The Dissertation Committee for Brett William Wendling
certifies that this is the approved version of the following dissertation:

Three Essays in Health Economics

Committee:

Daniel Slesnick, Supervisor

Stephen Donald

Richard Dusansky

Don Fullerton

David Warner

Three Essays in Health Economics

by

Brett William Wendling, B.S.;M.S.

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To my lovely wife, Lisa.

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Brett William Wendling

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Brett William Wendling, Ph.D.
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Supervisor: Daniel Slesnick

As medical care becomes an increasingly large share of Gross Domestic Product, understanding the mechanisms for how and why medical care spending is rising becomes increasingly important. Such an evaluation should consider the productivity relationship between medical care and health. An evaluation of medical productivity involves the measurement of medical care input prices, disease treatment output prices, and the productive relationship between medical care inputs and disease treatment health outcomes.

Medical care price measurement is complicated by the heterogeneity of services, the role of insurance in negotiating prices, rapid technological advancements

in medical care and limited availability of transaction price data. Health outcome prices are difficult to construct because of the difficulty in measuring health outcomes, the heterogeneity of health outcomes, and the messy relationship between consumption goods and health. Finally, in addition to accurate input and output price measurement, a productivity assessment requires a measurable causal relationship between medical care services and health outcomes. To date, all of these requirements have been insurmountable hurdles to assessing the productivity of medical care for the entire United States economy.

This dissertation uses the Medical care Expenditure Panel Survey to address the necessary requirements for evaluating the productivity of medical care. The second chapter constructs regional medical care price indices using transaction prices that control for service type heterogeneity. The data employed in the analysis associates the observed medical care spending with the diseases the spending is used to treat. This association is exploited in the third chapter, which constructs medical care treatment prices for twelve of the major health conditions in the United States. The fourth chapter compares the productivity of medical care services used to produce disease treatment health outcomes across insurance types.

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Chapter 1

Introduction

Medical care is becoming an increasingly important share of the economy. It currently represents a larger share of Gross Domestic Product than food and the growth rate in medical care spending consistently outpaces the inflation rate. Understanding the mechanisms for how and why medical care spending increases is therefore becoming increasingly important. However, a formal assessment of the welfare implications of the increased spending is difficult to determine. Much of the difficulty arises from the complexity involved in measuring medical care productivity. On the one hand, medical care may be becoming more productive such that increased medical care spending may result in significantly longer and more productive lives that improve health outcomes and enhance societal well-being. On the other hand, increased spending may be independent of increasing medical care productivity, and thus reflect increasing prices for identical services, or a deterioration in the health of the average citizen for reasons exogenous to the medical care market. Which of these possibilities explains the nature of the current rise in medical care costs is an important empirical question.

Empirically measuring the causal relationship between medical care and health, in other words the productivity of medical care, requires specifying a struc-

tural relationship between medical care services and health outcomes. The nature of this relationship is well-defined in the literature. Medical care is an input in the production of health (Grossman, 1972). The production process is disease specific and requires that the considered inputs and outputs be allowed to depend on the disease considered. The technological process that relates medical services to health depends on an estimable technological relationship and observed and unobserved patient characteristics (see Berndt, Busch and Frank (2001); Cutler, McClellan and Newhouse (1998); and Triplett (1999) for a discussion of this literature).

Any such evaluation begins with the measurement of medical care prices. However, medical care price measurement is complicated by the heterogeneity of services, the role of insurance in negotiating prices, rapid technological advancements in medical care and the collection of transaction prices that may differ dramatically from reported list charges. The first chapter of this dissertation uses the Medical care Expenditure Panel Survey to construct regional medical care price indices that control for these issues over the period 1996-2003.

One of the more important aspects of the medical care market is its dynamism. Medical care regularly introduces new drugs, procedures and medical devices into the marketplace. Evaluation of whether technological advancement affects society's ability to produce better health outcomes in an efficient manner is an important empirical question. However, evaluating the efficiency of medical care markets is complicated by health measurement difficulties, the heterogeneity of diseases and medical services, and limited availability of transaction prices data. The third chapter of the dissertation addresses several of these productivity issues by constructing disease treatment prices. Currently, no government statistics associate medical care service expenditures with the diseases those services are used to treat. Consequently, the government statistics such as the National Health Accounts, the Producer's Price Index (PPI) and the Medical Care component of the Consumer

Price Index (mCPI) cannot enable even a cursory evaluation of productivity because they cannot relate the input services they consider to the health outputs they produce. The productivity and efficiency of medical care markets are addressed by constructing health care output prices for twelve of the major health conditions in the United States. The analysis also uses the Medical care Expenditure Panel Survey over the period 1996-2003.

Once the ability to identify productivity has been established, one can make productivity comparisons over time, across regions, and as the fourth chapter exploits, across insurance types. In the medical care sector more than 80% of medical expenditures are paid by insurers in behalf of patients. Moreover, the entities that make payments for medical care in behalf of the patients are a heterogeneous group that includes public insurance payers such as Medicaid and Medicare, private insurance payers, and individual patients. Despite the large role of medical care insurance and the heterogeneous nature of the insurance types, very little is known about how the presence of insurance affects the technologies employed to treat disease or the health outcomes that come as a result of that treatment. Evaluation of how medical care treatments depend on the insurance type of the patient is performed for three of the most costly health conditions in the United States over the period 1996-2003. The evaluation uses the Medical Care Expenditure Panel Survey to test whether the input demands in specific disease treatments differ across insurance types. The differences are interpreted as technological differences across insurance types. The technologies are then mapped into health outcomes in order to decompose the effect of insurance on health outcomes.

Chapter 2

Medical Care Input Prices

In order to implement a productivity assessment, a natural place to begin is with the construction of input prices. Inputs in the health care sector are medical care services. Medical care price construction begins by defining what constitutes a medical care service. There is some disagreement about how medical care services should be defined, but this paper argues that medical care services should be defined narrowly and in such a way that allows for the identification of differences in medical care service intensity across regions, over time and across diseases (see Newhouse (2001) for an overview of medical care price measurement issues). Medical care prices that are defined in this way facilitate future technological comparisons of disease treatments.

Although defining what constitutes a medical care service and constructing its price appear to be simple conceptual exercises, in practice the procedures are complicated by several important and unique market features. These features include the heterogeneity of medical care services, rapid technological advancements in medical care, the role of insurance in negotiating prices, and differences between unobserved transaction prices and reported list charges.

Product heterogeneity is important in medical care. Medical care includes

services as varied as drugs, orthopedic supplies, hospital stays, and office visits. Even within specific service categories the administered service can vary in complexity. For example, some office visits are routine checkups while others may involve surgery. Related to this type of heterogeneity is the issue of technological innovation. The incorporation of technological advancement into prices is difficult in any market, but these difficulties are exacerbated in dynamic markets like medical care. New drugs, surgical procedures, and other service improvements are regularly introduced. How to compare them to older technologies is not obvious.

The construction of medical care prices is also complicated by the complex nature of financial exchanges made in the medical care market. Specifically, the actual price paid for a service is made exceedingly obtuse by the role of insurance. Indeed, the amount paid and by whom the payment was made often depends on the service, the insurer and potentially the health condition of the patient. Moreover, the insurer is often the government which may have motives other than profit maximization. Insurers may offer a menu of indemnity plans to patients, and may negotiate with medical care providers for prices. The outcomes of these relationships, such as the total price paid for a service and the share of the price paid by the patient, may ultimately result from the relative strength of the insurance firm's bargaining position. Many factors affect the bargaining positions of the insurance firm including the presence of other insurance firms, the density of medical care providers in the area, the size of local employers, and the demographic characteristics of the population. Consequently, there are many reasons for why the prices actually received by medical care providers may differ substantially from the reported list charges often used in determining medical care prices. Moreover, these differences may be economically important because of the large role of insurance. Roughly 80% of medical expenditures are made by insurers in behalf of patients, and thus the bargaining position of the insurer may have large implications on the

actual price received by the medical care providers.

This paper uses the Medical care Expenditure Panel Survey (MEPS) over the years 1996-2003 to construct medical care prices. The constructed prices use the full *expenditures* received by the medical care provider. All prices control for technological advancements, service-type heterogeneity, patient characteristics and insurance payer using hedonic pricing models and price index aggregation theory.

2.1 Methodology

Medical care prices are defined as regional price levels for homogenous medical care service products over the period 1996-2003 using the MEPS. Service type heterogeneity is controlled using a variant of the Country Product Dummy variable (CPD) model described in detail by Summers (1973). The CPD model is a hedonic pricing model that has been used extensively to estimate cross-country purchasing power parities. This paper follows Kokoski, Cardiff and Moulton (1994) in implementing a CPD model to construct price levels across geographic regions in the United States for medical care services. The services are organized into a hierarchy of four aggregation levels. The most aggregated service level is the *Group*. The constructed Groups correspond directly with the National Health Accounts (NHA)[1]. Groups are subdivided into categories of decreasing aggregation. These categories are *Expenditure Classes* (EC), *Stratum*, and *Entry-Level-Items* (ELIs). As an example, one of the ELI services considered is Acyclovir. Acyclovir is a molecular pharmaceutical product in the group *Drugs*, the Stratum *Anti-Viral Agents*, and the expenditure category *Anti-infective Medications*. All events are assigned to sub-categories by the author using the description of the services provided by the MEPS. The group-level services and their associated sub-categories are listed in Appendix 1.

[1]The 1996 MEPS survey is the only sample to report nursing home care. Thus, there is no group, reported here, that corresponds with nursing home care in the National Health Accounts.

Implementation proceeds as follows. The price of an event i that belongs to ELI s is estimated using the following hedonic regression:

$$\ln P_i^s = \alpha_0 + \sum_{k=2}^{K} \beta_k^s R_{ki} + \sum_{j=1}^{J} \gamma_j^s C_{ji} \tag{2.1}$$

In equation 1, β_k^s and γ_j^s are estimated coefficients, P_i^s is the total expenditures paid for the event i, and R_{ki} is a region-year dummy variable that is one if the event occurred in region-year k, and zero if it did not. C_{ji} is the jth characteristic of event i. The characteristics included in the hedonic regressions vary by ELI but often include disease and insurance type indicators as well as demographic variables such as age and gender. The price of the sth service in region-year k relative to the reference area is $exp(\hat{\beta}_k^s)$.

Once the ELI prices have been estimated, I use the log of the disaggregated ELI prices, $\ln P_k^s = \hat{\beta}_k^s$, to construct the aggregate stratum-level prices. The aggregation procedure is performed by taking the share-weighted-average of the n ELI prices that are members of stratum v in region-year k:

$$\ln P_k^v = \sum_{s \in v}^{n} w_{ks}^v \ln P_k^s \tag{2.2}$$

Here, $\ln P_k^v$ is the log price of stratum v services for the region-year k, and w_k^s is the expenditure of ELI s in region-year k as a share of total expenditure in the region-year k spent on all ELIs in stratum v.

The next step in the aggregation procedure uses the stratum level prices, $\ln P_k^v$, to construct EC-level prices. The EC-level price aggregation procedure employs a bilateral Tornquist comparison in order to facilitate multi-lateral comparisons across region-years. Using this procedure, the Tornquist bilateral price comparison of region-year j to region-year k for EC u uses the following weighted geometric average of the V stratum-level prices that are members of EC u to determine each

region-year bilateral comparison price:

$$\ln P^u_{jk} = (1/2) \sum_{v \in u}^{V} (w^u_{vj} + w^u_{vk}) \ln(P^v_j / P^v_k) \tag{2.3}$$

In Equation 3, w^u_{vj} and w^u_{vk} represents stratum v's fraction of total EC u expenditure in regions j and k, respectively. If there are K region-years, then this procedure results in a KxK matrix of bilateral prices. These bilateral prices are used to construct a multi-lateral price index for each EC-level region year. The multi-lateral price for a region-year, $\ln P^u_k$, is determined by taking the weighted share of the K bilateral prices such that:

$$\ln P^u_k = \sum_{j=1}^{K} s^u_j \ln P^u_{jk} \tag{2.4}$$

where s^u_j is the share of spending in region j on total spending on EC u services.

The data often do not support the creation of all the disaggregated sub-categories. Dental visits and drugs are estimated at the most disaggregated ELI level, but hospital care is estimated at the stratum level, physician and non-physician office care are estimated at the EC-level, and home health care and other supplies are estimated at the group level. For these cases, the method described above can be used sequentially to obtain multilateral prices at successively higher levels of aggregation.

2.2 Implementation with the MEPS

The most important feature of the MEPS is the nature of the reported expenditure data. The MEPS reports the medical care consumption for every individual in a nationally representative individual level survey. The total medical care expenditures associated with all types of medical care received by every respondent is reported for each individual in the survey. The expenditures include and distinguish between

all payments made by and in behalf of the respondent, and include payments made by the respondent's family, private insurance, public insurance such as Medicare and Medicaid, workman's compensation and automobile insurance. All expenditures are associated with a medical care event such as a prescription or a hospital stay. Finally, the survey includes a follow-up component that interviews the medical care provider to determine the expenditures received for each event associated with the survey respondent. This follow-up component accounts for expenditures forgone that occur as a result of charity care, bad debt, provider discounts, insurance discounts and other potential sources of discrepancies between reported list charges and the actual expenditures received.

2.2.1 Group-level services

The specific group-level medical care services considered are dental care, home health care, hospital care, physician ambulatory care, non physician ambulatory care, drugs, durable supplies and non-pharmaceutical non-durable supplies. These groups are an exhaustive list of the medical care consumption reported by the MEPS over the full period 1996-2003. The services reported by the MEPS are organized in such a way as to correspond roughly with the NHA. Table 1 presents the ratio of medical care expenditures to the reported list charges for several of the group-level services considered in the construction of medical care prices.[2] Charge data has been used by government statistics and several important cost-benefit studies to construct medical care prices. The results from Table 1 demonstrate the importance of using expenditure data to construct these prices.

Table 1 reveals that charges overstate the actual transaction expenditures by roughly 40% over this period. The ratio of overall annual expenditures to charges is always in the range of 52.7% - 66.3%. This ratio has steadily declined over the

[2]Drug charges are not reported by the MEPS, and are thus not included in the charge-expenditure ratio.

Table 2.1: Expenditure to Charge Ratio

Year	Dental	Home Health	Hospital	Doctor Office	Non-Dr Office	Other	All (non-Rx)
1996	0.813	0.785	0.619	0.679	0.754	0.912	0.663
1997	0.893	0.730	0.539	0.648	0.703	0.934	0.602
1998	0.860	0.810	0.517	0.626	0.729	0.912	0.582
1999	0.858	0.836	0.508	0.626	0.652	0.918	0.579
2000	0.846	0.855	0.477	0.601	0.659	0.894	0.547
2001	0.896	0.917	0.463	0.604	0.669	0.893	0.544
2002	0.893	0.919	0.441	0.614	0.724	0.906	0.533
2003	0.892	0.918	0.447	0.609	0.698	0.895	0.527

period, falling from its peak of 66.3% in 1996 to 52.7% in 2003. However, both the magnitude and the rate of decline in the overall ratio masks the relationship between expenditures and charges within each of the medical care services. For many of the services, the ratio of expenditures to charges remains flat over the period or even increases. The ratio for home health increases from 78.5% in 1996 to 91.8% in 2003. Dental care experiences a similar increase in the ratio from 81.3% in 1996 to 89.2% in 2003. Even those services that exhibit the same general pattern as the overall ratio have very different rates of decline. For instance, the ratio for hospital services, which appears to drive much of the overall ratio, declines very quickly from 61.9% in 1996 to less than 45% in 2003. This decline represents a 16-point change. However, office-based physician visits, which exhibits the same general pattern as hospital services, declines at a much slower rate from 67.9% in 1996 to 60.9% in 2003 for a total 7-point change.

The share of total medical care spending represented by each group-level service is listed in Table 2.[3] As can be seen from Table 2, hospital care represents approximately half of all medical care expenditures, which is the largest share of total medical care spending. However, this fraction has been steadily declining,

[3]Durable and non-durable supplies are combined into 'Other' medical care spending.

Table 2.2: Total Share

Year	Dental	Home Health	Hospital	Doctor Office	Non-Dr Office	Other	Drugs
1996	0.073	0.061	0.541	0.143	0.039	0.027	0.116
1997	0.080	0.052	0.530	0.140	0.040	0.029	0.128
1998	0.084	0.039	0.526	0.149	0.043	0.023	0.137
1999	0.086	0.052	0.492	0.146	0.042	0.028	0.155
2000	0.087	0.040	0.501	0.149	0.043	0.021	0.159
2001	0.079	0.042	0.469	0.158	0.050	0.022	0.180
2002	0.076	0.041	0.457	0.163	0.063	0.021	0.178
2003	0.073	0.031	0.478	0.147	0.059	0.021	0.191

and has fallen from 54% of total medical care spending in 1996 to 48% of spending in 2003. The same decreasing pattern is true for home health which has fallen from 6.1% of expenditures in 1996 to 3.1% of expenditures in 2003. In contrast, the fraction of spending represented by drugs and non-physician care has increased over the period. The fraction of total medical spending represented by drugs has increased dramatically from 11.6% of total expenditures in 1996 to 19.1% of total expenditures in 2003. The rise in the drug share of total medical care spending has drugs overtake physician ambulatory care as the second largest share of total spending in 1999. The rise in non-physician care has been less dramatic, rising from 3.9% of total expenditures in 1996 to not quite 6% of total expenditures in 2003. The other services, including dental care, physician care and other services have remained a steady fraction of the total spending over the period.

2.2.2 Controlling for Heterogeneity

The unit of observation, or event (as defined by the survey), depends on the group considered. The event for dental care, physician care and non-physician care is the visit. Home health events are measured as months of service. Drug events are defined by the survey as a prescription, but are combined with information from

Table 2.3: Per Person Utilization

Year	Dental	Home Health	Doctor Office	Non-Dr Office	Rx (Presc.)
1996	1.095	0.197	3.311	1.223	6.937
1997	1.058	0.164	3.148	1.288	6.907
1998	1.057	0.129	3.163	1.357	7.202
1999	1.071	0.126	3.110	1.258	7.481
2000	1.032	0.120	3.161	1.195	7.783
2001	1.058	0.122	3.340	1.374	8.773
2002	1.075	0.139	3.371	1.717	9.345
2003	1.071	0.135	3.318	1.795	9.650

Year	ER	Hospital Stays	Nights Per Person	Nights Per Stay	OP
1996	0.110	0.155	0.621	4.000	0.455
1997	0.114	0.148	0.583	3.934	0.466
1998	0.110	0.143	0.619	4.328	0.447
1999	0.111	0.137	0.544	3.964	0.420
2000	0.116	0.140	0.639	4.546	0.446
2001	0.118	0.161	0.617	3.836	0.516
2002	0.114	0.164	0.606	3.699	0.551
2003	0.113	0.161	0.616	3.830	0.538

Mosby's Drug Consult in order to construct the daily dose of a molecule. Durable and non-durable supplies are defined as the unit of supply considered, i.e. a towel, a bandage or a wheelchair. Hospital events are unique in that the definition of what constitutes an event depends on the stratum. Inpatient events are hospital "stays", while Emergency Room and outpatient events are defined as visits. The reported characteristics of these events are used to define a medical care service and control for the product heterogeneity.

Table 3 presents the aggregate per person utilization for each of the group-level services. Utilization is measured as the number of events per person, where events are defined to be consistent with the survey observations. Table 3 suggests that utilization for most services has remained flat over this period. This pattern

is consistent across office based physician and non-physician services, dental care, emergency room care and inpatient care. In addition, the relative intensity of inpatient care, measured as the nights per visit, has also remained relatively flat over this period. A couple of exceptions to this pattern stand out. The number of prescriptions written has increased steadily from seven prescriptions per person per year to almost ten prescriptions per person per year. In addition, the number of outpatient hospital visits has risen, but less dramatically. This rise appears to have been due to a shift in utilization patterns since the year 2000. Home health care has also experienced a shift in utilization patterns, but the shift occurred after 1997 and utilization decreased.

Estimation of separate hedonic prices for very specifically defined ELI services is the most appropriate method to control for product heterogeneity. Separate hedonic regressions for each medical care service implicitly allows all region-year prices to vary across services. However, this method is often infeasible because some services are observed infrequently in the data. Infrequent observation can lead to a loss of statistical power in determining the price. For this reason, some services are combined in order to address the statistical validity of the results.

When services are pooled the event characteristics are controlled by including event characteristic variables in the pooled hedonic regression. The number and type of controls included in the regression often depend on the type of service considered. For instance, office-based visits include controls for whether the visit includes a Magnetic Resonance Imaging (MRI) service or an X-ray, whereas drugs often include controls for the manufacturer and strength of the molecule. Although the service considered determines many of the controls included in the regression, some controls are included in almost every regression. These controls are listed below:

- *Region-Years*: Every hedonic regression includes thirty-nine region-years that are used to identify the price. Each of the eight years 1996-2003 are inter-

acted with five regions. The regions are defined by the geographical location of the area and whether the address is located in a Metropolitan Statistical Area (MSA). The regions include MSA-Northeast, MSA-Midwest, MSA-West, MSA-Southeast, and non-MSA. All of the interactions except for the 1996 MSA-Northeast interaction are included in each regression in order to identify the price of the service relative to the omitted region-year.

- *Insurance Indicators*: Each individual is assigned into one of six insurance types. The insurance types are private, Medicare only, Medicare and Private, Medicaid only, Medicare and Medicaid and other public insurance combinations, and no insurance. Each medical care event is associated with the insurance type of the respondent who received the event. Indicator variables for the associated insurance type are included in the hedonic regressions for all services.

- *Disease Types*: The MEPS associates each medical care event with a three-digit International Classification of Disease code (ICD-9 code). These codes are used to create indicator variables for what type of medical condition the associated event is used to treat. These indicators may identify the nature of the type of service provider seen. For example, whether a physician seen was a specialist or a general practitioner. The specificity of the disease type included in the regression depends on the type of service considered.

- *Demographic Characteristics*: The nature of some services may depend on the demographic characteristics of the individual being treated. For example, children may visit pediatricians, or women may visit their obstetrician even for routine checkups. Demographic variables are included to control for this type of heterogeneity. Demographics include age-group dummies and gender.

2.3 Office-based Physician Services

The MEPS reports every visit to either a physician or non-physician that occurred outside of the hospital by a survey respondent as office-based care. The MEPS provides specific details about office-based events including the service provider seen (i.e. a physician or non-physician), procedures performed during the event, and the "category" of the event. Office-based physician services are defined as office-based care where the patient reports seeing a physician during the visit. These services are compared with the physician services account from the NHA.

Office-based physician care services are estimated at the EC-level. Expenditure classes are defined using the types of procedures performed during the visit and the "category" of the visit. The procedures that occur during an event are neither exhaustive nor mutually exclusive and include surgeries, Xrays, MRIs, chemo-therapy, and/or physical therapy. Procedures do not include measures of the intensity or the duration of the services. Visit categories include whether the visit is a checkup, a treatment or diagnosis, maternity care, vision care, or an emergency visit. Any visit category can involve any one or more of the available procedures.

Two major types of EC-level type services are constructed, those services with surgeries and other major procedures, and those services without surgeries and major procedures. All visits that include a surgery are pooled together as a specifically defined service, regardless of the visit category. All services that include major services other than surgery, such as X-rays and MRIs, are pooled together separate from both the surgical visits and the other types of visits. All visits that do not include a surgical procedure or other major non-surgical procedure are categorized by their visit category. Some similar visit categories without major procedures are also pooled together. For example, well-child visits and checkups are combined together.

Office-based physician care visits are pooled with hospital outpatient physician care in order to increase the precision of the outpatient visits. Outpatient

Table 2.4: EC-level Shares for Physician Services

Year	Checkup	Diagnosis/ Treatment	Surgery	Non-Surgical Procedure	Psych-ological
1996	0.151	0.284	0.078	0.250	0.054
1997	0.147	0.285	0.076	0.268	0.045
1998	0.160	0.299	0.076	0.267	0.045
1999	0.159	0.278	0.069	0.299	0.039
2000	0.151	0.280	0.072	0.293	0.045
2001	0.155	0.270	0.074	0.306	0.042
2002	0.162	0.254	0.071	0.319	0.049
2003	0.163	0.267	0.069	0.319	0.044

Year	Post-operative	Allergy	Vision	Maternity	Other
1996	0.079	0.009	0.0236	0.048	0.023
1997	0.091	0.009	0.0218	0.043	0.014
1998	0.074	0.009	0.0170	0.041	0.013
1999	0.075	0.008	0.0164	0.043	0.014
2000	0.075	0.010	0.0154	0.044	0.016
2001	0.076	0.010	0.0153	0.037	0.014
2002	0.076	0.009	0.0128	0.033	0.014
2003	0.070	0.010	0.0157	0.031	0.011

events are associated with the exact same information as the office-based care, and thus outpatient events are categorized using the same procedure as above. See the section on Hospital care for a more detailed description of how outpatient care is combined with office-based care.

Hedonic regressions are performed separately for each expenditure class service. In order to control for product heterogeneity, the hedonic regressions include statistical controls for product types. The disease-type controls mentioned earlier are extremely important in the consideration of office visits. The MEPS does not report whether an individual sees a specialist or a general practitioner, only whether the individual saw a physician. However, physician types can be very heterogeneous and may include internists, cardiologists, neurologists, and general practitioners. Physician type heterogeneity is assumed to be controlled by the inclusion of ICD-9 condition code dummy variables in the hedonic regressions. Office-based physician regressions include statistical controls that indicate the types of procedures that occur at a visit in addition to the standard statistical controls such as insurance, demographic characteristics, region-years, and disease types. These additional controls include variables that indicate whether the patient received anesthesia and lab-tests. For those services that pool major procedure types other than anesthesia and lab tests, the hedonic regressions also include statistical controls for the type and number of procedures. For example, controls include whether the visit involved an X-Ray, an MRI, or an X-Ray and an MRI. Similarly, if the expenditure class regressions pool visit categories, dummy variables are included that identify the reported visit category.

Table 4 reports the expenditure share of physician care represented by each Expenditure Class. Non-surgical major procedures and diagnosis/treatment visits are the two largest expenditure categories and together represent more than half of all office-based physician spending. The share of diagnosis/treatment remains

Table 2.5: EC-level Prices for Physician Services

Region-Year	Checkup	Diagnosis/Treatment	Surgical	Non-Surgical	Psych-iatric	All Physician
MSA NE 1996	1.000	1.000	1.000	1.000	1.000	1.000
MSA NE 1997	0.948	0.980	0.935	0.962	0.751	0.951
MSA NE 1998	1.013	1.107	0.870	0.916	0.769	0.990
MSA NE 1999	1.036	1.091	1.092	1.045	0.942	1.056
MSA NE 2000	1.154	1.140	1.320	1.065	1.033	1.118
MSA NE 2001	1.223	1.211	1.463	1.148	1.099	1.206
MSA NE 2002	1.260	1.260	1.457	1.108	1.100	1.214
MSA NE 2003	1.247	1.292	1.550	1.184	1.125	1.271
MSA MW 1996	0.946	0.885	0.997	0.972	0.727	0.925
MSA MW 1997	0.932	0.904	1.178	1.050	0.790	0.966
MSA MW 1998	1.094	0.953	1.160	0.946	0.758	0.989
MSA MW 1999	1.049	1.056	1.066	1.173	0.807	1.098
MSA MW 2000	1.143	1.157	1.282	1.079	0.884	1.120
MSA MW 2001	1.324	1.242	1.460	1.217	0.967	1.246
MSA MW 2002	1.370	1.444	1.766	1.267	1.117	1.371
MSA MW 2003	1.418	1.447	1.770	1.289	1.079	1.399
MSA SE 1996	1.004	0.942	1.003	0.950	0.906	0.971
MSA SE 1997	0.936	0.912	1.052	0.893	0.828	0.923
MSA SE 1998	1.011	1.001	1.070	0.960	0.925	0.985
MSA SE 1999	0.991	1.002	1.058	1.020	0.805	0.994
MSA SE 2000	1.094	1.064	1.599	1.063	0.719	1.088
MSA SE 2001	1.267	1.209	1.388	1.128	0.956	1.188
MSA SE 2002	1.290	1.316	1.447	1.190	1.082	1.269
MSA SE 2003	1.305	1.345	1.803	1.206	1.028	1.306
MSA WE 1996	1.026	1.009	1.083	0.961	0.818	1.007
MSA WE 1997	1.089	1.093	1.177	1.071	0.786	1.088
MSA WE 1998	1.109	1.135	1.289	0.968	0.860	1.080
MSA WE 1999	1.172	1.181	1.284	1.141	0.880	1.166
MSA WE 2000	1.243	1.259	1.858	1.185	1.075	1.272
MSA WE 2001	1.467	1.397	1.690	1.309	1.200	1.393
MSA WE 2002	1.354	1.318	1.493	1.186	1.173	1.293
MSA WE 2003	1.407	1.368	1.677	1.265	1.049	1.344

Region-Year	Post-operative	Allergy	Vision	Maternity	Other	All Physician
MSA NE 1996	1.000	1.000	1.000	1.000	1.000	1.000
MSA NE 1997	0.948	0.940	0.945	1.102	0.780	0.951
MSA NE 1998	0.980	1.388	1.059	1.089	0.889	0.990
MSA NE 1999	1.018	1.293	1.057	1.196	0.873	1.056
MSA NE 2000	1.069	1.321	0.932	1.225	0.839	1.118
MSA NE 2001	1.237	1.528	1.129	1.259	0.969	1.206
MSA NE 2002	1.271	1.752	1.184	1.104	1.164	1.214
MSA NE 2003	1.327	1.541	1.356	1.516	1.390	1.271
MSA MW 1996	0.892	1.291	0.991	1.073	0.852	0.925
MSA MW 1997	0.899	1.021	0.874	1.190	0.682	0.966
MSA MW 1998	1.017	1.191	0.984	1.138	1.000	0.989
MSA MW 1999	1.247	1.362	1.110	1.325	0.811	1.098
MSA MW 2000	1.166	1.308	1.117	1.139	0.888	1.120
MSA MW 2001	1.260	1.788	1.055	1.239	1.194	1.246
MSA MW 2002	1.492	1.465	1.262	1.228	1.360	1.371
MSA MW 2003	1.500	1.624	1.460	1.541	1.352	1.399
MSA SE 1996	0.988	1.092	1.001	1.226	0.842	0.971
MSA SE 1997	0.934	1.117	0.972	1.099	0.792	0.923
MSA SE 1998	0.931	1.026	0.990	1.023	0.893	0.985
MSA SE 1999	1.052	1.106	0.993	0.856	0.879	0.994
MSA SE 2000	1.103	1.181	1.161	1.217	0.788	1.088
MSA SE 2001	1.205	1.461	1.152	1.209	1.090	1.188
MSA SE 2002	1.329	1.139	1.213	1.467	1.216	1.269
MSA SE 2003	1.333	1.689	1.289	1.439	1.178	1.306
MSA WE 1996	1.047	0.879	1.173	1.370	0.967	1.007
MSA WE 1997	1.211	1.338	1.149	1.293	0.840	1.088
MSA WE 1998	1.146	1.045	1.133	1.346	1.073	1.080
MSA WE 1999	1.331	1.285	1.114	1.199	1.013	1.166
MSA WE 2000	1.326	1.760	1.278	1.304	1.344	1.272
MSA WE 2001	1.396	1.542	1.402	1.680	1.107	1.393
MSA WE 2002	1.324	1.402	1.468	1.424	1.384	1.293
MSA WE 2003	1.402	1.527	1.291	1.413	1.178	1.344

Region Region-Year	Checkup	Diagnosis Treatment	Surgical	Non-Surgical	Psych-iatric	All Physician
NON-MSA 1996	0.890	0.859	1.061	0.955	0.767	0.915
NON-MSA 1997	0.889	0.868	1.203	0.966	0.604	0.922
NON-MSA 1998	0.948	0.954	1.283	1.036	0.666	0.988
NON-MSA 1999	1.056	1.040	1.306	1.130	0.824	1.073
NON-MSA 2000	1.128	1.094	1.382	1.186	0.874	1.141
NON-MSA 2001	1.240	1.201	1.611	1.120	0.930	1.189
NON-MSA 2002	1.279	1.296	1.484	1.152	0.996	1.250
NON-MSA 2003	1.350	1.335	1.663	1.210	0.907	1.299

Region-Year	Post-operative	Allergy	Vision	Maternity	Other	All Physician
NON-MSA 1996	0.907	1.010	0.890	1.223	0.804	0.915
NON-MSA 1997	0.959	0.977	1.007	0.989	0.945	0.922
NON-MSA 1998	1.079	1.144	0.930	0.886	0.872	0.988
NON-MSA 1999	1.029	1.014	1.055	1.095	0.949	1.073
NON-MSA 2000	1.169	1.225	1.115	1.231	0.935	1.141
NON-MSA 2001	1.199	1.158	1.295	1.229	0.908	1.189
NON-MSA 2002	1.273	1.519	1.130	1.684	1.158	1.250
NON-MSA 2003	1.348	1.473	1.315	1.490	1.010	1.299

relatively flat over this period while the share of non-surgical major procedure visits has increased significantly from 25% of office-based care to almost 32% of office-based care. Most of the other shares have remained relatively flat over time with the exceptions of maternity care and vision care which have declined over time. Maternity care's share of total physician expenditures has fallen from almost 5% of expenditures to slightly more than 3% of expenditures. Vision care began as very small share of expenditures and fell from 2.36% to slightly more than 1.5% of expenditures.

Table 5 reports the EC-level physician care multi-lateral prices over this period for the five major regions. The West region begins the period with highest price level for total office-based physician visits. The West also has the highest average price level over the period. However, the Midwest has the highest rate of increase at approximately 6.4% per year, and ends the period with the highest price level. Non-MSAs begin the period with lowest price level while the Southeast has the lowest price average price level over the period and the Northeast finishes the period with the lowest price level. The northeast has the lowest rate of increase of any region in the country at 3.3% per year which is almost a full point lower than the West, the region with second lowest inflation rate.

There are dramatic inflation rate differences across services. For instance, maternity care in the West rises at a rate of less than 1% per year, whereas surgical care increases nearly 10% per year in the Southeast. Surgical care has the highest inflation rate in four of the five regions, and in the West surgical care has the second highest inflation rate relative only to allergy care. Psychotherapeutic care has the lowest inflation rate in three of the five regions, but allergy care and maternity care have the lowest rates in the Midwest and the West respectively.

2.4 Office-based Non-Physician Care

Office-based non-physician services are defined as office-based care where the patient reports seeing a non-physician during the visit. These services are compared with the non-physician services account from the NHA. Office-based non-physician care services are estimated at the EC-level. Expenditure classes are defined using the medical care provider type of the visit. Although procedures and visit categories are reported for non-physician care, neither is used to define an expenditure class. Non-physician medical care provider types identified by the MEPS include technicians, social workers and occupational therapists, nurse practitioners, chiropractors, physical therapists, physician assistants, and psychologists.

Office-based non-physician care visits are pooled with hospital outpatient non-physician care in order to increase the precision of the outpatient visits. Outpatient events are associated with the exact same information as the office-based care, and thus outpatient events are categorized using the same procedure as above. See the section on Hospital care for a more detailed description of how outpatient care is combined with office-based care.

Hedonic regressions are performed separately for each expenditure class service. In order to control for product heterogeneity, the hedonic regressions include statistical controls for product types. Some types of services provided during a non-physician visit are controlled by including ICD-9 condition code dummy variables in the hedonic regressions for each event. Unlike the physician care services these dummy variables are not relied upon to identify the type of physician performing the visit. In addition to the insurance, demographic and region-year controls included in the standard regressions, office-based non-physician regressions also include statistical controls for visit characteristics. The hedonic regressions for all non-physician services include statistical controls for the type and number of procedures performed at a visit. These procedures are neither exhaustive nor mutually exclusive, and in-

Table 2.6: Non-Physician Expenditure Shares

Year	Chiro-practor	Nurse Pract.	Optom-etrist	Psych-ologist	Tech-nician	Physical Therapist	Social Worker	Other
1996	0.096	0.182	0.058	0.080	0.212	0.191	0.047	0.134
1997	0.118	0.214	0.056	0.074	0.209	0.170	0.050	0.109
1998	0.133	0.186	0.058	0.092	0.219	0.193	0.028	0.093
1999	0.124	0.158	0.056	0.089	0.239	0.153	0.035	0.146
2000	0.138	0.210	0.042	0.078	0.225	0.177	0.039	0.091
2001	0.106	0.225	0.046	0.067	0.244	0.176	0.038	0.098
2002	0.102	0.216	0.049	0.048	0.288	0.164	0.020	0.113
2003	0.110	0.194	0.038	0.045	0.279	0.173	0.035	0.126

clude Xrays, MRIs, chemo-therapy, and/or physical therapy. Non-physicians do not perform surgeries, and thus the surgeries are not included as control variables in the regressions. All non-physician visits also include dummy variables used to identify the reported visit categories.

Table 6 reports the share of total non-physician expenditures on each EC-level non-physician service. Technicians, nurse practitioners and physical therapists account for most of the spending on non-physician care. In addition to representing a large share of total non-physician expenditures, the share of technician care has risen from approximately 21% of non-physician expenditures in 1996, to almost 28% in 2003. This trend occurs at the same time that non-surgical procedure spending for physicians has experienced increases. The trend for nurse practitioners, physical therapists and many of the other service types remains relatively flat over this period. Exceptions include optometrist care which has steadily declined as a share of total non-physician care over the period from 5.8% in 1996 to 3.8% in 2003. This pattern occurs parallel to the decline in the share of vision care spending for physician services. Psychologist visits have undergone a downward shift in utilization patterns beginning in 2001. Prior to 2001, psychologist expenditures never represented less than 7% of medical spending, but in 2002 and 2003 psychological visits

have represented less than 5% of total non-physician care spending.

Table 2.7: Non-Physician EC-level Prices

Year	Chiro-practor	Nurse Pract.	Optom-etrist	Psych-ologist	Tech-nician	Total Non-Dr
MSA NE 1996	1	1	1	1	1	1
MSA NE 1997	0.906	1.084	0.712	0.892	0.838	0.918
MSA NE 1998	0.879	0.823	0.797	0.941	0.855	0.883
MSA NE 1999	0.899	1.059	0.797	1.059	1.185	1.022
MSA NE 2000	0.858	1.368	0.901	1.122	0.898	1.024
MSA NE 2001	0.979	1.452	0.979	1.243	1.102	1.132
MSA NE 2002	1.108	1.559	1.03	1.355	1.16	1.208
MSA NE 2003	0.985	1.547	0.992	1.214	1.015	1.116
MSA MW 1996	0.825	0.847	1.061	0.895	0.888	0.933
MSA MW 1997	0.728	0.974	0.858	1.08	0.828	0.922
MSA MW 1998	0.78	1.051	0.82	1.072	0.959	0.996
MSA MW 1999	0.853	1.296	0.917	1.215	0.931	1.011
MSA MW 2000	0.908	1.248	0.753	1.163	1.222	1.096
MSA MW 2001	0.900	1.208	0.838	1.082	1.077	1.091
MSA MW 2002	1.016	1.461	0.803	1.202	1.093	1.145
MSA MW 2003	0.996	1.583	0.885	1.31	1.087	1.158
MSA SE 1996	1.009	0.769	0.909	0.93	0.895	0.88
MSA SE 1997	0.679	0.804	0.766	1.053	0.817	0.814
MSA SE 1998	0.911	0.93	0.662	1.015	0.728	0.83
MSA SE 1999	0.95	0.899	0.74	0.85	0.766	0.898
MSA SE 2000	0.906	1.153	0.739	0.901	0.85	0.952
MSA SE 2001	1.034	1.368	0.754	1.112	1.095	1.102
MSA SE 2002	1.182	1.177	0.871	1.117	1.053	1.123
MSA SE 2003	1.071	1.479	0.89	1.196	1.09	1.166
MSA WE 1996	0.788	1.154	1.106	0.814	0.95	0.991
MSA WE 1997	0.983	1.085	0.859	0.992	1.094	1.017
MSA WE 1998	0.811	1.14	0.835	0.902	0.866	0.952
MSA WE 1999	0.732	1.518	0.915	1.215	1.166	1.102
MSA WE 2000	1.007	1.768	0.923	1.167	1.011	1.162
MSA WE 2001	1.140	2.054	0.987	1.289	1.459	1.395
MSA WE 2002	1.083	1.588	1.06	1.219	1.248	1.261
MSA WE 2003	1.049	1.74	0.843	1.076	1.406	1.298

MSA-Northeast	MSA-Midwest	MSA-Southeast	MSA-West	Non-MSA
		Physical Therapist		
1	1.174	0.897	1.064	0.927
0.916	1.037	0.772	1.01	0.779
0.872	1.109	0.937	1.109	0.998
0.974	0.889	1.017	0.943	0.937
0.981	1.116	1.089	1.156	0.991
1.095	1.132	1.122	1.233	1.15
1.212	1.102	1.34	1.373	1.142
1.053	1.056	1.12	1.182	1.144
		Social Worker		
1	0.782	1.061	0.956	0.938
1.002	1.133	1.096	0.983	0.699
0.899	1.003	0.774	0.737	0.607
1.021	1.293	0.754	0.688	0.674
1.628	0.89	1.181	0.793	1.257
0.727	1.273	1.026	0.983	1.523
0.783	1.079	1.033	1.009	0.938
1.1	1.549	1.195	1.335	1.212
		Other		
1	0.901	0.801	0.988	0.863
0.913	0.904	0.796	0.909	0.612
0.97	1.092	0.677	0.917	0.661
0.836	0.9	1.115	1.096	0.768
0.792	0.959	0.802	0.986	1.217
1.138	1.122	0.914	1.192	1.015
1.014	1.158	1.048	1.029	0.9
0.998	0.963	1.126	1.143	1.127

Year	Chiro-practor	Nurse Pract.	Optom-etrist	Psych-ologist	Tech-nician	Total N-P
NON-MSA 1996	0.765	0.832	0.676	0.882	0.877	0.852
NON-MSA 1997	0.817	0.874	0.766	0.875	0.802	0.79
NON-MSA 1998	0.781	0.921	0.805	0.827	0.856	0.848
NON-MSA 1999	0.835	0.946	0.728	0.958	0.981	0.894
NON-MSA 2000	0.908	1.001	0.741	1.179	1.027	1.011
NON-MSA 2001	0.944	1.18	1.003	1.031	1.008	1.072
NON-MSA 2002	0.929	1.421	0.872	1.114	1.063	1.094
NON-MSA 2003	0.931	1.411	0.841	1.118	1.167	1.155

Table 7 presents the non-physician EC-level multi-lateral prices. Although price movements for non-physician services appear much more uneven than in the more homogenously defined physician services, we are heartened by the general pattern consistencies observed between physician and non-physician visits. The West region has the highest average price level for non-physician services over the period, as it did in the physician visits. The Northeast experiences the lowest rate of increase of all regions at slightly less than 1.5% increase per year. This pattern is also consistent with the findings in the physician visits. The West begins the period with the second-highest price level, slightly lower than the Northeast, and finishes the period with the highest price level of all regions.

Non-physician services begin the period with a price decline. Prices decline between 1996 and 1997 in four of the five regions, and decline at some point between 1996 and 1998 for all five regions. The rate of price increases for non-physician services is much slower than the rate of price increases of physician services. The two regions that experience the highest rates of inflation in non-physician services, Non-MSA and the Southeast, experience inflation rates of 4.4% and 3.9% rate per year, respectively. In contrast the physician services experienced inflation rates above 6.5% per year over the same period.

The rates of price increases within non-physician EC-level services are hard

to determine. Observed price spikes in a particular year may explain most of the total increase. However, systematic patterns emerge. Nurse practitioners experience the fastest rate of increase in four of the five regions and the second highest rate of increase in the Midwest region. In addition, either optometric services or chiropractic care account for the service with the lowest rate of increase in every region. Moreover, those services that have low rates of increase appear to have flat or even decreasing prices over the period, whereas those services with high rates of increase consistently have rates of increase between 3 - 10 % per year.

2.5 Dental Services

Dental care is the largest fraction of office-based non-physician care. It is therefore reported separately from the other types of non-physician care in both the MEPS and the NHA. The MEPS provides much more detail concerning the procedures and the types of providers seen during dental visits than is provided for other types of non-physician services. However, dental visits are not associated with ICD-9 disease codes as the overwhelming fraction of other medical care services are. Thus, the types of conditions treated at each visit must be controlled using a combination of the procedures and visit characteristics.

A non-trivial fraction of dental care spending and utilization is represented by orthodontic care, which has highly irregular financing. A large fraction of orthodontic care is paid upfront with a large fixed cost. Although maintenance care is provided on a regular basis over an extended period of potentially years, these visits do not typically involve subsequent payments. Orthodontic prices are therefore not defined over a single visit like other types of dental care, but is rather defined over all services used in straightening teeth.

Dental care services are defined at the ELI-level, which is the most disaggregated service level. For the reasons described above, the ELI-level dental care

Table 2.8: Dental Care EC-level Expenditure Shares

Year	General	Surgery	Cosmetic	Orthodontics
1996	0.551	0.133	0.212	0.103
1997	0.549	0.130	0.235	0.086
1998	0.566	0.114	0.232	0.088
1999	0.533	0.127	0.232	0.108
2000	0.523	0.112	0.218	0.146
2001	0.544	0.120	0.206	0.130
2002	0.549	0.119	0.240	0.091
2003	0.557	0.108	0.231	0.104

services are defined using the type of dental provider seen and the service characteristics provided by the MEPS. The services include whether the patient received a general exam, a filling, crowns, bridges, X-rays, orthodontic care, oral surgery, treatment for an abscessed tooth, or a root canal. Other services include teeth whitening, implants, and general teeth cleaning. The binary service characteristics that define the ELI services are listed in Appendix 1.

In addition to the standard insurance and demographic controls included in each of the hedonic regressions, dental care services also include controls for the specific types of services performed at visits. For instance, cosmetic service visits include controls for whether the visit whitened teeth or inserted an implant. Surgical visits include whether the surgery was gum surgery or other types of surgery. All service types control for whether the patient saw a general dentist or a specialist such as an endodentist or a periodontist. In addition, orthodontic services include a variable for whether the visit was part of a "fixed-fee" arrangement.

The EC-level service shares for all of dental care expenditures are presented in Table 8. General dental services represent more than half of dental care spending. Somewhat surprising is the importance of cosmetic services which represents more than 20% of dental care. All expenditure shares remain relatively flat over this period.

Table 9 presents the EC-level dental care multi-lateral prices for the period 1996-2003. Consistent with the results from the physician and non-physician office-based visits, the West region has the highest price level for overall dental care prices. The West region begins and ends the period with the highest price level of any other region. The non-MSA region has the overall lowest price level of any of the regions and also begins and ends the period with lowest price level.

The rate of dental care price increases is brisk. None of the regions experience less than 5.5% inflation, and the Southeast experiences more than 9% inflation per year. The regional ordering of rates of increase for dental services is consistent with the office-based non-physician services. Dental care price increases are the fastest in the Southeast and the Non-MSA regions and the slowest in the Northeast.

The service type that experiences the largest price change varies significantly by region. Depending on the region, any one of the services may represent either the largest or the smallest price change over the period, although general dental services never represents the largest price change and dental surgery never represents the smallest price change. The price changes of individual services can vary quite dramatically. Dental surgery in the Southeast increases at more than 16% per year, and the increases in these prices occur steadily over the period.

Table 2.9: Dental Care EC-level Prices

Year	General	Surgery	Cosmetic	Orthodontics	Dental
MSA NE 1996	1	1	1	1	1
MSA NE 1997	1.039	1.079	0.937	0.925	1.015
MSA NE 1998	1.102	1.179	1.363	0.892	1.157
MSA NE 1999	1.225	1.237	1.268	1.182	1.236
MSA NE 2000	1.229	1.589	1.24	1.449	1.302
MSA NE 2001	1.269	1.532	1.15	1.912	1.344
MSA NE 2002	1.326	1.612	1.374	1.463	1.39
MSA NE 2003	1.438	1.334	1.32	1.804	1.443
MSA MW 1996	0.878	1.165	0.893	1.395	0.972
MSA MW 1997	0.914	1.16	0.997	1.015	0.975
MSA MW 1998	1.05	1.456	1.046	0.844	1.073
MSA MW 1999	1.073	1.33	1.147	1.309	1.146
MSA MW 2000	1.176	1.338	1.116	1.419	1.211
MSA MW 2001	1.195	1.528	1.18	1.546	1.275
MSA MW 2002	1.317	1.736	1.424	1.256	1.385
MSA MW 2003	1.46	1.765	1.593	1.503	1.536
MSA SE 1996	0.914	0.858	0.866	0.862	0.896
MSA SE 1997	0.95	1.084	1.105	0.87	0.996
MSA SE 1998	1.086	1.181	1.077	0.735	1.069
MSA SE 1999	1.059	1.595	1.404	1.018	1.192
MSA SE 2000	1.171	1.432	1.329	1.548	1.286
MSA SE 2001	1.196	1.371	1.264	1.521	1.273
MSA SE 2002	1.349	1.571	1.603	1.438	1.448
MSA SE 2003	1.415	1.996	1.61	1.69	1.555
MSA WE 1996	1.143	1.284	1.151	1.34	1.187
MSA WE 1997	1.18	1.365	1.31	1.082	1.227
MSA WE 1998	1.303	1.657	1.418	1.252	1.366
MSA WE 1999	1.266	1.446	1.439	1.956	1.415
MSA WE 2000	1.342	1.367	1.324	1.684	1.389
MSA WE 2001	1.382	1.764	1.306	1.442	1.421
MSA WE 2002	1.471	1.7	1.605	1.408	1.531
MSA WE 2003	1.708	1.75	1.839	1.536	1.737

Year	General	Surgery	Cosmetic	Orthodontics	Dental
NON-MSA 1996	0.806	0.816	0.698	0.74	0.782
NON-MSA 1997	0.88	1.089	1.033	0.819	0.935
NON-MSA 1998	0.863	1.103	1.028	0.705	0.912
NON-MSA 1999	0.94	1.242	1.235	1.034	1.053
NON-MSA 2000	1.116	1.464	1.137	1.564	1.222
NON-MSA 2001	1.163	1.376	1.134	1.408	1.214
NON-MSA 2002	1.201	1.459	1.309	1.11	1.251
NON-MSA 2003	1.172	1.718	1.364	1.424	1.302

2.6 Hospital Care

Hospital care services are extremely heterogeneous but infrequently consumed events. The MEPS reports three types of hospital care: Emergency Room (ER) Care, Hospital Outpatient Care and Inpatient Care. These services are very heterogeneous, which is exemplified by the fact that they have different event-type definitions. ER and outpatient care events are defined as visits, whereas inpatient events are defined as stays, or nights. Because of the extreme level of service type heterogeneity in hospital care services, these broad EC-level services are disaggregated into Strata using event characteristics. The structure of the hospital service hierarchy is defined in Appendix 1.

The reported event characteristics used to define hospital Strata depend on the expenditure class considered. Outpatient and ER services define a Stratum by whether the patient saw a physician and whether the visit involved a major procedure. Inpatient care defines Strata by whether the stay includes an operation. Sometimes, a relationship between ER and inpatient care exists. If inpatient care was initiated in the ER, then the dates identifying when care began and ended for both the inpatient and ER care are used to identify the relationship.

2.6.1 ER and Inpatient Care

The estimation of ER and inpatient hospital events proceeds similarly to the estimation procedure for other event types. Each event is assigned to a Stratum based on event characteristics. The event characteristics used to assign an ER event into a Stratum include whether the category of visit is an emergency or non-emergency. The characteristics of inpatient stays used to assign an event into a Stratum include whether an operation was performed at the event. In addition to the event characteristics used to assign events into Strata, ER visits are linked to hospital stays by matching the inpatient admission date to the ER visit date. For those visits with matching dates, the expenditure information from the ER is added to the inpatient information and both events are defined as an inpatient event.

The statistical controls included in the hedonic pricing regression for inpatient and emergency room care include the standard disease type, demographic and insurance controls included in most all of the hedonic regressions. Additional controls for whether an ER visit included lab tests, X-rays, surgeries and other major procedures were also included in the hedonic regressions for Emergency Room care. Inpatient care included controls for the length of stay and whether the admission was initiated at the ER.

2.6.2 Outpatient Care

MEPS reports the exact same information for outpatient care as it does for office-based care. We exploit this information parallel in order to assign outpatient events to strata and estimate their price. Outpatient care is pooled with office-based care. The criterion used to assign office-based care into Expenditure classes is the exact same criterion used to assign outpatient care into strata. For outpatient care that included a trip to the physician, events are assigned into strata using the category of the visit and whether the visit involved a surgical or another non-surgical major

Table 2.10: Hospital Service Expenditure Shares

Year	ER	Inpatient	Outpatient Doctor	Outpatient Non-Dr
1996	0.054	0.747	0.128	0.072
1997	0.059	0.729	0.130	0.082
1998	0.055	0.722	0.151	0.072
1999	0.055	0.751	0.131	0.063
2000	0.054	0.765	0.118	0.063
2001	0.066	0.729	0.132	0.073
2002	0.066	0.716	0.135	0.082
2003	0.060	0.737	0.132	0.072

procedure. For outpatient care from non-physicians, the medical care provider type is used to assign the outpatient visit to the strata. Once the stratum type has been assigned to the event, the price of the event is estimated by including interactions of whether the event occurred in the hospital with year dummies and region dummies. Thus, the hedonic regression for a hospital outpatient checkup event would include twelve hospital interactions, five region interactions and seven year interactions. The price of the outpatient event would be identified using the hospital interactions and the baseline office visit event.

2.6.3 Combined Hospital Services

Table 10 presents the hospital service expenditure shares. Inpatient care represents the vast majority of expenditures at more than 70% of hospital spending in every year, while ER spending represents the smallest fraction of spending. The share of service spending remains almost constant over the period for all of the service types considered.

Table 2.11: Hospital EC-level Prices

Region-Year	Emergency Room	Inpatient	Outpatient Non-Dr	Outpatient Doctor	All Hospital
MSA NE 1996	1	1	1	1	1
MSA NE 1997	0.970	0.880	1.068	0.840	0.898
MSA NE 1998	0.969	1.070	0.794	0.973	1.031
MSA NE 1999	1.046	1.246	0.966	1.037	1.186
MSA NE 2000	1.119	1.022	0.868	0.953	1.007
MSA NE 2001	1.063	1.114	0.908	1.090	1.092
MSA NE 2002	1.268	1.299	0.979	1.158	1.252
MSA NE 2003	1.495	1.595	0.865	1.290	1.477
MSA MW 1996	1.045	1.182	1.070	1.013	1.145
MSA MW 1997	1.122	1.177	1.300	1.005	1.165
MSA MW 1998	1.078	1.086	1.054	1.155	1.097
MSA MW 1999	1.222	1.191	0.996	1.101	1.167
MSA MW 2000	1.256	1.252	1.292	0.985	1.221
MSA MW 2001	1.408	1.309	1.046	1.163	1.276
MSA MW 2002	1.53	1.397	1.078	1.409	1.382
MSA MW 2003	1.636	1.718	1.116	1.498	1.632
MSA SE 1996	0.918	0.997	1.009	1.134	1.009
MSA SE 1997	1.007	1.056	1.160	1.018	1.053
MSA SE 1998	1.168	1.003	0.802	1.237	1.030
MSA SE 1999	1.025	1.139	0.827	1.148	1.111
MSA SE 2000	1.211	1.187	0.956	1.175	1.169
MSA SE 2001	1.207	1.197	1.065	1.223	1.192
MSA SE 2002	1.362	1.345	1.035	1.382	1.327
MSA SE 2003	1.429	1.490	1.121	1.621	1.475
MSA WE 1996	1.096	1.016	0.953	0.814	0.990
MSA WE 1997	1.151	1.177	1.233	0.797	1.124
MSA WE 1998	1.163	1.107	0.776	0.948	1.062
MSA WE 1999	1.191	1.200	0.938	0.916	1.143
MSA WE 2000	1.121	1.143	0.930	0.919	1.093
MSA WE 2001	1.451	1.257	1.142	0.994	1.225
MSA WE 2002	1.377	1.342	0.985	0.969	1.270
MSA WE 2003	1.576	1.602	1.089	1.097	1.495

Region-Year	Emergency Room	Inpatient	Outpatient Non-Dr	Outpatient Doctor	All Hospital
NON-MSA 1996	1.023	1.065	0.936	1.055	1.053
NON-MSA 1997	1.035	1.067	1.064	0.994	1.057
NON-MSA 1998	0.99	1.07	0.835	1.277	1.074
NON-MSA 1999	1.009	1.166	0.876	1.205	1.139
NON-MSA 2000	0.991	1.166	0.992	1.073	1.132
NON-MSA 2001	1.107	1.177	0.912	1.188	1.154
NON-MSA 2002	1.265	1.336	0.963	1.288	1.292
NON-MSA 2003	1.41	1.502	1.072	1.431	1.449

Table 10 presents EC-level hospital prices. The Midwest has the highest average price-level of any of the five regions. The Midwest both begins and ends the period with the highest price level. The Northeast has the lowest price level of any of the regions, beginning the period with a price level higher than the West region, but finishing the period with the absolute lowest price level.

Many of the regions experienced flat and even decreasing hospital prices in the early part of the period. The Northeast experienced a price decline between 1996 and 1997, and three of the four other regions experienced a decline in prices between 1997 and 1998. The non-MSA region is the only region not to experience a price decline between 1996 and 1998, however prices increased very slowly in the non-MSA over that period at less than 1% per year. After 2000, all of the regions experienced a much faster rate of price increase than did the period prior to 2000. The rate of price increase for all regions after 2000 has been between 7.3% and 12% per year, whereas the rate of increase prior to that period had been between 0-3.5% per year. The West experienced the highest rate of price increase of any of the five regions at more than 6.3% per year. The Non-MSA region experienced the lowest level of price increase at 4.6% price increase.

2.7 Drugs

The MEPS reports detailed prescription information for every drug purchased by respondents to the survey. Unfortunately, prescription events are not comparable across drugs because they vary in strength and quantity. In addition, the same drug may be supplied in different types of forms. For example, prescription strength acetaminophen is supplied as both a syrup for children and a pill for adults. Moreover, previous literature has found that the same molecule of drug administered in the same form, strength and quantity may vary dramatically in price based solely on the manufacturer of the product, or even whether the drug is branded as a generic or name-brand drug by the same manufacturer (see Griliches (1994) and Frank and Salkever (1997)).

In order to address these issues we define a drug by the active ingredient, which the literature generally refers to as the molecule. The molecule associated with the drug identifies the ELI service for drugs. The event of the drug is constructed to be the daily dose of the drug in order to be consistent across drug types. The daily dose is chosen as the unit of choice because all drugs have a daily dose, and the daily dose provides an intuitive therapeutic relationship between the drugs. The total quantity of days is constructed using the prescription information supplied by the MEPS such as the quantity and strength of the drug combined with daily dose information provided by the Mosby's Drug Consult. The daily dose of the drug is allowed to vary by the age, weight and three-digit ICD-9 disease code of the patient.

The stratum and expenditure classes of the molecules are assigned using the therapeutic class of the drug provided by the most recent MEPS surveys. The therapeutic class of the drug is broken into sub-categories. Which category and sub-category defines an expenditure class and a stratum depends on the size of the categories and subcategories, measured in the number of molecules contained in the category. The hierarchy of molecules and their assigned stratum and expenditure

classes are reported in Appendix 1.

The ELI-level service is defined as the unique molecule produced by a manufacturer. If molecules are supplied in multiple forms, such as pills and syrups, then the ELI service distinguishes between forms. The ELI-level regressions include statistical controls for the strength of the molecule in addition to the standard disease type, insurance type and demographic controls included in the regressions for most services. If some ELI services must be pooled for statistical reasons, then dummy variables indicating the manufacturer of the drug are included in the hedonic regressions. If molecules are pooled for statistical reasons, then molecule identifiers are included in the regression in lieu of manufacturer controls.

Table 12 reports the expenditure share of the major EC-level drug types over the period considered. Cardiovascular agents represent the largest share of total drug spending, followed by hormones and Psychotherapeutic medications. Topical agents represent the lowest fraction of spending of any of the major categories of drugs.

The most striking pattern in drug consumption has occurred with Cardiovascular Agents and Anti-Lipid medications. Cardiovascular agents have steadily decreased as a share of total spending from almost 27% of spending in 1996 to less than 20% of spending in 2003. Meanwhile, Anti-Lipid medications have steadily increased their share from approximately 8% of spending in 1996 to more than 13% of spending in 2003 to become the second largest expenditure class of any drug category including hormones and psychotherapeutic medications.

Anti-infective agents appear to have exhibited a shift in consumption from prior to post 1998. Anti-infective medications represented greater than 6% of drug consumption prior to 1998 and fell to 3.2% of drug consumption by 2003. Many of the other drug expenditure class categories remain flat over this period.

Table 13 presents the EC-level drug prices for the major drug categories. In contrast to the prices of other services, regional price differences are very small.

Table 2.12: Expenditure Shares for Drugs

Year	Anti-Infectious	Anti-Lipid	CV Agents	Central Nervous	Analgesics	GI Agents
1996	0.075	0.080	0.269	0.056	0.079	0.086
1997	0.061	0.084	0.248	0.055	0.082	0.077
1998	0.038	0.090	0.240	0.057	0.085	0.084
1999	0.048	0.092	0.243	0.055	0.079	0.073
2000	0.034	0.098	0.218	0.056	0.086	0.073
2001	0.037	0.108	0.204	0.047	0.095	0.090
2002	0.033	0.122	0.199	0.056	0.085	0.095
2003	0.032	0.135	0.199	0.060	0.084	0.113

Year	Hormones	Misc Agents	Nutrition Nutrition	Respiratory Agents	Topical Agents	Psych. Agents
1996	0.144	0.026	0.011	0.063	0.013	0.099
1997	0.148	0.027	0.013	0.075	0.012	0.118
1998	0.156	0.020	0.012	0.075	0.011	0.133
1999	0.166	0.028	0.011	0.085	0.013	0.107
2000	0.161	0.028	0.011	0.084	0.009	0.142
2001	0.145	0.027	0.009	0.099	0.007	0.132
2002	0.143	0.034	0.011	0.090	0.008	0.124
2003	0.124	0.040	0.010	0.072	0.006	0.124

There is little difference in the price levels and inflation rates of drugs across regions. The inflation rate ranges between 4.2% per year in the Midwest and 4.9% per year in the West.

Although regional variability in drug service prices is small, the variability in price changes across drug services can be very large. Miscellaneous agents in the Non-MSA region increase at a rate of less than 2% per year, whereas the Anti-infective agents in the Midwest have price increases of almost 14% per year. Anti-infective medications have had significant price shifts during the period. Anti-infective prices in the Northeast rose from less than 1.09 prior to 1999 to greater than 1.43 after 1998. All regions experience similar price increases for Anti-infective medications.

Analgesics also experiences a price shift during the period, although not as severe as the price shift experienced by Anti-infective medications.

Table 2.13: EC-level Drug Prices

Region -Year	Anti- Infect	Anti- Lipid	CV Agents	CNS Agents	Anal- gesic	G.I. Agent	All Rx
MSA NE 1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MSA NE 1997	1.016	1.048	1.023	1.158	1.054	1.050	1.051
MSA NE 1998	1.089	1.126	1.039	1.322	1.060	1.174	1.086
MSA NE 1999	1.667	1.202	1.143	1.818	1.130	1.194	1.198
MSA NE 2000	1.505	1.243	1.210	1.335	1.075	1.151	1.184
MSA NE 2001	1.435	1.327	1.240	1.387	1.272	1.553	1.286
MSA NE 2002	1.505	1.353	1.227	1.431	1.557	1.318	1.294
MSA NE 2003	1.745	1.316	1.286	1.559	1.414	1.258	1.357
MSA MW 1996	0.968	0.969	0.969	1.026	1.005	1.035	0.997
MSA MW 1997	1.097	1.075	0.997	1.119	1.055	1.089	1.050
MSA MW 1998	1.058	1.095	1.004	1.117	1.062	1.122	1.065
MSA MW 1999	1.304	1.172	1.110	1.333	1.184	1.226	1.159
MSA MW 2000	1.320	1.130	1.121	1.201	1.069	1.154	1.154
MSA MW 2001	1.469	1.251	1.193	1.444	1.162	1.292	1.245
MSA MW 2002	1.594	1.367	1.209	1.507	1.237	1.267	1.293
MSA MW 2003	2.032	1.307	1.241	1.513	1.444	1.187	1.335
MSA SE 1996	1.013	1.037	0.980	1.084	1.027	0.987	0.998
MSA SE 1997	0.977	1.053	1.006	1.060	1.039	1.023	1.029
MSA SE 1998	1.084	1.112	0.988	1.056	1.068	1.120	1.055
MSA SE 1999	1.447	1.211	1.102	1.573	1.080	1.208	1.146
MSA SE 2000	1.449	1.156	1.139	1.282	0.999	1.211	1.165
MSA SE 2001	1.559	1.233	1.166	1.483	1.179	1.251	1.248
MSA SE 2002	1.599	1.346	1.212	1.400	1.189	1.242	1.279
MSA SE 2003	1.772	1.326	1.303	1.408	1.358	1.199	1.341
MSA WE 1996	0.964	0.984	0.942	0.949	1.027	1.030	0.979
MSA WE 1997	1.032	1.056	0.969	1.140	1.037	1.078	1.046
MSA WE 1998	1.076	1.137	1.000	1.073	1.024	1.169	1.057
MSA WE 1999	1.414	1.176	1.116	1.396	1.153	1.123	1.148
MSA WE 2000	1.367	1.179	1.105	1.318	1.195	1.128	1.186
MSA WE 2001	1.326	1.191	1.207	1.506	1.330	1.293	1.266
MSA WE 2002	1.396	1.295	1.194	1.454	1.367	1.223	1.289
MSA WE 2003	1.862	1.331	1.248	1.513	1.556	1.268	1.366

Region-Year	Hormones	Misc Agent	Nutrition	Respiratory	Topical	Psych	All Rx
MSA NE 1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MSA NE 1997	0.998	1.180	1.016	1.165	1.099	1.161	1.051
MSA NE 1998	1.073	1.168	1.230	1.138	1.161	1.167	1.086
MSA NE 1999	1.267	1.293	1.220	1.161	1.288	1.342	1.198
MSA NE 2000	1.246	1.223	1.508	1.292	1.398	1.249	1.184
MSA NE 2001	1.401	1.226	1.510	1.412	1.405	1.513	1.286
MSA NE 2002	1.513	1.210	1.423	1.473	1.486	1.372	1.294
MSA NE 2003	1.731	1.203	1.547	1.683	1.432	1.676	1.357
MSA MW 1996	1.002	1.018	1.141	0.984	1.007	1.053	0.997
MSA MW 1997	1.038	1.137	1.165	1.080	1.194	1.143	1.050
MSA MW 1998	1.059	1.156	1.013	1.118	1.298	1.205	1.065
MSA MW 1999	1.134	1.261	1.107	1.155	1.323	1.464	1.159
MSA MW 2000	1.254	1.045	1.353	1.226	1.354	1.431	1.154
MSA MW 2001	1.445	1.128	1.596	1.342	1.379	1.491	1.245
MSA MW 2002	1.567	1.168	1.821	1.469	1.629	1.515	1.293
MSA MW 2003	1.701	1.405	1.781	1.555	1.511	1.580	1.335
MSA SE 1996	0.918	1.000	1.038	1.053	1.014	1.033	0.998
MSA SE 1997	1.008	1.117	1.086	1.078	1.157	1.107	1.029
MSA SE 1998	1.050	1.169	1.202	1.057	1.223	1.166	1.055
MSA SE 1999	1.129	1.042	1.264	1.148	1.204	1.300	1.146
MSA SE 2000	1.207	1.124	1.339	1.208	2.406	1.406	1.165
MSA SE 2001	1.388	1.270	1.796	1.484	1.296	1.471	1.248
MSA SE 2002	1.587	1.112	1.946	1.477	1.457	1.462	1.279
MSA SE 2003	1.690	1.282	1.765	1.730	1.513	1.580	1.341
MSA WE 1996	0.918	1.057	1.015	1.011	1.139	1.000	0.979
MSA WE 1997	1.085	1.066	1.053	1.130	1.207	1.156	1.046
MSA WE 1998	1.017	1.031	1.212	1.118	1.043	1.187	1.057
MSA WE 1999	1.109	1.153	1.372	1.150	1.322	1.404	1.148
MSA WE 2000	1.244	1.125	1.222	1.308	1.639	1.505	1.186
MSA WE 2001	1.507	1.257	1.302	1.431	1.421	1.463	1.266
MSA WE 2002	1.552	1.166	1.641	1.573	1.432	1.528	1.289
MSA WE 2003	1.652	1.225	2.069	1.752	1.527	1.690	1.366

Region-Year	Hormones	Misc Agent	Nutrition	Respiratory	Topical	Psych	All Rx
NON-MSA 1996	0.986	1.049	1.179	0.939	1.167	1.025	1.010
NON-MSA 1997	1.066	1.148	1.194	1.093	1.108	1.099	1.045
NON-MSA 1998	1.086	1.066	1.254	1.086	1.274	1.213	1.073
NON-MSA 1999	1.137	1.109	1.300	1.172	1.482	1.355	1.144
NON-MSA 2000	1.215	1.056	1.269	1.237	1.548	1.446	1.176
NON-MSA 2001	1.401	1.115	1.523	1.369	1.413	1.505	1.241
NON-MSA 2002	1.619	1.178	1.520	1.463	1.444	1.501	1.293
NON-MSA 2003	1.797	1.192	1.751	1.589	1.514	1.622	1.345

Region -Year	Anti-Infect	Anti-Lipid	CV Agents	CNS Agents	Analgesic	G.I. Agent	All Rx
NON-MSA 1996	1.061	1.022	0.989	1.026	1.025	1.038	1.010
NON-MSA 1997	1.109	1.093	0.991	1.015	1.031	1.068	1.045
NON-MSA 1998	1.015	1.143	1.005	1.134	1.094	1.119	1.073
NON-MSA 1999	1.490	1.185	1.104	1.358	1.082	1.107	1.144
NON-MSA 2000	1.415	1.192	1.188	1.311	1.090	1.104	1.176
NON-MSA 2001	1.504	1.216	1.166	1.400	1.229	1.323	1.241
NON-MSA 2002	1.581	1.368	1.194	1.489	1.313	1.246	1.293
NON-MSA 2003	1.778	1.327	1.246	1.465	1.448	1.276	1.345

Table 2.14: Home Health Care Group-level Prices

Year	Northeast	Midwest	Southeast	West	Non-MSA
1996	1.000	0.573	0.756	0.747	0.720
1997	0.714	0.614	0.643	0.847	0.648
1998	0.770	0.509	0.640	0.680	0.542
1999	0.811	0.559	0.565	0.472	0.683
2000	0.859	0.637	0.571	0.832	0.598
2001	1.034	0.634	0.653	1.403	0.767
2002	1.107	0.815	0.758	0.667	0.744
2003	0.914	0.697	0.688	0.731	0.665

2.8 Home Health

Home health care is defined as a visit by any medical care provider to the patient's home. Home health services are recorded as months of care by the MEPS. A home health month includes indicator variables for whether a type of provider visited the home, such as a physician, a nurse practitioner, a social worker, a physical therapist or even a volunteer. The MEPS also reports information concerning the frequency of visits by the medical care provider, broadly what services were performed during the visits and whether the medical care provider works for an agency.

Home health care is a unique and infrequently consumed event. Home health care is therefore estimated at the group level. Thus, all information concerning the type of medical care provider, the frequency of visits and what occurred during the visit are included as statistical controls in the single hedonic regression performed to estimate home health care prices. The multi-lateral group-level home health care prices are reported in Table 14.

Table 14 presents home health care multi-lateral group-level prices. As with non-physician care services, home health care service inflation rates are difficult to determine with confidence, as price changes are a bit uneven. However, trends emerge. Prices appear to remain relatively flat, and even decrease over the period.

Four of the five regions experience prices that are lower in 2003 than they were in 1996. The Midwest region is the only region with an increase in prices, and the level of increase was less than 2.7% per year. The price levels for care in the Northeast appears significantly higher than price levels in other regions of the country.

2.9 Durable and Non-durable Supplies

Medical care supplies include eyeglasses, bandages, wheelchairs, hearing aids, syringes, and other medical care equipment. The MEPS reports most of these supplies as 'other' medical care services, but reports diabetic equipment as if it were a pharmaceutical service. The MEPS typically categorizes other medical care supplies into approximately eight categories that include ambulance, eyeglasses and contact lenses, hearing devices, medical equipment, orthopedic devices, and other. Other supplies typically have a text description of what 'Other' means, and most other services can reasonably be assigned to one of the assigned categories. For example, canes and wheelchairs and are assigned to orthopedic devices, and towels are included in disposable supplies. None of the supplies are associated with an ICD-9 code, and thus the disease the supply is used to treat is often unknown.

ELI-level services are defined by supply category. In addition to the standard controls for demographics and insurance type, those services that combine supply categories include controls for the types of categories included. For example, medical equipment includes controls for whether the medical equipment is a hearing device.

Table 15 reports the group-level multi-lateral prices for durable and non-durable supplies. The Midwest region has the highest overall price level for durable supplies. They begin the period with the second-highest price level and end the period with the highest price level of any of the five regions. The Southeast has the lowest price level for durable supplies. They begin and end the period with the lowest price level.

Table 2.15: Durable and Non-Durable Supply Group-level Prices

Durable				
Northeast	Midwest	Southeast	West	Non-MSA
1	1.149	0.963	1.242	1.008
0.990	0.985	1.057	1.107	0.955
1.148	0.924	1.012	1.007	0.981
1.006	1.035	0.960	1.161	1.170
1.185	1.171	0.994	1.074	1.009
1.084	1.218	1.108	1.208	1.120
1.246	1.357	1.265	1.156	1.230
1.265	1.305	1.137	1.137	1.218
Non-Durable				
Northeast	Midwest	Southeast	West	Non-MSA
1	0.799	0.701	0.906	0.990
1.147	1.236	0.873	0.894	0.924
0.964	0.845	0.825	0.836	0.987
1.820	1.684	1.095	1.352	1.489
1.457	0.866	1.122	0.819	0.934
1.353	1.115	1.314	2.090	1.483
0.979	1.192	1.369	0.997	1.042
1.215	1.158	1.478	1.496	0.854

Price increases in durable supplies have been relatively mild as compared to other services groups. No region faces price increases faster than the 3.3% increase per year experienced by the Northeast, and prices actually decrease in the West over the period. Although part of the West's decreasing prices is explained by the unusually high prices faced in 1996, the region faces extremely flat prices for durable supplies throughout the period.

The Northeast region faces the highest average price level for non-durable supplies. They begin the period with the highest price level but end the period with prices significantly lower than either the Southeast or the West regions. The non-MSA region has the lowest average price level for non-durable supplies. The non-MSA region begins the period with one of the highest price levels, but ends the period with the lowest price level of any region.

Non-durable supply prices appear to change somewhat unevenly making the rate of price increase for these services difficult to determine. However, there appear to be large differences in the price changes faced by different regions. The Southeast appears to experience a relatively steady 13.8% rate of price increase over this period which is the largest price change of any region. They experience this extreme price increase while facing some of the lowest price levels of any region. The other regions appear to face high prices in late 1990s and in the early 2000s, but experience a price decline in 2002 and 2003.

2.10 The Role of Insurance

Insurance type characteristics are included as statistical controls in the hedonic regression for every estimated service. Insurance has an overwhelmingly important role in determining the price of medical care services. The coefficients on the insurance variables are statistically significant and economically important in every hedonic service. Moreover, the effect of insurance type is consistent across services.

Table 2.16: The Role of Insurance in Selected Services

Service	Medicare	Private & Medicare	Medicaid	Other Pub. Comb.	Uninsured
		Inpatient/Emergency Room			
ER Emergency	-0.201	-0.425	-0.629	-0.479	-0.151
ER Non-Emergency	-0.268	-0.393	-0.529	-0.474	-0.259
ER Non-Doctor	-0.166	-0.415	-0.325	-0.491	-0.093
Inpatient	-0.188	-0.211	-0.265	-0.332	-0.611
		Dental Care			
Clean Only/Hygenist	-0.070	-0.147	-0.417	-0.200	-0.122
Clean Only/Dentist	-0.123	-0.117	-0.471	-0.262	-0.197
Filling Only/Dentist	-0.096	-0.096	-0.480	-0.297	-0.117
Xray Only	-0.090	-0.073	-0.521	-0.318	-0.142
Combination	-0.019	-0.030	-0.568	-0.470	-0.190
Root Canal	0.064	-0.164	-0.367	0.063	0.007
Abscessed Tooth	-0.365	-0.716	-0.416	-0.473	-0.321
Oral Surgery	-0.145	-0.031	-0.668	-0.405	-0.121
Crowns	-0.183	-0.061	-0.184	-0.297	-0.212
Cosmetic	-0.048	-0.187	-0.464	-0.395	0.185
General Exam/Hygenist	-0.062	-0.054	-0.469	-0.211	-0.126
General Exam/Dentist	-0.068	-0.034	-0.520	-0.289	-0.095
Other Dental Services	-0.165	-0.062	-0.521	-0.424	-0.190
Orthodontist	-	-	-0.660	-0.536	-0.311
		Office-based Physician			
Checkups	-0.114	-0.189	-0.178	-0.142	-0.175
Treatment/Diagnosis	-0.019	-0.112	-0.156	-0.026	-0.169
Surgery	-0.282	-0.490	-0.479	-0.421	-0.170
Major Procedure	-0.110	-0.268	-0.325	-0.199	-0.167
Psychological	0.002	-0.187	-0.147	-0.127	-0.402
Postoperative	-0.117	-0.214	-0.113	-0.132	-0.172
Allergy	0.107	0.105	-0.309	-0.100	-0.068
Vision	-0.149	-0.215	-0.090	-0.135	0.060
Pregnancy	-	-	-0.128	-0.114	0.004
Other	0.009	-0.084	-0.257	-0.167	-0.156

Table 16 reports the insurance coefficients for a select group of services. Table 16 reveals that private insurance pays more for every service considered than does any other insurance type. The magnitude of these price differences can be quite large. For instance Private+Medicare pays more than 70% less than does private insurance. The differences in the price paid by private insurance relative to Medicaid insurance consistently has a large magnitude. Medicaid pays 26% less for inpatient care than does private insurance. Inpatient care is by far the most expensive medical service considered. For every other service considered, Private insurance rarely pays less than 30% more for services than does Medicaid.

Although the pattern that private insurance pays more is consistent for all of insurance types and all services, the size of the differences, and often the "rank" of the insurance types vary by service. For hospital care, Medicare typically pays more for services than does private and Medicare, which pays more for services than does public combinations and Medicaid . The magnitude of the differences between the privately insured and other non-Medicaid insurance types is smaller for dental services than it is for hospital services. However, the rank order remains pretty much the same.

2.11 Conclusion

Medical care price measurement is complicated by the role of insurance in masking transaction prices, the heterogeneity of services, and dynamic technological advancement. We have employed a nationally representative dataset of medical care consumption in order to construct medical care prices that control for product heterogeneity and insurance type pricing differences. We use an extension of the CPD hedonic pricing model as applied to medical care services to control for product heterogeneity and technological innovation. We have shown that the individual services within service groups can experience vastly different price changes than other

services within the group or the group as a whole. These large differences in price levels and price changes across services implies that the failure to control for product heterogeneity may significantly alter the measured prices for these services. In addition, we have demonstrated that the use of list charges rather than expenditures may significantly bias the results not least because charges overstate expenditures and their relationship to expenditures differs across service types. Finally, we have shown that price levels and inflation rates vary dramatically across regions, and that insurance type is an important determinant of prices for nearly all of the services considered.

These results are applicable to current discussions of how to invest money and human capital resources into the construction of medical care price indices. The current discussion includes the possibility of purchasing claims and hospital data to facilitate such calculations. Our results suggest that any such analysis should be able to account for medical care spending differences across service types, regions and insurance.

Appendix 1: Services

Group 1: Hospital Services

EC 11: ER Services

Stratum 111: ER Emergency

Stratum 112: ER Non-Emergency

EC 12: Inpatient Services

Stratum 121: Inpatient Operation

Stratum 124: Inpatient non-Operation

EC 13: Outpatient Physician

Stratum 131: Outpatient Physician Checkup

Stratum 132: Outpatient Physician Post-Operative Care

Stratum 133: Outpatient Physician Treatment

Stratum 134: Outpatient Physician Maternity

Stratum 135: Outpatient Physician Mental

Stratum 135: Outpatient Physician Treatment

Stratum 136: Outpatient Surgery

Stratum 137: Outpatient Physician Non-Surgery Procedure

Stratum 138: Outpatient Physician Other

EC 14: Outpatient Other Professionals

Stratum 141: Chiropractors

Stratum 142: Nurse Practitioners

Stratum 143: Optometrists

Stratum 144: Podiatrists

Stratum 145: Physician Assistants

Stratum 146: Physical Therapists

Stratum 147: Psychologists

Stratum 148: Technicians

Stratum 149: Other Health Professionals

Group 2: Physician and Clinical Services

EC 21: Surgical Procedures

EC 22: Checkup

EC 23: Treatment and Diagnosis

EC 24: Psych Care

EC 25: Postoperative Care

EC 26: Immunological Care

EC 27: Vision Care

EC 28: Maternity Care

EC 29: Other Care

Group 3: Other Professional Services

EC 31: Chiropractors

EC 32: Nurse Practitioners

EC 33: Optometrists

EC 34: Podiatrists

EC 35: Physician Assistants

EC 36: Physical and Occupational Therapists

EC 37: Psychologists

EC 38: Technicians

EC 39: Other Non-Physician Professionals

Group 4: Dental Services

EC 41: General Dental Services

Stratum 411: Dental Hygienists

41101 DENTIST CLEANING ONLY/HYGENIST

41102 DENTIST GENERAL EXAM/HYGENIST

Stratum 412: Dental Services - No Hygienists

41201 DENTIST CLEANING ONLY

41202 DENTIST FILLING ONLY

41203 DENTIST XRAY ONLY

41204 DENTIST COMBINATION: FILLING/XRAY/CLEANING

EC 42: Dental Surgery

42001 DENTIST ROOT CANAL

42002 DENTIST ABSCESSED TOOTH

42003 DENTIST ORAL SURGERY

EC 43: Dental Cosmetic Services

43001 DENTIST CROWNS/BRIDGES/INLAY

43002 DENTIST COSMETIC

EC 44: Orthodontics

Group 5: Durable Medical Products

50001 EYEGLASSES

50002 ORTHOPEDIC

50002 MEDICAL EQUIPMENT

Group 6: Home Health

Group 7: Pharmaceutical

EC 70: Anti-Infective

Stratum 700: Amebicides

70001 METRONIDAZOLE

Stratum 701: Anti-fungal

70101 FLUCONAZOLE

Stratum 702: Anti-viral Agents

70201 ACYCLOVIR

Stratum 703: Cephalosporin

70301 CEFPROZIL

70302 CEFUROXIME

70303 CEPHALEXIN

Stratum 704: Macrolide

70401 ERYTAB/ERYTHROMYCIN

70402 AZITHROMYCIN

Stratum 705: Penicillin

70501 AMPICILLIN

70502 AMOXICILLIN

70503 AMOXICILLIN/CLAVULANTE

70504 PENICILLIN V POTASSIUM

Stratum 706: Quinoline

70601 CIPROFLOXACIN

70602 LEVOFLOXACIN

70601 SULFASALAZINE

Stratum 707: Tetracyclines

70701 DOXYCYCLINE

70702 MINOCYCLINE

Stratum 708: Urinary Anti-Infective

70801 NITROFURANTOIN

70802 SULFAMETHOXAZOLE TRIMETHOPRIM

EC 71: Anti-Hyperlipidemic Agents

Stratum 710: HMG-COA Reductase inhibitors

71001 ATORVASTATIN

71002 CERIVASTATIN

71003 FLUVASTATIN

71004 LOVASTATIN

71005 PRAVASTATIN

71006 SIMVASTATIN

Stratum 711: Fibric Acid Derivatives

71101 GEMFIBROZIL

71102 FENOFIBRATE

EC 72: Cardiovascular Agents

Stratum 720: Angiotensin Converting Enzyme (ACE) Inhibitors

72001 CAPTOPRIL

72002 ENALAPRIL

72003 LISINOPRIL

72004 MOEXIPRIL HCl

72005 FOSINOPRIL (MONOPRIL)

72006 QUINAPRIL HCl

72007 RAMIPRIL

Stratum 721: Anti-Adrenergic agents, peripherally acting

72101 DOXAZOSIN

72102 TAMULOSON

72103 TERAZOSIN

Stratum 722: Anti-Adrenergic agents, centrally acting

72201 CLONIDINE HCl

72202 GUANFACINE HCl

Stratum 723: Anti-Anginal Agents

72301 ISOSORBIDE

72302 NITROGLYCERIN

72303 QUINIDINE SULFATE

Stratum 724: Beta-Adrenergic Blocking

72401 ATENOLOL

72402 LABETALOL

72403 METOPROLOL

72404 NADOLOL

72405 PROPRANOLOL HCl

72406 TOPROL

Stratum 725: Calcium Channel Blocking Agents

72501 AMLODIPINE

72502 DILTIAZEM

72503 FELODIPINE

72504 NIFEDIPINE

72505 VERAPAMIL

Stratum 726: Diuretics

72601 BUMETANIDE

72602 FUROSEMIDE

72603 HYDROCLOROTHIAZIDE (HCTZ)

72604 INDAPAMIDE

72605 METOLAZONE

72606 SPIRONOLACTONE

72607 TORSEMIDE

Stratum 727: Inotropic Agents

72701 DIGOXIN

72702 LANOXIN

Stratum 728: Anti-Hypertensive Combinations

72801 AMLODIPINE/BENAZEPRIL

72802 HCTZ/TRIAMTERENE

72803 HCTZ/BENAZEPRIL

72804 HCTZ/BISOPROLOL

72805 HCTZ/LISINOPRIL

72806 HCTZ/LOSARTAN POTASSIUM

72807 HCTZ/Other Combinations

Stratum 729: Angio-Tensin II Inhibitors

72901 IRBESARTAN

72902 LOSARTAN POTASSIUM

72903 VALSARTAN

EC 73A: Central Nervous System Agents

Stratum 73A1: Anti-convulsants

73A101 CARBAMAZEPINE

73A102 CLONAZEPAM

73A103 DIAZEPAM

73A104 DIVALPROEX

73A105 GABAPENTIN

73A106 LORAZEPAM

73A107 PHENYTOIN

Stratum 73A2: Antiemetic/Anti-vertigo Agents

73A201 DIPHENHYDRAMINE

73A202 MECLIZINE

73A203 METOCLOPRAMIDE

73A204 PHENOBARBITAL

73A205 PROMETHAZINE

73A206 PROMETHAZINE/CODEINE

Stratum 73A3: Anti-Parkinson Agents

73A301 BENZTROPINE

73A302 CARBIDOPA/LEVODOPA

Stratum 73A4: Muscle Relaxants

73A401 BACLOFEN

73A402 CARISOPRODOL

73A403 CYCLOBENZAPRINE

73A404 METHOCARBAMOL

Stratum 73A5: Miscellaneous Central Nervous System Agents

73A501 AMPHETAMINE/DEXTROAMPHETAMINE

73A502 DONEPEZIL

73A503 METHYLPHENIDATE

73A504 DEXTROAMPHETAMINE

Stratum 73A6: Anorexiant

73A601 PHENTERMINE/PHENTERMINE RESIN

EC 73B: Analgesic CNS Acting Agents

Stratum 73B0: Misc. Analgesics

73B001 ACETAMINOPHEN

73B002 ASPIRIN

73B003 HYDROXYCHLOROQUINE

73B004 SUMATRIPTAN SUCCINATE

73B005 TRAMADOL

73B006 ANTI-MIGRAINE AGENTS (MISC)

73B007 OTHER ANALGESICS

Stratum 73B1: Cox-2 Inhibitors

73B101 CELECOXIB

73B102 ROFECOXIB

Stratum 73B2: Narcotics and Narcotic Combinations

73B201 ACETAMINOPHEN/CODEINE

73B202 ASPIRIN/OXYCODONE

73B203 ACETAMINAPHEN/PROPOXYPHENE

73B204 APAP/HYDROCODONE

73B205 MORPHINE SULPHATE

73B206 OXYCODONE

73B207 PROPOXYPHENE

73B208 ACETAMINOPHEN/BUTALBITAL/CAFFEINE

Stratum 73B3: Non-Steroidal Anti-Inflammatory Agents

73B301 DICLOFENAC

73B302 ETODOLAC

73B303 IBUPROFEN

73B304 INDOMETHACIN

73B305 KETOPROFEN

73B306 NABUMETONE

73B307 NAPROXEN

73B308 OXAPROZIN

73B309 PIROXICAM

73B310 SULINDAC

73B311 DICLOFENAC/MISOPROSTOL

EC 74: Gastro-Intestinal Agents

Stratum 740: H2 Antagonists

74001 CIMETIDINE

74002 FAMOTIDINE

74003 NIZATIDINE

74004 RANITIDINE

Stratum 741: Misc. Gastro-Intestinal Agents

74101 CISAPRIDE

74102 DICYCLOMINE

74103 DOCUSATE SODIUM

Stratum 742: Proton Pump Inhibitors

74201 ESOMEPRAZOLE MAGNESIUM

74202 LANSOPRAZOLE

74203 OMEPRAZOLE

74204 PANTOPRAZOLE

74205 RABEPRAZOLE SODIUM

EC 75: Hormones

Stratum 750: Adrenal Cortical Steroids

75001 METHYLPREDNISOLONE

75002 PREDNISONE

Stratum 751: Anti-Diabetic Agents

75101 GLIMEPIRIDE

75102 GLIPIZIDE

75103 GLYBURIDE

75104 INSULIN

75105 METFORMIN

75106 PIOGLITAZONE

75107 ROSIGLITAZONE

Stratum 752: Misc. Hormones

75201 LEVOTHYROXINE

75202 RELOXIFENE

75203 TAMOXIFEN

75204 ALENDRONATE

Stratum 753: Sex Hormones

75301 DESOGESTREL ETHINYL ESTRADIOL

75302 ESTRADIOL SINGLE THERAPY

75303 ESTRADIOL COMBO THERAPY

75304 ESTROGENS/METHYLTESTOSTERONE

75305 ESTROPIPATE

75306 FINASTERIDE

75307 MEDROXY-PROGESTERONE

75308 PROGESTERONE

EC 76: Misc. Agents

Stratum 760: Anti-Metabolites

76001 METHOTREXATE

Stratum 761: Misc. Coagulation Modifiers

76101 CLOPIDOGREL

76102 PENTOXIFYLLINE

76103 TICLOPIDINE

76104 WARFARIN SODIUM

Stratum 762: Genito-urinary Tract Agents

76201 OXYBUTYNIN

76202 TOLTERODINE

Stratum 763: Anti-Gout Agents

76301 ALLOPURINOL

76302 COLCHICINE

EC 77: Nutritional Products

Stratum 770: Vitamin and Mineral Combinations

77001 CALCIUM

77002 FERROUS SULFATE

77003 FOLIC ACID

77004 POTASSIUM CHLORIDE

77005 PRENATAL VITAMINS

77006 ASCORBIC ACID

EC 78: Respiratory Agents

Stratum 780: Adrenal Cortical Steroids

78001 BUDESONIDE

78002 PREDNISOLONE

78003 TRIAMCINOLONE

Stratum 781: Anti-Histamines

78101 CETIRIZINE

78102 FEXOFENADINE

78103 HYDROXYZINE

78104 LORATADINE/PSEUDOEPHEDRINE

Stratum 782: Broncho-Dilators

78201 ALBUTEROL

78202 ALBUTEROL/IPRATROPIUM

78203 IPRATROPIUM BROMIDE

78204 SALMETROLXINAFOATE

78205 THEOPHYLLINE

Stratum 783: Respiratory Inhalant Products

78301 BECLOMETHASONE DIPROPIONATE

78302 FLUNOSOLIDE

78303 FLUTICASONE PROPIONATE

Stratum 784: Upper Respiratory Combinations

78401 CARBINOXAMINE/DEXTROMETHORPHAN

78402 GUAIFENESIN

78403 GUAIFENESIN/PSEUDOEPHEDRINE

78404 GUAIFENESIN/PHENYLPROPANOLAMINE

78405 HYDROCODONE/HOMATROP

Stratum 785: Leukotriene Modifiers

78501 MONTELUKAST SODIUM

78502 ZAFIRLUCAST

EC 79A: Topical Agents

Stratum 79A0: Dermatological Agents

79A001 MUPIROCIN/BACTROBAN

79A002 BETAMETHASONE DIPROPIONATE

79A003 NYSTATIN

79A004 TRETINOIN

Stratum 79A1: Ophthalmic Preparations

79A101 DORZOLAMIDE

79A102 LATANOPROST

79A103 PILOCARPINE

79A104 TIMOLOL

Stratum 79A2: Otic Preparations

79A201 HYDROCORTISONE

Stratum 79A3: Nasal Preparations

79A301 MOMETASONE

EC 79B: Psycho-Therapeutic Agents

Stratum 79B0: Anxiolytics, Sedatives, and Hypnotics

79B001 ALPRAZOLAM

79B002 BUSPIRONE

79B003 DOXEPIN

79B004 TEMAZEPAM

79B005 ZOLPIDEM TARTRATE

Stratum 79B1: Anti-Depressants

79B101 AMITRIPTYLINE

79B102 BUPROPION

79B103 CITALOPRAM

79B104 FLUOXETINE HCl

79B105 IMIPRAMINE

79B106 NORTRIPTYLINE

79B107 PAROXETINE

79B108 SERTRALINE

79B109 SERZONE

79B110 TRAZODONE

79B111 VENLAXAFINE

Stratum 79B2: Anti-psychotics

79B201 LITHIUM

79B202 OLANZAPINE

79B203 RISPERIDONE

Group 8: Other Non-Durable

80001 AMBULANCE PRIVATE INSURANCE

80002 AMBULANCE UNINSURED/PUBLIC INSURANCE

80003 DISPOSABLE SUPPLIES

80004 OTHER

Chapter 3

Disease Treatment Prices

This chapter addresses the productivity and efficiency of medical care markets by constructing medical care output prices for twelve of the most costly health conditions in the United States. The analysis uses the 1996-2003 Medical Care Expenditure Panel Survey (MEPS), a nationally representative dataset of medical care expenditures. The construction of disease accounts and disease treatment prices facilitate a regional and dynamic treatment cost analysis. The dynamic analysis assesses whether the prices or the mix of input services used to treat a disease has changed over time. The regional analysis assesses whether treatments of the same condition use different resource intensity across regions. The organization of medical care spending into disease accounts facilitates the ability to sensibly attribute health outcomes to the disease treatments considered.

3.1 Measuring Medical Care Prices

3.1.1 Difficulties in Price Measurement

That medical care should be treated as an input into health has been known for some time. Thirty years ago, Michael Grossman (1972) introduced his seminal theoretical

model that focused on medical care as the key health production input. Forty years ago, Anne Scitovsky (1964) had argued for the creation of national disease accounts. Despite having the conceptual framework for relating medical care to health for some time, success at empirically incorporating either of these ideas into national accounts has been limited. Currently, none of the national accounts relate medical care inputs to health outputs. However, newly available data and renewed interest has led to recent progress in the methods used to implement this conceptual framework.

The difficulties in applying these concepts are fundamental. The empirical relationship between medical care services and health outcomes is complicated by the difficulty in measuring initial health, health outcomes, medical care input prices, and the productive relationship between medical care and health outcomes. Transaction prices for medical care are difficult to collect and may differ dramatically from listed charges because of insurance negotiation, bad debt, and the provision of free or discounted care. Medical care inputs and health outputs are both extremely heterogeneous and accounting for this heterogeneity can be difficult. Moreover, even if health outcomes and medical care input prices could be perfectly measured, a productivity analysis requires that inputs are associated with outputs, which in this case relates medical care services to health outcomes. However, none of the government statistics such as the National Health Accounts, the Producer's Price Index (PPI) and the Medical Care component of the Consumer Price Index (mCPI) relate the input services they consider to the health outputs they produce. Consequently, these statistics cannot enable even a cursory productivity evaluation.

The major innovation of the last decade has been the method in which to empirically implement these concepts. The literature is fast coming to the consensus that a disease-specific empirical implementation of medical care productivity evaluation is the proper approach. For example, Cutler et al (1996) examines heart attack treatments, Berndt et. al (1997) examines depression treatment, Evans (2005) ex-

amines AIDS treatment and other studies have examined psychoses (Duggan, 2005) and automobile injury treatments (Doyle, 2005). This cursory survey of the literature suggests that any future empirical assessment of medical care productivity likely begins by attributing medical care services to the specific diseases they are used to treat. An examination of the productivity of medical care as a whole should account for the spending by all insurance types including the privately insured, the publicly insured, and the uninsured, and should also include the spending from all regions of the economy. The direction of this research suggests that steps should be taken to organize the construction of "disease accounts" from a nationally representative dataset in order to attribute the medical care spending in the United States to disease treatments, thereby enabling future research related to the topic of medical care productivity.

The disease specific nature of medical care productivity arises because of the heterogeneity of disease characteristics. Diseases vary dramatically in their duration, treatment protocols and health consequences. For instance, diabetes treatment is a very complex chronic condition that may involve a lifetime of hospital visits, insulin shots, and other drug regimens. In contrast, upper respiratory infections are acute conditions that can be very simple to treat and may involve a trip to the doctor's office and a week's worth of antibiotics. The health response to treatment can also vary dramatically across diseases. Diseases may be preventable with vaccine, curable, treated indefinitely but never cured, or have no available effective treatment. The differences in these outcomes may change over time with technological advancement. Related to the potential outcomes of the treatment are the health consequences of the disease itself. Some diseases may increase mortality risks but are not physically debilitating, such as high cholesterol. Other conditions may be physically debilitating but do not change the risk of death, such as arthritis. Other conditions, such as diabetes, can be both debilitating and mortal.

Although attributing observed health outcomes to medical care productivity requires the specification of a structural relationship between medical care services and health outcomes, the "disease accounts", presented here, provide a cursory productivity assessment by facilitating a "back of the envelope" calculation of regional health outcome price levels and their changes over time in the aggregate.

3.1.2 Methodology of Treatment Price Measurement

Disease treatments are defined as the medical care service bundles consumed by individuals for the purpose of treating disease type d. Disease d is determined by the three-digit ICD-9 code associated with the medical care event. Disease treatment prices are defined as regional price levels over the period 1996-2003 using the MEPS. The medical care services used in disease treatment are referred to as *Entry-Level-Items* (ELIs). Input service type heterogeneity is controlled using a variant of the Country Product Dummy variable (CPD) model described in detail by Summers (1973). The CPD model is a hedonic pricing model that has been used extensively to estimate cross-country purchasing power parities. This paper follows Kokoski, Cardiff and Moulton (1994) in implementing a CPD model to construct price levels across geographic regions in the United States for medical care services. The services are organized into a hierarchy of two aggregation levels, where the most aggregated service level is the disease treatment. As an example, the treatment of depression is a commodity aggregate of the pharmaceutical products Fluoxetine HCl and Paroxetine HCl, Psychiatrist office visits, Psychologist office visits, and other ELI-level services used in the treatment of ICD-9 code 311 Depressive Disorders.

Implementation proceeds as follows. The price of an event i that belongs to ELI v is estimated using the following hedonic regression:

$$\ln P_i^v = \alpha_0 + \sum_{k=2}^{K} \beta_k^v R_{ki} + \sum_{j=1}^{J} \gamma_j^v C_{ji} \tag{3.1}$$

In equation 1, β_k^v and γ_j^v are estimated coefficients, P_i^v is the total expenditures paid for the event i, and R_{ki} is a region-year dummy variable that is one if the event occurred in region-year k, and zero if it did not. C_{ji} is the jth characteristic of event i. The characteristics included in the hedonic regressions vary by ELI but often include disease and insurance type indicators as well as demographic variables such as age and gender. The price of the vth service in region-year k relative to the reference area is $exp(\hat{\beta}_k^v)$.

In order to construct disease price levels for region-year k, $\ln P_k^d$, the aggregation procedure employs a bilateral Tornquist comparison of ELI items. Using the following procedure, the Tornquist bilateral price comparison of region-year j to region-year k for ELI v uses the following weighted geometric average of the V ELI-level prices that are used to treat condition d.

$$\ln P_{jk}^d = (1/2) \sum_{v \in d}^{V} (w_{vj}^d + w_{vk}^d) \ln(P_j^v / P_k^v) \tag{3.2}$$

In Equation 2, w_{vj}^d and w_{vk}^d represents ELI v's fraction of total disease d expenditure in regions j and k, respectively. If there are K region-years, then this procedure results in a KxK matrix of bilateral prices. These bilateral prices are used to construct a multi-lateral price index for each disease-level region year using the Elteto, Koves, and Szulc (EKS) method described by Dreschler (1973), and implemented in Caves, Christensen, and Diewert (1982). The multi-lateral price for a region-year, $\ln P_k^d$, is determined by taking the weighted share of the K bilateral prices such that:

$$\ln P_k^d = \sum_{j=1}^{K} s_j^d \ln P_{jk}^d \tag{3.3}$$

where s_j^d is the share of spending in region-year j on total disease d spending. This procedures is conducted for twelve of the most costly disease types found in a representative sample of the United States population.

3.1.3 Observed Care versus Defined Care

The method used to define the bundle of services used to treat a disease implicitly defines the treatment protocol using the observed service shares. However, the observed services may be endogenous, because the bundle may depend on the relative prices of the services in the bundle. For example, a physician may prescribe an unnecessary treatment if the relative price of that treatment is high and the patient is insured against the full cost of the procedure.

In order to control for this issue one could use pre-defined protocols as defined by medical science to define the relative quantities of care used in the determination of a treatment. However, many legitimate and highly substitutable protocol options are available for the treatment of a single disease, and the protocol used in practice varies for a multitude of reasons usually not observed in the MEPS data. For instance, the treatment of depression may involve combining drugs with visits to psychiatrists and psychologists. The observed combination of drugs and visits depends on whether the patient responds better to the physician sessions or drugs, and potentially the aversion of the patient to taking drugs. The dispersal of medical knowledge also plays an important role in determining the protocol for many conditions.

Many of these unobserved changes are orthogonal to price, and we would like to incorporate them in our price index. We proceed with the assumption that these aspects of treatment are more important components of treatment than are the potential "churning" and "moral hazard" aspects of care introduced using the strict-protocol method.

3.1.4 Methodology of Health Outcome Measurement

There are two types of health outcome metrics used to measure output. The health measures are the age-adjusted mortality rate and the probability that an individual

has a disease-specific negative health outcome. Age-adjustment mortality rates for disease type j are calculated using the direct method which is described with the following equation:

$$M_j = \sum_{i=1}^{n} r_{ji} \cdot (p_i/P) \tag{3.4}$$

The following list defines notation:

- M_j is the age-adjusted mortality rate of disease j per 100,000 people.
- r_{ji} is the mortality rate of disease j per 100,000 people in age-group i.
- p_i is the fraction of the population in age-group i.
- n is the total number of age-groups
- $P = \sum_{i=1}^{n} p_i$ represent the total population, which is the sum of all age groups $i = 1, ..., n$.

For the mortality statistics reported here, the age distribution of the population used is that of the 2000 census. Eleven age-groups are used for the mortality calculations that include less than 1, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85 and over.

The probability that an individual has a disease-specific negative health outcome is calculated for changes in observed health indicators. For instance, the observed indicator may be an indicator for whether mobility decreased during the period. The observed health indicators, I, are modelled as being directly related to a latent health variable, h^*. The relationship between latent health and the health indicator may either be increasing or decreasing in health. To fix ideas consider indicators that are decreasing in health. If the indicator variable takes on only two values, such as whether health deteriorated, then the indicator function is defined as follows:

- if $h^* < \overline{h}$ then I=1
- if $h^* >= \overline{h}$ then I=0

This binomial function describes the relationship between latent health and health outcomes. Latent health is modelled as a function of demographic characteristics such as age, sex, income, region, insurance type, race, and most importantly, year. In order to be consistent with the other measures of health, latent health depends on age as measured by eleven dummy variables representing the age-groups listed above. The probability that a health outcome occurs depends on patient characteristics, and the total expenditure spent on treatment. The probability that an observed health outcome occurs for an indicator function is defined using the following equation:

$$Pr(h^* < \overline{h}) = \Phi(\alpha + \sum_{l=1}^{L} \gamma_l Z_{li} + \sum_{t=1997}^{2003} Y_{ti} < \upsilon_i) \tag{3.5}$$

In this equation, demographic characteristics denoted by the variable Z and time denoted by Y determine health. This equation depends on eight year dummy variables, Y, and l demographic variables, Z, that include the eleven age dummy variables, and six insurance type dummy variables. If $\upsilon = (\overline{h} - \epsilon)$ is distributed standard normal then $\Phi(\cdot)$ is the cumulative normal distribution function, and this relationship can be estimated as a probit using standard techniques. The predicted probability of the health outcome for a specific individual evaluated at different years is the health measure used in the analysis.

3.2 Disease Costs

The MEPS reports the medical care consumption for every individual in a nationally representative individual level survey. The total medical care expenditures are

associated with each type of medical care service consumed by each respondent. The reported expenditures include and distinguish between all payments made by and in behalf of the individual such as payments made by the family, private insurance, public insurance such as Medicare and Medicaid, workman's compensation and automobile insurance. All expenditures are associated with a medical care event such as a prescription or a hospital stay. In addition to expenditure information, each event is associated with the medical condition the service was used to treat. The survey asks each respondent to describe the condition, and these descriptions are used by professional coders hired by the MEPS to assign ICD-9 codes to each medical care event in the survey.

The MEPS conducts a follow-up component to the survey which surveys the medical care provider in order to determine the expenditures received for each event reported by the individual respondents. This follow-up component accounts for charity care, bad debt, provider discounts, insurance discounts and other potential sources of discrepancies between reported list charges and the actual expenditures received by the provider. The follow-up component also allows the survey to collect information about events not reported by the survey respondent.

3.2.1 Annual Treatment Costs

There are no government statistics that allow for the simple decomposition of medical care cost changes over time into medical care input price changes, changing treatment algorithms for conditions, condition prevalence changes, or many other health and technological changes important in evaluating medical care sector productivity. This type of decomposition analysis begins by considering the changing aggregate costs for the treatment of identical medical conditions over time.

Table 1 presents the national annual aggregate treatment costs, and the fraction of total medical care costs that are represented by each disease. The cost

Table 3.1: National Treatment Costs (in billions)

Disease Chapter	1996	1997	1998	1999	2000	2001	2002	2003
Infectious	7.66	7.62	7.46	11.51	7.94	9.73	12.71	12.87
% of Year Exp.	0.012	0.013	0.012	0.018	0.012	0.013	0.016	0.015
Neoplasms	32.26	33.96	34.82	31.24	37.65	41.09	43.09	41.88
% of Year Exp.	0.052	0.056	0.058	0.050	0.058	0.057	0.054	0.049
Endocrine	16.40	18.14	19.16	21.48	23.16	33.14	32.82	36.80
% of Year Exp.	0.027	0.030	0.032	0.034	0.036	0.046	0.041	0.043
Blood Conditions	2.56	3.43	1.42	2.06	2.56	3.40	4.13	2.93
% of Year Exp.	0.004	0.006	0.002	0.003	0.004	0.005	0.005	0.003
Mental Health	23.49	24.35	25.64	30.48	27.54	33.10	32.94	34.03
% of Year Exp.	0.038	0.040	0.042	0.049	0.043	0.046	0.042	0.040
Nervous System	35.57	33.75	35.91	34.40	35.38	39.62	46.35	48.33
% of Year Exp.	0.058	0.056	0.059	0.055	0.055	0.055	0.058	0.057
Circulatory	69.98	76.59	77.89	73.59	78.47	78.77	80.02	96.73
% of Year Exp.	0.114	0.127	0.129	0.117	0.122	0.109	0.101	0.114
Respiratory	36.09	34.74	35.72	39.08	37.71	42.85	46.48	43.47
% of Year Exp.	0.059	0.058	0.059	0.062	0.058	0.059	0.059	0.051
Gastro-Intestinal	26.68	24.38	25.30	26.99	27.88	35.40	41.92	43.57
% of Year Exp.	0.043	0.041	0.042	0.043	0.043	0.049	0.053	0.051
Genito-Urinary	19.27	19.66	18.31	19.07	21.69	25.05	29.66	30.25
% of Year Exp.	0.031	0.033	0.030	0.030	0.034	0.035	0.037	0.036
Preg. + Peri-Natal	50.31	30.63	33.32	34.20	41.17	44.76	46.45	50.16
% of Year Exp.	0.082	0.051	0.055	0.054	0.064	0.062	0.059	0.059
Skin	8.71	8.72	9.38	9.32	11.14	11.84	14.22	13.07
% of Year Exp.	0.014	0.014	0.016	0.015	0.017	0.016	0.018	0.015
Musculo-Skeletal	33.60	30.91	33.29	34.70	37.82	41.93	49.67	56.99
% of Year Exp.	0.055	0.051	0.055	0.055	0.059	0.058	0.063	0.067
Injuries	38.61	37.07	34.01	41.47	36.56	40.75	42.56	46.39
% of Year Exp.	0.063	0.062	0.056	0.066	0.057	0.056	0.054	0.054
Preventative+Other	133.32	129.63	135.49	142.54	144.33	159.50	172.15	178.60
% of Year Exp.	0.216	0.215	0.224	0.227	0.224	0.220	0.217	0.210
Multiple Conditions	81.50	87.99	76.70	75.38	73.72	83.68	98.32	115.34
% of Year Exp.	0.132	0.146	0.127	0.120	0.114	0.115	0.124	0.135
Total	**616.0**	**601.6**	**603.8**	**627.5**	**644.7**	**724.6**	**793.5**	**851.4**

statistics are organized by ICD-9 chapter headings. All costs are discounted by the Urban Consumer Price Index (CPI-U) and reported in year 2000 dollars. Some services are associated with either multiple ICD-9 codes or are not associated with any ICD-9 codes. For instance, spending on dental care and durable supplies are not associated with ICD-9 codes by the MEPS. Some of these services are assigned to a relevant ICD-9 chapter. For example, eyeglasses are assigned to nervous system spending and dental care is assigned to other 'other' spending. Missing ICD-9 codes not assigned to relevant ICD chapter headings are listed here as 'preventative' care. If spending is associated with multiple ICD-9 codes, then spending for those services are associated with 'multiple conditions'. Almost 90% of multiple condition spending involves either endocrine or circulatory condition treatments.

Table 1 reports that total treatment expenditures, in real terms, remained relatively flat from 1996 to 1999, and actually decreased between 1996 and 1997. However, the flat spending period of the mid 1990s changed to sharply rising expenditures in the early part of the 2000s. Medical care expenditures have increased 35% since 1999. Although the costs of most chapter heading conditions follow similar patterns to the overall cost pattern, some differences arise. Pregnancy and peri-natal condition spending experience large cost declines between 1996 and 1997. Combined costs in these chapters fall from $50 billion in 1996 to $30 billion in 1997 and this drop appears to drive the decrease in total medical care spending in those years. This decrease is so dramatic that the 1996 spending level for these services are never again achieved, even after the rapid medical expenditures growth in the 2000s. Although the magnitude of the spending drop for these conditions is quite large relative to other disease type spending, the pattern is not inconsistent. Many of the other conditions experience either flat spending or mild decreases in medical care expenditures over the mid 1990s. There are some important differences, however. Endocrine conditions, mental health conditions and circulatory conditions all

experience steady increases in real spending throughout the entire period, but still experience faster increases in the later part of the period.

Despite the increases in total spending since 1999, the fraction of spending represented by any one condition has remained stable for nearly all of the conditions considered throughout the whole period. Notable exceptions to this pattern include endocrine conditions and pregnancy services. Endocrine conditions have steadily increased as a fraction of total medical care spending from 2.7% of spending in 1996 to 4.3% of spending in 2003. Pregnancy and peri-natal services fall from 8.2% of care in 1996 to less 6% of care in 2003, but most of this change occurs in the one year between 1996 and 1997.

3.2.2 Disease Prevalence

Evaluating efficiency in medical care markets begins by understanding why medical care costs have been rising since 1999. The national costs of treating a condition can be defined as the product of the number of people receiving treatment and the price of the treatment. Understanding the nature of the observed increasing medical care costs begins by understanding how the prevalence of conditions is changing over time. Table 2 reports the prevalence rates for diseases observed in the United States. Prevalence rates are defined as the percent of the total population with a disease. The population includes all ages, sexes, ethnicity types and races observed in the non-institutionalized United States population. The reported conditions are organized by and include the ICD-9 chapter headings. The reported three-digit level conditions are the most costly conditions in each of the major heading categories. The reported prevalence of the three-digit ICD-9 code conditions, such as hypertension, represent the weighted percentage of individuals that either report having hypertension during the year, or report seeking treatment for hypertension.[1] The

[1]Although documentation suggests that an individual can report having a condition without seeking treatment, there are no individuals in the survey that have a condition without seeking

prevalence of the major chapter conditions, such as circulatory conditions, is the percentage of people in the sample who report or sought care for at least one of the 3-digit ICD-9 code conditions identified with the major chapter.[2]

The prevalence rates vary substantially across disease types. Peri-natal conditions (premature babies) represent the least prevalent conditions at less than 1% of the population. These conditions are uncommon because the conditions are uniquely found in a narrowly defined age demographic, namely newborns aged less than one year old. In contrast, respiratory conditions are the most prevalent condition in the United States. Roughly 40% of the population has at least one respiratory condition in any given year. Respiratory conditions include common acute conditions such as influenza, and upper respiratory infections (i.e. the common cold) that are typically short in duration and cheap to treat. However, the chronic respiratory conditions that represent the most costly conditions within the group each make up a small fraction of all respiratory conditions. In fact, the most common 3-digit level condition considered is hypertension, a circulatory condition, not a respiratory condition. Hypertension, or high blood pressure, afflicts between 10 and 14 percent of the population whereas the most common respiratory condition considered is allergic rhinitis which represents between 6.7-9.5% of the population.

The vast majority of major chapter conditions considered have very little change in their prevalence rates over the period. Neoplasms, blood conditions, gastro-intestinal conditions, genito-urinary conditions, musculo-skeletal conditions, injuries and other conditions experience either no change or no discernible pattern in prevalence rates over the period. In addition, very few of the conditions appear to be declining in prevalence over time. Infectious diseases and respiratory conditions are much less common in 2003 than they were in 1996 and 1997, but the differences

treatment for that condition.

[2]By definition, the prevalence sum of 3-digit ICD-9 prevalence rates is greater than or equal to the major chapter prevalence rates.

Table 3.2: Disease Prevalence

Disease Type	1996	1997	1998	1999	2000	2001	2002	2003
Infectious	0.2971	0.2202	0.1954	0.2014	0.1909	0.1892	0.1940	0.1956
008 Intestinal Inf.	0.1870	0.1218	0.0982	0.1141	0.0999	0.0901	0.0970	0.0980
042 H.I.V.	0.0005	0.0004	0.0009	0.0008	0.0003	0.0007	0.0008	0.0005
079 Viral NOS	0.0370	0.0244	0.0222	0.0229	0.0223	0.0276	0.0252	0.0233
Neoplasms	0.0521	0.0518	0.0507	0.0502	0.0521	0.0551	0.0585	0.0579
162 Trachea/Lung	0.0012	0.0012	0.0013	0.0013	0.0013	0.0013	0.0014	0.0014
174 Female Breast	0.0023	0.0032	0.0039	0.0041	0.0038	0.0042	0.0042	0.0033
239 Unspecified	0.0119	0.0095	0.0094	0.0081	0.0072	0.0082	0.0091	0.0098
Endocrine	0.1237	0.1293	0.1299	0.1369	0.1483	0.1613	0.1651	0.1682
250 Diabetes	0.0359	0.0389	0.0414	0.0431	0.0444	0.0459	0.0496	0.0505
272 Lipoid	0.0302	0.0378	0.0421	0.0457	0.0555	0.0639	0.0743	0.0814
Blood Conditions	0.0177	0.0160	0.0151	0.0164	0.0184	0.0197	0.0202	0.0196
Mental Health	0.1520	0.1563	0.1579	0.1547	0.1600	0.1752	0.1858	0.1875
296 Psychoses	0.0031	0.0036	0.0049	0.0047	0.0048	0.0058	0.0065	0.0059
300 Neurotic	0.0244	0.0248	0.0251	0.0251	0.0298	0.0351	0.0463	0.0490
311 Depressive	0.0470	0.0549	0.0544	0.0533	0.0551	0.0609	0.0678	0.0688
Nervous System	0.2521	0.2310	0.2143	0.1989	0.1931	0.2068	0.2034	0.2094
354 Mononeuritis	0.0073	0.0073	0.0072	0.0058	0.0061	0.0079	0.0068	0.0077
365 Glaucoma	0.0130	0.0119	0.0113	0.0114	0.0107	0.0118	0.0127	0.0126
366 Cataract	0.0154	0.0156	0.0140	0.0138	0.0134	0.0155	0.0160	0.0166
382 Otitis Media	0.0667	0.0599	0.0521	0.0492	0.0478	0.0493	0.0445	0.0420
Circulatory	0.1569	0.1648	0.1671	0.1669	0.1705	0.1778	0.1963	0.2010
401 Hypertension	0.1016	0.1093	0.1127	0.1145	0.1214	0.1261	0.1367	0.1431
410 A.M.I.	0.0050	0.0068	0.0059	0.0050	0.0051	0.0040	0.0051	0.0056
414 Heart Disease	0.0043	0.0035	0.0029	0.0031	0.0035	0.0036	0.0035	0.0039
427 Dysrhythmia	0.0114	0.0123	0.0132	0.0144	0.0127	0.0135	0.0144	0.0148
428 Heart Failure	0.0044	0.0054	0.0051	0.0051	0.0046	0.0060	0.0064	0.0067
429 Heart Disease	0.0209	0.0233	0.0226	0.0236	0.0241	0.0220	0.0224	0.0217
436 C.V.A. (stroke)	0.0077	0.0081	0.0077	0.0069	0.0073	0.0065	0.0075	0.0075
444 Arterial Embolism	0.0025	0.0035	0.0025	0.0031	0.0037	0.0030	0.0036	0.0044

Disease Prevalence (cont.)

Disease Type	1996	1997	1998	1999	2000	2001	2002	2003
Respiratory	0.4798	0.4200	0.4002	0.3973	0.3923	0.4108	0.3946	0.4007
473 Sinusitis	0.0702	0.0597	0.0480	0.0511	0.0523	0.0557	0.0554	0.0540
477 Allergic Rhinitis	0.0715	0.0670	0.0726	0.0773	0.0750	0.0911	0.0955	0.0941
486 Pneumonia NOS	0.0177	0.0169	0.0154	0.0159	0.0147	0.0168	0.0169	0.0183
492 Emphysema	0.0048	0.0054	0.0054	0.0052	0.0056	0.0060	0.0056	0.0046
493 Asthma	0.0385	0.0427	0.0421	0.0418	0.0437	0.0470	0.0512	0.0491
786 Other	0.0367	0.0368	0.0338	0.0320	0.0304	0.0353	0.0382	0.0380
Gasto-Intestinal	0.1682	0.1493	0.1421	0.1327	0.1416	0.1545	0.1701	0.1781
530 Esophagus	0.0072	0.0077	0.0111	0.0152	0.0227	0.0293	0.0371	0.0464
536 Stomach	0.0367	0.0330	0.0311	0.0240	0.0259	0.0305	0.0307	0.0277
553 Hernia	0.0121	0.0116	0.0110	0.0110	0.0100	0.0099	0.0096	0.0107
575 Gallbladder	0.0027	0.0039	0.0035	0.0034	0.0031	0.0032	0.0044	0.0044
Genito-Urinary	0.1260	0.1174	0.1026	0.1024	0.1102	0.1160	0.1131	0.1123
586 Renal Failure	0.0013	0.0016	0.0012	0.0009	0.0012	0.0016	0.0021	0.0019
Pregnancy	0.0441	0.0445	0.0407	0.0429	0.0493	0.0510	0.0475	0.0507
V22 Normal Preg.	0.0243	0.0233	0.0224	0.0228	0.0261	0.0240	0.0232	0.0247
Skin	0.1313	0.1175	0.1140	0.1086	0.1131	0.1220	0.1278	0.1254
Musculo-Skeletal	0.1985	0.2028	0.1996	0.1932	0.1959	0.2125	0.2283	0.2298
716 Arthropathies	0.0506	0.0513	0.0506	0.0524	0.0543	0.0907	0.0644	0.0617
719 Joint Disorders	0.0323	0.0300	0.0315	0.0322	0.0316	0.0000	0.0389	0.0417
Peri-Natal	0.0017	0.0009	0.0004	0.0004	0.0007	0.0007	0.0009	0.0009
Injuries	0.1994	0.2029	0.1855	0.1729	0.1718	0.1813	0.1793	0.1835
722 Intervertebral	0.0100	0.0132	0.0135	0.0129	0.0136	0.0132	0.0168	0.0161
724 Back Disorder	0.0543	0.0603	0.0582	0.0548	0.0557	0.0595	0.0651	0.0664
820 Fractured Femur	0.0013	0.0014	0.0019	0.0019	0.0015	0.0015	0.0019	0.0017
959 Injury	0.0369	0.0422	0.0360	0.0349	0.0395	0.0357	0.0399	0.0382
Other	0.1844	0.1578	0.1379	0.1446	0.1586	0.1621	0.1468	0.1505
780 Gen. Symptoms	0.0744	0.0673	0.0605	0.0595	0.0633	0.0724	0.0759	0.0796

in prevalence rates for those conditions appears to be explained by outliers. The prevalence rate of infectious diseases falls 10 points in the two years between 1996 and 1998, and then remains remarkably stable over the next six years. Similarly, the prevalence rate for respiratory conditions falls 7 points over the same period and then remains steady for the rest of the period. The sharp drop in infectious disease prevalence appears to be explained by the concurrent drop in intestinal infection prevalence. Almost all of the change in infectious diseases can be attributed to the change in this one disease. The explanation for the sharp change in respiratory conditions is less clear. None of the costly chronic conditions underwent a change that would explain the overall prevalence rate change in respiratory conditions. The drop in respiratory conditions appears to have occurred in less costly but more prevalent respiratory conditions not listed. Nervous system conditions may be the only major chapter disease type that experiences a steady decline in prevalence over the period. The prevalence rate of nervous system conditions declines at a steady two points per year from 1996 to 1999.

Although few conditions are declining in prevalence over the period, a number of conditions experience prevalence increases. Circulatory conditions and endocrine conditions experience the largest rate of increased prevalence, an approximate 4.5 point increase from 1996 to 2003. The two most costly endocrine conditions, Diabetes Mellitus and Disorders of Lipoid Metabolism (high cholesterol), both experience prevalence rate increases over the period. Lipoid disorders has the fastest rate of increase of any condition considered, rising from 3.0% of the population in 1996 to more than 8.0% of the population in 2003. Diabetes also increases over the period, albeit not as quickly as Lipoid disorders. Diabetes afflicts 3.5% of the population in 1996 and increases to 5.0% of the population in 2003. Circulatory conditions experience a more uneven rise in prevalence rates than the endocrine conditions. A small fraction of the population experiences any one of the acute circulatory conditions

Table 3.3: Age Distribution

Age Group	1996	1997	1998	1999	2000	2001	2002	2003
Age < 2	0.0288	0.0275	0.0272	0.0273	0.0283	0.0278	0.0257	0.0245
Age 2-6	0.0747	0.0753	0.0740	0.0742	0.0733	0.0695	0.0678	0.0678
Age 7-12	0.0890	0.0891	0.0893	0.0908	0.0875	0.0862	0.0867	0.0861
Age 13-18	0.0876	0.0869	0.0893	0.0849	0.0861	0.0870	0.0872	0.0873
Age 19-29	0.1523	0.1492	0.1468	0.1465	0.1462	0.1463	0.1477	0.1491
Age 30-39	0.1584	0.1567	0.1526	0.1519	0.1519	0.1461	0.1418	0.1379
Age 40-49	0.1500	0.1512	0.1515	0.1504	0.1511	0.1529	0.1532	0.1538
Age 50-64	0.1325	0.1381	0.1438	0.1485	0.1506	0.1581	0.1642	0.1670
Age 65-75	0.0694	0.0685	0.0673	0.0652	0.0668	0.0656	0.0646	0.0656
Age < 75	0.0572	0.0575	0.0581	0.0602	0.0582	0.0605	0.0612	0.0608

considered, such as acute myocardial infarction (heart attack), or CVA (stroke), and the prevalence rate of these acute conditions remains stable throughout the period. However, the increased prevalence of hypertension (high blood pressure) has been dramatic, and its increase explains almost all of the increase in circulatory condition prevalence. Hypertension prevalence has increased from 10% of the population in 1996 to over 14% of the population in 2003. Mental health conditions also experience prevalence increases, although they are milder increases than either circulatory or endocrine condition increases. The total increase in mental health condition prevalence is 3.5 points over the full period. The change in mental health prevalence is largely due to the increasing prevalence of both neurotic and depressive disorders.

Many of the changes in prevalence rates of the population may be thought to be associated with changes in the age distribution. Hypertension, lipoid disorders and diabetes are conditions that typically affect individuals late in life. Even depression may be thought to be more prevalent in the aged. In addition, the decrease in Otitis Media, middle ear infections uncommon in adults but common in young children, appears to explain much of the change in nervous system conditions. Table 3 presents changes in the age distribution of the population over this period. As can

be seen, the fraction of the population in the oldest age groups has grown significantly over the period. The age group that is 50 and older has grown from 25% of the population in 1996 to 29% of the population in 2003. This demographic trend is important in explaining the changes in the prevalence of hypertension, lipoid disorders and diabetes that are concentrated in this age group. However, the changing prevalence of otitis media does not appear to be due to changes in the age distribution of the population. The fraction of the population under 12 does fall over the period, but the fall in the youngest demographic group occurs late in the period, whereas the fall in otitis media prevalence occurs between 1996 and 1999.

3.2.3 Cost Per Person

The second step in understanding the rising costs of medical care is to gain an understanding of treatment prices. A rough, but straightforward measure of resource allocation is the per person cost of treatment. This measure provides an overview of how economic resources are allocated among diseases, and provides a starting point for an analysis of treatment costs in the economy. However, per person treatment costs should not be thought of as treatment prices for they do not control for service intensity, service type dynamics or patient characteristics.

Table 4 presents the per person treatment costs for many of the most costly conditions in the United States. The per person costs are constructed by dividing the weighted sum of expenditures spent treating a condition by the weighted sum of people who report having the listed condition. All expenditures are reported in 2000 dollars discounted using the overall Consumer Price Urban (CPI-U) Index. Changes in per person costs represent changes relative to the overall inflation rate as measured by the CPI-U.

Immediately apparent from Table 4 is the degree of treatment cost heterogeneity between disease groups. For example, lung cancer costs nearly $10,000 per

Table 3.4: Cost Per Person

Disease Type	1996	1997	1998	1999	2000	2001	2002	2003	Overall
Infectious	94	358	166	336	120	260	202	202	213
008 Intestinal	28	38	33	34	42	42	45	51	38
042 H.I.V.	3,219	5,192	3,548	6,088	2,280	6,902	6,951	8,417	5,562
079 Viral	140	100	94	150	126	112	217	171	140
Neoplasms	2,315	3,925	2,740	3,233	2,581	3,165	2,658	2,693	2,905
162 Trachea/Lung	11,263	6,007	11,297	10,807	11,643	8,310	8,582	9,962	9,740
174 Breast	2,633	4,478	3,211	1,722	3,051	5,250	3,827	3,858	3,543
239 Unspecified	1,083	2,273	1,249	1,372	1,223	1,132	1,467	1,813	1,456
Endocrine	291	873	348	638	200	477	302	331	423
250 Diabetes	819	864	716	835	909	1,239	1,081	1,070	957
272 Lipoid	462	403	389	434	400	471	457	551	457
Blood	972	7,342	1,413	4,191	632	2,871	1,354	1,650	2,450
Mental Health	462	389	483	562	329	343	400	297	403
296 Psychoses	1,823	1,768	1,394	940	1,222	2,632	1,489	1,239	1,562
300 Neurotic	426	398	503	426	401	382	422	411	418
311 Depressive	520	529	487	499	542	576	524	556	531
Nervous System	508	465	641	614	589	573	787	682	605
354 Mononeuritis	651	799	1,008	502	800	932	629	1,057	812
365 Glaucoma	407	422	506	483	381	482	551	647	489
366 Cataract	1,077	999	1,130	1,081	940	827	1,207	798	1,003
382 Otitis Media	134	138	179	146	170	160	176	186	159
Circulatory	1,436	1,394	1,536	1,307	1,311	1,160	1,097	1,220	1,296
401 Hypertension	393	378	391	464	428	472	489	511	446
410 A.M.I.	10,172	7,062	4,282	6,495	6,611	6,583	7,978	7,656	7,067
414 Ischemic	3,380	3,974	1,532	2,031	3,920	2,425	1,571	2,182	2,653
427 Dysrhythmia	2,103	920	1,306	920	1,023	1,390	1,339	971	1,226
428 Heart Fail.	2,782	2,314	3,813	4,785	2,524	3,476	2,156	1,879	2,909
429 Heart Dis.	1,435	1,629	1,248	1,362	1,374	1,431	1,712	1,239	1,429
436 C.V.A.	4,484	4,006	4,416	3,150	4,907	4,267	3,138	4,303	4,084
444 Arterial Emb.	4,071	2,769	4,795	4,570	4,751	3,809	2,731	2,490	3,629

Cost per Person (cont.)

Disease Type	1996	1997	1998	1999	2000	2001	2002	2003	Overall
Respiratory	261	240	327	312	274	244	327	241	277
473 Sinusitis	105	116	171	219	127	162	199	160	155
477 Allergy	168	175	219	216	222	258	272	253	228
486 Pneumonia	1,665	1,269	1,632	1,650	2,127	1,055	1,571	927	1,464
492 Emphysema	1,142	2,596	2,644	876	1,582	1,417	754	918	1,493
493 Asthma	427	350	298	425	399	501	504	536	436
786 Other	544	355	604	422	473	499	653	597	523
G.I.	522	502	851	753	614	602	668	555	627
530 Esophagus	598	655	619	545	434	549	635	714	607
536 Stomach	269	205	208	245	251	295	382	392	281
553 Hernia	1,030	973	764	1,050	777	1,592	1,067	1,209	1,056
575 Gallbladder	3,967	2,412	1,596	3,759	2,182	2,733	3,532	3,441	2,962
Gen.-Urinary	525	552	1,020	879	662	643	928	800	744
586 Renal Fail.	3,498	3,729	9,770	8,609	8,647	7,210	7,999	5,613	6,744
Pregnancy	4,058	2,436	4,176	3,787	3,016	2,951	2,956	2,988	3,260
V22 Preg.	5,832	3,750	4,872	4,630	4,829	5,470	4,730	5,450	4,959
Skin	201	233	791	783	357	255	487	281	414
Musc-Skel	578	597	852	578	529	548	680	671	631
716 Arthropathy	399	336	333	249	348	476	380	491	388
719 Joint Dis.	577	455	440	357	595	-	661	728	559
722 Intervert.	1,186	1,440	1,147	1,418	1,313	1,159	1,335	1,287	1,289
724 Back Dis.	441	275	279	341	359	392	401	489	375
Peri-Natal	9,643	38,084	203,342	33,767	38,460	6,510	64,737	18,057	37,363
Injuries	731	829	1,135	908	808	780	942	841	870
820 Frac. Femur	7,481	7,156	6,214	4,691	7,899	5,376	7,241	6,083	6,448
959 Injury	709	618	415	733	527	651	678	666	625
Other	1,268	1,755	2,456	1,837	1,662	1,685	2,203	1,957	1,830
780 Symptoms	295	218	294	312	274	367	441	383	329

person per year, whereas intestinal infections are less than $40 per person per year. Within chapter cost heterogeneity is nearly as important as the between chapter cost heterogeneity. For instance, infectious diseases includes both the cheapest treatment considered, intestinal infections, and one of most expensive disease treatments, H.I.V..

Treatment costs per person have generally experienced an upward trend. Twelve of the sixteen major chapter headings experience higher real per person treatment costs in 2003 than in 1996. Two of the four chapter heading groups that experienced a decline in per person costs over the full period are pregnancy and respiratory conditions. Both of these conditions have seen real cost increases since 1997. Only circulatory and mental health conditions have experienced a steady decline in real per person costs over the period.

Although real treatment costs have been rising over the period, the changes have been typically mild, but the magnitude depends on the condition considered. The ICD chapter with the largest per person cost increases are peri-natal conditions, the least prevalent conditions considered, and infectious disease, the cheapest condition considered. However, endocrine conditions, which are both expensive and prevalent conditions, also experience significant increases in per person costs over the period. Within chapter variance in per person disease costs are as important as the between chapter cost differences. For instance, many of the acute circulatory conditions, such as acute myocardial infarction (heart attack) and stroke, have per person costs that remain flat or even decrease over the period. However, hypertension, which is also a circulatory condition, experiences a substantial increase in the per person costs over the period.

Table 3.5: Treatment Technology - Input Shares

Disease	Drugs	Office Doctor	Office Non-Dr	Inpatient /E.R.	Out-patient	Other
Infectious Disease	0.301	0.245	0.029	0.341	0.057	0.028
008 Intestinal Infection	0.100	0.385	0.020	0.429	0.044	0.022
042 H.I.V.	0.425	0.079	0.017	0.297	0.061	0.121
079 Viral Infection NOS	0.048	0.240	0.018	0.673	0.011	0.010
Neoplasms	0.036	0.193	0.046	0.504	0.193	0.027
162 Trachea/Lung	0.014	0.111	0.044	0.609	0.120	0.102
173 Skin Neoplasm	0.006	0.589	0.017	0.154	0.172	0.061
174 Female Breast	0.082	0.214	0.058	0.275	0.344	0.026
239 Unspecified Neoplasm	0.014	0.198	0.035	0.535	0.163	0.056
Endocrine	0.65	0.111	0.026	0.157	0.047	0.009
250 Diabetes Mellitus	0.360	0.151	0.023	0.213	0.039	0.215
272 Lipoid Disorder	0.852	0.074	0.026	0.006	0.026	0.017
Blood Conditions	0.178	0.169	0.051	0.477	0.122	0.004
Mental Health	0.438	0.133	0.105	0.201	0.05	0.072
296 Affective Psychoses	0.331	0.139	0.093	0.316	0.053	0.067
300 Neurotic Disorders	0.455	0.157	0.083	0.185	0.012	0.108
311 Depressive Disorder	0.446	0.150	0.113	0.225	0.030	0.037
Nervous System	0.142	0.213	0.048	0.134	0.145	0.318
354 Mononeuritis Upper Limb	0.024	0.310	0.100	0.062	0.473	0.030
365 Glaucoma	0.399	0.353	0.022	0.022	0.082	0.122
366 Cataract	0.022	0.404	0.017	0.037	0.518	0.002
382 Otitis Media	0.117	0.503	0.024	0.156	0.138	0.061
Circulatory	0.236	0.071	0.015	0.608	0.056	0.014
401 Hypertension	0.635	0.152	0.018	0.108	0.023	0.064
410 Acute Myocardial Infarct	0.030	0.044	0.008	0.870	0.026	0.022
414 Ischemic Heart Disease	0.096	0.072	0.012	0.716	0.084	0.020
427 Cardiac Dysrhythmia	0.153	0.119	0.028	0.603	0.085	0.013
428 Heart Failure	0.073	0.048	0.005	0.768	0.045	0.062
429 Heart Disease	0.181	0.096	0.016	0.569	0.077	0.062
436 C.V.A. (stroke)	0.032	0.027	0.012	0.774	0.052	0.103
444 Arterial Embolism	0.040	0.051	0.011	0.824	0.056	0.018
All Conditions	0.159	0.149	0.047	0.406	0.093	0.146

Treatment Technology (cont.)

Disease	Drugs	Office Doctor	Office Non-Dr	Inpatient /E.R.	Out-patient	Other
Respiratory	0.410	0.355	0.035	0.078	0.122	0.000
473 Chronic Sinusitis	0.323	0.393	0.040	0.119	0.125	0.000
477 Allergic Rhinitis	0.609	0.215	0.131	0.022	0.022	0.000
486 Pneumonia	0.018	0.054	0.005	0.896	0.013	0.014
492 Emphysema	0.150	0.051	0.008	0.690	0.042	0.059
493 Asthma	0.445	0.141	0.020	0.339	0.025	0.029
786 Other Respiratory	0.043	0.114	0.017	0.728	0.094	0.004
Gastro-Intestinal	0.249	0.091	0.012	0.508	0.137	0.004
530 Diseases Of Esophagus	0.673	0.081	0.008	0.136	0.101	0.001
536 Stomach Function	0.387	0.111	0.020	0.360	0.115	0.008
553 Abdominal Hernia	0.146	0.114	0.009	0.422	0.302	0.007
575 Gallbladder Disorder	0.007	0.068	0.007	0.745	0.171	0.002
Genito-Urinary	0.155	0.2	0.068	0.348	0.228	0.002
586 Renal Failure	0.022	0.202	0.194	0.288	0.291	0.002
Pregnancy	0.03	0.105	0.019	0.819	0.025	0.002
V22 Normal Pregnancy	0.003	0.111	0.018	0.844	0.022	0.002
Skin Conditions	0.254	0.313	0.042	0.261	0.111	0.019
Musculo-Skeletal	0.182	0.193	0.12	0.324	0.146	0.036
716 Arthropathies NOS	0.337	0.186	0.055	0.273	0.086	0.062
719 Joint Disorder NOS	0.049	0.179	0.097	0.434	0.202	0.040
722 Intervertebral Disc	0.069	0.184	0.144	0.440	0.152	0.011
724 Back Disorder NOS	0.090	0.247	0.226	0.308	0.123	0.005
Peri-natal	0.005	0.009	0.006	0.963	0.008	0.009
Injury	0.031	0.171	0.077	0.542	0.131	0.049
820 Fractured Femur	0.004	0.020	0.003	0.877	0.006	0.090
959 Injury NOS	0.029	0.213	0.128	0.488	0.133	0.010
Other	0.062	0.039	0.015	0.08	0.03	0.774
780 General Symptoms	0.172	0.108	0.027	0.586	0.081	0.027
All Conditions	0.159	0.149	0.047	0.406	0.093	0.146

3.2.4 Disease Treatment Technology

How input services are used to treat conditions helps determine the role of technology in explaining medical care costs. Disease treatment employs a heterogeneous bundle of medical care services such as drugs, office visits, hospital stays, and durable and non-durable supplies to treat conditions. Table 5 presents an overview of the input services employed to treat the most costly diseases in the United States. As can be seen from Table 5, approximately half of all medical care expenditures occur in the hospital as either E.R., inpatient, or outpatient care. Drugs and office-based physician care represent 16% and 15% of total expenditures, respectively, which are the largest expenditure shares other than hospital. Other services such as durable and non-durable supplies, dental care, and home health care together represent approximately 15% of total medical care spending, but that spending is highly concentrated in nervous system conditions and other diseases. Non-doctor visits represent the smallest fraction of total medical care expenditures.

The relative intensity of input services varies significantly across diseases. For instance, more than 65% of endocrine treatment expenditures are on drugs, whereas no other chapter spends more than 45% of treatment expenditures on drugs. Pregnancy and peri-natal conditions each spend more than 80% of treatment expenditures on inpatient and E.R. services. Only 60% of circulatory care spending is represented by inpatient and E.R care despite the fact that circulatory care is the second most hospital intensive chapter. Input service intensity heterogeneity exists within chapters, as well. Hypertension is a drug intensive treatment that spends 80% of its total treatment expenditures on drugs. However, none of the other circulatory conditions considered spend more than 30% of total spending on drugs. Mental health spending also experiences within chapter variance in service intensity. Depressive and neurotic disorders are drug intensive treatments that spend more than 50% of total treatment expenditures on drugs, whereas psychoses

treatment spends less than 40% of total treatment expenditures on drugs.

The service intensity is difficult to predict, but is disease specific. For instance, observable characteristics of the disease, such as the per person cost or the disease prevalence, do not help determine the service intensity of the condition. One might believe that expensive conditions are hospital intensive. However, intestinal infections, the cheapest condition considered, is a relatively hospital intensive condition. Moreover, H.I.V. treatment, one of the most expensive conditions, is not very hospital intensive. One might assume that prevalent conditions are treated outside of the hospital. However, arthropathies (arthritis) and emphysema are fairly prevalent hospital intensive conditions.

3.3 Treatment Prices - A Disease Comparison

Disease treatment prices are constructed using the procedure described in Section 2 in order to control for service intensity, service type dynamics, and patient characteristics. This procedure implicitly uses index theory to construct a commodity aggregate for the price of a disease treatment. The commodities are medical care service inputs that are used in the treatment of a disease. The price of each medical care input service is constructed by controlling for the types of activities that occur during an event, demographic characteristics of the individual, and the insurance type that paid for the event. Service intensity is identified by constructing the share of expenditures spent on a specific service that is used in the treatment of a disease.

As section 3 has demonstrated, diseases vary dramatically in per person costs and the technologies used to treat them. These differences persist within aggregate categories of related diseases as defined by the ICD system. In order to account for these types of heterogeneity in the construction of disease prices the diseases are defined as narrowly as possible. The most specific definitions available on the MEPS are 3-digit ICD-9 codes. The 3-digit conditions considered are chosen from

each of the chapter headings. The chosen diseases are often either the most costly or most prevalent condition within each of the ICD-9 chapter headings.

3.3.1 Naive Estimates

Table 6 presents a summary of the treatment price increases for several diseases. The results in Table 6 assume that treatment outcomes have not changed at all over the period. Presented along the rows are the average annual price changes over the period for each of the regions. For example, stomach infections in the Northeast have undergone a 33.6% increase that is equivalent to a 4.2% per year price increase averaged over the period 1996 to 2003.

Information concerning the total costs of the disease considered is also listed among the results presented in Table 6. This information includes the cost per person of the disease in 2000 dollars, the percent of total spending represented by this disease as a fraction of total ICD-9 chapter spending, and the annual average total costs of the disease in billions of dollars deflated to the year 2000. For example, stomach infections cost $1.29 billion per year, which is approximately $38 per person, and represents slightly more than 15% of total spending on infectious diseases. The percent of total spending represented by the disease considered is presented in order to provide a measure for how representative the disease is in each chapter.

Table 6 demonstrates that the rate of price increases are also very heterogeneous across diseases. For example, consider three costly conditions: pregnancy, diabetes, and hypertension. These three conditions face vastly different price conditions. The rates of increase vary across diseases and the regions face different price increases across diseases. For example, diabetes faces the highest price increases in the Midwest, but hypertension has the highest rate of increase in the West and pregnancy faces the fastest rate of increase in the Northeast.

The most costly diseases have neither the lowest nor the highest rates of

Table 3.6: Summary of Disease Treatment Prices

Variable	Stomach Infections	Skin Cancer	Diabetes	Depr-ession	Otitis Media	Hyper-tension
Chapter	Infectious Disease	Neoplasms	Endocrine System	Mental Health	Nervous system	Circul-atory
Northeast Increase	0.0425	0.0782	0.0396	0.0316	0.0904	0.0378
Midwest Increase	0.0583	0.0543	0.0567	0.0437	0.0659	0.0390
Southeast Increase	0.0473	0.0537	0.0503	0.0371	0.0508	0.0392
West Increase	0.0446	0.0429	0.0521	0.0477	0.0451	0.0411
Non-MSA Increase	0.0407	0.0352	0.0398	0.0339	0.0414	0.0257
Annual Costs (billions)	1.29	1.45	17.63	10.49	2.42	18.63
Cost per Person	38		957	531	159	446
% of Chapter	0.1531	0.0397	0.7478	0.3725	0.0650	0.2396

Variable	AMI	Heart Disease	Asthma	Stomach Disorder	Preg-nancy	Arthritis
Chapter	Circu-latory	Circu-latory	Respir-atory	Gastro-Intestinal	Pregnancy	Musculo-skeletal
Northeast Increase	0.0596	0.0642	0.0459	0.0402	0.0552	0.0423
Midwest Increase	0.0473	0.0419	0.0460	0.0250	0.0454	0.0408
Southeast Increase	0.0582	0.0458	0.0468	0.0384	0.0461	0.0378
West Increase	0.0605	0.0460	0.0437	0.0309	0.0448	0.0429
Non-MSA Increase	0.0271	0.0279	0.0440	0.0279	0.0235	0.0247
Annual Costs (billions)	11.98	11.59	6.09	2.61	34.14	7.67
Cost per Person	7,067	1,429	436	281	4,959	388
% of Chapter	0.1540	0.1491	0.1643	0.0848	0.8859	0.1967

change over the period. Rather, Otitis Media faces the highest rate of price increase and stomach disorder treatment experiences some of the lowest price increases. Treatment prices for Otitis Media increase at a rate faster than 6.5% per year for two regions - the Northeast and the Midwest. No other conditions face rates of increase of at least 6.5% per year in more than one region. Moreover, Otitis Media prices in the Northeast increase at a rate of 9% per year which is 1.2% per year faster than the next highest rate of increase - skin cancer in the Northeast. In contrast, Stomach disorders do not experience price increases greater than 4% per year. Stomach disorder treatment prices in the Midwest face price increases as low as 2.5% per year. However, 2.5% per year is not the slowest rate of increase observed. Pregnancy services in the non-MSA region experiences a rate of increase less than 2.4% per year.

Overall, regional price differences and the magnitude of price increases depend on the disease, but some patterns appear. The Northeast appears to face some of the highest price increases for several conditions. The Northeast region has the highest or second-highest rate of increase for eight of the fourteen conditions considered, which is greater than any other region. On the other hand, the non-MSA region never has the highest rate of increase and has the lowest rate of increase for nine of the fourteen conditions considered.

3.3.2 Accounting for Health Outcomes

Although the treatment prices presented in Table 6 account for heterogeneity in the types of services used to treat disease, they fail to account for whether changes in services are yielding different health outcomes over time. Failing to account for these changes implicitly ignores quality improvements of these services over time. The observed technological changes may be advancing the health of society, and an index of disease treatments should account for these health improvements. Accounting

for health improvements requires health outcome measures of each of the diseases considered.

Table 7 provides aggregate health outcome trends for several of the diseases considered. Under some (admittedly strong) assumptions, the association of the outcome measure with the disease whose treatment we consider suggests that changes in these measures over time identify the productivity of medical treatment.[3] Simply stated, these measures represent medical care output.

The outcome measures considered are disease specific. For six conditions that include stomach infections, skin cancer, diabetes, acute myocardial infarction (heart attacks), heart disease, and hypertension we consider the age-adjusted mortality. The description for how the age-adjustment was performed for mortality is described in Section 2. Similarly, the age-adjusted suicide and infant mortality rates are used to evaluate depression and pregnancy, respectively. For all of the conditions considered here, mortality statistics are taken from vital statistics records and published by the Centers for Disease Control and Prevention (2005).

Asthma and arthritis use slightly different health measures. For asthma we use the percent of adults who experience an asthma attack within the past twelve months among self-reported asthmatics. Reported results are calculated and tabulated by the CDC (2005) from the Behavioral Risk Factor Surveillance Survey (BRFSS) over the period 1996-2002. For arthritis, the health measure is constructed by the author from the MEPS. The reported measure is the probability that an individual's mobility will increase within the year conditional on initial health and demographic characteristics such as age, sex, race, income and insurance status. Initial health is measured as whether an individual had any activity limitation prior to the initiation of arthritis treatment within the year. Mobility is measured as whether the individual walks a mile, walks up stairs, bends down, or grabs a pen

[3] see Heidenreich and McClellan (2001) for a discussion of this issue especially with respect to heart attacks.

Table 3.7: Health Outcomes

Disease	1996	1997	1998	1999	2000	2001	2002	2003
	Age-adjusted Mortality Per 100,000							
Stomach Infections	-	-	-	0.37	0.45	0.51	0.77	-
Skin Cancer	-	-	-	3.4	3.4	3.5	3.4	-
Diabetes	23.8	23.7	24.2	25.0	25.0	25.3	25.4	25.3
Depression (Suicide)	11.5	11.2	11.1	10.5	10.4	10.7	10.9	10.8
A.M.I.	-	-	71.8	69.2	67.1	63.9	60.5	-
Heart Disease	212.1	203.6	196.9	194.6	186.8	177.8	170.8	162.9
Hypertension	-	-	-	14.74	15.41	16.03	16.62	-
Pregnancy (Infant Mortality)	7.3	7.2	7.2	7.0	6.9	6.8	7.0	-
	Asthma Attack within Last Year							
Asthma	3.7	3.4	3.3	3.4	3.8	3.7	3.3	-
	Probability of Mobility Deterioration for Arthritics							
Arthritis	0.335	0.379	0.372	0.351	0.397	0.371	0.369	0.393

with difficulty. Mobility changes are measured as changes in the mobility status from the earliest wave in the year to the latest wave in the year.

Of the conditions that use mortality as the health outcome measure, stomach infections are the least deadly of all the conditions. Less than one person per 100,000 dies as a result of contracting a stomach infection. However, since 1999 the rate of mortality rate of this condition has more than doubled from .37 in 1999 to .77 in 2002. Hypertension has a much higher mortality rate than do stomach infections, but experiences a similar trend rising from 14.74 to 16.62 per 100,000.

In contrast to stomach conditions, heart disease is clearly the most fatal disease of the conditions considered. The age adjusted mortality of heart disease is always more than 150 per 100,000. However, the mortality rate from this disease has fallen dramatically over the period from 212 per 100,000 in 1996 to 163 in 2003. Moreover, the mortality rate of this disease has not experienced a single year of increase over this period. Acute Myocardial Infarctions have also seen significant

decreases in mortality, falling from 71.8 per 100,000 in 1998 to 60.5 per 100,000 in 2002.

The suicide rate, a health outcome used to measure the efficacy of depression treatment, fell over the period 1996-2000 from 11.5 to 10.4. However, since 2000 the suicide rate has increased, if only slightly, from 10.4 to 10.8 per 100,000. The other health conditions examined have very flat trends over the period. Diabetes experiences a mild mortality rate increase over the period, whereas infant mortality falls slightly and skin cancer mortality remains exactly the same. The number of asthma attacks and the percent of people gaining mobility for arthritis also have not changed much over the period.

The values presented in Table 8 represent the average annual percentage change in treatment prices over the period. Price changes labelled as outcome incorporate changes in health outcome measures, whereas price changes labelled naive do not account for health outcomes. Both the naive and the outcome-based measures are determined relative to the earliest period for which the outcome measure is available. For instance, if the outcome-based measure is the age-adjusted mortality, then the price increase is defined as the percent increase of treatment prices needed to maintain the same level of age-adjusted mortality observed in the earliest period - often the year 1996. The outcome-based measures are constructed by first determining the ratio of age-adjusted mortality rates in the given year to the age-adjusted mortality rate of the earliest year observed. For example, this ratio for diabetes mortality is 1.063 in 2003. This ratio is then multiplied by the naive price for the relevant year. The reported changes are the percentage change of this product over the period where outcomes are observed.

The importance of health outcomes are very important for determining the price of disease. For instance, some diseases, such as heart disease and acute myocardial infarction, have had improved health outcomes over the period, which has

Table 3.8: Price Increases for Outcome-Based Measures

Region	Statistic	Diabetes	Depression	Heart Disease	Arthritis	Asthma
MSA Northeast	Naive	0.039	0.032	0.064	0.042	0.046
	Outcome	0.050	0.022	0.020	0.071	0.018
MSA Midwest	Naive	0.057	0.044	0.042	0.040	0.046
	Outcome	0.068	0.033	0.003	0.068	0.022
MSA Southeast	Naive	0.050	0.037	0.046	0.037	0.047
	Outcome	0.061	0.027	0.006	0.065	0.023
MSA West	Naive	0.052	0.048	0.046	0.043	0.044
	Outcome	0.063	0.037	0.006	0.072	0.018
Non-MSA	Naive	0.049	0.042	0.037	0.033	0.056
	Outcome	0.060	0.032	-0.001	0.060	0.029

Region	Statistic	AMI	Hypertension	Infection	Skin Cancer	Pregnancy
MSA Northeast	Naive	0.042	0.030	0.013	0.066	0.055
	Outcome	0.004	0.066	0.297	0.066	0.029
MSA Midwest	Naive	0.063	0.044	0.082	0.111	0.045
	Outcome	0.021	0.082	0.440	0.111	0.016
MSA Southeast	Naive	0.069	0.052	0.094	0.113	0.046
	Outcome	0.026	0.090	0.467	0.113	0.037
MSA West	Naive	0.050	0.018	0.055	0.049	0.045
	Outcome	0.010	0.053	0.386	0.049	0.026
Non-MSA	Naive	0.050	0.032	0.071	0.058	0.029
	Outcome	0.011	0.068	0.418	0.058	0.024

mitigated much of the treatment price increases observed over the period. However, other conditions such as hypertension and arthritis have had deteriorating outcomes over the period, and thus accounting for health outcomes has exacerbated any price increases in those treatments. The importance of health outcomes is so severe that it can reverse the ranking of diseases. For instance, heart disease as measured by the naive estimate faces faster price increases in the Northeast than any other disease. However, after accounting for health outcomes, heart disease treatment is second only to AMI as having one of the lowest rates of increase.

The price changes calculated using this method attributes the entire change in observed health outcomes to the quality of medical care services over time. Attributing the entire fraction of observed changes to medical care productivity relies on strong assumptions about the demographic and behavioral compositional changes of society. For these results to be attributed to medical care, changes in diet, smoking habits, and environmental factors such as the safety of working environments must also not have changed.

3.4 Treatment Prices - Dynamic & Regional Analysis

The following sections examine the price levels and price increases for each of the twelve conditions considered. The analysis evaluates whether certain regions have higher price levels than other regions of the country and whether the price increases found in the previous section are uniform over the period. These sections also offer some insight as to why the observed price changes occur by examining the dynamics of medical care technology for each disease. All results are presented under the assumption that outcomes remain constant over the period.

3.4.1 Chapter 1: Infectious Disease

Infectious diseases include communicable or transmissible diseases as well as a few diseases of unknown but possibly infectious origin. Infectious diseases include most amoebic, parasitic, bacterial, protozoal, and viral infections, but exclude influenza, acute respiratory infections, and certain localized infections. Intestinal infections are infections found in the stomach that are not due to other specific parasitic, bacterial, viral or other type organism elsewhere listed. Although intestinal infections are fairly cheap to treat, the prevalence of the condition is responsible for it being the most costly infectious disease in the United States. Intestinal infections represent the most prevalent infectious disease considered, and they consequently represent more than 15% of infectious disease spending. Although the prevalence of these conditions has fallen off since 1996, the prevalence rate has remained stable since 1998.

The treatment of stomach infections is surprisingly hospital intensive. Moreover, the share of hospital spending that includes outpatient, inpatient, and emergency room services, has increased over the period from 35.7% of spending to more than 43% of spending. Much of this increase has occurred since 2000. Drugs and physician office visits make up the bulk of the other spending on this treatment, each

Table 3.9: Stomach Infection Treatment Shares

Year	Anti-Infective	G.I. Agent	Hormones	Other Rx	Inpatient/ ER	Out-patient	Doctor Office	Non-Doctor Office
1996	0.086	0.006	0.155	0.032	0.292	0.066	0.348	0.015
1997	0.047	0.010	0.085	0.038	0.540	0.013	0.253	0.014
1998	0.043	0.022	0.106	0.036	0.276	0.088	0.414	0.015
1999	0.091	0.013	0.158	0.047	0.293	0.011	0.368	0.018
2000	0.056	0.010	0.187	0.036	0.323	0.060	0.315	0.012
2001	0.060	0.022	0.177	0.029	0.410	0.012	0.276	0.015
2002	0.067	0.024	0.151	0.043	0.313	0.042	0.329	0.032
2003	0.047	0.020	0.145	0.050	0.410	0.023	0.290	0.014

Table 3.10: Stomach Infection Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	0.994	0.956	0.983	0.927
1997	0.973	1.042	0.993	1.111	0.958
1998	1.078	1.053	1.028	1.099	0.942
1999	1.316	1.135	1.048	1.157	1.058
2000	1.101	1.137	1.121	1.169	1.062
2001	1.176	1.271	1.205	1.308	1.141
2002	1.259	1.368	1.313	1.285	1.235
2003	1.341	1.459	1.318	1.335	1.310

representing more than 25% of spending. The make-up of this spending does not appear to have changed systematically over the period. The share of anti-infective medications fell in half from 1996 to 1997, but has remained stable since 1997. G.I. agents have grown from less than 0.5% of spending to slightly more than 2% of spending.

Treatment prices for infectious disease treatment have risen by between 4.3% and 5.8% per year. The Midwest experienced the highest rate of increase of any region, whereas the Northeast region, faces the lowest price increases in the country. These two regions, the Midwest and the Northeast, have some of the highest price

levels in the country despite having such different rates of increase. The Northeast and the Midwest regions both begin and end the period with the highest price levels in the country, swapping places over the period. The non-MSA region, in contrast, has the lowest price levels of any region, beginning and ending the period with the lowest price levels of any region.

The price increases have been uneven over the period. Four of the five regions experience rates of increase that are higher after 2000 than they are prior to 2000. The rate of increase is twice is fast in the later part of the period than it is in the earlier part of the period for the Northeast and the Midwest, regions that experience some of the highest price levels in the country.

3.4.2 Chapter 2: Neoplasms

The ICD chapter, neoplasms, are the group of conditions that include what are commonly referred to as cancers. Neoplasms are new and abnormal growths of tissue that serve no life sustenance or procreation purpose. Some neoplasms become progressively worse and may metastasize by spreading to other organs. Neoplasms that become worse are referred to as malignant. Those neoplasms that are unlikely to become worse or metastasize are generally regarded as benign.

The general idea behind neoplasm treatment is to remove the neoplasm, whether it is benign or malignant. If a neoplasm becomes worse it is defined as cancerous and can be quickly fatal. The severity of cancer depends upon, among other things, the location of the growth. In particular, the severity depends upon the importance of the tissue containing the cancer. Therefore, neoplasms are identified using whether the growth is either benign or malignant and the location of the growth such as the lung, the breast, the prostrate or the skin. Removal of a neoplasm can involve drugs, radiation, intravenous chemicals, and/or surgery. The removal process may involve destroying healthy tissue as well as cancerous tissue.

Moreover, the process may involve the removal of an organ vital for life sustenance such as a lung or the liver. The seriousness of these diseases and the nature of the treatment result in rather discrete consequences. The treatment either works and the individual is cured, or the treatment fails, and the person dies. It is rare, although not impossible, for an individual to contract a neoplasm and have the patient live on indefinitely contracting new neoplasms that are constantly treated one after the other.

Neoplasms as a class are relatively common and represent a large fraction of total medical care expenditures and deaths. However, the nature of treatment and health outcomes suggests that individuals who had neoplasms in the past are unlikely to continue treatment in the sample period. Therefore, a very small fraction of the population receives treatment for a specific type of neoplasm located in a specific tissue during any year of the sample. Unfortunately, treatment protocols vary significantly across tissue types considered. These characteristics make using the MEPS to price one of the representative diseases difficult, because pricing a single three-digit ICD-9 code provides very small sample sizes, but aggregating neoplasms treats unlike treatments as if they were the same. For these reasons, we choose to price the most prevalent type of neoplasm, skin cancer, although treatment costs for skin neoplasms are a small fraction of total neoplasm spending and both breast and prostate cancers are more prevalent among their relevant populations. [4]

Skin cancer treatment is an office visit intensive treatment. More than half of expenditures are associated with physician visits. More than half of the expenditures on office visits involve surgical procedures. Hospital expenditures represent approximately 30% of total expenditures on skin cancer, also a large fraction of total expenditures. The dynamics of these inputs have not undergone any systematic

[4]The prevalence rate of prostate cancer is zero among women because they do not have a prostate, and breast cancer is very uncommon among men. Hence, skin cancer is the most prevalent cancer for the population as a whole.

Table 3.11: Skin Cancer Input Shares

Year	IP/ER	Outpatient	Dr Office Surgery	Non-Surgery Dr. Office	Non-Dr Office	Rx
1996	0.249	0.143	0.323	0.246	0.003	0.036
1997	0.018	0.257	0.344	0.304	0.010	0.067
1998	0.076	0.427	0.205	0.229	0.032	0.031
1999	0.144	0.225	0.291	0.244	0.038	0.058
2000	0.028	0.177	0.283	0.368	0.082	0.062
2001	0.105	0.153	0.405	0.238	0.043	0.056
2002	0.189	0.177	0.263	0.292	0.023	0.057
2003	0.063	0.163	0.280	0.405	0.028	0.061

Table 3.12: Skin Cancer Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.240	1.244	1.226	1.240
1997	1.176	1.293	1.221	1.305	1.276
1998	1.219	1.344	1.389	1.386	1.422
1999	1.363	1.379	1.274	1.445	1.441
2000	1.415	1.399	1.544	1.639	1.440
2001	1.545	1.539	1.505	1.685	1.571
2002	1.515	1.749	1.626	1.517	1.560
2003	1.626	1.781	1.779	1.648	1.735

change over the period. Inpatient care has fallen as a share of expenditures while office visits and in particular surgical office visits have risen as a share of expenditures from 1996 to 2003. However, these changes do not appear to point to a pattern, as the changes over time have been erratic.

The treatment prices of skin cancer treatment have undergone high rates of price increase that have varied significantly across regions. The Northeast region has seen the highest rate of price increase at 7.8% per year, while the West region has seen a much lower rate of increase of 4.3% per year that is nearly of half that experienced in the Northeast. Much the increase in the Northeast region occurred

in the one year between 1996 and 1997. Since 1997, however, the Southeast has seen the highest rate of increase at over 6.5% per year, but the Northeast still has the second highest rate of increase of any region at 5.5% per year.

Price levels also vary significantly across regions. The Midwest has one of the highest price levels in the country, ending the period with the highest price level and beginning the period with a price level second only to the Southeast. However, the West also has high price levels, and has higher price levels than the Midwest in five of the eight years considered. The Northeast, despite its high rate of increase, experiences some of the lowest price levels in the country. They begin and end the period with the lowest price level.

3.4.3 Chapter 3: Endocrine Conditions

The ICD chapter listed here as "Endocrine conditions" includes nutritional, metabolic, endocrine and metabolic disorders that are not due to neoplasms. The endocrine system is characterized as a system of glandular organs. The organs that comprise the endocrine system include the pancreas, hypothalamus, pituitary, thyroid, parathyroids, pineal body, adrenal glands, and reproductive glands, which are either ovaries or testes depending on the sex of the individual. The endocrine system's primary function is the secretion of hormones into the bloodstream which are then used by cells in the body to help maintain and regulate body functions. The type of body functions maintained and regulated depend on the hormones considered. Disorders of these conditions can be related to the cellular response to these hormones or the ability of the glands to produce or regulate the secretion of these hormones.

Diabetes is a disease in which the body does not produce or properly use insulin, which is a hormone needed to convert sugar, starches and other food into energy. The pancreas is the organ primarily responsible for the production of insulin. Diabetes has serious health consequences. Since diabetics have trouble converting

Table 3.13: Diabetes Treatment Shares

Year	ER	Inpatient	Out-patient	Dr Office	Non-Dr Office
1996	0.008	0.331	0.129	0.206	0.034
1997	0.015	0.327	0.066	0.211	0.037
1998	0.012	0.285	0.056	0.272	0.046
1999	0.011	0.235	0.033	0.244	0.027
2000	0.008	0.217	0.059	0.239	0.025
2001	0.025	0.318	0.056	0.206	0.018
2002	0.005	0.233	0.036	0.224	0.054
2003	0.012	0.225	0.033	0.211	0.036

Year	Anti-Lipid	Cardio-vascular	Hor-mones	Anti-Diabetic
1996	0.050	0.028	0.013	0.201
1997	0.070	0.021	0.020	0.233
1998	0.082	0.020	0.023	0.203
1999	0.105	0.027	0.019	0.299
2000	0.104	0.029	0.021	0.297
2001	0.111	0.025	0.017	0.225
2002	0.134	0.034	0.020	0.259
2003	0.165	0.035	0.016	0.267

sugars and starches to energy, diabetics can often have blood sugar levels that are too high. The high blood sugar levels in turn contribute to kidney disease, blindness, nervous system disorders, increased blood pressure, the possible loss of extremities, and eventually death.

Diabetes is an expensive condition on a per person basis, costing approximately $1,000 per year, and is highly prevalent. Diabetes is easily the most costly endocrine condition to treat in the United States, representing nearly 75% of all endocrine condition spending. Moreover, diabetes is becoming increasingly prevalent over time. The rate of increase of diabetes prevalence is among the fastest in the United States, making diabetes one of the most important diseases to consider.

The technology used to treat diabetes employs a diverse set of services.

Table 3.14: Diabetes Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	0.948	0.930	0.941	0.894
1997	0.902	0.949	0.932	1.015	0.896
1998	1.023	1.009	0.967	1.036	0.961
1999	1.113	1.061	1.015	1.119	0.989
2000	1.147	1.102	1.075	1.136	1.075
2001	1.164	1.227	1.143	1.260	1.138
2002	1.221	1.272	1.237	1.251	1.197
2003	1.315	1.377	1.303	1.332	1.245

Drugs, hospital care, and office-based physician care each represent at least 20% of treatment expenditures in any given year. However, the treatment technology has changed dramatically over the period. Hospital care has fallen from 47% of expenditures in 1996 to 27% of expenditures in 2003, while drug expenditures have risen from 29% of expenditures in 1996 to 48% of expenditures in 2003. Much of the fall in hospital care share has been due to the smaller share of inpatient and outpatient care. Inpatient care has fallen from more than 33% of total expenditures to less than 23% of expenditures, which is more than a 11 point change. The share of outpatient care has been more uneven but nearly as dramatic. The share of outpatient was nearly cut in half between 1996 and 1997 falling from 12.9% to 6.6%, and since 1997 the share of outpatient care was cut in half again from 6.6% to 3.3%.

Taking the place of hospital care has been the employment of cardiovascular, anti-lipid, and new anti-diabetic medications. Anti-lipid medications have experienced the largest share increase of any service rising from approximately 5% of medical care in 1996 to 17% of medical care in 2003. The share changes of other services have not been as steady as anti-lipid medications. However, 1999 witnessed the introduction of two new anti-diabetic medications, Rosiglitazone and Pioglitazone, and the shares of total spending represented by anti-diabetic drugs reflect

this introduction. 1999 and 2000 represent the largest share of diabetes treatment spending on anti-diabetic medications. The shares have decreased since their peak, however, and they finish the period at 26.7% of total spending. Cardiovascular medications have undergone milder increases than both anti-diabetic and anti-lipid medications, rising only 1 point over the period.

Diabetes treatment prices have risen by between 4 and 5.7 percent per year over the period. The variation in both the regional price levels and the inflation rates is fairly small. The West experiences the highest average price level over the period, although they neither start nor end the period with the highest price level. The Non-MSA region has the lowest price level, beginning and ending the period with the lowest price level. The Midwest has experienced the highest rate of inflation of any region at nearly 5.7% per year.

3.4.4 Chapter 5: Mental Health Conditions

Mental disorders include a vast array of conditions associated with brain functioning. The conditions typically reveal themselves in the individual's ability to function socially. The most obvious mental health conditions include schizophrenia, mental retardation and conditions with demonstrable cerebral disease, brain injury, or other cerebral dysfunctions. Schizophrenia is the mental health condition most closely associated with insanity, where the patient claims to see visions and hear voices that are not there, and experiences a high degree of general confusion. Mental retardation conditions are characterized by arrested or incomplete development of the mind, that leads to impairment of skills that contribute to the overall level of intelligence, and cognitive, language, motor, and social abilities. Mental health conditions also include substance abuse and mood disorders. Substance abuse conditions are all attributable to the use of one or more psychoactive substances, which may or may not have been medically prescribed. Mood disorders affect mood changes which are

either sudden or persistent. Systematic mood changes are usually accompanied by changes in the overall level of activity of an individual. The onset of mood changes can often be related to stressful events or situations and tend to be recurrent.

We examine the treatment price of depressive disorders. If a patient suffers from depressive disorders they will have depressive episodes that exhibit lowering of mood, reduction of energy, and decrease in activity. These episodes affect the capacity for enjoyment, interest, reduce concentration, and are commonly associated with marked tiredness. Depressives often have sleep that is disturbed, appetite that is diminished, and self-esteem and self-confidence that are reduced. Finally, depressives may have some ideas of guilt or worthlessness that are often present. The lowered mood of a depressed individual varies little from day to day, and is unresponsive to circumstances. Depressive disorders may be accompanied by waking up in the middle of the night, slower reflexes, agitation, loss of appetite, weight loss, and loss of libido.

In addition to these serious health consequences, depression treatment is the costliest mental health condition and one of the costliest conditions in the United States. Depression represents nearly one third of total mental health costs. Depression is the most prevalent mental health condition, and one of the most prevalent chronic conditions in the United States afflicting between 5-7% of the population, annually. Moreover, the rate of increase in prevalence has been among the fastest of any condition in the United States.

The treatment of depression is fairly drug and hospital intensive. Drugs and inpatient care together represent nearly 70% of all expenditures. Drugs alone represent 44% of nominal depression treatment expenditures. The treatment technology has been changing over time. Depression treatment is becoming more drug intensive and less hospital intensive over time. Inpatient care has fallen from 38% of expenditures in 1996 to 13% of expenditures in 2003. Meanwhile, drugs have increased

Table 3.15: Depression Input Shares

Year Year	IP/ER IP/ER	Out-patient	Doctor Office	Non-Dr Office	CNS Agents	Anti-Depress	Other Psych
1996	0.383	0.028	0.182	0.112	0.024	0.243	0.029
1997	0.379	0.041	0.139	0.108	0.025	0.266	0.040
1998	0.310	0.054	0.132	0.105	0.032	0.306	0.062
1999	0.410	0.009	0.128	0.100	0.026	0.270	0.057
2000	0.190	0.013	0.163	0.129	0.053	0.355	0.097
2001	0.230	0.026	0.161	0.121	0.048	0.354	0.060
2002	0.175	0.028	0.201	0.103	0.056	0.367	0.070
2003	0.126	0.051	0.172	0.120	0.066	0.387	0.079

Table 3.16: Depression Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	0.928	0.921	0.908	0.876
1997	0.941	0.997	0.955	0.981	0.881
1998	1.000	0.975	0.973	0.968	0.911
1999	1.114	1.066	0.986	1.081	0.999
2000	1.111	1.056	1.018	1.106	1.107
2001	1.136	1.150	1.100	1.171	1.069
2002	1.131	1.183	1.142	1.170	1.118
2003	1.252	1.253	1.193	1.255	1.171

as a share of expenditures from less than 30% of expenditures in 1996 to more than half of expenditures by 2003.

All three categories of drugs have seen increasing expenditure shares over this period. The share of expenditures represented by Central Nervous System (CNS) agents and other psychotherapeutic agents have nearly tripled over the period. CNS agents have increased from 2.4% of expenditures to 6.6% of expenditures and other psychotherapeutic agents have increased from 2.9% to 7.9% over the period. Anti-depressant medications have also seen large share increases, rising from 24.3% of expenditures in 1996 to 38.7% of expenditures in 2003.

Depression treatment prices rise by between 3.2% per year, and 4.8% per year. The Northeast region has the highest treatment prices for depression. The Northeast begins the period with the highest depression prices, and ends the period with the second highest depression prices despite a sharp decline in prices between 1996 and 1997. However, the Northeast experiences the slowest rate of price increases over the period. The non-MSA region has the lowest treatment prices of any region, beginning and ending the period with the lowest treatment prices of any region. The West experiences the highest rate of price increase of any region beginning the period with the second-lowest price level and ending the period with the highest price level.

3.4.5 Chapter 6: Nervous System Conditions

Nervous system disorders include a heterogeneous array of conditions that affect the nervous system. Nervous system conditions rarely or only indirectly affect cognitive functioning, which differentiates them from mental health conditions that directly affect cognition. The manifestation of nervous system conditions as health outcomes takes a variety of forms. Epilepsy is characterized by random seizures that vary in frequency and severity across individuals. Multiple sclerosis and Parkinson's disease limit the ability of the individual to perform physical activities, although for different reasons. Deafness and cataracts, which are also nervous system conditions, directly affect sensory perception.

The condition we choose to examine is Otitis Media. Otitis Media is an interesting condition to examine in that it has several features that are unique among the diseases considered here. First, Otitis Media prevalence has been declining over the period, although it is one of the most prevalent conditions considered. Moreover, the prevalence changes do not appear to be due to demographic changes. Second, the condition is almost uniquely present among children, whereas many of the other

Table 3.17: Otitis Media Input Shares

Year	Inpatient/ ER	Out-patient	Anti-Infective	Anal-gesics	Non-Dr Office	Dr. Office Procedure	Dr. Office Non-Proc.
1996	0.104	0.208	0.085	0.018	0.019	0.105	0.461
1997	0.191	0.156	0.062	0.010	0.020	0.078	0.482
1998	0.282	0.186	0.046	0.022	0.024	0.038	0.400
1999	0.139	0.121	0.087	0.014	0.043	0.091	0.505
2000	0.258	0.060	0.103	0.008	0.011	0.080	0.481
2001	0.208	0.130	0.112	0.029	0.037	0.071	0.412
2002	0.136	0.125	0.092	0.014	0.028	0.113	0.492
2003	0.195	0.124	0.069	0.018	0.021	0.117	0.457

conditions considered have at least some presence among adults and often the elderly. Finally, despite the low cost per person, the condition remains one of the costliest conditions to treat because of the high prevalence.

The treatment of Otitis Media is physician visit intensive. More than half of all treatment expenditures are spent on Dr. office visits, and the nature of the physician visit spending has changed over the period. The fraction of total disease spending that involves a major surgical or non-surgical procedure has exhibited a period of decline from 1996 to 1998, and then a period of increase from 1998 to 2003, while the fraction of total disease spending related to other physician office spending has remained relatively flat over the period. The share of spending due to major procedures performed at the office appears inversely related to the share of spending on hospital care. In 1998 hospital care represents 46% of total spending while physician procedure spending only represents 3.8% of spending, their peak and trough, respectively. In 2002 hospital care represents the lowest share (tied with 1999) of spending during the period, and office visit care represents the second highest share of spending during the period. This pattern appears to suggest that some of the major services used to treat otitis media might be performed either in the hospital or in the physician's office.

Table 3.18: Otitis Media Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.259	1.324	1.333	1.259
1997	1.302	1.360	1.284	1.423	1.287
1998	1.437	1.370	1.407	1.481	1.403
1999	1.511	1.482	1.421	1.616	1.488
2000	1.497	1.499	1.503	1.590	1.491
2001	1.583	1.655	1.616	1.762	1.589
2002	1.646	1.846	1.740	1.696	1.683
2003	1.724	1.923	1.862	1.814	1.786

Otitis Media treatment price increases range from 4.5% per year in the West to 9% per year in the Northeast. Although the Northeast has a rate of increase that is much higher than any other region, much of the increase occurs in one year. Between 1996 and 1997 Otitis Media treatment prices in the Northeast increased almost 30%. Moreover, the 1996 price level in the Northeast is 25% lower than the price level of any other region in that year. All of these results suggest that 1996 price levels in the Northeast may be incredibly low, however prices continue to increase at a brisk 4.6% per year pace throughout the rest of the period, as well.

The West begins the period with the highest price levels of any region, but by 2002 both the Midwest and the Southeast face higher price levels than the West. The Northeast regions faces the lowest price levels beginning and ending the period with the lowest price levels.

3.4.6 Chapter 7: Circulatory Conditions

Circulatory conditions are any condition that represent a malfunction of the circulation of blood throughout the body. Circulatory disorders are either related to the functioning of the heart or the blood vessels that carry blood throughout the body. Circulatory conditions represent by far the largest fraction of medical care

spending of any of the ICD chapter heading categories. Circulatory spending is twice as costly as the next costliest chapter heading. Treatment spending on circulatory conditions alone represent more than 10% of total spending. Moreover, the vast majority of spending on multiple conditions involves at least one and often multiple circulatory conditions. Combining these spending categories suggests that circulatory conditions represent nearly 20% of total medical care spending.

Circulatory conditions left untreated have dire consequences. Several of the acute circulatory conditions, including Acute Myocardial Infarction (heart attack) and C.V.A (Stroke), would often result in immediate death without medical attention. Chronic circulatory medical conditions, such as hypertension, complicate the nature and severity of other conditions, such as diabetes, and increase the likelihood of an acute circulatory condition. We consider the treatment prices of three representative circulatory conditions: hypertension, A.M.I., and heart disease.

Table 3.19: Hypertension Input Shares

Year	Hospital	Dr Office	Non-Dr Office	Anti-lipid	Misc. Agents
1996	0.160	0.200	0.016	0.025	0.026
1997	0.176	0.199	0.020	0.031	0.025
1998	0.135	0.254	0.019	0.047	0.019
1999	0.160	0.198	0.009	0.039	0.023
2000	0.186	0.189	0.015	0.058	0.024
2001	0.177	0.196	0.018	0.055	0.025
2002	0.144	0.215	0.029	0.065	0.041
2003	0.175	0.180	0.022	0.072	0.050

Year	Cardio-Vasc	ACE Inhibitor	Beta Blocker	Ca Channel Blocker
1996	0.144	0.133	0.079	0.218
1997	0.160	0.121	0.077	0.190
1998	0.164	0.108	0.073	0.181
1999	0.212	0.115	0.067	0.177
2000	0.182	0.126	0.074	0.146
2001	0.180	0.122	0.079	0.147
2002	0.175	0.110	0.091	0.130
2003	0.200	0.100	0.087	0.114

Hypertension

Hypertension, or high blood pressure, is one of the most costly conditions to treat in the United States. Hypertension represents nearly 20% of circulatory condition spending, which is twice as costly as the next closest ICD chapter heading. The cost of this condition is driven by its prevalence. Although relatively cheap to treat on a per person basis, hypertension is the most prevalent chronic condition in the United States and is also the most prevalent circulatory condition in the United States. Hypertension has experienced the fastest rate of prevalence increase of any medical condition considered, despite being listed as the most prevalent chronic condition in 1996. The rise in the prevalence of this condition may be related to

Table 3.20: Hypertension Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.030	1.022	1.080	0.969
1997	1.023	1.087	1.024	1.204	0.954
1998	1.087	1.125	1.064	1.143	1.010
1999	1.197	1.198	1.098	1.255	1.105
2000	1.159	1.200	1.163	1.268	1.157
2001	1.264	1.351	1.270	1.389	1.225
2002	1.342	1.411	1.325	1.347	1.245
2003	1.372	1.482	1.377	1.450	1.276

the increasing fraction of the population that is entering into the oldest age groups. For this reason, hypertension may continue to become more prevalent over time as an increasing fraction of the population enters these age groups.

Hypertension treatment is extremely drug intensive. More than 60% of total spending for hypertension is on drugs. The stability of input spending is stable over this period. Hospital spending, office visit spending, and total drug spending remain almost constant over the period. However, the distribution of drug spending has changed fairly substantially over time. Anti-lipid spending has become an increasingly important part of therapy. The share of total treatment spending devoted to anti-lipid medications has increased from 2.5% in 1996 to 7.2% in 2003. This share increase has come at the expense of cardiovascular medications which have dropped in proportion from 57.4% of spending in 1996 to 50.2% of spending in 2003. Most of the decrease in cardiovascular medications has come within calcium channel blocker medications, whose share of total expenditures has fallen in half from 21.8% of total expenditures to 11.4% of total expenditures.

Hypertension treatment prices have increased at a rate that varies between 4.0% and 5.5% per year. The Midwest region experiences the highest rate of increase over the period, but the West begins and ends the period with the highest price

levels. The non-MSA region is the lowest rate of increase of any region and has among the lowest treatment price levels in the country, beginning and ending the period with the lowest treatment price level. Four of the five regions experience price increases that are slower between 1996-2000 than over the period 2000-2003.

Acute Myocardial Infarction

Acute Myocardial Infarctions (A.M.I.), commonly referred to as heart attacks, are the second most costly circulatory conditions in the United States and one of the five most costly health conditions in the United States, despite affecting less than one percent of the population. AMI treatment has remained relatively the same over time. Treatment is hospital intensive. Slightly more than 80% of expenditures are represented by hospital care. The total fraction as well as the fractions represented by different types of hospital care such as inpatient operations, other inpatient care, outpatient care and Emergency Room care exhibit mild fluctuations over the period, but remain relatively flat. The share of expenditures represented by physician office visits rose to its peak of nearly 14% of expenditures in 1997, but then fell dramatically in a single period, and never again represented more than 3.5% of total expenditures. This peak corresponds with the lowest share of hospital expenditures during the entire period.

Treatment prices increases for AMI have been uneven over the period. In the early part of the period from 1996 to 2000, treatment price increases were fairly mild ranging from less than 1% per year in the Midwest to 3.4% in the West. However, since 2000, the rate of increase has doubled and more than tripled in some areas ranging from 4.9% per year in the non-MSA region to 9.6% per year in the Northeast region.

The regions also face fairly different price levels and rates of increase over the period. The Midwest region begins and ends the period with the highest price levels.

Table 3.21: AMI Treatment Input Shares

Year	ER	Out-patient	IP Operation	IP Non-Operation	Doctor Office	Non-Dr Office	Rxs
1996	0.009	0.033	0.347	0.480	0.062	0.009	0.061
1997	0.025	0.048	0.186	0.532	0.139	0.004	0.065
1998	0.015	0.027	0.218	0.599	0.031	0.013	0.098
1999	0.020	0.018	0.322	0.520	0.029	0.002	0.089
2000	0.024	0.023	0.292	0.567	0.021	0.009	0.064
2001	0.067	0.036	0.260	0.509	0.032	0.031	0.066
2002	0.007	0.010	0.265	0.616	0.029	0.009	0.063
2003	0.025	0.038	0.140	0.697	0.032	0.003	0.065

Table 3.22: AMI Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.169	1.034	1.028	1.104
1997	0.970	1.124	1.078	1.162	1.078
1998	1.071	1.039	1.030	1.056	1.089
1999	1.156	1.189	1.163	1.180	1.194
2000	1.067	1.199	1.208	1.157	1.207
2001	1.133	1.270	1.226	1.244	1.208
2002	1.299	1.365	1.384	1.318	1.361
2003	1.476	1.610	1.514	1.524	1.446

The Northeast begins the period with the lowest price level, and ends the period with lower price levels than every region except the non-MSA region. The non-MSA region experiences the lowest level of overall price increase for this treatment at approximately 3.9% per year, whereas the West region experiences the highest level of overall price increases of 6% per year.

Heart Disease

Heart disease is the second most prevalent circulatory condition considered, and the third most costly circulatory condition. Heart disease is also among the top 10

Table 3.23: Heart Disease Treatment Input Shares

Year	ER	In-patient	Out-patient	Anti--Lipid	Cardio-vascular	Other Rx	Doctor Office	Non-Dr Office
1996	0.012	0.544	0.082	0.020	0.189	0.050	0.087	0.016
1997	0.045	0.516	0.070	0.022	0.182	0.045	0.099	0.022
1998	0.006	0.469	0.087	0.040	0.213	0.055	0.116	0.011
1999	0.008	0.460	0.078	0.031	0.209	0.065	0.142	0.007
2000	0.006	0.524	0.090	0.038	0.182	0.060	0.084	0.016
2001	0.018	0.513	0.076	0.047	0.179	0.059	0.096	0.011
2002	0.012	0.509	0.064	0.046	0.159	0.065	0.128	0.017
2003	0.030	0.441	0.084	0.056	0.172	0.079	0.103	0.036

most costly conditions to treat in the United States. The treatment of heart disease is hospital intensive. More than half of treatment expenditures are represented by hospital care. The fraction of total heart disease treatment expenditures represented by hospital care has fallen over the period from 63% of total expenditures in 1996 to 55% of total expenditures in 2003. However, the share of different types of hospital services that comprise hospital care does not appear to exhibit a systematic pattern. The share of total expenditures represented by drugs has increased from approximately 26% of total expenditures to 30.6% of expenditures. Much of this change is accounted for by the increasing share of anti-lipid medications. Cardiovascular medications increased as a share of treatment expenditures from 1996 to 1998, but have since declined to a level lower than it began in 1996.

Heart disease treatment prices have seen uneven price increases that have varied significantly across regions. The Northeast region has seen the highest rate of increase at greater than 6.4% per year over the full period, whereas the non-MSA region saw the lowest rate of increase at 3.7% per year over the same period. Most of the increase in prices occurred after the year 2000 for every region. Rates of increase after the year 2000 ranged from 4.0-7.2% per year, whereas price increases were at a much milder 1.4-3.5% per year prior to 2000.

Table 3.24: Heart Disease Treatment Input Shares

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.177	1.094	1.095	1.130
1997	1.017	1.167	1.117	1.179	1.074
1998	1.176	1.173	1.109	1.184	1.109
1999	1.272	1.268	1.227	1.276	1.226
2000	1.175	1.259	1.262	1.253	1.258
2001	1.257	1.358	1.314	1.356	1.282
2002	1.355	1.432	1.427	1.389	1.392
2003	1.514	1.571	1.495	1.498	1.463

Price levels were also very different across regions. The Midwest began and ended the period with the highest price levels, whereas the Northeast had lower price levels than any other region for 5 of the eight years, and finishing the period with price levels were lower than every region except the non-MSA region.

3.4.7 Chapter 8: Respiratory Conditions

Respiratory conditions are the most prevalent conditions in the United States, affecting nearly half of the United States population each year, and several of the chronic respiratory conditions are increasing in prevalence over the period. For these reasons alone, evaluation of respiratory condition treatment prices are interesting from a medical care productivity perspective. However, the potentially causal relationship between respiratory conditions and environmental factors such as air pollutants may provide a broader motivation for the study of the treatment prices for these conditions.

Asthma is the second most costly and third most prevalent chronic respiratory condition. Asthma represents approximately one-seventh of total respiratory spending. The disease can affect anyone, but is especially important among children. Asthma is therefore one of the few chronic conditions highly prevalent among

Table 3.25: Asthma Treatment Shares

Year	IP/ ER	Out-patient	Other Rx	Resp Agent	Anti-histamine	Broncho-dilator	Doctor Office	Non-Dr Office
1996	0.371	0.0364	0.048	0.0176	0.026	0.2408	0.224	0.0363
1997	0.393	0.0306	0.047	0.0226	0.056	0.2411	0.193	0.0177
1998	0.273	0.0163	0.048	0.0410	0.062	0.2127	0.320	0.0265
1999	0.360	0.0206	0.043	0.0530	0.070	0.2468	0.162	0.0447
2000	0.301	0.0307	0.039	0.0434	0.082	0.2951	0.193	0.0154
2001	0.363	0.0197	0.041	0.0587	0.088	0.2628	0.149	0.0171
2002	0.288	0.0596	0.043	0.0592	0.099	0.2308	0.194	0.0265
2003	0.305	0.0242	0.053	0.0716	0.104	0.2304	0.188	0.0236

children. The prevalence of this condition has increased from 3.8% of the population in 1996 to 4.9% in 2003 despite a declining fraction of the population in the under 18 age group.

Asthma treatment uses drugs and emergency room visits as the primary medical care inputs. Approximately 44% of asthma treatment spending is for drugs, and more than 30% of treatment spending is on Emergency Room and hospital visits. The hospital share of treatment spending has declined from 41% of spending to 33% of spending over the period. Much of this decline has been due to a decline in the share of Emergency Room visit spending. The drug share of treatment spending has increased sharply over the period. The drug share of spending was 33% of spending in 1996, and by 2000 the drug share of spending had risen to greater than 45% of spending. This share has remained relatively constant since 2000. Much of the increase in drug spending has been on anti-histamines and other respiratory medications, which have both experienced dramatic share increases over the period. Antihistamines have risen from 2.6% of spending in 1996 to 10.4% of spending in 2003, and other respiratory medications have increased from less than 2% to 7.2% of spending over the same period. Not all drugs have seen such an increase, however. The share of spending on broncho-dilators, which represents the largest share of

Table 3.26: Asthma Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.023	0.982	1.021	0.919
1997	1.013	1.078	1.014	1.101	0.960
1998	1.096	1.076	1.026	1.086	0.998
1999	1.147	1.150	1.074	1.159	1.088
2000	1.130	1.136	1.123	1.176	1.089
2001	1.214	1.264	1.239	1.290	1.144
2002	1.265	1.322	1.281	1.285	1.240
2003	1.367	1.399	1.350	1.376	1.328

drug spending for asthma treatment, has actually fallen as a share of spending from 24% in 1996 to 23% in 2003. Other medications, which are comprised primarily of steroidal hormones, fell in the beginning of the period from nearly 5% of spending to less than 4% of spending, but has rebounded since 2000 and now represents greater than 5% of asthma treatment spending.

Asthma treatment prices have very small differences in price increases across regions. Asthma treatment price increases range from a low of 4.4% per year in the West to a high of 5.6% per year in the non-MSA region. Price levels also have very small variation across regions. Although the non-MSA region has high rate of price increase, it both begins and ends the period with the lowest price levels. The Midwest both begins and ends the period with the highest price levels. However, the West region has higher price levels than does the Midwest for five of the eight years.

3.4.8 Chapter 9: Gastro-Intestinal Conditions

Stomach function disorders are the fourth most costly G.I. disorders, and one of the two most prevalent G.I. disorders. Stomach function disorders began the period as the most prevalent stomach disorder, but has fallen to the second most prevalent

Table 3.27: Stomach Function Disorder Input Shares

Year	Inpatient /ER	Out-patient	Doctor Office	Non-Dr Office	Gastro-Agents	H2 Antagonists
1996	0.542	0.097	0.097	0.018	0.024	0.221
1997	0.353	0.139	0.140	0.012	0.104	0.253
1998	0.440	0.114	0.125	0.030	0.157	0.135
1999	0.432	0.098	0.131	0.004	0.189	0.146
2000	0.356	0.154	0.107	0.014	0.255	0.114
2001	0.312	0.110	0.131	0.017	0.301	0.129
2002	0.324	0.116	0.135	0.032	0.295	0.098
2003	0.238	0.182	0.140	0.028	0.323	0.088

G.I. disorder because of the prevalence increase of esophagus disorders.

Stomach function disorders have become less hospital intensive and more drug intensive over the period. Hospital care has fallen from more than 60% of expenditures to 42% of total expenditures over the period. Most of the decline occurred in inpatient and emergency room care which fell from 54% of expenditures to 23.8% of expenditures. Outpatient care actually experiences a 9 point share increase since 1996, although 7 of the 9 point change occurs in the one year between 2002 and 2003.

Drug expenditures have increased from 24% of expenditures to 32% of expenditures over the period. The increase in drug share was not uniform. Gastrointestinal agents including proton pump inhibitors have increased dramatically over the period from 2.4% of expenditures to 32.3% of expenditures. H_2 antagonists, which had represented the largest share of drug expenditures in 1996, experience an extremely dramatic decline over the period from 22.1% of expenditures in 1996 to 8.8% of expenditures in 2003.

Stomach function disorder prices experience increases of between 2.5% and 4.0% per year. Three of the five regions experience a price decline between 1996 and 1997, but all regions experience price increases between 1997 and 2003 that

Table 3.28: Stomach Function Disorder Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.144	1.047	1.102	1.000
1997	1.025	1.069	1.021	1.165	0.976
1998	1.155	1.128	1.085	1.147	1.047
1999	1.237	1.220	1.161	1.136	1.027
2000	1.174	1.157	1.187	1.137	1.015
2001	1.313	1.342	1.303	1.303	1.256
2002	1.316	1.351	1.353	1.318	1.261
2003	1.324	1.374	1.372	1.374	1.275

offset any decline that may have occurred during the first year of the period. The Northeast region experiences the fastest rate of increase of any region, whereas the Midwest experienced the lowest inflation rate of any region. The Midwest, however, experiences some of the highest price levels of any region. They begin the period with the highest price level and end the period with a price level second only to the West region. The non-MSA region begins and ends the period with the lowest price levels of any region, and faces the second lowest rate of increase of any region.

3.4.9 Chapter 11: Pregnancy

Pregnancy is one of the most studied medical care conditions by economists. Pregnancy services are important in that every person has some experience with them (at least once in a lifetime), and the services are relatively expensive on a per person basis in the United States. Pregnancy can also have important health consequences. Complications during a pregnancy can affect the health status of at least one individual, and potentially multiple individuals (i.e. the mother and the child) for a lifetime.

Pregnancy also offers implementation advantages over other conditions for studying important economic questions. The population of pregnant individuals are

Table 3.29: Pregnancy Input Shares

Year	Inpatient Operation	Inpatient Non-Oper	ER	Out-patient
1996	0.465	0.326	0.009	0.039
1997	0.639	0.182	0.008	0.025
1998	0.511	0.323	0.007	0.036
1999	0.546	0.281	0.004	0.022
2000	0.561	0.264	0.012	0.023
2001	0.464	0.360	0.007	0.027
2002	0.430	0.356	0.011	0.019
2003	0.468	0.349	0.006	0.019

Year	Dr. Office Procedures	Dr. Office Other	Non-Dr Office	Drugs
1996	0.011	0.126	0.021	0.004
1997	0.012	0.106	0.024	0.004
1998	0.012	0.098	0.009	0.003
1999	0.012	0.110	0.021	0.005
2000	0.016	0.103	0.015	0.005
2001	0.024	0.096	0.017	0.004
2002	0.015	0.142	0.022	0.005
2003	0.020	0.105	0.027	0.006

relatively homogeneous with respect to their ages and genders. Pregnancy is unlikely to be misdiagnosed and most are reported, thus mitigating some sources of selection bias. Moreover, the stage of development for treatment initiation is often known. In addition, pregnancies potentially have significant variance in health outcomes and offer several relevant health outcome variables that are continuous and comparable across individuals. For these reasons, pregnancy provides a useful and important example of a condition that allows economists to determine the relationship between medical care, health status, and economic variables such as medical care prices, income and insurance status.

Pregnancy services are very hospital intensive. Roughly 80% of total spending on pregnancy services is on hospital services. More than half of the hospital

Table 3.30: Pregnancy Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.124	1.007	1.045	1.054
1997	0.926	1.176	1.066	1.191	1.014
1998	1.087	1.109	1.004	1.126	1.020
1999	1.253	1.175	1.093	1.192	1.106
2000	1.039	1.186	1.173	1.143	1.109
2001	1.116	1.255	1.190	1.277	1.134
2002	1.253	1.302	1.323	1.286	1.285
2003	1.442	1.532	1.378	1.419	1.301

expenditures are associated with surgical operations such as C-sections. Although no steady trends emerge in inpatient care, since 2001 the share of total expenditures represented by operations has been lower than prior to 2001. Prior to 2001, four of the five years had operation expenditures that represented more than half of all pregnancy service expenditures. However, since 2001, the share of pregnancy service spending represented by operations has fallen to between 43-46% of medical expenditures. This drop in the operation share of total pregnancy service spending was offset by inpatient care that did not involve an operation. Since 2001, non-operation inpatient care has represented between 35-36% of care. Prior to 2001 non-operation care represented between 18-33% of total expenditures.

Hospital outpatient care has also seen a decline in its share of expenditures. The share of total expenditures represented by outpatient services has fallen in half from 4% of expenditures in 1996 to 2% of expenditures in 2003. Many of the other services have no discernible pattern over this period. Doctor office visits involving a procedure have risen from 1% of care in 1996 to 2% of care in 2003, but this change is hardly a trend. Less than 1% of spending is on pre-natal drugs, and this fraction has not changed over the period.

Price increases for pregnancy services have been somewhat uneven. Prices

rose very slowly at the beginning of the period. All five regions experience some decline in prices between 1996 and 1998, and the West is the only region that does not experience a decline that results in prices lower than their 1996 level. Since 2000, prices have increased at a much faster rate. The rates of increase are very different across regions. The Northeast region experiences price increases of 5.5% per year which is much faster than the 2.9% annual increase in the non-MSA region. Price levels are also very different across regions. The Northeast region begins the period with the lowest price level of any region, but the high rate of increase causes the Northeast to end the period with prices higher than three of the four other regions. The non-MSA region finishes the period with the lowest price level, although it began the period with price levels higher than every region but the Midwest. The Midwest has the highest price levels of any region, and they begin and end the period with the highest price level.

3.4.10 Chapter 13: Musculo-skeletal Conditions

Arthropathies are the costliest and most prevalent musculo-skeletal conditions in the United States. There are several types of arthritic conditions that can afflict individuals, such as rheumatoid and osteo- arthritis, neither of which are considered here. Rather, arthritis is defined as a broader and more general definition of arthropathies, which are both more prevalent and likelier to afflict a younger population. Although more likelier to afflict the young, arthropathies are still concentrated among the old and its prevalence is increasing as the population ages.

Arthritis is rarely mortal, but can be a very debilitating and painful disease. The pain can prevent people from doing fine tasks such as holding a pencil or typing on a keyboard, and gross tasks such as walking up and down stairs or around the block. The debilitating nature of the disease and the low risk of it causing death provides a stark and interesting contrast with the health characteristics of other

Table 3.31: Arthropathies Input Shares

Year	IP/ER	Out-patient	Narcotic	Non-Steroidal	Other Analgesic	Doctor Office	Non-Dr Office
1996	0.296	0.059	0.011	0.125	0.003	0.355	0.152
1997	0.263	0.074	0.017	0.127	0.014	0.338	0.166
1998	0.235	0.084	0.019	0.133	0.009	0.319	0.200
1999	0.052	0.126	0.026	0.196	0.132	0.178	0.290
2000	0.195	0.055	0.024	0.089	0.179	0.250	0.208
2001	0.216	0.091	0.017	0.041	0.138	0.307	0.189
2002	0.165	0.060	0.025	0.061	0.220	0.225	0.243
2003	0.165	0.095	0.022	0.048	0.212	0.260	0.198

conditions, such as hypertension, whose defining characteristics are correlations with potential death. Moreover, some of the drug treatments which may be effective in treating arthritis have been recently shown to come at an increased mortality risk. This treatment characteristic may provide potential future research opportunities for revealed preferences over risk, pain, mobility and mortality.

Arthritis treatment has undergone some dramatic treatment changes over the period. In 1999, a new class of medications were introduced that are jointly referred to as Cox-2 inhibitors and listed as 'other analgesic' medications in the shares Table. The medication shares presented suggest that this introduction resulted in a dramatic shift in the methods used to treat arthritis. After 1999, 'other analgesic' medications, led by the Cox-2 inhibitors, jump from representing less than 1% of treatment expenditures in 1996, to representing greater than 20% of treatment expenditures by 2002. After the introduction of Cox-2 inhibitors, office visits, hospital care, and non-steroidal medication services all experience very large drops in expenditure shares.

Not surprisingly, treatment prices for arthritis reflect the shift in treatment protocol that has occurred over the period. Treatment prices remain relatively flat between 1996-1999. The rate of increase ranges from less than 1% per year in

Table 3.32: Arthropathies Treatment Prices

Year	MSA Northeast	MSA Midwest	MSA Southeast	MSA West	Non-MSA
1996	1	1.050	1.031	1.048	1.037
1997	0.958	1.054	1.025	1.081	0.994
1998	1.031	1.059	1.039	1.074	1.005
1999	1.077	1.122	1.042	1.115	1.055
2000	1.093	1.103	1.090	1.195	1.116
2001	1.186	1.216	1.220	1.328	1.212
2002	1.332	1.294	1.276	1.320	1.241
2003	1.339	1.393	1.343	1.408	1.241

the Southeast and the non-MSA regions to slightly less than 2% per year in the Northeast. Arthritis treatment prices actually fall between 1996 and 1997 in three of the five regions. However, between 1999 and 2003 the rate of increase nearly doubles. The rate of price increases range between 4.8% per year in the Northeast and non-MSA regions to 5.7% per year in the Southeast region.

Price levels are relatively similar across regions. The West region begins the period with a price level slightly lower than those in the Midwest, but finish the period with the highest price level of any region. The non-MSA region begins the period with higher price levels than the Northeast and the Southeast, but its low inflation rate allows it to finish the period with the lowest price level of any region.

3.5 Conclusion

This paper constructs "disease accounts" used to evaluate medical care production. The disease accounts attribute medical care spending to disease treatments using International Classification of Disease codes associated with medical care services consumed by respondents to a nationally representative survey. We have demonstrated that the prevalence, total costs, per person costs, and treatment technologies

vary substantially across diseases. Moreover, we have shown that identical medical care input services, such as anti-lipid medications, are used in the treatment of several disease treatments, such as diabetes, hypertension and heart disease, in varying proportions with potentially different health outcome results. These results demonstrate the importance of considering the relationship between medical care and disease treatment in understanding the nature of rising medical care costs.

The analysis has identified technological innovation as changes in medical care input shares such as drugs, office-based surgical events, and inpatient operation services. Technological advancements have had substantial effects on the nature of disease treatment for many conditions. Moreover, technological advancements often affect disease treatment prices.

Our dynamic analysis has demonstrated that the period examined has an uneven rate of price increase for several diseases. The period from 1996 to 2000 experiences significantly lower price increases than does the period 2000 to 2003 for several diseases including pregnancy and AMI treatment. These results are despite relatively flat shares of input services used in the treatment of these conditions. Our regional comparison finds that medical care treatment prices vary significantly across regions. This regional variance is evident in both the price levels and the rates of increase. The non-MSA region typically has lower price levels and lower inflation rates than does the rest of the country, while the Northeast region, although typically beginning the period with lower treatment prices than other regions, experiences higher rates of increase than other regions and often ends the period with prices that are among the highest in the country.

Chapter 4

Insurance Type Differences in Medical Productivity

Fifteen percent of GDP is currently represented by medical care services, and more than 80% of these expenditures are paid by insurers in behalf of patients. The types of insurance are heterogeneous, representing a patchwork of public and private medical care insurance types. U.S. citizens may remain uninsured, purchase private insurance, or if they qualify, obtain public insurance such as Medicaid for the poor and Medicare for the elderly. The government share of total medical expenditures is almost 40% of total medical care spending. This cursory view of the market suggests that insurance in general, and government provided insurance in particular, has a prominent role. The large role of the government in this market suggests that whether the differences in insurance plan characteristics translate into disease treatment differences, and how those potential differences translate into health outcomes are important criteria for making policy decisions. However, the effect of insurance on these important features of the medical care market is largely unknown. This paper addresses these issues using the nationally representative Medical Care Expenditure Panel Survey (MEPS) over the period 1996-2003. The

paper empirically tests whether the input demands used in disease treatments differ across insurance types. The differences are interpreted as one aspect of technological differences in treating disease. These differences are mapped into health outcome differences across insurance types using a production function model of health. The production model maps medical care inputs to health outcomes, and facilitates an explanation for the insurance effects on health outcomes.

4.0.1 Context

Economic studies examining medical care productivity in general, and the quality effects of medical insurance in particular, have thus far been limited by both data and conceptual limitations. The most important conceptual limitation hindering progress has been the lack of a believable and relevant measure of health. Although many publicly available data sources provide insurance information of the respondents, few of these sources report an interpersonally comparable and objective cardinal measure of health useful in an evaluation of medical care productivity. Rather, these sources provide health measures such as self-reported health status or activity limitation indicators. These variables considered alone are either interpersonally incomparable or largely inapplicable. For instance, self-reported measures beg the question of whether a five for a woman is truly a worse health state than a three for a man (or vice versa). Activity limitation variables used alone would rate an active woman who recently sprained an ankle in worse health than an otherwise able hypertensive woman nearing a heart attack. Many of the competing alternatives to these measures are not much use, either. Studies that evaluate health in developing countries employ stunting measures, and some studies in the United States and elsewhere use birth weight to proxy for the health of newborns. However, the nature of these measures suggests that they are inapplicable for the vast majority of United States citizens.

Although health measurement still appears as a looming issue for current and future research, promising and dramatic advancement has occurred in the recent literature. This research has focused on the effectiveness of medical care in producing disease treatment.[1] A number of authors including Cutler (2001), Berndt, Busch, and Frank, (2001), and Triplett (1999) have argued that the productivity of medical care in the United States should be evaluated by how well medical care treats disease. Moreover, they have empirically examined specific disease treatments including depression treatment, and heart attack treatment. Although much of their argument is framed as a discussion of how this type of evaluation affects price indices and national accounts, the issues they raise have broader implications for any research that evaluates medical care markets. The most relevant implication for this paper is the view that disaggregated medical care services should be evaluated as inputs into the treatment of disease. The evaluation of medical care services as inputs into disease treatment production identifies the technology used to produce the good consumed in the market, namely better health outcomes. By identifying the technology used to produce disease treatment, one can then compare technological changes over time, across heterogeneous individuals and as this paper exploits, across insurance types.

Despite the large role of insurance in medical care markets, and the ability of insurance to affect the technology employed to treat disease, few studies have evaluated the quality of medical care offered by different insurance types using a disease treatment framework. This omission has been largely due to data availability. Many of the studies that employ the disease treatment framework use insurance claims data. The nature of such data limits analysis to the evaluation of technological changes over time experienced by an insured subgroup. The exceptions known to this author include comparisons of Health Maintenance Organizations versus in-

[1] I use the word "disease" in reference to any health condition that requires medical attention, including conditions such as pregnancies that many would not consider to be a "disease".

demnity private insurance plans in Massachusetts (see Cutler et. al. (2000) and Altman et. al (2003)), Medicaid insurance versus other types of insurance on HIV mortality Battacharya et. al. (2003) and the pregnancy studies mentioned earlier (see Currie and Gruber (1996)). The MEPS data employed in this study is from a nationally representative sample of households that allows comparisons of disease treatments for many different types of conditions and across households of different insurance types, including the uninsured.

The focus on disease treatment has not eliminated the need for a relevant health measure applicable to the United States population. Health measures are necessary to assess the quality of disease treatment in producing health. The necessary measures would allow for comparisons over time and across individuals. However, the focus on disease treatment has made some of the available health measures relevant in context. This paper exploits the context of disease treatment and the panel aspect of the MEPS to evaluate how treatments have affected health outcomes. The measures employed are changes in disease co-morbidities and self-reported measures that occur as a result of disease treatment.

4.1 The Economic Model

A health production model introduced by Michael Grossman (1972) facilitates a comparison of insurance type disease treatment effects. The model assumes that medical care and non-medical care services act as inputs into the production of health. Medical care inputs include drugs, hospital stays, Dr. office visits, and other medical care services. All of the medical care inputs are available in the MEPS. Non-medical care health inputs include diet, exercise, and proper adherence to medical care protocol. Non-medical care health inputs are largely unavailable in the MEPS and are therefore controlled using demographic characteristics, such as the income and education of the patient. Technological advancements in the

production of health are identified in this model as time effects. The following list specifies notation:

- $m = (m_1, ..., m_K)$ is a $1xK$ vector of medical care service quantities
- $M_r = f(m_1, ..., m_K)$ is a treatment. Treatments are discrete indicators that are one for a specific set of non-zero medical care service quantities and zero for any other set of medical care service quantities
- $Z = (z_1, ..., z_J)$ represent the J types of non-medical care health inputs and time effects
- $\Theta = (\theta_1, ..., \theta_{R-1})$, $\beta = (\beta_1, ..., \beta_R)$, $\gamma = (\gamma_1, ..., \gamma_J)$ are parameter vectors to be estimated in the demand and health production models
- $\hat{\Theta} = (\hat{\theta}_1, ..., \hat{\theta}_{R-1})$, $\hat{\beta} = (\hat{\beta}_1, ..., \hat{\beta}_R)$, $\hat{\gamma} = (\hat{\gamma}_1, ..., \hat{\gamma}_J)$ are the estimated values for the parameter vectors in the demand and health production models
- $H = H(h_1(M_1, Z, t, \Theta_1), \cdots, h_D(M_D, Z, t, \Theta_D))$ a production function relating inputs to disease treatments $d = 1, \cdots, D$

Health production is modelled as if medical providers produce health subject to available technologies, prices of services, and constraints imposed by the insurance firm. We assume that medical providers act as perfect agents of the patient, and thus act subject to the constraints imposed on them by the patient's income in addition to the institutional features of the insurance firm.

The formal analysis involves a series of modelling stages. The first stage models the demand for medical care services. The demand for medical care services is performed separately for patients of different insurance types. Medical care service demand is modelled as an input demand into the production of health. Input demands depend on prices of medical care, patient characteristics and insurance type.

The second stage models the production of health. Health depends on medical care treatments and demographic characteristics. The results from the first two stages are combined and used to determine the expected health outcomes conditioned on the service demands for the different insurance types. The insurance types are compared with respect to the treatments chosen and the outcomes that occur as a result of those treatments.

4.1.1 Medical Care Input Demand

Medical care service bundles are organized into treatments. Treatments are defined by the set of non-zero medical care service expenditures used to treat a specific disease. Treatments are discrete items that are exhaustive and mutually exclusive. All patients defined as having a specific disease are assigned to a single treatment. The array of available treatments is disease specific and available to each insurance type. As an example, depression has several treatments that include office visits alone and office visits with prescribed drugs.

Treatment demand is modelled as a discrete choice by the insurance firm. An insurance firm chooses to treat a patient with treatment r if treatment r is better for the firm than all of the available treatments $s \neq r$. The probability that an insurance firm chooses a specific treatment depends on the characteristics of the individual and the prices faced by the insurance firm. The functional relationship is given below:

$$Pr(M = M_r) = \Lambda((\theta_{0r} + \theta'_{zr}Z) - (\theta_{0s} + \theta'_{zs}Z) > (\epsilon_s - \epsilon_r)) \;\; \forall s \neq r \tag{4.1}$$

If $\epsilon_s \;\forall s$ are independent and distributed Weibull then Λ can be estimated using a standard multi-nomial logit. The resultant probability that a specific treat-

ment is chosen is estimated from this model and calculated as:

$$Pr(M = M_r) = \hat{\Lambda}_r(\cdot) = \frac{exp(\hat{\theta}_{0r} + \hat{\theta}'_{zr}Z)}{1 + \sum_{s=1}^{R-1} exp(\hat{\theta}_{0s} + \hat{\theta}'_{zs}Z)} \tag{4.2}$$

The probability of choosing each treatment $M_r \;\; r = 1, ..., R$ is determined for each insurance type $l = 1, ..., L$ such that the technological protocol of the insurance type is defined as $\hat{\Lambda}_l = (\hat{\Lambda}_{l1}, \cdots, \hat{\Lambda}_{lR})$. The differences in technological protocol across insurance types are determined by taking the difference in these probabilities.

4.1.2 Health Production

The relationship between health outcomes and medical care service inputs is determined by estimating a health production function. Health is modelled as a latent variable, h_i^*, that depends on the observed treatments, $M_i = (M_{11i}, \cdots, M_{LRi})$, and non-medical care inputs $Z_i = (z_{1i}, \cdots, z_{Ji})$. Imposing a functional form on latent health implies the following equation:

$$h_i^* = \alpha + \sum_{l=1}^{L}\sum_{r=1}^{R} \beta_{lr} M_{lri} + \sum_{j=1}^{J} \gamma_j z_{ji} = \alpha + \beta' M_i + \gamma' Z_i + \epsilon_i \tag{4.3}$$

In the health equation above, the relationship between health output and the medical care service inputs is linear and dependent on the parameters $\gamma = (\gamma_1, ..., \gamma_J), \beta = (\beta_1, ..., \beta_{LR})$. The vector of inputs used in determining health production depends on the disease type considered. To allow for the possibility that treatment type quality varies by insurance type, insurance is interacted with treatment type. This type of interaction allows for the possibility of inferior physicians treating Medicaid patients, or inferior hospital services provided to the Uninsured.

Many of the observed health outcomes are health indicators. For instance, the observed outcome may be an indicator of whether an adverse health state occurred during the period, or whether mental health improved. The observed health

indicators, I, are modelled as being directly related to the latent health variable. The relationship between latent health and the health indicator may either be increasing or decreasing in health. To fix ideas consider indicators that are decreasing in health. If the indicator variable takes on only two values, such as whether health deteriorated, then the indicator function is defined as follows:

- if $h^* < \overline{h}$ then I=1
- if $h^* >= \overline{h}$ then I=0

This binomial function describes the relationship between latent health and health outcomes. The relationship between the medical care service inputs and health outcomes is determined by replacing the right-hand side of equation 3 with h^* in the above equation. The relationship between medical care services and health outcomes is estimated by modelling the probability of observing the health outcome that depends on latent health. The probability that a health outcome occurs depends on treatments, patient characteristics, and the total expenditure spent on treatment.

The effect of total medical care spending on health depends on the type of condition considered. Medical spending is interacted with age for progressive chronic conditions such as arthritis and hypertension. This interaction implicitly models medical care treatment as an effort to delay the inevitable consequences of persistent chronic conditions. For other types of conditions, such as depression, the association of the disease with age is not straightforward. For these conditions the effects of treatment enter independent of age. The effect of no treatment is determined by considering the effects of trivial medical care spending on the worst treatment for all diseases.[2]

In the binomial case, the probability that an observed health outcome occurs

[2]Trivial spending is defined as one dollar for depression and less than twenty dollars for hypertension and arthritis.

for an indicator function that decreases in health is defined using the following equation:

$$Pr(h^* < \overline{h}) = \Phi(\alpha + \sum_{l=1}^{L}\sum_{r=1}^{R}\beta_{lr}M_{lri} + \gamma' Z_i < \upsilon_i) \tag{4.4}$$

If $\upsilon = (\overline{h} - \epsilon)$ is distributed standard normal then $\Phi(\cdot)$ is the cumulative normal distribution function, and this relationship can be estimated with a probit using standard techniques.

4.1.3 Health Outcome Differences Across Insurance Types

Observed differences in health outcomes between the insurance types can be separated into demographic, protocol and quality effects. Quality effects are defined as the outcome differences between the insurance types for the same treatments. Protocol effects are defined as the probability difference of observationally equivalent individuals receiving different treatments for the same condition. Demographic effects are the health outcome differences between the insurance samples that are explained by differences in the sample treated.

Both treatment quality and protocol differences across observationally equivalent individuals have several theoretical explanations. Physician quality may be heterogeneous. Physicians may expend more effort for some patients as compared to others. The drugs prescribed for a treatment considered in our analysis may have adverse interaction effects with unobserved drugs prescribed for other conditions. Patients may not be warned to avoid certain food types or behaviors, or they may not adhere to warnings when given.[3] Unobserved individual characteristics such as smoking status, weight, or unobserved co-morbidities may also affect treatment. Drugs may interact with health conditions not considered in the analysis. These unobserved differences in individual heterogeneity may affect either the treatment quality or protocol, or both.

[3]For instance, grapefruits commonly interact adversely with many drugs.

In order to explain the outcome differences between insurance types the results are decomposed using an extension of the Oaxaca-Blinder decomposition. Fairlie (2003) describes the technique for limited dependent variable models. The difference in probability of observing a health outcome is decomposed into quality, demographic and protocol components for two insurance samples l and k. The total difference between the samples is defined by the following equation:

$$\frac{1}{N_l}\sum_{i=1}^{N_l} Pr(I=1|M_{il}, Z_{il}, \hat{\Theta}_l) - \frac{1}{N_k}\sum_{i=1}^{N_k} Pr(I=1|M_{ik}, Z_{ik}, \hat{\Theta}_k) = \overline{\Phi}_l(\cdot) - \overline{\Phi}_k(\cdot) \quad (4.5)$$

The above equation defines the total difference in the probability of observing a the health outcome between insurance types l and k with sample sizes N_l and N_k, respectively. In order to decompose the overall differences into components, one must specify which group is the comparison group, l, and the compared group, k.[4] Private insurance is considered the comparison group in each analysis. The component effects are determined by setting the predicted outcome difference equal to the linear sum of the quality component, the demographic component, and the protocol component. This equation is defined as following:

$$\begin{aligned}\overline{\Phi}_l(\cdot) - \overline{\Phi}_k(\cdot) = &(\frac{1}{N_k}\sum_{i=1}^{N_k}\Phi(X'_{ik}\beta_l) - \frac{1}{N_k}\sum_{i=1}^{N_k}\Phi(X'_{ik}\beta_k)) + \\ &(\frac{1}{N_l}\sum_{i=1}^{N_l}\Phi(X'_{il}\beta_l) - \frac{1}{N_k}\sum_{i=1}^{N_k}\Phi(\hat{X}'_{ik}\beta_l)) + \\ &(\frac{1}{N_k}\sum_{i=1}^{N_k}\Phi(\hat{X}'_{ik}\beta_l) - \frac{1}{N_k}\sum_{i=1}^{N_k}\Phi(X'_{ik}\beta_l))\end{aligned} \quad (4.6)$$

Equation 6 introduces some notation. X_l are the observed demographic and treatment characteristics for individual i with insurance type l. $\hat{X}_k$ is the vector of predicted treatments for an individual with characteristics X_k if they were to have

[4]The decomposition is sensitive to the comparison group chosen.

insurance type l as determined by Equation 2.

The first term on the right hand side is the quality component. The quality component is identified by holding the demographics and treatment protocols constant across groups and comparing the changes in quality effects. This difference is performed by assigning the quality effects of insurance type l to the sample of insurance type k and comparing the predicted outcomes to the predicted outcomes of insurance type k's own quality effects. The second term on the right-hand side is the demographic component. The demographic component is identified by holding the quality and protocol effects constant and comparing the predicted outcome differences that occur as a result of different sample compositions. The third term on the right-hand side is the protocol component. The protocol component is identified by holding the demographic and quality types constant and comparing the outcomes of the observed protocols for insurance type k with the outcomes from the predicted protocols of the insurance type k sample if they were to have received the protocol of an insurance type l individual.

4.2 Data

The data requirements necessary to estimate the differences in disease treatment outcomes across insurance types are demanding. The data must include detailed information on medical care insurance, medical care services and enough detailed health information to construct disease treatments and evaluate their outcomes. The data employed to estimate this relationship is the 1996-2003 Medical Expenditure Panel Surveys (MEPS). The MEPS reports demographic, health and medical care expenditure information for approximately 30,000 individuals per year.[5] The MEPS has a complicated data structure that links individuals from a nationally represen-

[5]Specifically, the sample sizes are 1996: 22,601; 1997: 34,551; 1998: 24,072; 1999: 24,618; 2000: 25,096; 2001: 33,556; 2002: 39,165; 2003: 34,215

tative household survey to medical "events" that are defined by the survey. The MEPS defines events as one of eight possible interactions of a patient with a medical care provider. The nature of the event depends on the service provider and includes a hospital stay, a home health month, a filled prescription, a dental care visit, and a physician visit. The reported expenditures associated with each event includes and distinguishes between all payments made by and in behalf of the individual or household member for services defined by the event type. Chapter 2 provides a full description of these event types. The participants are interviewed five times over a 2.5 year period in order to report every medical event that occurs within a two-year window. The resultant panel reports all expenditures made beginning on January 1 of the first interview year and ending on December 31 of the following year for everyone in the survey. All other time dependent information on the survey depends on the date of the interview round.

The medical care insurance information includes whether the individual is covered by private insurance, Medicaid, Medicare, veteran's insurance, other public insurance, or remains uninsured. The survey also provides further detail related to the type of private insurance held by the individual. This information includes an identifier for the policyholder and plan characteristics such as whether the insurance was provided through the job, supplemental insurance information, and the out-of-pocket insurance premiums paid by the family. The survey identifies all insurance plans, both private and public, that cover the individual.

The MEPS reports several categories of health indicators for every individual in the sample. The indicators include both objective and subjective measures of health. All years of the survey include the objective three-digit International Classification of Disease version 9 (ICD-9) code indicator for everyone in the survey. These codes are obtained by professional coders interpreting descriptions of ailments made by the survey participants. Individuals may be associated with multiple ICD-9

codes. Some conditions are associated with additional health information including the date at which the individual first contracted the condition, whether the individual is still receiving treatment for the condition, and a subjective measure of how the condition affects the individual's overall health. All surveys also include yes/no indicators for whether the individual has limitations in daily activities. Included among these indicators are whether the individual has difficulty lifting 10 pounds, difficulty walking up 10 stairs, and difficulty grasping with their fingers. Early surveys include height and weight bio-metric information for children. This information is omitted in later surveys which instead reports the body mass index for both children and adults. Finally, all surveys include subjective measures (integer ratings from 1-5) of overall and mental health.

In addition to the medical care insurance, medical care expenditure and health information provided by the MEPS, the MEPS also reports detailed labor supply and demographic information for each individual. This information includes geographic region, educational attainment, marital status, age, sex, race, ethnicity, and total income.

4.3 The Sample

The comparison of insurance type quality differences must account for sample differences. The various insurance types cover different demographic populations, which may be responsible for observed treatment differences across insurance types. For instance, two insurance groups may have different treatment protocols for the same disease. One insurance group may also represent a younger population than the other group. If different treatment protocols are prescribed to individuals of different ages then observed treatment differences may be due to age effects across populations rather than systematic quality differences between the insurance types. Controlling for these differences requires accounting for demographic characteristics

in the demand for treatments.

Assessing the sample differences begins with categorizing individuals into disease and insurance types. Three insurance types are considered: the privately insured, the uninsured, and the publicly insured (Medicaid). Whether an individual is covered by an insurance type at all during the year determines the category of insurance assigned to an individual. The classification algorithm follows a hierarchy. The privately insured are defined as anyone who has private insurance, regardless of other insurance coverage. The Medicaid population is defined as those individuals with Medicaid insurance and no private insurance, and the uninsured are defined as those individuals without any insurance at all. Individuals who are covered by public insurance, but are not covered by either Medicaid or Medicare are omitted from the sample because of small sample sizes. Individuals with any type of Medicare coverage are also omitted from the sample. Age is important in determining treatment, and the age distributions of Medicare and other insurance populations rarely overlap. The dissimilar age groups causes quality comparisons between Medicare insurance and other types of insurance to be difficult.

Disease types are assigned to both individuals and medical care "events" using the International Classification of Disease version 9 (ICD-9) codes. ICD-9 codes present different levels of specificity and are classified in a manner that allows for aggregation to like conditions. The most specific code presented in the MEPS data is the three-digit code that identifies more than 500 diseases. The most aggregate parsing of diseases are the eighteen major chapter headings.[6] Events are associated with specific diseases only if the disease, as specified by the ICD-9 code, is directly associated with the event. Events associated with more than one disease are

[6]The conditions originally classified into the major chapter headings fourteen and sixteen are re-classified into other relevant chapters. When the relevant chapter is unclear to the author, the category is re-classified into Chapter 18. For instance, the three digit ICD-9 "V01 Communicable disease contact" was originally in Chapter 16, and is re-classified into Chapter 1 Infectious Disease. However, "V19 Family History Other Condition", also classified in Chapter 16 is re-classified into Chapter 18.

Table 4.1: Demographics by Disease

Variables	Diabetes	Depr-ession	Hyper-tension	Arthritis	Total
Private Insurance N=133,734					
Age	49.55	40.43	50.57	50.40	31.51
Under 16	0.014	0.038	0.004	0.009	0.240
Female	0.470	0.690	0.508	0.598	0.504
No Degree + < 16	0.194	0.176	0.137	0.165	0.366
HS Diploma	0.488	0.431	0.514	0.511	0.355
Bachelor's Plus	0.312	0.392	0.346	0.320	0.277
Nonwhite	0.305	0.139	0.241	0.186	0.240
Receives Disability	0.053	0.053	0.037	0.054	0.010
> 16 Income (2000 Dollars)	31,209	30,971	35,871	33,522	33,177
Prevalence*	0.025	0.050	0.079	0.033	0.638
Medicaid N=33,523					
Age	47.39	35.19	48.28	48.32	18.27
Under 16	0.025	0.107	0.009	0.030	0.566
Female	0.707	0.717	0.667	0.697	0.569
No Degree + < 16	0.630	0.610	0.590	0.655	0.820
HS Diploma	0.314	0.329	0.348	0.303	0.156
Bachelor's Plus	0.049	0.058	0.056	0.040	0.022
Nonwhite	0.595	0.423	0.580	0.538	0.604
Receives Disability	0.636	0.450	0.580	0.612	0.127
> 16 Income (2000 Dollars)	6,811	7,792	7,367	6,948	7,597
Prevalence*	0.030	0.069	0.055	0.033	0.092
Uninsured N=36,350					
Age	50.03	39.57	51.04	51.00	30.98
Under 16	0.000	0.012	0.003	0.004	0.170
Female	0.523	0.603	0.598	0.629	0.447
No Degree + < 16	0.467	0.382	0.429	0.445	0.510
HS Diploma	0.367	0.463	0.433	0.441	0.372
Bachelor's Plus	0.152	0.149	0.134	0.104	0.112
Nonwhite	0.538	0.309	0.478	0.432	0.488
Receives Disability	0.154	0.151	0.158	0.191	0.034
> 16 Income (2000 Dollars)	14,971	14,169	15,549	13,845	16,129
Prevalence*	0.025	0.051	0.051	0.026	0.118

*The prevalence total is the fraction of the U.S. population that is insured.

considered as a treatment in all of the listed conditions. Individuals are assigned to a three-digit disease category if they are associated with any event that is associated with the disease category during the year.

Table 1 lists the demographic characteristics for a nationally representative sample of several important diseases. Table 1 presents the age, sex, education, income, and race, by disease for the insurance types under consideration. These characteristics have all been shown to be correlates of health and have some theoretical justification in the explanation of health differences. Income may provide access to health-promoting leisure activities (exercise), and nutritious food types. The reported income is the CPI-deflated sum total of all income sources including wages, assets, sales and rental income for individuals older than 16 years of age. Education has been shown to be negatively correlated with tobacco and alcohol consumption, and may indicate adherence to medical care protocols and familiarity with the efficacy of non-medical inputs into health. Education is reported as the highest degree attained by the individual. Sex, race and age are reported because genetic and age differences may explain health differences by themselves, and they may indicate different medical care protocol needs.

The characteristics are reported separately for each of the different insurance types. Comparing the demographic characteristics along the far right column reveals dramatic differences across insurance types. Medicaid recipients represent a higher proportion of women than does either private insurance or the uninsured. The uninsured represent a higher proportion of men than either the privately insured or the Medicaid populations. The average age of Medicaid recipients is much younger than the average age of either the uninsured or the insured populations. Much of the age difference between Medicaid insurance and other types of insurance can be explained by the fraction of children covered by the insurance types. More than fifty-five percent of the Medicaid population is children, whereas the uninsured and the

privately insured are mainly comprised of adults. The average age of the uninsured and the privately insured are both close to thirty years old, but the fraction of the privately insured that are children is much higher than the fraction of the uninsured that are children.

The socio-economic status differences across insurance types are large. Private insurance represents a more educated and wealthier group of individuals than either the Medicaid or uninsured populations. More than 80% of the privately insured have at least a high school diploma, whereas less than half of Medicaid patients and slightly more than half of the uninsured have a high school diploma. The income differences across insurance types are large. Privately insured adults make approximately twice the income of uninsured adults, and more than four times the income of Medicaid adults. In addition to these explicit socio-economic indicators, the uninsured and Medicaid populations have much higher minority populations than does the privately insured. More than half of the Medicaid population and nearly half of the Uninsured populations are non-white, whereas less than 30% of the privately insured are non-white. Minorities may have different access to care, due either to physician discrimination or urban location, as well as different genetic differences that necessitate different treatments.[7]

The distribution of health outcomes depends on the health measure considered. The fraction of individuals receiving disability insurance suggests that the Medicaid and uninsured populations are in unambiguously worse health than are the privately insured. Of the privately insured with one of the health conditions considered, less than ten percent receive disability insurance. In contrast, greater than fifteen percent of the sick uninsured receive disability and greater than half of the sick Medicaid population receives disability insurance. However, one may need to be identified as disabled in order to qualify for Medicaid insurance, thus distort-

[7]Non-white includes ethnic Hispanics.

ing the intuition behind this measure. An alternative measure, the prevalence of the specific conditions, tells a slightly different story. The same fraction of the privately insured and the Uninsured have diabetes, and the same fraction of Medicaid individuals and the privately insured have arthritis. Both Medicaid and the Uninsured have lower prevalence rates of hypertension than does the privately insured, and the uninsured fairs better than both the Medicaid and privately insured populations for arthritis. Thus, these prevalence measures suggest that the health differences of the two samples may not be that different.

The conditions considered often affect older members of society. The average age of individuals with a condition is older than the full sample average age for all of the conditions considered and for each insurance type. Moreover, the conditions considered disproportionately affect adults. However, the average age is not constant across diseases, and appears to be an important determinant of the type of condition treated. Hypertension, diabetes and cancer (Neoplasms) afflict an older population than depression and 'other conditions'. 'Other conditions' includes conditions that afflict the young such as asthma, pregnancy, otitis media and influenza. Many of the conditions considered appear to disproportionately affect women.

Socio-economic status does not vary dramatically across disease types within insurance types. Income levels and education levels remain fairly constant across disease types. However, cancer presents itself as an exception to this rule. Cancer patients appear to be disproportionately well-educated and wealthy relative to the population as a whole and the populations of other disease types. This effect for cancer is persistent across insurance types. Race appears to play a role in determining health, but the effect of race is not consistent. Whites appear to be more prone to arthritis, cancer and depression, whereas non-whites are more prone to diabetes.

Finally, a caveat should be mentioned. The observed differences in disease prevalence may have an alternative explanation than prevalence. The disease mea-

sure is a report by the individual of conditions for which they have sought care or untreated illness descriptions.[8] Women or the privately insured may be more likely to seek care earlier than other groups, and may therefore be more aware of their health conditions. For this reason, the differences in prevalence may be due to the awareness of their disease rather than the prevalence.

Due to sample size issues, the method used to categorize individuals into insurance types does not account for transition dynamics. For instance, an individual may be classified as privately insured, although they may be uninsured for part of the period. The classification procedure chosen here defaults individuals into the privately insured insurance type. This procedure implicitly defines the Medicaid and uninsured groups as those individuals who persistently have non-private insurance.

Table 2 provides information on the persistence of insurance types for those individuals classified as having Medicaid and private insurance. For the full sample of individuals, 80% of individuals classified as privately insured report having private insurance for 12 months of the year, and 90% of individuals classified as having private insurance report being privately insured for more than half the year. Less than 5% of the privately insured ever report having Medicaid during the year. Some individuals report being privately insured at some point during the year, although they do not report having private insurance in any specific month. However, this group always represents less than 2.5% percent of individuals.

The persistence of private insurance for each disease considered is at least as long as it is for the full sample. This observation suggests that within the disease types considered the insurance classifications are at least as accurate as the entire sample. For instance, the persistence statistics for depression are similar to the sample as a whole with regards to persistence duration and the fraction holding Medicaid insurance. However, hypertension and arthritic patients are less likely

[8] More than 90% of those with a reported condition have sought care for the condition.

Table 4.2: Insurance Transition

	Months Privately Insured	Months Insured by Medicaid
	Whole Sample	
0 months	0.020	0.0
1 - 2	0.037	0.076
3 - 6	0.065	0.125
7 - 9	0.052	0.104
10 - 11	0.040	0.070
12 months	0.802	0.659
% with Medicaid	0.043	-
	Depression	
0 months	0.022	0.0
1 - 2	0.035	0.064
3 - 6	0.061	0.110
7 - 9	0.051	0.087
10 - 11	0.042	0.067
12 months	0.805	0.703
% with Medicaid	0.042	-
	Hypertension	
0 months	0.003	0.0
1 - 2	0.019	0.056
3 - 6	0.037	0.096
7 - 9	0.034	0.080
10 - 11	0.028	0.054
12 months	0.887	0.739
% with Medicaid	0.019	-
	Arthritis	
0 months	0.005	0.0
1 - 2	0.022	0.050
3 - 6	0.043	0.098
7 - 9	0.033	0.074
10 - 11	0.025	0.056
12 months	0.883	0.743
% with Medicaid	0.021	-

to have Medicaid insurance and more likely to have longer duration periods than the full sample of privately insured. Between 94-95% of hypertension and arthritic patients classified as having private insurance are privately insured for more than half of the year, and more than 88% of these patients have private insurance for 12 months of the year.

The persistence duration of Medicaid insurance is shorter than that of private insurance persistence duration. Only 65.9% of Medicaid patients have Medicaid for all 12 months, and approximately 3/4 of the population hold Medicaid for at least half the year. As was true with the privately insured, individuals with a condition have longer persistence durations than does the Medicaid sample as a whole. Also consistent with the privately insured, depression patients have the shortest Medicaid duration periods of the conditions considered. More than 85% of individuals with hypertension and arthritis have Medicaid insurance for more than six months during the year, and nearly 3/4 of this population has Medicaid for the full 12 months of the year. Unlike the privately insured, all of those classified into the Medicaid population can identify at least one month where they had Medicaid. Moreover, none of the Medicaid population has private insurance, because those individuals would be classified into the private insurance population.

4.4 A Description of Treatments

Diseases can vary significantly in their treatment complexity, protocols and health consequences. For instance, diabetes treatment is very complex, and may involve a lifetime of hospital visits, insulin shots, and other drug regimens. In contrast, upper respiratory infections can be very simple to treat and may involve a trip to the doctor's office and a week's worth of antibiotics. The response to treatment may also vary across diseases. The known conditions have a wide spectrum of potential outcomes that differ by disease. Diseases may be preventable with vaccine, curable,

Table 4.3: Per Person Disease Costs

Condition	Private	Medicaid	Uninsured
Depression	1001	1547	947
Hypertension	602	1061	587
Arthritis	656	684	513
Diabetes	1107	1879	1349

treated indefinitely but never cured, or have no available treatment. The differences in these outcomes have changed over time with technological advancement. Related to the potential outcomes of the treatment are the health consequences of disease treatment. Conditions may vary significantly in how they affect health. Some diseases may increase mortality risks but are not physically debilitating, such as high cholesterol. Other conditions may be physically debilitating but do not change the risk of death, such as arthritis. Other conditions, such as diabetes, are potentially both debilitating and mortal.

The treatment outcomes are related to the nature of the disease, and are consequently also very heterogeneous. Disease treatments may be able to address some of the undesirable properties of the disease, but not others. For instance, diuretic drugs may help with the uncomfortable aspects of hypertension, but may not address the mortality risks associated with the disease. In some cases medical care services may worsen some aspects of health while treating other aspects. For instance, some arthritic drugs have been shown to increase mortality, although they are effective at relieving pain and morbidities. Cancer treatment often employs therapies that increase morbidities in an attempt at lowering mortality.

4.4.1 Cost Per Disease

Although the nature of disease treatment is extremely complex, a good starting point for comparing the nature of them begins by comparing the average total costs per

person across diseases. The following analysis considers three disease treatments - arthritis treatment, depression treatment, and hypertension treatment. These conditions represent three of the ten most prevalent chronic conditions in the United States, and two of the ten most costly conditions to treat in the United States. All three conditions have effective treatments available that involve multiple medical care services.

The costs associated with a specific ICD-9 code include all of the expenditures paid to a medical care provider made by and in behalf of the patient with the condition. The expenditures included in this calculation are limited to those expenditures associated with the medical events that specifically list the three digit ICD-9 code as the reason for the event. Therefore, an individual who has both diabetes and hypertension and visits the physician for a checkup is included in the total cost of hypertension only if the checkup specifically lists hypertension as the reason for the visit.[9] Medical events that are never associated with ICD-9 codes are not included in the per person cost of specific conditions. The costs of specific diseases, as determined by the ICD-9 code, are calculated by summing the total annual expenditures included in the treatment of the disease and dividing the sum by the total number of individuals receiving treatment for that condition within the year. All costs are associated with the calendar year in which they were accrued. Individuals with a disease include only those individuals who had some positive spending on the disease within the year. [10] The costs in each year are weighted to reflect a nationally representative sample, and are deflated by the annual Consumer Price Index-Urban presented in year 2000 dollars.

The per person treatment costs of the conditions considered are economically

[9]The costs associated with events that list multiple conditions as the reason for the event are included in the treatment costs of all the conditions listed.

[10]This may significantly affect the cost per person, as some individuals may have a disease and receive treatment, but spend zero dollars on treatment because of bad debt or the receipt of charity care.

important.[11] Diabetes treatment, the most expensive condition considered, is more than $1,000 per person per year. Arthritis treatment, the least expensive condition considered, is less than $700 per person per year. These differences in costs suggest that either the treatment complexity differs across diseases, or that the prices of the inputs used to treat the diseases are different, or both.

Comparison of treatment costs for the same condition across insurance types reveals some striking evidence in the cost per person of treating diseases. Table 3 reveals that on average, Medicaid insurance pays the most for disease treatments per patient per year for every condition considered. The uninsured pay less for treatment costs than does either the privately insured or Medicaid patients for all of the conditions considered except diabetes. The size of these differences can be quite large. Medicaid pays at least 50% more than does private insurance for all treatments other than arthritis treatment. Private insurance pays up to 30% more than the uninsured, but does pay less for diabetes treatment.

The reasons for these differences are not revealed by examining aggregate cost differences. Treatment cost differences across diseases and between insurance types have many potential sources including differences in treatment algorithms, severity of the conditions treated, and potential treatment compliance. In the case of the uninsured, the differences in costs may potentially reflect the provision of free or discounted care by service providers to the uninsured, or bad debts incurred and not paid in full during the survey period. Explaining the reason for the observed differences requires identifying these effects.

[11] The relative size of these cost differences is economically important but small relative to other medical conditions that could have been considered. In contrast to the cost differences observed between the conditions considered here, H.I.V. treatment can be upwards of $4,000 per person per year and upper respiratory infections may be less than $50 per person per year.

4.4.2 Disease Treatment Types

The reasons for why differences in the costs of disease treatments are observed is addressed by examining the medical care services used in the treatment of disease. Protocol differences across insurance types are defined as input service differences used in disease treatment. Table 4 examines aggregate protocol and cost differences in disease treatments. The disease treatment protocols are defined as bundles of input services specific to treat a disease and are listed in Table 4 under the column heading "Treatment". The treatments are defined by whether individuals have some positive spending on a particular bundle of medical care service events associated with the disease. The treatments represent an exhaustive list of potential treatments available to the patient.

The number and types of treatment are specific to the disease but represent four broadly defined categories of services: hospital care, office visits alone, drugs alone and combinations of non-hospital services. A hospital treatment is defined as any treatment that includes a hospital stay or visits to either the emergency room or an outpatient facility located within the hospital.[12] Treatments that include office visits may involve visits to either physician or non-physician offices. The drugs considered depend on the disease. Arthritis drugs include Non-steroidal anti-inflammatory medications such as Ibuprofen, narcotics such as codeine, and other analgesics such as Cox-2 inhibitors. Depression drugs include Selective Serotonin Re-uptake Inhibitors (SSRIs) such as Fluoxetine HCl (Prozac), and other anti-depressants such as Wellbutrin. Depression also considers anxiolytics, and anti-convulsant medications such as Diazepam. Hypertension drugs include Beta-adrenergic blocking agents (Beta-blockers) such as Atenolol, and Angiotensin Converting Enzyme (ACE) Inhibitors such as Lisinopril. Anti-hypertensive medications

[12]Events must be associated with an ICD-9 code for the expenditures to be included in the share calculations. For this reason, the caveats associated with how expenditures were allocated to cost per person calculations also apply to Table 3 as well.

Table 4.4: Treatment Costs and Utilization

Treatment	Per Person Costs	Utilization Rate
716 Arthropathies		
Hospital	2756	0.095
Office Only	325	0.230
Office + Other Rx	802	0.090
Office + "Ibuprofen"	463	0.136
"Ibuprofen"	186	0.170
Other Rxs Only	360	0.127
Other Non-hospital	644	0.153
311 Depression		
Hospital	6588	0.054
Office Only	481	0.128
Office + SSRI	798	0.183
Office + Other Rx	1055	0.113
SSRI Only	423	0.232
All Non-hospital	318	0.110
SSRI + Other Rx	1432	0.181
401 Hypertension		
Hospital	2713	0.050
Office Only	258	0.080
Other Card Rxs	361	0.182
ACE Inhibitor	301	0.070
Beta Blocker	217	0.053
Office + ACE	482	0.063
Office + Card Rxs	618	0.185
Office + Beta Blkr	917	0.045
Office + ACE + Card	839	0.049
Office + Rxs	809	0.103
Other Treatments	604	0.121

are often supplied in combination with each other and/or diuretics in a class of drugs referred to as 'Combination therapies'. Combination therapies are considered together with 'other' medications used to treat hypertension. The other medications may include other anti-hypertensive medications such as Amlodipine (a calcium channel blocker), or medications used to treat the confounding effects that hypertension has on other conditions such as high cholesterol. These drugs include the HMG-COA reductase inhibitors such as Atorvastatin. Chapter 2 provides a complete list of the items considered in each of the service categories.

The disease treatment technology is defined by the input services used to treat disease. The utilization rates that define the fraction of people who receive the specified treatment for the associated disease are presented in Table 4. The utilization rates suggest that the treatments are not very hospital intensive. Less than 10% of all treatments for any of these conditions involve hospital care. In contrast, at least 50% of all treatments involve an office visit, and more than 65% of treatments involve the use of drugs. The intensity of these broad service types depend on the disease considered.

Treatments vary significantly in their costs within a condition. Hospital treatment stands out as being the most costly type of treatment. Hospital care is consistently the most expensive type of treatment for each of the diseases considered, and the costs of hospital treatment are up to 20 times higher than the costs of other types of treatments. Service combination therapy is typically more expensive than treatments that are intensive in only one type of service. Whether drug-only treatments or office-only treatments are more costly depends on the disease.

Tale 5 presents disease treatment costs by insurance types. Table 5 reveals that the costs of identical treatments for identical diseases varies across insurance types. The size of these differences can be dramatic. For instance, the privately insured hospital treatments for depression are $2500 dollars more expensive than

are hospital treatments for depressed Medicaid patients. Private insurance is not always more expensive than Medicaid insurance, however. Office visit treatments for hypertension can be close to $500 more expensive for Medicaid patients than are privately insured office visits.

Note that the direction of these "costs" is inconsistent across insurance types. Table 3 suggests that Medicaid patients are more costly to treat for identical conditions, but Table 5 suggests that the difference in these costs is not necessarily derived from the costs of individual treatments. Moreover, the observed differences in the use and cost of these services by insurance types may represent quality differences, differences in demographic composition across insurance type populations, the initial health of the individuals receiving treatment, or the behavioral differences of the patients receiving treatment. Identification of quality differences on health outcomes requires controlling for these other possibilities and measuring health outcomes without confounding the demographic and initial health effects with treatment effects. The evidence provided in Tables 1, 3 and 5 suggest that these differences are potentially important in determining treatments and outcomes.

4.5 Explaining Treatment Differences

4.5.1 The Demand for Medical Care Service Inputs

The analysis explaining differences in treatments across insurance types begins with the estimation of input demands. These differences provide protocol differences across insurance types. The protocol differences from this estimation are used in the next section to decompose the health consequences of treatment into protocol, quality, and demographic differences across insurance types.

Medical care input demand is modelled using Equation 2. The demand for treatments is defined as the probability that a treatment is used. Each individual

Table 4.5: Treatment Costs by Insurance Type

Treatment	Private	Medicaid	Uninsured
716 Arthritis			
Hospital	2818	2648	2270
Office Only	329	348	257
Office + Other Rx	780	748	1152
Office + "Ibuprofen"	461	517	375
"Ibuprofen"	195	142	158
Other Rxs Only	374	319	246
Other Non-hospital	664	620	505
311 Depression			
Hospital	7872	5393	5381
Office Only	514	496	283
Office + SSRI	817	740	796
Office + Other Rx	1006	1257	838
SSRI Only	433	386	364
All Non-hospital	303	385	260
SSRI + Other Rx	1357	1827	1167
401 Hypertension			
Hospital	2499	4012	2118
Office Only	226	598	223
Other Card Rxs	366	351	316
ACE Inhibitor	305	290	257
Beta Blocker	221	176	208
Office + ACE	484	522	429
Office + Card Rxs	625	686	499
Office + Beta Blkr	869	1366	953
Office + ACE + Card	823	1110	717
Office + Rxs	778	1101	775
Other Treatments	597	688	599

Table 4.6: Medical Care Service Demands

Treatment	Private	Medicaid	Uninsured
	Arthritis		
Hospital	0.102	0.226	0.182
Office Only	0.288	0.303	0.061
Office + Other Rx	0.153	0.077	0.014
Office + "Ibuprofen"	0.073	0.052	0.005
"Ibuprofen"	0.067	0.112	0.114
Other Rxs Only	0.234	0.111	0.439
Other Non-hospital	0.083	0.118	0.185
	Depression		
Hospital	0.039	0.190	0.022
Office Only	0.191	0.187	0.218
Office + SSRI	0.140	0.226	0.121
Office + Other Rx	0.162	0.061	0.024
SSRI Only	0.206	0.096	0.407
All Non-hospital	0.132	0.062	0.069
SSRI + Other Rx	0.131	0.179	0.139
	Hypertension		
Hospital	0.033	0.136	0.075
Office Only	0.084	0.055	0.133
Other Card Rxs	0.137	0.100	0.087
ACE Inhibitor	0.079	0.142	0.074
Beta Blocker	0.074	0.056	0.093
Office + ACE	0.089	0.064	0.044
Office + Card Rxs	0.177	0.095	0.078
Office + Beta Blkr	0.032	0.042	0.012
Office + ACE + Card	0.041	0.116	0.020
Office + Rxs	0.167	0.086	0.066
Other Treatments	0.086	0.108	0.318

can demand one, and only one of these treatments. All treatments are available to all individuals regardless of insurance type. The probability of choosing one of the disease treatments is estimated separately for each insurance type using maximum likelihood. The determinants of demand are specific to the disease considered, but always include demographics of the patient such as age, sex, race, education, and income of the patients. Both linear and quadratic age terms are included in every treatment demand function. Unobserved technological effects are controlled using the year of treatment.[13]

Although we control for the initial health of the patient by measuring outcomes using changes in health status over the year, we also include related health measure controls in the estimation procedure to account for the condition severity. The measures chosen vary across conditions. For hypertension and arthritis demands, we implicitly consider the medical history of the patient. For hypertension, medical history is defined as whether the patient has a co-morbid condition prior to receiving hypertension treatment. Such a definition is interpreted as having a reoccurring chronic medical condition. For arthritis, the medical history is defined as whether the patient has an activity limitation in the first survey round of the year. Depression includes controls for whether the individual has a neurotic or psychotic condition in addition to depression. The predicted probabilities for each insurance type and each disease is presented in Table 5 for an initially healthy fifty year-old white male with a high school diploma, and at least $30,000 of personal income in the West region 2003.

Table 7 reports the demands for disease treatments by insurance type. The comparison of private insurance service demand with Medicaid service demand finds that Medicaid insurance is more likely to use hospital services than private insurance. Private insurance is also more likely to use both office visit services and drug only

[13]How time enters into the demand equations depends on the treatment considered.

services than Medicaid patients. All of these results are consistent across disease types.

The one consistent pattern between the uninsured and the privately insured is that the uninsured are consistently less likely to visit the office than are the privately insured. Other than the office visit demand, the relationship between the demands of the uninsured and the privately insured depends on the disease considered. For instance, the uninsured has a larger demand for hospital services than the privately insured in the treatment of hypertension and arthritis, but has a lower demand for hospital services in the treatment of depression. A larger proportion of the uninsured consume drug-only services than the privately insured in the treatment of depression and arthritis. However, the uninsured have smaller drug-only demands in the treatment of hypertension.

Demographic characteristics play a large part in determining the types of treatment sought. The size and direction of the results varies across insurance types. The most important demographic characteristics are age, income, education, sex, and race. The pattern among these groups is that young, poor minorities demand hospital treatment more frequently than other demographic groups. In order to demonstrate the importance of these demographic characteristics in explaining treatment, Table 6 presents the demand for services by insurance type for a 60-year old highly educated white man in the highest income group against the demands of a 30-year old uneducated minority man in the lowest income group for the three diseases considered. Note the hospital treatment demand for the young minority in the low income group is a much higher fraction of all treatments than it is for the older white man in the highest income group for Medicaid patients and the privately insured. This result holds for all conditions. The uninsured also exhibit this pattern for arthritis, but the uninsured who are young and poor are less likely to use hospitals in the treatment of depression and hypertension. Despite controlling

for the importance of these effects, the pattern of Medicaid patients using hospital services more intensively than the privately insured and the uninsured remains for both groups.

Table 4.7: Service Demands by Demographic Characteristics

	Young, Poor, Nonwhite			Old, High Income, White		
Treatment	Private	Medicaid	Uninsured	Private	Medicaid	Uninsured
			Depression			
Hospital	0.086	0.218	0.022	0.015	0.116	0.069
Office	0.353	0.305	0.477	0.060	0.160	0.293
Office + SSRI	0.133	0.158	0.154	0.133	0.153	0.114
Office + Other Rx	0.122	0.046	0.018	0.177	0.168	0.017
Other Rxs	0.132	0.068	0.238	0.289	0.043	0.279
SSRI	0.078	0.045	0.035	0.199	0.113	0.131
SSRI + Other Rx	0.096	0.162	0.056	0.128	0.248	0.097
			Hypertension			
Hospital	0.056	0.278	0.145	0.031	0.113	0.203
Office Only	0.163	0.151	0.206	0.202	0.155	0.134
Other Cards	0.126	0.100	0.106	0.121	0.224	0.074
ACE Inhibitors	0.057	0.068	0.047	0.086	0.046	0.045
Beta Blockers	0.056	0.035	0.080	0.069	0.073	0.070
Office + ACE	0.074	0.054	0.065	0.055	0.084	0.073
Office + Card	0.233	0.103	0.117	0.186	0.038	0.064
Office + Beta Blkr	0.021	0.019	0.017	0.035	0.024	0.014
Office+ACE+ Other	0.034	0.061	0.015	0.019	0.096	0.015
Office + Other	0.132	0.051	0.053	0.134	0.055	0.068
Other Treatment	0.049	0.078	0.150	0.063	0.092	0.241
			Arthritis			
Hospital	0.122	0.194	0.214	0.118	0.171	0.157
Office Only	0.355	0.384	0.222	0.283	0.453	0.154
Office + Other Rx	0.104	0.106	0.040	0.165	0.038	0.079
Office + Ibuprofen	0.151	0.089	0.019	0.058	0.064	0.015
Ibuprofen	0.049	0.088	0.098	0.081	0.106	0.212
Other Rxs	0.107	0.037	0.265	0.193	0.058	0.181
Non-Hospital	0.111	0.101	0.142	0.101	0.110	0.202

4.5.2 Health Production Differences Across Insurance Types

In order to identify the effects of treatment on health production, the panel nature of the data is exploited. The MEPS surveys individuals in episodes called 'rounds' at least twice within a year. The survey collects health information by round for several health indicators, and collects ICD-9 code information by the date of the event. The health measures employed in the health production analysis are changes in health status that have occurred after the initiation of treatment for the condition considered.

The health measure for arthritis is defined as whether the individual experienced an improvement (deterioration) of physical functioning within the period. The survey asks in the first, third and fifth survey rounds whether an individual has a physical functioning limitation. If the individual does have a physical limitation the survey follows up the question with a series of related questions that inquire as to whether the performance of the activity involves "1 No difficulty", "2 Some difficulty", "3 A lot of difficulty" or whether the individual is "4 Unable to do" the activity. Improvements (deteriorations) are defined by the author in a hierarchical fashion. If the individual status changed from either having a physical functioning to not having one or vice versa, the implied health change was used. If the individual already had a physical functioning limitation and improved or deteriorated in walking a mile, the health change for the difficulty walking a mile was used. If no change occurred for the walking a mile measure, then the author used changes in the difficulty measure for bending, reaching, standing for 20 minutes and stepping up stairs, in that order. The medical history of arthritis is defined by the activity limitation which is a variable distinct from the physical functioning variables.

The health measure used for hypertension is a measure of the changes in whether one had a related ICD-9 event. Hypertension has been shown by medical science to be causally related to the ICD-9 codes 410 Acute Myocardial Infarction,

413 Angina Pectoris, 414/ 429 Heart Disease, 427 Cardiac Dysrhythmia, 428 Heart failure, 436 CVA (stroke), 444 Arterial Embolism, 459 Other Circulatory Disease, and 785 Cardiovascular Symptoms.[14] If treatment for any one of these conditions occurred after hypertension treatment is initiated then the individual is defined as having a co-morbid event. If the individual was diagnosed with the condition before hypertension treatment was initiated then the individual is flagged as having a medical history of these conditions.

The health measure used for depression is defined as changes in the self-reported mental health measures. Self-reported health is provided in each round of the survey, and at least twice during the year. If mental health improved or remained unchanged, but was not reported as always in the lowest health state, then mental health is recorded as did not deteriorate. If mental health either deteriorated or remained at the lowest provided level, then mental health was said to have deteriorated.

Each of the health measures provided are indicators for whether health changed during the period after treatment was initiated. The effect of treatment type on health is estimated using Equation 4. Treatments are defined as dummy variables, and interacted with the insurance types. The interaction with the insurance types allows private insurance physicians to be a different quality than are Medicaid physicians and the physicians seen by the uninsured. Other covariates include medical history, age, sex, education, and income. Time is included to control for technological change. None of the other covariates are interacted with insurance type.

Total medical care expenditures is included in all three health production functions, but the nature of its entry depends on the type of condition. For progres-

[14]The list of conditions was constructed by examining the twenty most common co-morbidities seen alongside hypertension in the MEPS and consulting with a practicing physician on whether the condition in question was causally related to hypertension.

Table 4.8: Health Effects by Insurance Types

Treatment	Private	Std. Error	Medicaid	Std. Error	Uninsured	Std. Error
			Hypertension			
No Treatment	0.215		0.215		0.215	
Hospital	0.117	(0.0007)	0.174	(0.0018)	0.157	(0.0020)
Office Only	0.077	(0.0004)	0.085	(0.0014)	0.094	(0.0013)
Other Card Rxs	0.075	(0.0002)	0.101	(0.0010)	0.106	(0.0009)
ACE Inhibitor	0.070	(0.0003)	0.068	(0.0014)	0.076	(0.0013)
Beta Blocker	0.114	(0.0006)	0.061	(0.0028)	0.108	(0.0022)
Off. + ACE	0.048	(0.0002)	0.072	(0.0016)	0.061	(0.0011)
Off. + Card Rxs	0.079	(0.0003)	0.131	(0.0009)	0.035	(0.0003)
Off. + Beta Blkr	0.137	(0.0008)	0.165	(0.0031)	0.131	(0.0027)
Off. + ACE + Card	0.083	(0.0005)	0.214	(0.0032)	0.129	(0.0023)
Off. + Rxs	0.140	(0.0006)	0.169	(0.0016)	0.126	(0.0015)
Other Treatments	0.149	(0.0006)	0.159	(0.0014)	0.174	(0.0015)
			Depression			
No Treatment	0.521		0.521		0.521	
Hospital	0.423	(0.0033)	0.501	(0.0038)	0.457	(0.0021)
Office Only	0.341	(0.0017)	0.351	(0.0027)	0.495	(0.0014)
Office + SSRI	0.347	(0.0015)	0.412	(0.0028)	0.365	(0.0013)
Office + Other Rx	0.359	(0.0019)	0.374	(0.0030)	0.382	(0.0013)
SSRI Only	0.313	(0.0014)	0.391	(0.0032)	0.346	(0.0012)
All Non-hospital	0.321	(0.0018)	0.399	(0.0037)	0.407	(0.0014)
SSRI + Other Rx	0.365	(0.0017)	0.461	(0.0028)	0.417	(0.0014)
			Arthritis			
No Treatment	0.730		0.730		0.730	
Hospital	0.524	(0.0010)	0.580	(0.0010)	0.631	(0.0009)
Off. Only	0.494	(0.0037)	0.524	(0.0010)	0.545	(0.0009)
Off. + Other Rx	0.441	(0.0061)	0.700	(0.0062)	0.553	(0.0017)
Off. + "Ibuprofen"	0.571	(0.0040)	0.471	(0.0008)	0.560	(0.0007)
Ibuprofen	0.552	(0.0039)	0.636	(0.0009)	0.614	(0.0008)
Other Rxs Only	0.624	(0.0044)	0.685	(0.0010)	0.663	(0.0008)
Other Non-hospital	0.487	(0.0026)	0.605	(0.0010)	0.591	(0.0009)

sive and degenerative chronic conditions such as hypertension and arthritis, total medical care expenditures enter in two ways. It is interacted with age and included as a health shifter. This modelling form imposes that medical care treatment acts by halting the aging process and also allows for medical care to be detrimental to health for certain age groups who are unlikely to be treated for the condition. Medical care expenditures are entered directly into the production function for depression because depression is not characterized as a progressive or degenerative condition. The no treatment alternative presented in Table 8 is defined as trivial medical care spending on treatments without health production.

Table 8 reports the predicted probability of a health outcome for three conditions under different treatment regimes for an individual with specific characteristics.[15] The treatment effect on health outcomes are reported separately by insurance types. Table 8 reveals that all types of medical care treatment are effective in producing health. The no treatment option always results in either worse or no better health outcomes than any treatment alternative. The difference between the no treatment option and the available treatments depends on the condition, but the effects can be large. For instance, hypertension patients without treatment have a 21.5% chance of contracting a related co-morbid condition, whereas the privately insured who take ACE inhibitors have a 5% chance of contracting these types of conditions. More than half of the untreated depressed get worse, and nearly 75% of the untreated arthritics deteriorate within the year. However, treatments can reduce these probabilities to less than 32% and 47% for depression and arthritis, respectively. The standard errors for these probabilities suggest that the observed differences across insurance types are statistically significant.

The efficacy of treatment differs across insurance types. The most consistent pattern that appears across insurance types is the persistent inferiority of Medicaid

[15]The characteristic chosen is an average-aged white, Western male, in 2003 without a history of related medical conditions.

treatment relative to either the uninsured or the privately insured treatments. The inferiority of Medicaid is true for most treatments and all conditions, with the possible exceptions being the drug only treatments for hypertension. The differences between the insured and the uninsured are present, but are typically not as large as they are between private insurance and Medicaid insurance. Different treatments for the same disease appear to exhibit different levels of efficacy.

Comparing the efficacy levels of the different treatments within the same disease fails to account for the endogenous nature of treatment. Which treatment is received depends on individual characteristics. To account for the endogenous nature of the treatment received, the insurance types are compared against each other and the differences in health effects are decomposed into quality, demographic and protocol components. Table 9 presents the overall health differences between the insurance types decomposed into these component effects. Two key results appear from the decomposition. The first result is that protocol differences explain very little of the variation in health outcomes between the insurance types. In other words, that Medicaid takes individuals to the hospital more frequently than does private insurance explains very little of the differences in health between the samples. The second key result is that quality differences often play a large role in explaining the differences in the insurance types. For arthritis and depression, more than half of the difference in health outcomes is explained by the quality differences of the insurance types. In other words, the hospitals used to treat the privately insured are more effective than are the hospitals used to treat the Medicaid patients. This large quality result is also true for hypertension when comparing the privately insured to Medicaid, but there appears to be no quality effect between the insured and the uninsured for hypertension. The demographic effect explains the observed sample differences that are not explained by either the protocol or the quality effects. Demographic effects vary across diseases. These effects are quite

Table 4.9: Overall Health Effects Decomposed

Insurance	Quality	Demographic	Protocol	Total Effect
		Arthritis		
Medicaid	-0.0441	-0.0962	-0.0034	-0.1437
Uninsured	-0.0517	-0.0332	-0.0050	-0.0900
		Depression		
Medicaid	-0.0596	0.0007	-0.0097	-0.0686
Uninsured	-0.0576	-0.0023	-0.0040	-0.0639
		Hypertension		
Medicaid	-0.0265	-0.0203	-0.0029	-0.0497
Uninsured	-0.0050	-0.0073	-0.0016	-0.0139

important for arthritis, and explain much of the difference between Medicaid and the privately insured for hypertension, but explain very little of the insurance type differences for depression.

4.6 Sample Selection into Insurance Types

The sample of individuals may differ across insurance types in ways that are unobserved to the econometrician but correlated with the variables of interest. For instance, Medicaid patients and the uninsured may delay seeking treatment for mild conditions, and thus initiate treatment for conditions only after they have progressed to a point of greater severity than that of the privately insured. For this reason, the privately insured may be healthier in unobserved ways than are the non-privately insured. Moreover, the uninsured and Medicaid patients may be less likely to comply with their treatment than the privately insured in ways that are unobserved, potentially exacerbating the unobserved health differences across samples.

These unobserved differences between the samples may affect both the demand and the health production results. The demand for services may be affected because the types of medical care services used in treatment depend on the initial

health of the individual. For example, individuals with severe health conditions may be more likely than other relatively healthy individuals to seek hospital treatment. Health production results may be affected because the response to treatment may depend on the initial health of the individual. Unobserved differences, such as those described above, are often corrected using instrumental variable techniques. This technique is valid if instrumental variables are available that are correlated with insurance status but uncorrelated with unobserved health. Although potential instruments exist, such as spousal occupation and spousal insurance status, implementation of these techniques are complicated by the discrete nature of the insurance decisions and the treatment and health measures. Short of using instrumental variable techniques, an analysis to determine the size and direction of the uncorrected biases is useful.

4.6.1 Selection and Health Production

Consider health production. The direction of the effect of prior illness on treatment efficacy is ambiguous, a priori. Individuals with prior health conditions may respond either better or worse to treatment than individuals without prior health conditions. For instance, sicker patients would respond better to treatment if being sicker provides more room for improvement and thus allows for a higher probability of improvement. Sicker patients would respond worse to treatment if the illness severity hardens the response to treatment. In addition, the ambiguity of the treatment efficacy response to initial health may materialize differently across diseases. However, despite the theoretical ambiguity of unobserved health effects on treatment efficacy, the results of the decomposition analysis, thus far, yield a similar pattern across diseases. Namely, protocol effects are unimportant whereas quality effects are important in explaining health differences across insurance types.

The effects of observed initial health conditions may provide some insight

Table 4.10: The Effect of Initial Health on Health Outcomes

Treatment	Private	Medicaid	Uninsured	Private	Medicaid	Uninsured	Difference
				Depression			
	No Psych condition			Psych Condition			
Hospital	0.426	0.503	0.460	0.410	0.488	0.445	-0.015
Office Only	0.339	0.348	0.492	0.299	0.308	0.448	-0.040
Office + SSRI	0.336	0.404	0.351	0.286	0.349	0.299	-0.050
Office + Other Rx	0.376	0.397	0.401	0.286	0.305	0.308	-0.090
SSRI Only	0.315	0.396	0.350	0.216	0.286	0.245	-0.099
All Non-hospital	0.331	0.414	0.416	0.303	0.383	0.385	-0.028
SSRI + Other Rx	0.352	0.441	0.401	0.357	0.446	0.406	0.005
				Hypertension			
	No Old Problem			Old Problem			
Hospital	0.118	0.176	0.159	0.042	0.070	0.061	-0.076
Office Only	0.078	0.086	0.094	0.025	0.028	0.032	-0.053
Other Card Rxs	0.076	0.102	0.107	0.024	0.035	0.037	-0.052
ACE Inhibitor	0.071	0.069	0.077	0.022	0.021	0.025	-0.049
Beta Blocker	0.115	0.061	0.109	0.041	0.019	0.038	-0.074
Office + ACE	0.048	0.073	0.062	0.014	0.023	0.019	-0.035
Office + Card Rxs	0.080	0.132	0.035	0.026	0.048	0.009	-0.054
Office + Beta Blkr	0.138	0.166	0.132	0.051	0.065	0.049	-0.087
Office + ACE + Card	0.084	0.215	0.130	0.027	0.092	0.048	-0.057
Office + Rxs	0.141	0.170	0.127	0.053	0.067	0.046	-0.088
Other Treatments	0.150	0.161	0.175	0.057	0.063	0.070	-0.093
				Arthritis			
	No Limitation			Condition Limitation			
Hospital	0.524	0.580	0.631	0.807	0.843	0.873	0.283
Office Only	0.494	0.524	0.545	0.878	0.893	0.902	0.384
Office + Other Rx	0.441	0.700	0.553	0.839	0.952	0.898	0.398
Office + "Ibuprofen"	0.571	0.471	0.560	0.890	0.835	0.885	0.319
"Ibuprofen"	0.552	0.636	0.614	0.875	0.915	0.905	0.323
Other Rxs Only	0.624	0.685	0.663	0.859	0.893	0.882	0.236
Other Non-hospital	0.487	0.605	0.591	0.830	0.895	0.888	0.343

as to how unobserved health status may affect our results. Table 10 presents the probability of health deterioration for individuals with and without observed disease-specific health conditions. The results in Table 10 suggest that depressed and hypertensive patients who have initial health conditions respond better to treatment than individuals without related health conditions. In contrast to depression and hypertension, arthritic patients with prior health conditions respond worse to treatment than individuals without prior health conditions. These results provide some evidence of the ambiguity for how initial health affects the response to treatment.

The differences in these results may occur as a result of the outcome measure chosen. The outcome metrics for depression and arthritis are measured as changes relative to the initial period. The better depression outcomes for the sicker patients may represent lower health levels, but higher probabilities of change. The worse arthritis outcomes likely represent both lower health levels and lower probabilities of change. However, the outcome metric for hypertension represents the probability of contracting a related chronic condition after receiving hypertension treatment. The probability differences of this measure unambiguously represent higher levels of health for patients who are initially sick with chronic health conditions. These results suggest that sicker hypertensive individuals may either be more responsive to treatment, or are better at complying with physician advice in unobserved ways. Sick hypertensive patients may comply better to advice because they are more keenly aware of the consequences if they do not.

For further intuition for how observable health metrics affect treatment efficacy, we consider how disability status affects our overall results. Individuals are classified as disabled if they receive disability payments by the government for any reason. Therefore, disability status is not necessarily associated with the severity of the condition considered but could be associated with some other health effect not considered in the analysis. For this reason, disability status provides a reason-

Table 4.11: Decomposition Controlling for Disability

	Quality	Demographic	Protocol	Total
		Hypertension		
Medicaid	-0.0153	-0.0336	-0.0015	-0.0503
Uninsured	-0.0022	-0.0105	-0.0012	-0.0140
		Arthritis		
Medicaid	-0.0451	-0.0935	-0.0044	-0.1430
Uninsured	-0.0520	-0.0326	-0.0052	-0.0898
		Depression		
Medicaid	-0.0400	-0.0209	-0.0077	-0.0686
Uninsured	-0.0495	-0.0109	-0.0033	-0.0636

ably good observable metric for how unobserved health differences may affect our results. Table 11 presents the health decomposition described in section 2 repeated when one includes controls for disability status in both the health production and service demand equations. Comparing the results in Table 11 with those of Table 9, the same qualitative results are retained. Protocol health effects remain very small and quality effects explain at least 30% of the total difference between Medicaid insurance and private insurance for every disease considered.

Although our qualitative results are retained across samples, the results add ambiguity to our intuition for how unobserved health may bias our results. The disease-specific effects suggest that failing to control for unobserved health would bias the quality differences that exacerbate differences for arthritis, but attenuate differences for hypertension and depression. The results for disability suggest exactly the opposite intuition. Failure to control for disability status exacerbates the quality differences between insurance types for hypertension and depression treatments, but does not affect the quality effects for arthritis treatment.

Table 4.12: The Effect of Initial Health on Service Demand

	Private	Medicaid	Uninsured	Private	Medicaid	Uninsured
			Depression			
	No Psych condition			Psych Condition		
Hospital	0.039	0.190	0.022	0.037	0.159	0.031
Office Only	0.191	0.187	0.218	0.062	0.041	0.142
Office + SSRI	0.140	0.226	0.121	0.049	0.141	0.046
Office + Other Rx	0.162	0.061	0.024	0.228	0.097	0.058
SSRI Only	0.206	0.096	0.407	0.079	0.067	0.364
All Non-hospital	0.132	0.062	0.069	0.167	0.140	0.037
SSRI + Other Rx	0.131	0.179	0.139	0.377	0.354	0.321
			Hypertension			
	No Old Problem			Old Problem		
Hospital	0.033	0.136	0.075	0.066	0.215	0.061
Office Only	0.084	0.055	0.133	0.044	0.014	0.068
Other Card Rxs	0.137	0.100	0.087	0.078	0.058	0.048
ACE Inhibitor	0.079	0.142	0.074	0.034	0.091	0.061
Beta Blocker	0.074	0.056	0.093	0.103	0.050	0.110
Office + ACE	0.089	0.064	0.044	0.027	0.012	0.008
Office + Card Rxs	0.177	0.095	0.078	0.101	0.041	0.029
Office + Beta Blkr	0.032	0.042	0.012	0.036	0.042	0.007
Office + ACE + Card	0.041	0.116	0.020	0.037	0.150	0.022
Office + Rxs	0.167	0.086	0.066	0.300	0.106	0.083
Other Treatments	0.086	0.108	0.318	0.173	0.220	0.503
			Arthritis			
	No Limitation			Condition Limitation		
Hospital	0.102	0.226	0.182	0.146	0.231	0.126
Office Only	0.288	0.303	0.061	0.182	0.241	0.047
Office + Other Rx	0.153	0.077	0.014	0.155	0.102	0.007
Office + "Ibuprofen"	0.073	0.052	0.005	0.059	0.058	0.002
"Ibuprofen"	0.067	0.112	0.114	0.054	0.087	0.070
Other Rxs Only	0.234	0.111	0.439	0.219	0.081	0.320
Other Non-hospital	0.083	0.118	0.185	0.184	0.200	0.427

4.6.2 Selection and Service Demand

Service type demand might be thought to consist of three broad types of service demands: hospital treatment, office-based treatment, and drug-only treatment. How unobserved health status affects the demand for services likely depends on the marginal productivity and prices of these services. Many believe, a priori, that hospital treatment may provide the greatest marginal productivity of any of the available treatment regimens, and would thus expect that lower initial health states should increase the demand for their services. However, for some sick patients hospitals may not be the most productive service. Even if hospitals are more productive at treating sicker patients, economic theory suggests that individuals may fail to choose factor-inputs with the highest marginal productivity when relative prices do not reflect their relative productivity.

Table 12 provides some evidence that initial health has an ambiguous effect on the demand for services. The disease and insurance type considered have important influences over how prior medical conditions affect treatment demand. Table 12 reveals that hypertensive and arthritic patients with disease-specific health problems are less likely to be treated with drug-only treatments than are patients without these health conditions. However, whether drug-only care is substituted for hospital or office-based care depends on the insurance type of the individual. The uninsured substitute from drug care to office-based care, whereas Medicaid patients and the privately insured substitute from drug care to hospital care. The pattern for depression is much different than it is for the other conditions. Depression patients are more likely to seek drug-only care and are less likely to consume office-based care when they also have neurotic conditions. Hospital care for the neurotically depressed does not change much for either the privately insured or the uninsured, and actually drops for the sicker Medicaid patients.

Controlling for disability status in the service demand equations reveals sim-

Table 4.13: The Effect of Disability on Service Demand

	Private	Medicaid	Uninsured	Private	Medicaid	Uninsured
	No Disability			Disability		
			Depression			
Hospital	0.036	0.142	0.015	0.074	0.219	0.048
Office Only	0.196	0.271	0.229	0.108	0.136	0.183
Office + SSRI	0.140	0.225	0.123	0.134	0.222	0.117
Office + Other Rx	0.161	0.051	0.026	0.179	0.068	0.021
SSRI Only	0.211	0.126	0.441	0.145	0.073	0.322
All Non-hospital	0.132	0.058	0.059	0.130	0.064	0.092
SSRI + Other Rx	0.124	0.127	0.107	0.230	0.218	0.217
			Hypertension			
Hospital	0.032	0.135	0.069	0.050	0.135	0.096
Office Only	0.087	0.061	0.140	0.048	0.051	0.107
Other Card Rxs	0.140	0.110	0.088	0.090	0.089	0.082
ACE Inhibitor	0.079	0.117	0.081	0.070	0.163	0.049
Beta Blocker	0.075	0.077	0.084	0.058	0.035	0.125
Office + ACE	0.089	0.067	0.044	0.088	0.062	0.044
Office + Card Rxs	0.177	0.105	0.076	0.182	0.088	0.084
Office + Beta Blkr	0.031	0.040	0.012	0.046	0.044	0.015
Office + ACE + Card	0.041	0.105	0.020	0.054	0.127	0.019
Office + Rxs	0.163	0.086	0.067	0.225	0.085	0.062
Other Treatments	0.086	0.099	0.319	0.088	0.120	0.318
			Arthritis			
Hospital	0.102	0.179	0.184	0.169	0.195	0.091
Office Only	0.288	0.381	0.064	0.193	0.339	0.052
Office + Other Rx	0.153	0.087	0.014	0.143	0.089	0.018
Office + "Ibuprofen"	0.073	0.050	0.005	0.104	0.061	0.008
"Ibuprofen"	0.067	0.105	0.108	0.067	0.111	0.107
Other Rxs Only	0.234	0.115	0.444	0.140	0.060	0.361
Other Non-hospital	0.083	0.082	0.182	0.185	0.146	0.364

ilar patterns to the disease-specific health controls with respect to drug-only care. Table 13 reveals that the disabled are less likely to consume drug-only care if they have arthritis or hypertension, but are more likely to consume drug-only care if they have depression. However, the patterns for hospital care and office-based care differ for the disabled as compared to the disease-specific health conditions. The treatment of hypertension remains virtually unchanged for Medicaid patients who become disabled. However, disabilities increase the probability that Medicaid and privately insured patients receive hospital treatment for all three conditions. Hospital treatment is consumed in lieu of drug-only care for all conditions except the depressed who substitute hospital care for office-based care. The disabled uninsured are also more likely to receive hospital care for depression and hypertension, but substitute away from hospital care and into office-based care for arthritis.

4.6.3 Summary of Selection Results

Although the qualitative results for treatment efficacy and service demand differences across insurance types are maintained when one controls for observed initial health and disability status, the effects of unobserved characteristics may add bias to the results. The effects of unobserved characteristics are theoretically ambiguous, and the empirical results presented in Tables 10-13 suggest that the sign and magnitude of the biases associated with unobserved health status are difficult to obtain. With regards to the efficacy of treatments in the production of health, the direction of the disease-specific health measure effects suggest that the reported quality differences may be a lower bound for some conditions. However, the addition of disability status controls attenuates the quality differences across insurance types.

With regards to the demand for service types conditional on having a condition, sicker individuals do not always consume hospital services more intensively than less sick individuals. Whether sicker individuals consume hospital services more intensively depends on the condition considered and the insurance type. The uninsured show a particular tendency to consume office-based care more intensively when they are sick, and the sicker depressed are always more likely to take drugs. Although there are significant differences in the types of services consumed by individuals with different insurance types, health conditions, and initial health states that may affect the cost of treatment, the differences never translate into overall health differences across samples.

4.7 Conclusions

This paper uses a nationally representative sample of medical care expenditures to address whether insurance type matters in the treatment of disease for several prevalent health conditions in the United States. The analysis decomposes the

differences between insurance type samples into protocol, demographic, and quality effects. However, identification of the protocol and quality differences across samples is complicated by potential sample differences. Medicaid patients are more likely to be disabled and to have prior health conditions relative to the privately insured and the uninsured. In addition, unobserved health differences between the samples may affect both the demand for treatments and the response of individuals to those treatments. The analysis attempts to control for these differences and sign the potential bias associated with unobserved differences across samples.

The results of the demand estimation suggest that treatment protocols differ significantly across insurance types. The most consistent pattern in demand across insurance types is the higher propensity of Medicaid patients to use hospital treatment relative to both the privately insured and the uninsured. In addition to the hospital pattern, the privately insured are also more likely to use drug and office visit treatments than does Medicaid insurance. These differences can be economically important. In contrast, the observed differences in hospital treatment demand between the uninsured and the privately insured is inconsistent across diseases, and for some conditions can be explained by demographic differences across samples.

Although the patterns between Medicaid patients and privately insured patients are consistent across diseases when controlling for observed health conditions and demographic statistics, the large health differences across samples suggest that unobserved health differences may explain some of the results. The unobserved differences are especially important if one believes that Medicaid patients are "sicker", or different in other ways that make them more likely to use hospital services. The direction of the bias associated with failure to control for these changes is hard to define and potentially works against the substance of the results. Reassuringly, protocol differences appear to explain very little of the health differences across samples. However, the protocols have vastly different costs, and may help explain cost

differences across samples.

The results of the health production estimation suggest that treatment qualities differ significantly across insurance types. These results control for initial health, disability status, and demographic characteristics. The most consistent pattern is that Medicaid recipients receive worse care than does the privately insured. The uninsured also appear to receive worse care than the privately insured, although the magnitudes of the differences are smaller. The treatment quality differences are able to explain an economically important fraction of the observed health differences between the samples. Theoretically, this result may occur if there is selection of physicians across insurance types such that Medicaid and uninsured patients see inferior physicians (i.e. less experienced). This result could also occur if identical physicians provide less care to Medicaid and uninsured patients in unobserved ways (i.e. spend less time with the patients). The result is consistent with previous literature that suggests physicians are less likely to treat Medicaid patients.

The large differences in observed health differences across samples suggests that unobserved health differences may weaken the conclusions in the production estimation. The observed health differences between the samples are quite large and economically important. If the unobserved health differences are as large as the observed health differences then the samples may be quite different, indeed. Unfortunately, the sign of the potential bias cannot be determined by the results thus far, and may potentially weaken the conclusions if one believes that Medicaid patients are sicker in unobserved ways that make them less responsive to treatment.

Appendix 2: Estimated Coefficients

The tables listed in this appendix present estimated demand coefficients, productivity coefficients and their standard errors. The demand estimates report standard errors in parentheses. Demand estimates are presented alongside χ^2 statistics that test the hypothesis of joint significance of the given variable in all of the treatment equations and their associated $p - values$. Several abbreviations are used in the presentation of these statistics including "Ibup." for Ibuprofen, "Oth." for other, "Off." for office, "Neur." for neurotic conditions, "Psych" for psychotic conditions, "BB" for Beta Blocker, "ACE" for ACE inhibitor, "Card" and "Card Rxs" for other cardiovascular medications, "Priv." for private insurance, "Mdcd." for Medicaid insurance, and "Unins." for the uninsured.

Table 4.14: Arthritis Demand Coefficients - Private Insurance

Variable	Hospital	Office	Off. + Oth.	Off. + Ibup.	Ibuprofen	Other	χ^2
Intercept	0.9638	2.285	-2.1464	1.8652	1.3547	-2.6014	138.43
	(0.470)	(0.389)	(0.651)	(0.429)	(0.436)	(0.565)	$< .0001$
Past	-0.434	-1.2535	-0.7843	-1.0027	-0.9981	-0.861	62.08
Condition	(0.199)	(0.188)	(0.219)	(0.203)	(0.192)	(0.200)	$< .0001$
Age	-0.0106	-0.0311	-0.0123	-0.0121	-0.0222	-0.0182	9.6
	(0.014)	(0.011)	(0.014)	(0.012)	(0.012)	(0.013)	0.1424
Age^2	1.04e-04	1.78e-04	2.31e-04	2.30e-05	3.23e-04	4.11e-04	17.95
	(1.37e-04)	(1.13e-04)	(1.37e-04)	(1.26e-04)	(1.20e-04)	(1.24e-04)	0.0064
High	-0.0227	0.4198	0.1224	0.0897	0.1847	0.8137	24.1
School	(0.200)	(0.171)	(0.205)	(0.180)	(0.179)	(0.198)	0.0005
College	0.2444	0.8186	0.273	0.2168	0.3306	0.5889	23.05
	(0.227)	(0.191)	(0.230)	(0.207)	(0.204)	(0.227)	0.0008
Female	-0.1316	-0.4437	-0.1694	-0.3636	-0.2152	-0.1629	14.73
	(0.163)	(0.132)	(0.162)	(0.147)	(0.143)	(0.148)	0.0225
Nonwhite	-0.1773	0.000137	-0.429	0.3246	-0.335	0.0305	26.24
	(0.184)	(0.144)	(0.188)	(0.156)	(0.161)	(0.162)	0.0002
Near Poor	-0.1029	-0.0349	-0.2385	-0.0116	-0.5366	-0.4162	5.31
	(0.323)	(0.269)	(0.343)	(0.290)	(0.313)	(0.320)	0.5051
High Inc.	-0.3274	-0.1403	-0.4922	-0.3988	-0.4447	-0.276	8.06
	(0.237)	(0.186)	(0.255)	(0.214)	(0.210)	(0.215)	0.2335
Non-MSA	-0.7357	-1.0561	-0.6657	-0.7356	-0.3818	-0.2594	28.72
	(0.269)	(0.236)	(0.281)	(0.265)	(0.265)	(0.265)	$< .0001$
Midwest	-0.6148	-0.7988	-0.7126	-0.4183	-0.0198	-0.5187	20.05
	(0.283)	(0.247)	(0.299)	(0.275)	(0.273)	(0.282)	0.0027
Southeast	-1.1218	-1.1012	-0.7015	-0.6667	-0.2526	-0.5094	37.13
	(0.271)	(0.231)	(0.277)	(0.256)	(0.258)	(0.262)	$< .0001$
West	-1.4324	-0.9188	-1.0171	-0.4055	-0.1904	-1.326	42.41
	(0.314)	(0.247)	(0.312)	(0.272)	(0.278)	(0.307)	$< .0001$
Year 1999	-0.449	-0.2557	2.4078	-0.7343	-0.4114	1.6376	60.6
	(0.316)	(0.250)	(0.532)	(0.264)	(0.242)	(0.449)	$< .0001$
Year 2000	-0.8408	-0.4892	2.7713	-1.1209	-0.7028	2.3272	125.36
	(0.325)	(0.242)	(0.509)	(0.266)	(0.237)	(0.409)	$< .0001$
Year 2001	0.0748	0.0887	2.8791	-0.9877	-1.2597	2.6512	222.43
	(0.209)	(0.176)	(0.480)	(0.194)	(0.196)	(0.373)	$< .0001$
Year 2002	-0.4682	-0.6668	2.8626	-1.0544	-1.3423	2.7507	196.74
	(0.241)	(0.204)	(0.485)	(0.213)	(0.215)	(0.377)	$< .0001$
Year 2003	-0.4693	-0.3535	2.6697	-1.5402	-1.4566	2.7017	192.9
	(0.262)	(0.213)	(0.496)	(0.261)	(0.242)	(0.386)	$< .0001$

Table 4.15: Arthritis Demand Coefficients - Medicaid Insurance

Variable	Hospital	Office	Off. + Oth	Off. + Ibup.	Ibuprofen	Other	χ^2
Intercept	0.4914	1.2503	-2.1409	0.8127	0.1255	-2.9654	18.41
	(0.850)	(0.698)	(1.222)	(0.764)	(0.817)	(1.182)	0.0053
Past	-0.5028	-0.7489	-0.2409	-0.4019	-0.7799	-0.8426	15.49
Condition	(0.291)	(0.241)	(0.351)	(0.255)	(0.263)	(0.331)	0.0168
Age	0.0273	0.0227	-0.00123	-0.00646	0.0252	0.0215	4.09
	(0.024)	(0.020)	(0.031)	(0.022)	(0.023)	(0.029)	0.665
Age^2	-4.30E-04	-1.20E-04	2.51E-04	7.60E-05	-1.60E-04	4.07E-06	6.07
	(2.51E-04)	(2.02E-04)	(2.94E-04)	(2.14E-04)	(2.18E-04)	(2.76E-04)	0.4151
High	0.2817	-0.3085	-0.2617	-0.1842	0.0267	0.5592	7.95
School	(0.309)	(0.278)	(0.374)	(0.289)	(0.291)	(0.345)	0.2419
College	0.4131	0.6607	-1.2623	-0.0796	-0.0475	0.264	5.45
	(0.588)	(0.473)	(1.110)	(0.562)	(0.622)	(0.735)	0.488
Female	0.00618	-0.3261	-0.241	-0.0913	0.0389	0.3426	3.99
	(0.324)	(0.256)	(0.376)	(0.277)	(0.294)	(0.394)	0.678
Nonwhite	0.1437	0.3591	0.5974	0.5167	0.1923	0.0497	5.84
	(0.307)	(0.253)	(0.380)	(0.269)	(0.280)	(0.348)	0.4411
Near Poor	0.2929	-0.5936	-1.055	0.0386	0.2141	0.7386	13.94
	(0.483)	(0.346)	(0.490)	(0.412)	(0.431)	(0.600)	0.0303
High	-0.1312	-0.4952	-0.5913	0.1004	0.1729	0.015	4.47
Income	(0.531)	(0.379)	(0.520)	(0.441)	(0.464)	(0.656)	0.6137
Non-MSA	-1.2188	-0.4981	-0.5508	-0.2283	-0.3878	-1.0676	12.48
	(0.395)	(0.367)	(0.476)	(0.402)	(0.411)	(0.473)	0.0521
Midwest	-1.0791	-0.5612	-0.372	0.3834	-0.1466	-0.5621	9.42
	(0.534)	(0.484)	(0.623)	(0.474)	(0.515)	(0.608)	0.1512
Southeast	-1.4536	-0.307	-0.6322	-0.3524	-0.4494	-0.1884	10.25
	(0.479)	(0.394)	(0.544)	(0.441)	(0.449)	(0.492)	0.1146
West	-1.8295	-0.9198	-1.9529	-0.663	-0.2656	-1.3701	25.48
	(0.462)	(0.388)	(0.611)	(0.426)	(0.412)	(0.525)	0.0003
Year 1999	-0.1222	-0.7497	0.7669	-1.1857	-0.3556	-0.7387	9.66
	(0.503)	(0.434)	(1.053)	(0.469)	(0.415)	(1.166)	0.1399
Year 2000	-1.3287	-1.6798	1.494	-2.1557	-1.6228	0.7415	45.07
	(0.579)	(0.450)	(0.855)	(0.504)	(0.451)	(0.679)	$< .0001$
Year 2001	-0.0245	-0.6701	2.7624	-0.9557	-1.2476	1.402	41.44
	(0.434)	(0.370)	(0.800)	(0.377)	(0.428)	(0.650)	$< .0001$
Year 2002	-0.2661	-0.7528	1.9189	-1.6729	-1.8903	1.6663	58.38
	(0.417)	(0.336)	(0.799)	(0.387)	(0.451)	(0.608)	$< .0001$
Year 2003	-0.407	-0.8493	1.405	-1.3261	-1.065	1.2594	34.26
	(0.434)	(0.345)	(0.833)	(0.360)	(0.367)	(0.625)	$< .0001$

Table 4.16: Arthritis Demand Coefficients - Uninsured

Variable	Hospital	Office	Off. + Oth	Off. + Ibup.	Ibuprofen	Other	χ^2
Intercept	-2.9597	0.4469	-3.3037	-0.7308	0.3749	-2.5781	12.4
	(1.607)	(1.228)	(2.036)	(1.512)	(1.308)	(1.505)	0.0536
Past	-1.2034	-1.1014	-1.47	-1.7728	-1.3339	-1.1523	18.79
Condition	(0.478)	(0.380)	(0.515)	(0.459)	(0.403)	(0.421)	0.0045
Age	0.0153	-0.0431	-0.0849	-0.0757	-0.0446	-0.00606	8.79
	(0.043)	(0.034)	(0.047)	(0.041)	(0.037)	(0.039)	0.1855
Age^2	9.40E-05	2.37E-04	9.07E-04	7.61E-04	6.26E-04	3.34E-04	11.02
	(3.66E-04)	(3.03E-04)	(3.94E-04)	(3.50E-04)	(3.16E-04)	(3.26E-04)	0.0878
High	1.1621	0.5158	0.0193	0.3441	0.9003	0.671	9.92
School	(0.479)	(0.395)	(0.543)	(0.462)	(0.417)	(0.438)	0.1281
College	0.9945	1.3802	0.8339	0.794	1.6097	0.5914	6.35
	(0.930)	(0.739)	(0.888)	(0.870)	(0.765)	(0.853)	0.3848
Female	0.028	0.3633	-0.1141	0.00261	0.2268	-0.0611	2.39
	(0.471)	(0.388)	(0.474)	(0.439)	(0.417)	(0.412)	0.8807
Nonwhite	2.0436	1.5807	1.0811	1.601	1.1098	0.8399	25.73
	(0.487)	(0.387)	(0.508)	(0.446)	(0.403)	(0.426)	0.0003
Near Poor	-0.1064	-0.2445	-0.3769	0.9684	0.4774	-0.3419	10.77
	(0.567)	(0.466)	(0.627)	(0.538)	(0.493)	(0.510)	0.0957
High	-0.3273	-0.0487	0.1338	0.6747	0.4541	-0.4282	7.75
Income	(0.546)	(0.431)	(0.540)	(0.512)	(0.458)	(0.481)	0.257
Non-MSA	1.314	1.5047	2.3214	2.2428	0.6171	0.9298	10.59
	(0.764)	(0.664)	(1.185)	(0.937)	(0.639)	(0.719)	0.1019
Midwest	1.6823	1.3179	3.0759	1.7719	0.255	1.6187	9.5
	(0.991)	(0.901)	(1.334)	(1.176)	(0.931)	(0.938)	0.1474
Southeast	0.0223	0.3824	1.0416	1.0614	-0.6234	0.1202	6.75
	(0.732)	(0.627)	(1.172)	(0.910)	(0.610)	(0.680)	0.3449
West	-0.1427	1.1563	2.0146	2.2775	0.6401	0.3221	9.59
	(0.963)	(0.738)	(1.243)	(0.994)	(0.726)	(0.826)	0.1432
Year 1999	-0.1472	-0.1472	0.8945	-1.4697	-1.1698	1.402	12.71
	(0.921)	(0.693)	(1.549)	(0.873)	(0.773)	(0.944)	0.0479
Year 2000	-0.5523	-0.5088	2.4162	-1.2771	-1.2437	1.4027	20.56
	(0.875)	(0.634)	(1.219)	(0.742)	(0.663)	(0.870)	0.0022
Year 2001	0.2025	-0.3906	2.5452	-0.9838	-1.5898	1.6269	33.26
	(0.660)	(0.531)	(1.149)	(0.587)	(0.576)	(0.783)	¡.0001
Year 2002	0.1093	-0.6423	2.6178	-0.7456	-1.4565	1.8754	30.27
	(0.708)	(0.556)	(1.154)	(0.597)	(0.596)	(0.781)	¡.0001
Year 2003	0.7791	-0.5014	2.6875	-1.2876	-1.0871	2.2398	37.12
	(0.676)	(0.576)	(1.174)	(0.690)	(0.590)	(0.783)	¡.0001

Table 4.17: Arthritis Production Coefficients

Parameter	Estimate	Std. Error	Parameter	Estimate	Std. Error
Intercept	-2.4176	1.3192	Near Poor	0.1517	0.0852
Priv. Hospital	0.465	0.2636	Middle Income	0.0771	0.0766
Priv. Office	0.5406	0.2552	High Income	0.029	0.0599
Priv. Office + Other Rx	0.675	0.262	Northeast	-0.0359	0.0769
Priv. Office + Ibuprofen	0.3458	0.2626	Midwest	-0.0867	0.072
Priv. Ibuprofen	0.3954	0.261	Southeast	0.0241	0.0621
Priv. Other Rxs	0.2109	0.2671	West	-0.0181	0.0739
Priv. Non-Hosp.	0.5581	0.2413	Age*(Low Exp.)	0.086	0.0562
Mcd. Hospital	0.3241	0.2683	Age^2*(Low Exp.)	-0.0009	0.0006
Mcd. Office	0.4651	0.2485	Age*(Middle Exp.)	0.0832	0.0294
Mcd. Office + Ibuprofen	0.5991	0.2512	Age^2*(Mid. Exp.)	-0.0008	0.0003
Mcd. Ibuprofen	0.1768	0.2629	Age*(Near High Exp.)	0.032	0.0408
Mcd. Other Rxs	0.0453	0.2913	Age^2*(Near High Exp.)	-0.0001	0.0004
Mcd. Non-Hospital	0.2602	0.236	Age*(High Exp.)	0.0332	0.0228
Unins. Hospital	0.1922	0.3175	Age^2*(High Exp.)	-0.0003	0.0002
Unins. Office	0.4127	0.2712	Middle Exp.	-0.0952	1.4641
Unins. Office + Other Rx	0.3928	0.3391	Near High Exp.	0.6914	1.6239
Unins. Office + Ibuprofen	0.3738	0.3022	High Exp.	1.1027	1.4043
Unins. Ibup.	0.2348	0.2828	Female	0.1894	0.0496
Unins. Other Rxs	0.1046	0.3008	High School	0.0754	0.0581
Unins. Non-Hosp.	0.2956	0.2812	College	-0.0507	0.0743
Prior Hospital	-0.8068	0.1586	Year 1997	-0.0145	0.1048
Prior Office	-1.1811	0.1328	Year 1998	-0.0357	0.1147
Prior Office + Other Rx	-1.14	0.1974	Year 1999	-0.1388	0.1144
Prior Office + Ibuprofen	-1.0486	0.1487	Year 2000	-0.2927	0.115
Prior Ibuprofen	-1.0206	0.1434	Year 2001	-0.3761	0.0996
Prior Other Rxs	-0.7616	0.1624	Year 2002	-0.164	0.1018
Prior Non-Hosp.	-0.9884	0.1164	Year 2003	-0.1898	0.105
Nonwhite	-0.0658	0.0529			

Table 4.18: Depression Demand Coefficients - Private

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Intercept	0.6235	1.6683	0.7596	0.1732	-0.2257	-0.7243	57.74
	(0.461)	(0.333)	(0.312)	(0.355)	(0.307)	(0.366)	$< .0001$
Age	-0.027	-0.00761	0.00262	-0.0022	0.0166	0.0111	13.95
	(0.016)	(0.011)	(0.009)	(0.010)	(0.008)	(0.010)	0.0302
Age^2	-8.00e-05	-3.50e-04	-1.50e-04	-2.36e-06	2.60e-05	1.25e-04	15.18
	(194e-6)	(133e-6)	(111e-6)	(126e-6)	(100e-6)	(120e-6)	0.0189
Neurotic	-0.415	-1.0984	-1.0307	-0.5235	-1.3773	-0.7868	165.72
	(0.196)	(0.145)	(0.123)	(0.137)	(0.118)	(0.139)	$< .0001$
Psychotic	-1.1039	-2.1747	-2.1127	-0.7126	-2.0114	-0.8149	191.32
	(0.287)	(0.243)	(0.217)	(0.188)	(0.200)	(0.196)	$< .0001$
High	-0.2758	-0.0373	-0.0426	-0.1339	0.0931	-0.1913	5.28
School	(0.229)	(0.176)	(0.157)	(0.182)	(0.147)	(0.172)	0.5085
College	-0.4456	0.1257	0.2826	0.3034	0.1634	-0.0356	13.51
	(0.240)	(0.178)	(0.160)	(0.181)	(0.152)	(0.177)	0.0356
Female	-0.4824	-0.3176	-0.0816	-0.2288	0.1666	-0.2193	29.25
	(0.180)	(0.128)	(0.116)	(0.130)	(0.111)	(0.129)	$< .0001$
Nonwhite	0.7828	0.6073	0.1886	0.0131	0.0595	-0.00262	33.85
	(0.208)	(0.152)	(0.144)	(0.169)	(0.139)	(0.168)	$< .0001$
Near Poor	-0.0976	0.1843	0.0544	0.2655	0.0706	0.1213	1.85
	(0.373)	(0.246)	(0.234)	(0.249)	(0.222)	(0.264)	0.933
High Inc.	0.2123	-0.4076	-0.0623	-0.1423	-0.1854	0.00128	10.05
	(0.216)	(0.177)	(0.148)	(0.175)	(0.141)	(0.167)	0.1225
Non-MSA	0.2594	-0.3095	0.123	-0.0714	0.384	0.6579	26.56
	(0.276)	(0.200)	(0.181)	(0.195)	(0.164)	(0.211)	0.0002
Midwest	0.2463	0.0807	0.318	-0.1955	0.2744	0.4407	12.13
	(0.281)	(0.192)	(0.180)	(0.201)	(0.167)	(0.219)	0.0591
Southeast	-0.4405	-0.5249	0.1224	-0.2739	0.0126	0.4567	27.34
	(0.282)	(0.187)	(0.167)	(0.183)	(0.156)	(0.202)	0.0001
West	-0.22	0.0957	0.3718	-0.0395	0.1672	0.5169	12.14
	(0.303)	(0.194)	(0.181)	(0.199)	(0.171)	(0.219)	0.059

Depression Demand Coefficients - Private (cont.)

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Year 1997	-0.4299	-0.3993	-0.1955	-0.2422	-0.00709	-0.5142	6.91
	(0.361)	(0.253)	(0.232)	(0.277)	(0.235)	(0.277)	0.329
Year 1998	-0.4792	-0.6744	-0.312	-0.6427	0.1488	-0.0825	15.5
	(0.389)	(0.281)	(0.250)	(0.316)	(0.246)	(0.280)	0.0167
Year 1999	-0.4285	-0.3272	-0.1502	-0.138	0.3466	-0.541	14.81
	(0.395)	(0.271)	(0.249)	(0.296)	(0.245)	(0.302)	0.0218
Year 2000	-0.5453	-0.4917	-0.2331	-0.2012	0.0832	-0.321	8.13
	(0.389)	(0.268)	(0.244)	(0.290)	(0.243)	(0.284)	0.2287
Year 2001	-0.5636	-0.7611	-0.4284	-0.3448	0.1096	-0.3935	19.34
	(0.349)	(0.250)	(0.226)	(0.268)	(0.224)	(0.259)	0.0036
Year 2002	-0.4106	-0.6578	-0.3883	0.073	0.2736	-0.2693	23.15
	(0.339)	(0.245)	(0.223)	(0.257)	(0.221)	(0.254)	0.0007
Year 2003	-0.632	-0.4242	-0.5618	0.1277	-0.032	0.0822	16.17
	(0.359)	(0.246)	(0.233)	(0.262)	(0.229)	(0.254)	0.0129

Table 4.19: Depression Demand Coefficients - Medicaid

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Intercept	1.197	0.971	0.063	-0.351	-0.284	-0.895	11.96
	(0.653)	(0.627)	(0.632)	(0.619)	(0.717)	(0.680)	0.0628
Age	-0.028	-0.023	0.016	-0.014	-0.021	-0.009	6.860
	(0.019)	(0.019)	(0.018)	(0.017)	(0.019)	(0.019)	0.3339
Age^2	6.50e-05	-6.00e-05	-3.60e-04	2.62e-04	8.60e-05	2.71e-04	9.39
	(229e-6)	(232e-6)	(220e-6)	(203e-6)	(224e-6)	(220e-6)	(153e-3)
Neurotic	-0.913	-2.357	-1.746	-0.438	-1.306	-0.669	109.18
	(0.229)	(0.286)	(0.238)	(0.208)	(0.234)	(0.234)	$< .0001$
Psychotic	-0.858	-2.195	-1.156	-0.225	-1.038	0.125	51.530
	(0.334)	(0.381)	(0.322)	(0.289)	(0.361)	(0.306)	$< .0001$
High	-0.107	-0.267	-0.145	-0.163	-0.091	0.007	1.750
School	(0.232)	(0.242)	(0.222)	(0.217)	(0.230)	(0.235)	0.9416
College	-0.796	0.177	-0.266	-0.222	-0.674	-0.415	11.96
	(0.337)	(0.302)	(0.302)	(0.288)	(0.340)	(0.333)	0.0629
Female	-0.503	-0.133	0.227	-0.375	0.723	-0.482	26.160
	(0.235)	(0.233)	(0.241)	(0.221)	(0.290)	(0.240)	0.0002
Nonwhite	0.002	0.321	-0.351	-0.145	-0.392	-0.133	13.57
	(0.215)	(0.209)	(0.203)	(0.198)	(0.216)	(0.217)	0.0348
Near Poor	0.543	-0.051	-0.040	0.602	-0.127	0.172	7.570
	(0.355)	(0.304)	(0.294)	(0.328)	(0.303)	(0.330)	0.2716
High	0.414	-0.078	-0.054	0.648	-0.223	0.319	7.73
Income	(0.380)	(0.325)	(0.318)	(0.347)	(0.333)	(0.352)	0.2589
Non-MSA	-1.155	-0.008	0.229	0.433	-0.186	0.862	36.490
	(0.305)	(0.292)	(0.290)	(0.270)	(0.306)	(0.330)	$< .0001$
Midwest	-0.785	-0.234	0.099	0.103	-0.343	0.215	9.47
	(0.333)	(0.343)	(0.337)	(0.318)	(0.366)	(0.409)	0.1489
Southeast	-0.704	-0.003	0.203	-0.253	0.187	0.987	23.210
	(0.296)	(0.301)	(0.309)	(0.316)	(0.309)	(0.341)	0.0007
West	-0.301	0.835	1.019	0.614	0.707	1.150	27.75
	(0.330)	(0.318)	(0.320)	(0.315)	(0.329)	(0.369)	0.0001

Depression Demand Coefficients - Medicaid (cont.)

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Year 1997	0.072	0.043	-0.135	-0.183	-0.018	-0.319	0.850
	(0.474)	(0.476)	(0.490)	(0.446)	(0.584)	(0.489)	0.9906
Year 1998	0.586	0.789	-0.140	-0.232	0.840	-0.303	8.72
	(0.500)	(0.498)	(0.550)	(0.498)	(0.586)	(0.544)	0.1898
Year 1999	0.065	0.337	0.601	-0.100	0.517	0.181	2.570
	(0.542)	(0.523)	(0.516)	(0.508)	(0.614)	(0.534)	0.8609
Year 2000	-0.144	0.241	-0.157	0.438	0.667	0.099	3.02
	(0.566)	(0.526)	(0.561)	(0.485)	(0.607)	(0.549)	0.8059
Year 2001	-0.898	-0.080	0.220	-0.207	0.437	-0.254	5.630
	(0.538)	(0.472)	(0.472)	(0.449)	(0.558)	(0.490)	0.4658
Year 2002	0.008	-0.781	0.274	-0.086	0.801	-0.118	8.49
	(0.459)	(0.478)	(0.452)	(0.420)	(0.530)	(0.458)	0.2042
Year 2003	-0.115	0.082	0.111	-0.595	0.341	-0.233	3.980
	(0.457)	(0.445)	(0.452)	(0.430)	(0.537)	(0.456)	0.6788

Table 4.20: Depression Demand Coefficients - Uninsured

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Intercept	-2.1968	2.7339	0.013	-1.1667	1.3282	0.6513	22.7
	(1.553)	(0.905)	(1.000)	(1.463)	(0.877)	(1.013)	0.0009
Age	-0.0438	-0.0586	-0.0176	-0.0256	-0.024	-0.0469	6.68
	(0.033)	(0.026)	(0.025)	(0.031)	(0.023)	(0.028)	0.3512
Age^2	3.51e-04	3.09e-04	5.54e-06	2.10e-04	2.58e-04	6.71e-04	6.73
	(369e-6)	(300e-6)	(288e-6)	(354e-6)	(263e-6)	(303e-6)	0.3469
Neurotic	-0.8489	-1.1308	-0.9985	-0.8849	-1.3003	-1.0456	23.41
	(0.409)	(0.326)	(0.307)	(0.395)	(0.295)	(0.344)	0.0007
Psychotic	-0.4937	-1.2647	-1.7961	0.0279	-0.9504	-1.4507	12.59
	(0.664)	(0.589)	(0.724)	(0.602)	(0.546)	(0.727)	0.0501
High School	0.116	-0.1778	-0.086	-0.365	-0.324	-0.1582	2.64
	(0.399)	(0.323)	(0.307)	(0.385)	(0.284)	(0.336)	0.8522
College	0.8685	1.027	0.5643	0.0854	-0.0215	0.3161	10.27
	(0.602)	(0.464)	(0.476)	(0.572)	(0.461)	(0.525)	0.1139
Female	-0.1346	-0.6495	-0.1325	-0.1411	0.3183	0.0452	12.67
	(0.389)	(0.305)	(0.305)	(0.371)	(0.293)	(0.337)	0.0485
Nonwhite	0.7118	1.3236	0.9807	0.5093	0.3171	0.2366	24.96
	(0.407)	(0.327)	(0.317)	(0.399)	(0.307)	(0.361)	0.0003
Near Poor	0.6452	-0.1357	0.0561	-0.6153	-0.3899	-0.4229	9.09
	(0.471)	(0.356)	(0.341)	(0.442)	(0.322)	(0.391)	0.1683
High Income	0.796	0.1755	0.0741	-0.00415	-0.0404	0.2818	4.36
	(0.475)	(0.354)	(0.347)	(0.410)	(0.317)	(0.365)	0.6285
Non-MSA	0.9389	-0.181	0.3813	1.2778	0.1404	0.3419	3.69
	(0.867)	(0.553)	(0.616)	(1.124)	(0.504)	(0.597)	0.7188
Midwest	1.7846	-0.1576	0.9113	2.6436	-0.0389	0.2198	11.82
	(0.963)	(0.716)	(0.744)	(1.178)	(0.676)	(0.802)	0.0662
Southeast	0.5605	-0.4454	0.5181	1.3471	-0.2923	0.1831	6.31
	(0.865)	(0.544)	(0.600)	(1.113)	(0.503)	(0.593)	0.3891
West	-0.1905	-0.3464	0.3924	1.5	-0.0981	0.00714	3.87
	(0.956)	(0.561)	(0.622)	(1.126)	(0.522)	(0.628)	0.6945

Depression Demand Coefficients - Uninsured (cont.)

	Hospital	Office	Off. + SSRI	Off. + Other Rxs	SSRI Only	Other Rxs	χ^2
Year 1997	1.7267	-0.3027	-0.0388	0.7325	0.01	-0.209	4.7
	(1.184)	(0.653)	(0.787)	(0.858)	(0.671)	(0.733)	0.5824
Year 1998	1.9802	0.4206	0.9649	0.1059	0.3233	0.3412	3.67
	(1.246)	(0.714)	(0.821)	(1.027)	(0.737)	(0.791)	0.7212
Year 1999	0.7067	-0.192	1.092	0.1706	0.2355	0.1798	3.91
	(1.384)	(0.761)	(0.831)	(1.038)	(0.765)	(0.820)	0.6891
Year 2000	-0.7868	-1.6587	0.2603	-0.2882	-0.2099	-1.248	11.49
	(1.511)	(0.701)	(0.732)	(0.884)	(0.639)	(0.762)	0.0744
Year 2001	0.8362	-1.2287	-0.0186	-0.6435	-0.3502	-0.7282	7.7
	(1.173)	(0.617)	(0.705)	(0.864)	(0.609)	(0.674)	0.2607
Year 2002	0.7847	-1.5617	0.1613	0.1244	-0.5856	-0.6962	13.33
	(1.153)	(0.612)	(0.682)	(0.793)	(0.601)	(0.653)	0.0381
Year 2003	1.5452	-0.4341	0.5446	0.1117	0.2939	-0.5553	6.85
	(1.169)	(0.623)	(0.718)	(0.858)	(0.629)	(0.715)	0.3346

Table 4.21: Depression Production Coefficients

Parameter	Estimate	Std. Error	Parameter	Estimate	Std. Error
Intercept	0.3432	0.2715	Northeast	-0.0873	0.0543
Psych Hospital	0.0389	0.2101	Midwest	0.0253	0.0531
Psych Office	0.1117	0.2109	Southeast	-0.0715	0.0474
Psych Office + SSRI	0.1429	0.1921	West	-0.0522	0.0514
Psych Office + Other Rxs	0.2496	0.1563	Near Poor	0.0192	0.061
Psych Other Rxs	0.3032	0.1921	Mid. Inc.	-0.0304	0.0528
Psych SSRI	0.0799	0.1683	High Inc.	-0.0354	0.0428
Psych SSRI + Other Rx	-0.0132	0.1116	Nonwhite	0.0438	0.0408
Neur Hospital	0.0223	0.15	Married	-0.0423	0.0364
Neur Office	-0.0612	0.1273	Age	-0.015	0.0068
Neur Office + SSRI	-0.1841	0.0989	Age^2	0.0002	0.0001
Neur Office + Other Rxs	0.077	0.1114	Female	0.0463	0.0369
Neur Other Rxs	-0.0313	0.0948	High School	0.0455	0.0434
Neur SSRI	0.0858	0.119	Some College	0.1577	0.0625
Neur SSRI + Other Rx	-0.1006	0.0825	College Plus	0.1047	0.0595
Priv Hospital	0.1961	0.1431	Year 1997	-0.0649	0.0767
Priv Office	0.4248	0.1406	Year 1998	-0.1306	0.0812
Priv Office + SSRI	0.4309	0.1346	Year 1999	-0.1528	0.0808
Priv Office + Other Rxs	0.3235	0.1422	Year 2000	-0.0601	0.0805
Priv Other Rxs	0.4906	0.1345	Year 2001	-0.1824	0.0741
Priv SSRI	0.4448	0.1456	Year 2002	-0.0702	0.072
Priv SSRI + Other Rx	0.3888	0.1367	Year 2003	-0.1007	0.0732
Mcd Office	0.3993	0.154	Log(Exp.)	0.026	0.0706
Mcd Office + SSRI	0.2529	0.1513	$Log(Exp.)^2$	-0.0033	0.0059
Mcd Office + Other Rxs	0.2699	0.1569			
Mcd Other Rxs	0.2721	0.1608			
Mcd SSRI	0.2266	0.1694			
Mcd SSRI + Other Rx	0.1566	0.1443			
Unins Hospital	0.1084	0.2072			
Unins Office	0.0285	0.1712			
Unins Office + SSRI	0.3926	0.1712			
Unins Office + Other Rxs	0.2605	0.213			
Unins Other Rxs	0.3947	0.161			
Unins SSRI	0.22	0.1919			
Unins SSRI + Other Rx	0.2605	0.1752			

Table 4.22: Hypertension Demand Coefficients - Private

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Intercept	1.008	2.313	1.271	0.910	0.866	1.337	1.856	-0.351	-0.125	0.938	101.99
	(0.387)	(0.331)	(0.289)	(0.355)	(0.381)	(0.360)	(0.285)	(0.420)	(0.410)	(0.329)	$< .0001$
Age	-0.024	-0.010	-0.001	-0.003	-0.009	0.004	-0.001	-0.012	0.011	-0.002	12.83
	(0.010)	(0.009)	(0.007)	(0.009)	(0.010)	(0.009)	(0.007)	(0.010)	(0.010)	(0.008)	0.2331
Age^2	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	67.8
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	$< .0001$
High School	-0.247	-0.229	-0.049	-0.018	-0.175	-0.292	-0.139	-0.170	-0.116	-0.161	8.14
	(0.156)	(0.142)	(0.113)	(0.150)	(0.154)	(0.148)	(0.112)	(0.161)	(0.156)	(0.126)	0.6148
College	-0.230	-0.037	0.058	0.169	-0.183	-0.283	-0.030	-0.087	-0.281	-0.129	14.12
	(0.174)	(0.154)	(0.124)	(0.160)	(0.170)	(0.161)	(0.123)	(0.178)	(0.175)	(0.138)	0.1675
Female	0.015	-0.003	0.217	-0.354	0.216	-0.237	0.074	0.308	-0.133	-0.194	77.86
	(0.113)	(0.098)	(0.077)	(0.098)	(0.107)	(0.103)	(0.078)	(0.115)	(0.111)	(0.088)	$< .0001$
Nonwhite	0.520	0.254	0.229	-0.038	-0.235	-0.036	0.407	-0.106	0.371	0.073	76.36
	(0.124)	(0.109)	(0.088)	(0.114)	(0.128)	(0.119)	(0.087)	(0.132)	(0.123)	(0.101)	$< .0001$
Historical	0.002	-1.348	-1.260	-1.530	-0.364	-1.883	-1.255	-0.574	-0.801	-0.110	259.88
Condition	(0.153)	(0.202)	(0.131)	(0.204)	(0.157)	(0.253)	(0.133)	(0.173)	(0.180)	(0.118)	$< .0001$
Near Poor	-0.033	-0.220	-0.351	-0.425	-0.476	-0.122	-0.216	0.148	-0.277	-0.215	8.49
	(0.266)	(0.252)	(0.198)	(0.277)	(0.302)	(0.258)	(0.193)	(0.262)	(0.284)	(0.224)	0.5814
High Income	-0.080	0.258	-0.120	-0.058	-0.090	-0.291	-0.034	0.264	-0.175	-0.036	16.82
	(0.179)	(0.148)	(0.127)	(0.164)	(0.175)	(0.180)	(0.126)	(0.172)	(0.186)	(0.143)	0.0785
Non-MSA	-0.061	-0.166	-0.056	-0.268	-0.245	-0.308	-0.214	0.004	-0.241	-0.376	16.46
	(0.167)	(0.141)	(0.114)	(0.144)	(0.151)	(0.153)	(0.116)	(0.166)	(0.168)	(0.126)	0.0872
Midwest	-0.251	-0.475	-0.190	-0.232	-0.251	-0.217	-0.373	0.114	-0.244	-0.555	27.11
	(0.188)	(0.162)	(0.126)	(0.157)	(0.167)	(0.163)	(0.128)	(0.181)	(0.180)	(0.140)	0.0025
Southeast	-0.062	-0.239	0.035	-0.212	-0.390	-0.167	0.115	-0.033	-0.070	-0.464	39
	(0.166)	(0.143)	(0.115)	(0.145)	(0.159)	(0.151)	(0.113)	(0.172)	(0.161)	(0.128)	$< .0001$
West	-0.291	-0.349	-0.205	0.012	-0.136	-0.242	-0.514	0.023	-0.276	-0.367	25.09
	(0.194)	(0.162)	(0.131)	(0.159)	(0.172)	(0.174)	(0.135)	(0.189)	(0.194)	(0.144)	0.0052

Hypertension Demand Coefficients - Private (cont.)

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Year 1997	-0.115	0.077	-0.017	0.028	0.264	-0.019	0.116	0.341	0.005	0.291	6.42
	(0.258)	(0.224)	(0.188)	(0.226)	(0.256)	(0.232)	(0.185)	(0.273)	(0.239)	(0.221)	0.7792
Year 1998	-0.347	0.169	-0.293	-0.381	-0.055	-0.179	-0.359	0.098	-0.442	0.012	15.21
	(0.273)	(0.227)	(0.195)	(0.244)	(0.272)	(0.242)	(0.196)	(0.287)	(0.260)	(0.232)	0.1246
Year 1999	-0.458	-0.455	-0.101	-0.333	-0.153	-0.561	-0.120	-0.126	-0.510	0.038	15.29
	(0.265)	(0.233)	(0.184)	(0.231)	(0.264)	(0.243)	(0.183)	(0.284)	(0.250)	(0.221)	0.1217
Year 2000	-0.660	-0.637	-0.174	-0.251	-0.120	-0.450	-0.411	-0.267	-0.495	0.080	20.34
	(0.267)	(0.233)	(0.181)	(0.222)	(0.256)	(0.232)	(0.183)	(0.282)	(0.243)	(0.215)	0.0262
Year 2001	-0.508	-0.593	-0.457	-0.346	-0.315	-0.431	-0.545	-0.171	-0.860	0.007	26.57
	(0.238)	(0.212)	(0.171)	(0.207)	(0.244)	(0.214)	(0.171)	(0.259)	(0.234)	(0.203)	0.003
Year 2002	-0.395	-0.613	-0.358	-0.576	-0.171	-0.612	-0.511	0.013	-0.586	-0.017	26.09
	(0.232)	(0.209)	(0.169)	(0.211)	(0.238)	(0.216)	(0.169)	(0.253)	(0.223)	(0.201)	0.0036
Year 2003	-0.364	-0.248	-0.298	-0.387	0.165	-0.589	-0.285	0.052	-0.861	0.264	33.58
	(0.247)	(0.216)	(0.178)	(0.218)	(0.244)	(0.230)	(0.177)	(0.265)	(0.248)	(0.208)	0.0002

Table 4.23: Hypertension Demand Coefficients - Medicaid

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Intercept	1.9095	2.3254	1.5669	0.9933	1.4062	1.8193	1.5942	-0.105	0.286	0.5749	15.76
	(0.776)	(0.839)	(0.757)	(0.977)	(1.212)	(0.974)	(0.711)	(1.051)	(0.994)	(0.824)	0.1068
Age	-0.0309	-0.0374	-0.0438	-0.0141	-0.0477	-0.0492	-0.0272	-0.0213	-0.0157	-0.039	8.37
	(0.020)	(0.022)	(0.019)	(0.025)	(0.034)	(0.026)	(0.018)	(0.028)	(0.026)	(0.021)	0.593
Age^2	5.60E-05	-1.40E-04	3.57E-04	1.60E-05	6.00E-05	3.02E-04	2.84E-04	3.36E-04	3.55E-04	5.92E-04	17.52
	(209E-6)	(231E-6)	(195E-6)	(257E-6)	(365E-6)	(265E-6)	(179E-6)	(271E-6)	(255E-6)	(202E-6)	0.0637
High	-0.0584	-0.4141	0.2285	-0.3445	0.1252	-0.3761	-0.1387	0.4975	0.1801	0.401	20
School	(0.250)	(0.278)	(0.232)	(0.314)	(0.408)	(0.326)	(0.217)	(0.315)	(0.310)	(0.240)	0.0293
College	0.1719	0.403	0.4765	-1.0928	-0.3358	-0.3752	-1.0737	-0.044	0.455	0.1515	15.31
	(0.493)	(0.489)	(0.439)	(0.811)	(0.853)	(0.644)	(0.547)	(0.704)	(0.572)	(0.500)	0.1213
Female	-0.2433	-0.4751	-0.3187	0.2312	-0.2583	-0.6801	-0.1734	-0.1103	-0.1379	-0.3695	10.29
	(0.256)	(0.274)	(0.244)	(0.336)	(0.422)	(0.312)	(0.229)	(0.342)	(0.324)	(0.249)	0.415
Nonwhite	0.6447	0.5844	0.1209	-0.6035	-0.7805	-0.2063	0.3554	-0.3407	-0.0995	-0.0258	34.52
	(0.268)	(0.288)	(0.239)	(0.304)	(0.402)	(0.315)	(0.225)	(0.320)	(0.314)	(0.244)	0.0002
Historical	-0.2511	-2.0573	-1.2454	-1.1572	-0.8211	-2.3499	-1.5622	-0.7002	-0.4495	-0.5056	87.86
Condition	(0.243)	(0.378)	(0.254)	(0.352)	(0.451)	(0.499)	(0.237)	(0.334)	(0.306)	(0.240)	¡.0001
Near Poor	-0.0806	0.0322	0.5771	0.2207	0.4085	0.573	0.6323	0.0359	0.4117	0.1963	10.06
	(0.324)	(0.371)	(0.337)	(0.417)	(0.607)	(0.479)	(0.311)	(0.422)	(0.436)	(0.317)	0.4357
High	-0.5934	0.0499	0.2878	-0.0729	0.118	0.4464	0.2665	-0.2331	-0.2703	-0.2646	10.62
Income	(0.352)	(0.385)	(0.354)	(0.444)	(0.653)	(0.500)	(0.327)	(0.457)	(0.478)	(0.341)	0.3879
Non-MSA	-0.1181	0.3842	-0.1019	-0.0667	0.0542	-0.1382	0.5301	0.0236	-0.4168	0.0929	14.35
	(0.310)	(0.329)	(0.300)	(0.364)	(0.487)	(0.395)	(0.274)	(0.421)	(0.403)	(0.299)	0.1578
Midwest	-0.7726	-1.0804	-0.0994	-1.2548	-1.2928	-0.1277	-0.00634	-0.1628	-0.5104	-0.7006	18.16
	(0.383)	(0.493)	(0.348)	(0.566)	(0.843)	(0.463)	(0.338)	(0.521)	(0.452)	(0.400)	0.0523
Southeast	-0.8064	-0.3273	-0.4352	-0.77	-0.2799	-0.6111	-0.1965	-0.0082	-0.7882	-0.7661	13.96
	(0.323)	(0.362)	(0.310)	(0.406)	(0.539)	(0.424)	(0.293)	(0.428)	(0.399)	(0.333)	0.175
West	-1.0146	-0.1089	-0.5314	-0.7255	-0.3784	-0.6443	-0.151	-0.1286	-1.0065	-0.1488	17.92
	(0.351)	(0.357)	(0.324)	(0.427)	(0.524)	(0.442)	(0.301)	(0.461)	(0.424)	(0.328)	0.0563

Hypertension Demand Coefficients - Medicaid (cont.)

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Year 1997	-0.3747	-0.1261	-0.2007	-0.4815	-0.4968	-0.199	-0.5942	-0.2617	-0.3499	-0.1068	2.85
	(0.548)	(0.597)	(0.521)	(0.720)	(0.874)	(0.669)	(0.473)	(0.692)	(0.592)	(0.576)	0.9848
Year 1998	-0.4385	0.5629	-0.4035	0.0802	-1.5455	-0.2635	-0.6915	-1.4962	-0.6905	0.301	14.08
	(0.582)	(0.595)	(0.560)	(0.713)	(1.241)	(0.717)	(0.504)	(0.943)	(0.664)	(0.586)	0.1695
Year 1999	0.383	0.1755	0.1589	0.013	-0.057	0.4459	-0.2378	0.3029	-1.2149	0.3534	7.18
	(0.590)	(0.664)	(0.583)	(0.772)	(0.950)	(0.712)	(0.535)	(0.741)	(0.817)	(0.632)	0.7079
Year 2000	-0.2207	0.00746	-0.0574	-0.7272	0.7513	-0.164	-0.2063	-0.79	-0.4134	0.2389	4.42
	(0.619)	(0.663)	(0.583)	(0.872)	(0.845)	(0.754)	(0.526)	(0.868)	(0.687)	(0.627)	0.9267
Year 2001	-0.6097	-0.6743	-0.7096	-0.6001	-1.665	-0.9189	-1.4683	-0.6381	-1.7618	-0.4261	16.22
	(0.526)	(0.579)	(0.508)	(0.681)	(1.003)	(0.669)	(0.469)	(0.677)	(0.683)	(0.560)	0.0936
Year 2002	-0.9943	-1.1203	-0.8264	-0.3143	-1.6208	-0.9189	-1.2387	-0.5547	-1.8406	-0.2058	17.5
	(0.512)	(0.577)	(0.490)	(0.639)	(0.917)	(0.635)	(0.445)	(0.649)	(0.623)	(0.535)	0.064
Year 2003	-0.2769	-0.7779	-0.3487	-0.0524	0.1749	-0.6371	-1.0702	-0.6144	-0.317	-0.3351	10.97
	(0.508)	(0.572)	(0.488)	(0.655)	(0.772)	(0.641)	(0.449)	(0.668)	(0.557)	(0.548)	0.3595

Table 4.24: Hypertension Demand Coefficients - Uninsured

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Intercept	0.319	1.727	-0.087	-0.175	0.027	-1.064	0.498	-2.109	-1.927	-0.889	23.37
	(0.838)	(0.808)	(0.755)	(0.961)	(1.023)	(1.030)	(0.728)	(1.180)	(1.048)	(0.932)	0.0095
Age	0.028	-0.001	-0.004	-0.003	-0.001	0.002	-0.001	-0.038	0.023	-0.010	6.95
	(0.021)	(0.021)	(0.019)	(0.024)	(0.026)	(0.023)	(0.018)	(0.029)	(0.027)	(0.023)	0.7306
Age^2	-6.90E-04	-5.00E-04	-1.00E-04	-1.60E-04	-2.60E-04	-2.40E-04	-1.90E-04	2.71E-04	-9.00E-05	6.50E-05	22.15
	(210E-6)	(205E-6)	(169E-6)	(219E-6)	(242E-6)	(219E-6)	(168E-6)	(261E-6)	(233E-6)	(203E-6)	0.0143
High	0.222	-0.205	0.167	0.002	0.187	-0.037	0.312	0.608	0.616	-0.361	17.58
School	(0.274)	(0.265)	(0.225)	(0.286)	(0.318)	(0.293)	(0.221)	(0.334)	(0.311)	(0.284)	0.0624
College	0.622	-0.323	-0.061	-0.527	0.239	0.205	-0.259	0.213	-0.044	0.229	10.06
	(0.390)	(0.411)	(0.344)	(0.471)	(0.433)	(0.418)	(0.358)	(0.537)	(0.527)	(0.374)	0.4354
Female	-0.028	0.026	0.234	-0.131	0.004	-0.201	0.128	0.302	0.058	0.026	5.39
	(0.252)	(0.246)	(0.212)	(0.266)	(0.287)	(0.267)	(0.209)	(0.328)	(0.296)	(0.252)	0.8639
Nonwhite	0.944	0.535	0.764	0.044	0.253	0.877	0.909	0.816	0.711	0.470	32.44
	(0.267)	(0.255)	(0.217)	(0.278)	(0.299)	(0.283)	(0.216)	(0.326)	(0.305)	(0.261)	0.0003
Historical	-0.661	-1.130	-1.054	-0.662	-0.287	-2.188	-1.438	-1.064	-0.322	-0.220	48
Condition	(0.313)	(0.339)	(0.265)	(0.337)	(0.344)	(0.544)	(0.284)	(0.447)	(0.340)	(0.290)	¡.0001
Near Poor	0.330	-0.083	0.110	-0.519	-0.944	-0.108	-0.048	-0.232	0.157	-0.291	15.06
	(0.304)	(0.298)	(0.250)	(0.349)	(0.388)	(0.335)	(0.252)	(0.385)	(0.360)	(0.315)	0.1298
High	0.188	-0.045	-0.018	0.044	-0.588	0.308	0.097	-0.055	0.276	0.018	7.68
Income	(0.303)	(0.287)	(0.247)	(0.301)	(0.342)	(0.308)	(0.241)	(0.365)	(0.341)	(0.291)	0.6601
Non-MSA	0.039	-0.246	0.761	0.179	0.113	0.203	0.687	1.373	0.436	0.615	23.11
	(0.359)	(0.327)	(0.291)	(0.381)	(0.377)	(0.374)	(0.289)	(0.518)	(0.417)	(0.345)	0.0103
Midwest	0.494	-0.371	0.810	1.273	0.714	0.971	0.798	1.886	0.405	1.419	19.89
	(0.537)	(0.582)	(0.457)	(0.533)	(0.557)	(0.543)	(0.460)	(0.684)	(0.656)	(0.516)	0.0303
Southeast	0.719	0.123	0.828	0.764	-0.011	0.447	1.016	1.465	0.649	0.665	20.75
	(0.370)	(0.355)	(0.323)	(0.411)	(0.432)	(0.407)	(0.319)	(0.561)	(0.442)	(0.395)	0.0229
West	0.089	0.798	0.532	0.993	0.556	0.995	0.979	0.301	0.501	0.994	14.56
	(0.450)	(0.388)	(0.359)	(0.453)	(0.472)	(0.441)	(0.349)	(0.576)	(0.525)	(0.425)	0.1489

Hypertension Demand Coefficients - Uninsured (cont.)

	Hospital	Office Only	Card Rxs	ACE	BB	Off. + ACE	Off. + Card	Off + ACE + Card	Office + Card	Other	χ^2
Year 1997	-0.639	0.018	0.056	-0.127	0.071	1.219	-0.384	-0.316	-0.731	-0.594	10.37
	(0.550)	(0.549)	(0.519)	(0.695)	(0.731)	(0.751)	(0.490)	(0.843)	(0.637)	(0.693)	0.4087
Year 1998	-0.209	0.098	0.073	0.316	-0.880	0.928	-0.236	-0.607	-1.265	0.009	7.82
	(0.592)	(0.603)	(0.577)	(0.734)	(0.982)	(0.818)	(0.543)	(1.027)	(0.819)	(0.722)	0.6462
Year 1999	-1.282	0.207	0.561	0.235	-0.065	0.541	-0.014	-0.125	-0.104	0.040	10.02
	(0.712)	(0.619)	(0.579)	(0.759)	(0.857)	(0.862)	(0.556)	(0.953)	(0.695)	(0.734)	0.4383
Year 2000	-1.072	-0.664	-0.090	0.003	-0.052	0.511	-0.640	-0.264	-0.641	-0.330	9.38
	(0.562)	(0.571)	(0.513)	(0.670)	(0.719)	(0.769)	(0.487)	(0.820)	(0.617)	(0.649)	0.4962
Year 2001	-1.070	-1.205	-0.009	-0.114	-0.049	0.588	-0.691	-0.374	-0.961	-0.108	15.91
	(0.539)	(0.575)	(0.497)	(0.656)	(0.704)	(0.743)	(0.472)	(0.801)	(0.619)	(0.619)	0.1023
Year 2002	-1.297	-0.933	-0.543	0.196	0.253	0.279	-1.099	0.235	-0.804	0.326	23.33
	(0.518)	(0.534)	(0.489)	(0.623)	(0.669)	(0.740)	(0.462)	(0.736)	(0.576)	(0.586)	0.0096
Year 2003	-1.428	-1.290	-0.756	-0.704	-0.566	-0.431	-1.400	0.070	-1.795	-0.374	18.73
	(0.539)	(0.554)	(0.510)	(0.666)	(0.719)	(0.769)	(0.480)	(0.770)	(0.663)	(0.618)	0.0438

Table 4.25: Hypertension Production Coefficients

Parameter	Estimate	Std. Error		Estimate	Std. Error
Intercept	-2.699	0.5434	Near Poor	0.2388	0.0726
Priv. Hospital	-0.3959	0.1959	Middle Income	0.1147	0.0642
Priv. Off.	-0.6322	0.2058	High Income	0.1196	0.049
Priv. Oth. Cards	-0.6461	0.1862	No Cond.*(Exp.)	-0.0533	0.1742
Priv. ACE	-0.6792	0.2042	No Cond.*(Exp^2)	0.009	0.014
Priv. BB	-0.4105	0.2013	Prior Cond.*(Exp.)	-0.1005	0.1024
Priv. Off. + ACE	-0.8715	0.2146	Prior Cond.*(Exp^2)	0.0178	0.0088
Priv. Off. + Card Rxs	-0.6178	0.1836	No Cond.*(Age)	0.0658	0.0255
Priv. Off. + BB	-0.301	0.1941	No Cond.*(Age^2)	-0.0006	0.0003
Priv. Off. + ACE + Rxs	-0.5907	0.2019	Prior Cond.*(Age)	0.0302	0.0178
Priv. Off. + Rxs	-0.2855	0.1838	Prior Cond.*(Age^2)	-0.0001	0.0002
Priv. Oth. Trtmt	-0.2467	0.1826	Nonwhite	-0.0893	0.0426
Mcd. Hospital	-0.1443	0.2109	Female	0.074	0.0397
Mcd. Off.	-0.5774	0.2797	High School	0.0135	0.0489
Mcd. Oth. Cards	-0.4811	0.2238	Some College	-0.0058	0.0757
Mcd. ACE	-0.6984	0.3197	College Plus	0.0124	0.0695
Mcd. BB	-0.7553	0.4625	Year 1997	0.1451	0.0887
Mcd. Off. + ACE	-0.6691	0.3207	Year 1998	0.0576	0.0971
Mcd. Off. + Card Rxs	-0.3297	0.1971	Year 1999	0.0374	0.0945
Mcd. Off. + BB	-0.1817	0.2621	Year 2000	0.0416	0.0927
Mcd. Off. + Rxs	-0.1662	0.2078	Year 2001	-0.0602	0.0894
Mcd. Oth. Trtmt	-0.2035	0.2083	Year 2002	0.1143	0.084
Unins. Hospital	-0.2121	0.2292	Year 2003	0.0939	0.0858
Unins. Off.	-0.5257	0.2637			
Unins. Oth. Cards	-0.4526	0.2149			
Unins. ACE	-0.6373	0.2963			
Unins. BB	-0.4453	0.2952			
Unins. Off. + ACE	-0.7491	0.3105			
Unins. Off. + Card Rxs	-1.023	0.2514			
Unins. Off. + BB	-0.3272	0.2809			
Unins. Off. + ACE + Rxs	-0.3381	0.2687			
Unins. Off. + Rxs	-0.3512	0.2377			
Unins. Oth. Trtmt	-0.1451	0.2096			

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Vita

Brett William Wendling was born in Cleveland, Ohio on October 26th, 1974, the son of William Lee Wendling and Patricia Marie Wendling. After graduating from Columbia, South Carolina's Irmo High School in 1993 he attended Wake Forest University. In May of 1997 Mr. Wendling received a Bachelor of Science degree in Mathematical Economics from Wake Forest University with a Magna Cum Laude distinction. After spending three years in industry and being a contributing author to two peer-reviewed publications, Mr. Wendling returned to graduate school at the University of Texas in the fall of 2000 to pursue a doctorate of philosophy in economics.

Permanent Address: 8711b Harper's Point Drive
Cincinnati, OH 45249

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