996, corresponding sell-out prices only increased 14%. Thus, gross margins for retail pharmacies selling AD products fell 3.5% from 1991 to 1996.

Table 9

DIVISIA RETAIL SELL-IN AND SELL-OUT PRICE INDEXES FOR ANTIDEPRESSANTS
(Sell-out is Dollars per Daily Dose of Leading Presentation,
Weighted Average over Channels, Same Channel Weights for Old and Young)

	SELL-IN DIVISIA PRICE INDEX			*SELL-OUT DIVISIA PRICE INDEX*		
YEAR	YOUNG	ELDERLY	TOTAL	YOUNG	ELDERLY	TOTAL
1991	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
1993	1.104	1.089	1.102	1.083	1.076	1.082
1994	1.110	1.064	1.105	1.081	1.073	1.080
1995	1.136	1.076	1.130	1.114	1.096	1.112
1996	1.188	1.116	1.181	1.142	1.121	1.140

GROSS MARGIN INDEX (SELL-IN/SELL-OUT)

YEAR	YOUNG	ELDERLY	TOTAL
1991	1.000	1.000	1.000
1992	0.990	0.994	0.992
1993	0.981	0.988	0.982
1994	0.974	1.008	0.977
1995	0.980	1.018	0.984
1996	0.962	1.004	0.965

Second, this declining gross margin primarily involved sales of ADs to the young, for whom sell-in retail acquisition prices increased 18.8% from 1991 to 1996 while sell-out prices increased 14.2%, implying a decline of 3.8% in gross margins. For the elderly, however, the gross margin has hardly declined at all, indeed it has increased very slightly, 0.4%.

One reason for this last result is that, as noted earlier and seen visually in Figure 4, the elderly are disproportionately large consumers of generic AD 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;[51] that turns out to be the case here as well.[52] One implication of this larger generic retail margin along with disproportionately large elderly use of generics is that retail pharmacy margins have been under greater downward

pressure from nonelderly customers than from the elderly. It must be emphasized, however, that these calculations in Table 8 assume that the methods of payments trends displayed in Table 1 are the same for ADs as over 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 the young, these gross margin differentials between young and old will tend to be overstated.

VI. SUMMARY AND ISSUES FOR FURTHER RESEARCH

Our purpose in this paper has been to examine whether prescription drug price inflation in the 1990s has differed between the elderly and the non-elderly, when prices are viewed at three alternative points in the distribution chain. Our first finding is that in the aggregate, over all therapeutic classes of prescription drugs, at the initial point in the distribution chain involving manufacturers' sales to wholesalers, retailers, and hospitals, we find essentially no age-related price inflation differential.

At an intermediate point in the distribution chain involving acquisition prices of retail pharmacies for purchases from manufactuers and wholesalers, we examine sell-in prices for three therapeutic classes of pharmaceuticals, antidepressants (ADs), antibiotics (ABs) and calcium channel blockers (CCBs) over the 1990-96 time period. Here we observe some elderly-young price inflation differentials. Specifically, we find that from 1990-96, the Divisia price index for ADs destined for use by the elderly grows at an average annual growth rate (AAGR) of 3.10%, while that for ADs destined for use by the young grows at a higher AAGR of 4.19%. The source of the elderly's lower inflation rate is their disproportionately greater use of older and generic drugs, whose prices are typically falling while those of newer and branded ADs are generally increasing.

For ABs, we observe a slightly different set of trends. Over the entire 1990-96 time period, the Divisia price index for ABs destined for use by the elderly grows at an AAGR of 1.17%, again somewhat less than the 1.74% for the young. Since 1992, however, the elderly price index for ABs has grown at an AAGR of 1.88%, considerably more than the 0.59% for the nonelderly. The source of this difference appears to be a more rapid growth by the elderly in the use of the newer, branded drugs than by the young, particularly since 1992. One interpretation of this apparent price inflation differential is that the more fragile elderly are disproportionately using the newer antibiotics that have not yet developed bacterial resistance, when being treated for severe or life-threatening infections such as pneumonia.

Finally, for the calcium channel blockers, the elderly-young sell-in price inflation differential is negligible, with AAGRs being 1.60% for the young and 1.77% for the elderly.

The final point we examine in the distribution chain involves sales of retail pharmacies to consumers/payors. For data limitation reasons, at present we are only able to compute sell-out price indexes for the antidepressant class of prescription drugs. The dramatically increasing share of prescriptions paid for by third party insurance since 1991 has resulted in retail pharmacy sell-out prices for ADs increasing less rapidly than sell-in prices. The retail pharmacy gross margin index over all customers appears to have fallen about 3.5% since 1991, with young patients enjoying most of the benefits of this increased power of managed care over time, at the expense of the retail pharmacy sector. For the elderly, the retail gross margin on ADs has not fallen -- indeed it has risen very slightly, reflecting in part the fact that the elderly are disproportionately large users of generic ADs, along with the previously documented finding that retail margins on generics tend to be larger than on branded products. It is worth noting that our sell-out and

gross margin calculations assume that trends in methods of payments among cash, Medicaid and third party payors are the same for the elderly and the young. To the extent that recently the elderly are enrolling in third party arrangements with drug benefits at a more rapid rate than the young, this gross margin differential will tend to be overstated, as will growth in sell-out prices for the elderly.

One useful extension of our empirical analysis would involve the introduction of mail order data into our analysis. Although mail order sales are currently only about 9% of all Rx drug dollar sales, mail order is a rapidly growing segment, and apparently one in which the elderly are disproportionately represented.[53] Excluding mail order Rx drug sales from our analysis most likely results in our overstating overall price growth for the elderly.

In this paper we have made no attempt to adjust estimated price inflation differentials for variations in the quality of the products used by the elderly vs. 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 greater elderly AB price inflation relative to the young, and smaller elderly AD price inflation when compared to the young, 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.

One clear finding emerging from this research, and corroborated in other studies cited by the CPI Commission, is that the use of a fixed weight Laspeyres price index procedure, such as that employed by the BLS, yields price indexes whose growth is misleading and distorted. In particular, for all three classes of drugs, and for all groups of customers, price growth as measured by the Laspeyres fixed weight procedure (as employed by the BLS)

resulted in greater measured inflation than the market share chain-weighted Divisia index. This finding is consistent with that of other studies cited in the CPI Commission report, and underlines the importance of their finding concerning the upward bias of the Laspeyres index and their recommendation of moving to a changing weight index.

Finally, in this paper we have examined inflation price differentials involving the elderly and the non-elderly. An implicit assumption 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? Are there more children living in poverty than there are elderly living solely on Social Security? Clearly, the formulation of appropriate public policy involving the elderly depends in part on the within vs. between issue involving the elderly.[54] In a somewhat different context involving other products, Robert Michael [1979] reports greater variation in expenditures within various demographic groups than between them. 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.[55]

FOOTNOTES

[1]United States Senate Finance Committee [1996].

[2]For a discussion of patterns in total acute care health *expenditures* by patient age group from 1953 to 1987, see Cutler and Meara [1997].

[3]Numbers in this paragraph are taken from Levit et al. [1996], Table 5, p. 222 and Table 11, p. 233.

[4]In 1994 (1990), the portion of total Rx spending from governmental sources was 19.3% (17.0%).

[5]IMS 1996 Class of Trade Analysis and Retail Method of Payment Analysis.

[6]U.S. Department of Commerce [1994], p. 3.

[7]For comparisons back to 1980, see Acs and Sabelhaus [1995].

[8]Note that these OOPs expenditures exclude all government funding, such as that for Medicare. Thus the 32% figure likely understates the elderly's proportion of total OOPs plus government health care expenditures.

[9]Employers may also be shifting health insurance premium costs and copayments/ deductibles to their employees. For discussion, see Baker-Kramer [1991] and Cowan et al. [1996].

[10]For an overview discussion, see Triplett [1997] and Getzen [1992].

[11]However, in constructing the BLS' Medical Consumer Price Index, the OOPs payments for health insurance are in turn distributed into payments by insurers for medical services, medical commodities, and health insurers' retained earnings. See Fixler [1996], Daugherty [1964], Ford and Sturm [1988], and Getzen [1992].

[12]United States Department of Labor, Bureau of Labor Statistics, CPI Detailed Report, Tables 1 and 3 (CPI for All Urban Consumers).

[13]However, for several years within the 1927-46 time period, year-to-year changes in the CPI were greater than for the MCPI. See Getzen [1992] for a discussion.

[14]US Senate Finance Committee [1996], fn. 71, p. 72.

[15]US Senate Finance Committee [1996], p. 60. Also see Shapiro and Wilcox [1996].

[16]US Senate Finance Committee [1996], pp. 58-62.

[17]US Senate Finance Committee [1996], p. iv.

[18]Lane [1996], p. 22. Also see references in footnote 11 above.

[19]U.S. Department of Labor, Bureau of Labor Statistics [1992], p. 140.

[20]See, for example, Berndt, Griliches and Rosett [1993], Griliches and

Cockburn [1994], and Berndt, Cockburn and Griliches [1996].

[21]See, for example, Kuttner [1997] and Gephardt [1997].

[22]For a review of literature on various BLS experimental price indexes, including a separate price index for the poor, both old and young, see Garner et al. [1996] and Moulton-Stewart [1997].

[23]Rice and Horowitz [1967], p. 28, based on US Department of Health, Education and Welfare [1967]. Rice-Horowitz [1967, p. 25] report that the December 1965-December 1966 price index growth rates ranged from 2.5% for cholecystectomy to 6.9% for prostatectomy, while the combined index for physicians' fees regularly priced for the CPI increased 7.8%.

[24]See Garner et al. [1996], p. 37 and Moulton-Stewart [1997], p. 18. The time costs of shopping could also differ for the elderly.

[25]See Amble and Stewart [1994] and Mason [1988]. The overall CPI refers to the CPI-All Urban Consumers index.

[26]Moulton-Stewart [1997], p. 21.

[27]Garner et al. [1996], p. 33.

[28]Rubin and Koelin [1996], p. 30. Also see Hitschler [1993].

[29]US Senate Finance Committee [1996], p. 72.

[30]In 1995 (1990), 78.9% (71.8%) of manufacturers sales were to wholesalers, 12.1% (15.8%) were to retailers and 4.8% (9.3%) were to hospitals. Source: Pharmaceutical Research and Manufacturers of America [1997], Figure 4-12, p. 30.

[31]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. Source: US Bureau of Labor Statistics, Producer Price Indexes, Data for June 1996, Table 5, p. 61.

[32]For further details, see IMS America [1996], ch. 11. A new prescription refers to a new script written by the physician; it could include several refills. After the patient exhausts the refills, a new prescription may again be written.

[33]Drug mentions are in thousands. We also obtained this NDTI data for 1992 and 1994. The 1992 and 1994 are very similar.

[34]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 Section IV below.

[35]For further details, see IMS America [1996], chapters 20 and 41.

[36]One might also argue that the very young are more vulnerable as well.

[37]This is clearly the case for antidepressants, such as the selective

serotonin reuptake inhibitors, which have similar efficacy but superior adverse interaction and side effect profiles relative to the older tricyclic antidepressants. See Berndt, Cockburn and Griliches [1996] for further discussion.

[38]For a discussion of pricing considerations involving drugs to treat acute vs. chronic conditions, see Lu and Comanor [1996].

[39]This is consistent with the common medical adage, "Don't shoot a singing bird".

[40]See, for example, Griliches and Cockburn [1994] and Berndt, Cockburn and Griliches [1996].

[41]See, for example, Berndt, Griliches and Rosett [1993], Kanoza [1996] and Ristow [1996].

[42]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.

[43]See U.S. Finance Committee [1996].

[44]The fixed weight Laspeyres price index is calculated as $L_t = \sum_i p_{it}q_{i0} / \sum_i p_{i0}q_{i0}$, where p_{it} is the price of item i in period t, p_{i0} is the base period price, and q_{i0} is the base period quantity. The Tornqvist discrete approximation to the Divisia index is calculated as $D_t = \exp[\sum_i \bar{w}_{it}(\ln p_{it} - \ln p_{i,t-1})] \cdot D_{t-1}$, where $\bar{w}_{it} = .5*(w_{it} + w_{i,t-1})$ and $w_{it} = p_{it}q_{it}/\sum_i p_{it}q_{it}$, and where D_0 is normalized to unity in the base year.

[45]This fixed weight procedure is not the same as that employed by the BLS in its CPI for prescription drugs, for a number of reasons, including the fact that the CPI uses only OOPs weights, whereas weights here include retail acquisition costs for products destined for payment by cash, third party and Medicaid. Moreover, the index here refers to retail acquisition costs, not retail sales to patients/payors. A description of the BLS' CPI method for prescription drugs is found in Cleeton et al. [1992] and Armknecht et al. [1994].

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

[47]For the Laspeyres, the number of AB items is fixed at 156, while for the Divisia, the number is 162, 172, 188, 188, 190, 192 and 196 from 1990 to 1996.

[48]The number of items in the 1990 fixed weight Laspeyres index is 46, while for the Divisia it is 50 in 1990-91, 54 in 1992-3, 58 in 1994-5 and 60 in 1996.

[49]These differences are computed as growth in the BLS' PPI by therapeutic class (systemic antiinfectives for ABs, psychotherapeutics for ADs and cardiovasculars for CCBs), reported in Table 6, minus growth in the Laspeyres Index All entries of Table 8.

[50]For further discussion, see Berndt, Cockburn and Griliches [1996], Berndt, Griliches and Rosett [1993], IMS America [1996] and Kanoza [1996].

[51]See, for example, the FTC study by Masson and Steiner [1985], as well as

Caves, Whinston and Hurwitz [1991].

[52]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% percentage margin [(sell-out/sell-in) - 1]. By comparison, for one of the well-known older generation tricyclic antidepressants, the sell-in price was 12¢, and the sell-out price was 54¢, implying a 42¢ absolute margin and a 350% percentage gross margin. Note that one would expect the percentage margin to be larger for generics, since a common dispensing fee is added to a lower generic acquisition price.

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

[54]For an early discussion of this issue in the "Stigler Commission" report, see Snyder [1961].

[55]On this, see recent unpublished research findings by David Cutler and Elizabeth Richardson [1997] and Angus Deaton and Christina Paxson [1997].

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