ABSTRACT

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Abstract

This dissertation consists of two essays. In the first one I exploit geographic variation in the Medicare Home Health Care reimbursement rate that arose as a result of legislation passed in 1997 to identify the impact of government coverage of home health care visits on the living arrangements of older Medicare beneficiaries. I find that less generous reimbursement policies lead to a greater fraction of elderly living in shared living arrangements. My estimates imply that the law change had a large effect on shared living arrangements. One way to see this is to consider how the reimbursement change differentially affected living arrangements in the state that was most impacted by the law relative to the median state. My results imply that the law change caused the fraction of the elderly living in shared living arrangements to increase by 8 percent more in the most impacted state relative to the increase in the median state.

In the second essay of this dissertation I use the imposition of limits in reimbursement for Medicare Home Health Care introduced in 1997 to study changes in exit patterns of home health care agencies in California between 1994 and 2000.

When using piece-wise-constant Exponential hazard models estimated on the entire sample of providers, I find that the imposition of limits in reimbursement had a statistically significant effect on exit of home health care agencies in California.

When conducting the analysis separately for for-profit and not-for-profit providers, results obtained with the piece-wise-constant Exponential model indicate that the imposition of limits in reimbursement had a statistically significant effect on exit for for-profit agencies, but had no statistically significant effect on not-for-profit agencies.

ESSAYS ON INFORMAL AND FORMAL CARE FOR THE ELDERLY

By

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Table of Contents

LIST OF FIGURES

LIST OF TABLES

Chapter 1: Institutional Background

1.1 Introduction

Population aging and increased prevalence of chronic health conditions among the elderly bring issues of long term care to the forefront in many developed countries. For example, in the United States between 1997 and 2004 the percentage of elderly 65 or older with a heart and circulatory condition increased from 64.5 to 67.7. Also, during the same period, the percentage of elderly with diabetes increased from 13.1 to 17.1 and the percentage of those with arthritis/joint pain increased from 44.5 to 50.6 (Freedman et al., 2006).[1] The two essays in this dissertation focus on home health care, a form of long term care that receives a significant amount of government funding in many countries (OECD, 2005). For instance, public expenditure on home health care in 2002 as a percentage of the GDP was 0.3 in the Netherlands, 0.2 in Canada, 0.6 in Germany, 0.4 in Denmark and 0.09 in the United States.[2]

In this dissertation I focus on the United States, where reimbursement generosity for home health care services to the elderly through the Medicare program has varied over time, and address two issues.

The first essay examines whether informal care increases with a reduction in government funding for home health care, and the second essay looks at whether changed reimbursement generosity had a differential effect on exit patterns for

[1] The percentage of elderly with obesity in the same period increased from 16 to 21.6.
[2] Data for all countries except the United States are from www.oecd.org. For the United States I consider expenditure on Medicare Home Health taken from the Medicaid and Medicare Statistical Supplement. The GDP for the United States for year 2002 can be found at www.bea.org.

for-profit and not-for-profit home health care providers. The periods examined are 1988 to 2000 for the first essay and 1994 to 2000 for the second. This chapter presents the institutional background that frames the two essays in chapters 2 and 3.

1.2 Background on Medicare and Medicare Home Health Care Reimbursement Change

Medicare was enacted by Congress in the United States in 1965 to meet the health insurance needs of the elderly and the disabled. During the time period considered by this dissertation, Medicare consisted of three parts: hospital insurance, known as Part A, a supplementary medical insurance, known as part B, and a third part, known as Part C, that expanded beneficiaries' options for participating in private-sector health care plans.[3] Medicare Part A is provided automatically and free of charge to people 65 or older that are eligible to receive Social Security or Railroad Retirement Benefits,[4] whether they are claiming these monthly benefits or not. Part A covers inpatient hospital care, short-term skilled nursing facilities services, hospice care, and home health care.

Medicare home health care consists of health care services provided in the home of eligible Medicare patients through periodic visits. More precisely, Medicare home care covers six health care services: skilled nursing, physical therapy, occupational therapy, speech therapy, medical social work and home health aid.[5] In

[3] In January 2006, Medicare Part D went into effect that allowed seniors for the first time to enroll in a Medicare-sponsored prescription drug plan.
[4] Medicare does not cover only all elderly 65+ that are eligible to receive social security benefits. Through time Congress expanded eligibility also to other categories. For a more comprehensive description of coverage see Health Care Financing Administration (2000).
[5] According to the definition of occupations that is given by the Bureau of Labor Statistics at http://www.bls.gov/soc/soc_j0a0.htm, occupational therapists "assess, plan, organize, and participate in rehabilitative programs that help restore vocational, homemaking, and daily living skills, as well as general independence, to disabled persons". Physical therapists "Assess, plan, organize, and participate

order to be eligible to receive Medicare home health care, Medicare beneficiaries need to be "home-bound" and in need of "intermittent" and "part-time"[6] skilled nursing, occupational or speech therapy. Also, patients need to be under the care of a physician in charge of prescribing and periodically reviewing the plan of care. Home health agencies are the providers that furnish home health care visits. In order to receive Medicare certification and therefore be eligible to receive Medicare reimbursement for the visits provided, home health agencies need to fulfill a series of administrative requirements that are described in the next section and that have the purpose of assuring a minimum quality of service.

Home health agencies represent the agents that are directly impacted by any Medicare reimbursement change. Because of this, and in order to better frame the home health care environment that led to the reimbursement change focus of this dissertation, it is useful to describe the reimbursement mechanism in place before 1997 as well as the incentives it created.

The Medicare reimbursement mechanism that home health agencies were entitled to receive in the period before the policy change studied in this dissertation was set in 1989. Before 1989, Medicare home health care visits were subject to an annual

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in rehabilitative programs that improve mobility, relieve pain, increase strength, and decrease or prevent deformity of patients suffering from disease or injury." Speech therapists "Assess and treat persons with speech, language, voice, and fluency disorders. May select alternative communication systems and teach their use. May perform research related to speech and language problems. "Medical social workers," according to Stanford School of Medicine, (at this web-site: http://smysp.stanford.edu/students/profiles/med_social_worker.html) "assist patients and their families with health-related problems and concerns. They lead support group discussions, help patients locate appropriate health care and other health services, and provide support to patients with serious or chronic illnesses. They help patients and their families find important resources they need to overcome unhealthy conditions such as child abuse, homelessness and drug abuse. They also help patients with finding legal resources and financial aid for paying for health services." " Home health aides performs personal care services, such as assistance with eating, bathing, and toileting; simple surgical dressing changes; assistance with certain medications; activities to support skilled therapy services; and routine care of prosthetic and orthotic devices", United States General Accounting Office, 2003.

limit and could be provided only after hospitalization. The rules enacted in 1989 significantly changed the previous regulations by eliminating the post-hospitalization requirement and the limit to the annual number of visits per user. Each home health agency only faced a limit on the maximum reimbursement for each type of visit, with the most skilled visits reimbursed at a higher rate than the lower skilled ones. With this reimbursement scheme, each agency had the incentive to minimizing the intensity of care per visit and to increase the number of visits per patient. In fact, aggregate data show that the number of visits per beneficiary went from 1.14 in 1988 to 7.8 in 1996.

This increase in the number of visits per beneficiary was due to two factors. The first is represented by the increase in the average annual number of visits per user that went from 24 in 1988 to 74 in 1996. Moreover, without the requirement of providing services only after hospitalization, agencies could serve a larger population of Medicare beneficiaries. This led to an increase in the fraction of Medicare beneficiaries that used the service from 4.9 percent in 1988 to 10.7 percent in 1996.

The expansion in the provision of services since 1989 was accompanied by a skyrocketing increase in Medicare home health care expenditures that went from $1.94 billion in 1988 to $16.76 billion in 1996.[7] The average payment per Medicare beneficiary on Medicare home health care went from $72 in 1989 to $497 in 1996, and the payment per person served went from $1410 in 1989 to $4660 in 1996. The number of providers went from 5695 in 1990 to 10127 in 1996. This growth in such a short period of time was without precedent. [8]

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[6] Health Care Financing Administration, 2000.
[7] In nominal dollars.
[8] Data are from the National Association for Home Care and Hospice and can be found on the web at: http://www.nahc.org/Consumer/hcstats.html.

This very quick and large growth in spending for Medicare home health care did not pass unnoticed and raised critiques of the generous reimbursement considered responsible for favoring abuses. In particular, because home health care was originally intended to furnish a skilled nursing service (Mortaugh et al., 2003), the critiques were exacerbated by the disproportionate increase in the percentage of personal care visits provided by home health aides.[9] In fact, home health aides' visits went from 33.6 percent of all home health care visits in 1988 to 48.9 percent of all Medicare home health care visits in 1996.[10]

In the Balanced Budget Act (BBA), enacted by Congress 1997, there are provisions intended to impose a limit on the increasing expenditures on Medicare home health care. [11]The change introduced by the law involved two steps. First, from 1997 to 2000, an Interim Payment System (IPS) was established that put a cap on how much each home care agency would be reimbursed per patient per year. The cap had two parts: 75 percent of the value was based on each agency's 1994 average per patient cost and 25 percent was based on the average per patient cost of the agency's census division.[12] The second step started in October 2000 when the IPS was changed to the

[9] For a detailed description of the duties of home health care aides, See footnote 5.
[10] In 1988 nursing care visits account for 51.1 percent of all Medicare home care visits, and physical therapy represented 11.5 percent of the visits. The remaining disciplines accounted for 3.6 percent of the total number of visits. In 1996 nursing care accounted for 41.1 percent of the visits, physical therapy was 7.3 percent and the other disciplines were only 2.7 percent of the total number of visits.
[11] The BBA contains provisions on several aspects of the health care environment as well as provisions on other sectors.
[12] A Census division is a cluster of states. There are in total 10 Census divisions: the New England division (Connecticut ,Maine, Massachusetts, New Hampshire, Rhode Island, Vermont), Middle Atlantic (New Jersey, New York and Pennsylvania), the East North Central division (Illinois, Indiana, Michigan, Ohio, Wisconsin) the West North Central division (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota), the South Atlantic division (Delaware, District of Columbia, Florida, Georgia, Maryland , North Carolina, South Carolina, Virginia, West Virginia), the East South Central division (Alabama, Kentucky, Mississippi and Tennessee), the West South Central division (Arkansas, Louisiana, Oklahoma, Texas), the Mountain division (Arizona, Colorado, Idaho, Montana,

Prospective Payment System (PPS) that is still in place. Under PPS, a home care agency receives a single payment for all items and services furnished during each 60-day episode of care. The payment rate is based on the national average cost of providing care in 1997, not on actual home health agency cost. To account for differences in beneficiary needs, PPS reimbursements are adjusted from a base rate.

In this dissertation, I concentrate on the first change in reimbursement, the IPS. The per visit reimbursement limit stayed in place after the IPS was implemented, so providers continued to have the incentive to minimize the intensity of care provided during each visit. However, the imposition of an average per patient cap created new incentives that are formally modeled by McKnight (2004). The author shows that imposing a limit on average reimbursement per user creates the incentive for agencies not to treat patients with long-term care needs.

In line with the predictions of theory, there is empirical evidence (McKnight, 2004, 2006) that the IPS caused a drop of 3.3 visits per Medicare beneficiary between 1996 and 1999.[13] With the average per patient visit cost of $63 in 1996, the value of the in-kind benefit that Medicare beneficiaries received after the policy change declined by $207. Because of the incentive to select relatively healthy patients, the decline in the number of visits per beneficiary should be due to both a decline in the fraction of Medicare beneficiaries that used the service and by a decline in the number of visits per user. In fact, the fraction of Medicare beneficiaries that used the service went from 10.7

Nevada, New Mexico, Utah, Wyoming), the Pacific division (Alaska, California, Hawaii, Oregon, Washington).

[13] This number varies slightly depending on the specification chosen. It crucially relies on assuming that agencies facing a binding constraint after the Interim Payment System would exceed the cost limit by an average 12 percent. This number is taken from an estimate developed by the Health Care financing Administration based on 1999 data. In this dissertation, I adopt a different framework for interpreting my

percent in 1996 to 8.5 percent in 1999. Also, between 1996 and 1999, the average number of visits per user went from 74 to 42. These downward trends in use were reflected in the decline in aggregate expenditure on Medicare home health care that went from $16.75 billion in 1996 to $7.93 billion in 1999. [14]

However, somewhat surprisingly, McKnight (2006) does not find evidence indicating that the decline in the provision of Home Health Care had an adverse impact on the health of elderly Medicare beneficiaries, not even the frailest ones. Several health measures were used to investigate this possibility: mortality, Body Mass Index, difficulty with stooping or kneeling, lifting 10 pounds and walking 2-3 blocks (McKnight, 2004, 2006).

McKnight's finding that home health care visits dropped substantially but the health of the elderly did not is puzzling. There are two possible explanations for this finding. The first is that the health measures she uses may not be adequate to detect a change in overall health of the elderly. The second is that, because informal care by friends or family members may be a reasonable substitute for part of the services covered by home health care, in particular home health aide services, it is possible that the elderly were able to substitute enough toward informal care to prevent measurable adverse health outcomes.[15] To further support this second hypothesis, it is worth recalling that home health aide visits, the type of visits that can be considered the most direct substitute of informal care, represented 48.9 percent of the total number of visits in the pre policy period. Moreover, home health aides' visits were the ones that

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results that uses the cross state measure of reimbursement generosity developed by McKnight (2004) and explained in chapter 2.

[14] In nominal dollars.

experienced the largest drop, representing only 34.3 percent of the total number of home health visits in 1999.

Theories of altruism as well as bargaining models of family decision making (Light and McGarry, 2003) suggest that informal care should increase when formal care does not meet the needs of the elderly. More specifically, in models of altruism children's utility function is increasing in elderly parents' well being, suggesting that the children should increase their transfers to the elderly facing adverse shocks. Bargaining models (Browning and Chiappori, 1998; Pezzin, Pollack and Schone, 2006), on the other hand, suggest that children are willing to increase informal care if induced to do so by increased transfers from the elderly. Chapter 2 tests whether informal care substitutes for formal home health care by examining whether the imposition of limits in reimbursement for Medicare home health care introduced by the BBA caused an increase in fraction of elderly that live with other relatives or with friends rather than living alone or with a spouse.

1.3 Certification of Medicare Home Health Care Agencies

According to the Social Security Act,[16] Medicare home health agencies may be public agencies or private organizations (or a subdivision of those) that provide part-time or intermittent skilled nursing services and at least one other therapeutic service (e.g. physical, speech or occupational therapy, medical social service or home health aide services) at the recipient's home. The home care services are provided under the care of a physician that should review the plan of care at lest every 62 days

[15] Another possibility is that measures of health, other than those measured by McKnight (2004, 2006), were affected. Unfortunately, there is not much evidence that addresses this possibility.

(Harrington et al., 1999). Besides these basic requirements, home health agencies must satisfy additional criteria in order to be eligible to obtain Medicare certification. These additional requirements can be grouped as follows: those pertaining to the organizational structure; those related to the agency's operations; and those concerned with the personnel policies and personnel qualifications. Furthermore, during regular surveys conducted by the Medicare program, the agency must disclose ownership and management information and update this information every time there is a change in ownership or management.

With regard to its organization, since each home health care agency can operate through multiple branches, the law requires that all the administrative records of the branches must be maintained by the parent organization. The home health agency also needs to have established a group of professional personnel in an advisory function on issues related to the services provided by the agency. The group includes a physician, a registered nurse and professionals from the appropriate disciplines pertaining to the services provided by the agency.

The regulations related to the operation of the home health agency are about patients' rights. The agency is required to provide each patient with a written notice of rights and must advise the patient of record disclosure policies and procedures. In addition, the agency is required to inform the patient about the care plan in advance as well as any ensuing changes to it.

Closer scrutiny of the laws regarding the acceptance of patients and their plan of care reveals that patients should be accepted into an agency's client list on the basis of reasonable expectations that patients' needs can be met at home. This last

[16] Section 1861(o) of the Act, (42 USC. 1395x).

requirement may have unintended consequences, because, on the basis of it, an agency could refuse the most disabled and chronic patients, who, after 1997, were also the least profitable ones to treat.

The rules related to personnel policies and qualifications require that all the personnel in an agency must meet qualification requirements in the state in which the agency operates and must be licensed by the state. While this may seem obvious for personnel furnishing skilled nursing services or the other therapeutic disciplines covered by Medicare, the law also requires that home health aides, mostly involved with personal care services, undergo training set up at the state level. The training must last at least 75 hours and must cover specific subject areas such as reading and recording temperature, pulse and respiration, basic infection control procedures, maintenance of a clean, safe and healthy environment, safe transfer techniques and ambulation.[17]

Medicare certification is assigned to a home health care agency after the agency has been surveyed and found to be compliant with the regulations. A home health agency is supposed to be periodically resurveyed and may lose its certification if found not to be compliant with one or more conditions of participation in the Medicare program. If surveyors find that a home health agency is not compliant and its deficiencies are considered to be at risk of jeopardizing patients' health, the regulations require that an agency follow a fast termination process. In the case where non-compliance pertains to less serious deficiencies, the agency follows a 90-days termination procedure. However, closure can ultimately be avoided by submitting a plan of correction.

Besides the above mentioned requirements, there are no further obstacles to obtaining certification as a home health care agency. Until 1997 the regulations did not even require that the owners of home health care agencies have previous health care experience and, perhaps more surprisingly, even people with criminal backgrounds could open a home health care agency, provided that their previous criminal activity was not related to Medicare or other federal health programs or illicit drugs (Gao, 1997). Certification is not only quite easy to acquire, but it is also rather difficult to lose. In fact, in fiscal years 1994, 1995 and 1996 about 3 percent of Medicare home health care certified agencies discontinued certification, for the most part because of closures or mergers. Terminations occurring as a result of deficiencies identified during the surveys were between 0.1 and 0.3 percent of all terminations from 1994 to 1996 (Gao, 1997).

The other aspect of the legislation that is particularly relevant for this dissertation is the rule regarding the adjustment across localities of Medicare payments to home health agencies. These adjustments take into account the differences in wages across areas. For example, because urban areas tend to have higher wages compared to rural ones, the baseline Medicare payment for a specific service is multiplied by an adjustment index that reflects the different compensation levels across urban and rural areas. Also, since different urban areas have different wages, the adjustment index across cities varies. For example, for agencies in San Francisco the upward adjustment to the baseline Medicare payment for a given service is higher than the one for agencies based in Atlanta, because the wages in San Francisco are higher. This rule implies that two agencies that locate in the same

[17] See Harrington et al, (1999) for a complete description of the training.

geographic area as defined by the reimbursement adjustment index receive the same reimbursement for each type of service provided.

This rule, together with evidence suggesting that home health care agencies that are Medicare certified provide a substantial fraction of their services to Medicare patients and therefore receive most of their revenues from Medicare,[18] allows me to reasonably identify the market in which an agency operates using the geographic areas corresponding to different adjustment indexes. In fact, it seems quite plausible to imagine that agencies that are located in the same area for reimbursement purposes might share similar unobservable characteristics that are correlated with their location choice.

As a final note related to the adjustment of payments across localities, I must mention that prior to the BBA the adjustment index was based on where an agency was located, but after the BBA the adjustment index has been based on where the patients visited by the agency reside. This change does not seem to alter the plausibility of the choice of the market where an agency operates as the market in which the agency was located before the policy change. In fact, it is reasonable to imagine that two agencies that located in a market with the same adjustment index in the years before the policy change will likely keep on sharing the same unobservable characteristics correlated with the location choice that they had when they first opened.

[18] For example, Medicare certified agencies in California in 1994 were providing 84 percent of their services to Medicare patients.

Chapter 2: Changing the Way the Elderly Live: Evidence from the Home Health Care Market in the United States

2.1 Introduction

Large fractions of the elderly populations of many developed countries live in "shared living arrangements", where they live with other relatives or with friends rather than living alone or with a spouse (See Table 2.1). One of the most common explanations for sharing living arrangements at old age is a decline in health that leads the elderly to increasingly rely upon regular care.

Table 2.1 shows large cross country variation in the fraction of older individuals that live in shared living arrangements. Several factors might explain these differences, including diverse cultural norms associated with intergenerational living arrangements (UN, 2005). Moreover, Table 2.1 shows that there is a negative relationship between the fraction of elderly that live in shared living arrangements and the share of resources that a country devotes to home health care services. This evidence seems to suggest that formal home health care may substitute, at least in part, for informal care provided by family members and friends and might be responsible for allowing a larger fraction of the elderly population to live independently. Establishing a causal relationship between the provision of formal and informal care is important because government support for home health care is expensive (Table 2.1), and population aging has raised policy makers' worries about the affordability of publicly provided home health care services

and about the consequences of home care for outcomes like labor supply (Herrera et al., 2003, OECD, 2005).

This paper provides an estimate of the substitutability between formal and informal care. More specifically, I examine the impact of the sharp decline in the provision of formal home health care, which resulted from the change in Medicare home care reimbursement, on the fraction of elderly in the United States that live in shared living arrangements. In principle, changes in formal home health care can impact the provision of informal care without varying living arrangements, but this is very difficult to measure empirically.[19] Moreover, it is presumably easier and less expensive to provide informal care if the elderly person needing care lives under the same roof as their informal caregivers.

Therefore, I focus here on examining the causal relationship between the provision of formal home health care and the fraction of elderly living in a shared living arrangement as one dimension of substituting between formal and informal care. To investigate the impact of the Medicare reimbursement change on the fraction of older Medicare beneficiaries living in shared living arrangements, I use the policy change introduced in 1997, which imposed a cap on the average reimbursement per patient that home care agencies were entitled to receive when treating elderly Medicare patients. The cap was based on a blend of each home health agency's average per patient cost in 1994 and the average per patient cost of home health agencies in the agency's census division. Because the cap had a regional component, even states with similar pre-policy

[19] For example, surveys like the Health and Retirement Survey and the European Share ask the caregivers how many hours of informal care they provide. It seems to me that this variable is likely to be measured with considerable error. On the contrary, it is less likely that a person misreports where she/he lives.

utilization potentially faced different restrictive reimbursement limits depending on their utilization relative to the average utilization in their census division. For example, agencies in Georgia and Oklahoma provided similar average amounts of care to their users before 1997, but agencies in Georgia faced a more restrictive cap as a result of the 1997 change than did agencies in Oklahoma, because the regional average per patient cost in the South Atlantic census division prior to the law change was lower than the regional average in the West South Central census division.[20]

The peculiar reimbursement mechanism introduced by the policy change allows me to exploit the variation across time and across states to estimate a reduced-form equation and identify the impact of the cap on the fraction of the elderly that live in a shared living arrangement. By relying on an exogenous source of variation in reimbursements this study improves upon the previous literature that used potentially endogenous policies (Hoeger, Picone and Sloan, 1997; Coyte and Stabile, 2001) targeted towards selected populations of elderly (Applebaum, 1988). To my knowledge, this is first study that uses a quasi-experiment to estimate the impact of home care policies on living arrangements by looking at all of the non-institutionalized population of elderly in a country.

In the last part of this chapter, I combine my reduced form estimate and McKnight's (2004, 2006) estimate of the impact of the reimbursement change on the number of Medicare home health care visits received by Medicare beneficiaries to provide a structural estimate of the impact of the number of Medicare home care visits on the fraction of older Medicare beneficiaries that live in shared living arrangements.

[20] This example is taken from McKnight, (2004, 2006).

2.2 Literature Review

A number of papers by economists have attempted to study the role that in-kind benefits in the form of home care play in the choice of living arrangement. Probably the most comprehensive study using non experimental evidence is the one by Hoerger, Picone and Sloan (1996) that used data from the National Long Term care Survey conducted by the Census Bureau in 1989 on a population of elderly that needed help in one of more activities of daily living. [21] Both elderly in the community and those residing in institutions were part of the sample. The authors had information on Medicaid eligibility subsidies, number of nursing home beds, state subsidies of formal care in the community and public cash payments to relatives and friends for care giving at a single point in time. They used a multinomial probit model to estimate the impact of the state policies on the probability that a disabled elderly person lives independently, in an intergenerational household, or enters a nursing home. When considering home health care, the authors find that the availability of local Medicaid[22] subsidies for home health care had no effect on nursing home entrance, while it increased the probability that elderly live independently.

Although the paper is very detailed, it also contains some limitations. Two points are worth noting. First of all, Medicaid home health care is available only to selected poor elderly. Therefore, findings for this group cannot be generalized to all the population of older individuals. Moreover, the study focuses on a reimbursement policy that is a function of unobservable characteristics of the elderly that likely impact their living arrangements. More specifically, Medicaid home and community based services

[21] Activities of daily living include bathing, dressing, toileting, transferring and eating.
[22] A brief description of Medicaid home health care is provided in section 2.5.3.

are in part financed by state resources and thus are dependent on resource availability and not just medical needs. In fact, there is big variation in the level of physical impairment required to be considered eligible to receive Medicaid home and community based services. It follows that, if beneficiaries in richer states are also healthier on average than beneficiaries in poorer states, the finding that higher expenditures are associated with a higher percentage of elderly living independently might be due to the selection of healthier individuals into richer states rather than to the home care benefit itself.

A more recent paper using Canadian data by Coyte and Stabile (2001) looks at the impact of publicly-provided home care benefits on informal care using repeated cross sections, but the impact on living arrangements is not studied. The reliance on comparing different Canadian provinces that self-select the level of care provided makes the paper subject to the same criticism as Hoerger, Picone and Sloan (1996). When looking at papers using experimental evidence, most studies rely on the National Long Term Care (Channeling) Demonstration Project financed by the Department of Health and Human Services in the 1980s. The goal of Channeling was to see whether home and community based services could be a cost effective alternative to institutionalization. The sample included individuals that were at least 65 years old and particularly frail. The average age was 79 and most of the participants in Channeling had multiple functional limitations. Moreover, 19 percent of the sample needed help with all activities of daily living. People that took part in the experiment were also particularly poor. Two interventions were tested: one "basic" intervention that provided

limited funding and a "financial" intervention that substantially expanded the set of home care services provided.

Christianson (1988) compares sample means and for the "financial" intervention finds that a 5 percent increase in the percent receiving in-home formal services was associated with a 1 percent point decrease in the percent receiving any informal care. Housework/laundry/shopping services, meal preparation and personal care were the measures of informal home care used to carry out the analysis. Pezzin, Kemper and Reschovsky (1996) used an ordered probit model on the data from Channeling and found that the financial intervention increased the probability of living alone for an unmarried individual by 7.1 percentage points.

The main criticism these studies are subject to is that the subpopulation studied was particularly frail, even when considering a subpopulation of elderly at the national level with the same functional limitations typical of Channeling participants. In particular, by using the National Long Term Care Survey, it has been shown that on a national level, elderly that would have met Channeling functional limitation criteria were much less likely than Channeling participants to live alone (Applebaum, 1988). Therefore, if Channeling participants were also less likely to change their living arrangements than a population of similarly impaired individuals at the national level, it follows that it is difficult to think about how to generalize the results from the experiment.

2.3 Empirical Framework

2.3.1 A Measure that Captures the Cross-State Variation Introduced by the Balanced Budget Act

After the policy change introduced by the BBA in 1997, in all 50 states the fraction of Medicare beneficiaries receiving Medicare home health care decreased sharply, and the average number of yearly visits per user plummeted.

In this chapter, the outcome variable of interest is the fraction of elderly Medicare beneficiaries 65 years of age or older that live in shared living arrangements, *i.e.* that live with somebody else besides the spouse if married or with somebody else if unmarried.[23] In the empirical model outlined in the next section, the time series component of the decline in the number of visits per beneficiary after the policy change is captured by inserting year dummies in the equation that models the impact of the IPS on the fraction of elderly that live in a shared living arrangement.

However, the peculiar way the BBA defines the new reimbursement scheme can be used to construct a measure that captures a cross-state component of the variation implied by the IPS. McKnight (2004, 2006) constructs this measure to identify the impact of the IPS introduced in 1997 by the BBA on the number of Medicare home care visits received by Medicare beneficiaries.

Here, I use the same measure to identify the impact of the IPS on the fraction of elderly Medicare beneficiaries that live in shared living arrangements.

The measure can be constructed by noticing that the census division component of the per-patient limit creates exogenous cross-agency variation. This can

[23] As in Gruber, Engelhardt and Perry,(2005).

be seen by considering two agencies: one that has an average per patient cost in 1994 above the average per patient cost in its census division and another that has a per patient cost in 1994 below the average per patient cost in its census division. Because part of the reimbursement limit is based on the census division utilization, the first agency faces a more restrictive constraint.

It is worth stressing that, because of the generalized increase in the provision of services between 1994 and 1997, it is *likely* that the limit is restrictive also for the second agency, despite that its average per patient cost of treating Medicare patients is below the average per patient cost of treating patients in its census division.

Ideally, in order to be able to use this cross-agency variation introduced by the reimbursement mechanism, I would need to have access to information on cost at the single agency level. Unfortunately, as McKnight (2004, 2006), I do not have access to these data. Instead, I have access to Medicare home health care utilization data aggregated at the state and census division level. With these data, I follow McKnight's (2004, 2006) suggestion that the reasoning applied to individual agencies should be valid, on average, when aggregating data at the state level. Therefore, with similar increasing trends between 1994 and 1997, states where aggregate home health agencies have below census division average per patient cost in 1994 face a limit in reimbursement that is less restrictive than the limit faced by states where, on average, the average per patient cost in 1994 is above the average per patient cost in their census division.

To create the variable used by McKnight (2004, 2006) to capture the

cross-state variation in reimbursement I need to use a measure of cost. Here I follow McKnight and identify the average number of visits per user as the most appropriate measure of cost to use.[24] More formally, McKnight (2004, 2006) defines the following measure of restriction in reimbursement generosity:

(1) $\text{Restrictiveness}_{sc} = \bar{A}_S - \bar{A}_C$

where $\bar{A}_S$ is the average number of Medicare home care visits per user in 1994 in state s and $\bar{A}_C$ is the average number of Medicare home care visits per user in 1994 in state s' s census division. The restrictiveness measure is between -40.9 (Kentucky) and 34.7 (Utah). For example, Figure 2.1 shows the cross-state measure of variation for the Mountain census division and the South Atlantic census division, two census divisions that have a particularly large number of states. Figure 2.1 shows that in both census divisions in 1994 there were states that had an average number of visits per user above (the states with a positive number) and below (the states with a negative number) the average number of visits per user in their census division. [25]

Was the cap imposed by the IPS restrictive for those states with a negative $\text{Restrictiveness}_{sc}$? There are two reasons to think that this was indeed the case. First, the cap imposed by the IPS was based upon utilization levels in 1994 and between 1994 and 1997 there was a generalized increase in average Medicare home health care utilization even in states with a negative measure. To better illustrate this point, I constructed the cap for all states and compare utilization levels in each state in 1996

[24] The reasons are due to the functioning of the indexing of the Medicare reimbursement across different localities. Appendix I goes in more in detail in explaining why the average number of visits per user has been used here.

[25] In all census divisions there are states with an average number of visits per user in 1994 above and below the average number of visits per user in their census divisions.

with the cap. There are 33 states with a negative $Restrictiveness_{sc}$ measure. Only 9 of these in 1996 were providing an average number of visits below the cap.

However, it is very likely that the cap was binding also in these 9 states, because the cap is based on *average* utilization levels in each state. An example might be useful to illustrate this point. I consider a hypothetical state, state s. For simplicity, I assume that state s is in a census division that in 1994 was providing, on average, 25 visits per user. I also assume that in state s there are only three agencies that are treating the same number of patients. I suppose that in 1994 the three agencies provided 10, 20 and 30 visits per patient, respectively, for an average of 20 visits per patient. I also assume that the three agencies in 1996 provided 12, 22 and 32, visits per patient, respectively, an average of 22 visits per patients in the state in 1996. The average restrictiveness measure in this state is -5. The maximum reimbursement limit implied by the cap for these three agencies in state s is 13.75, 21.25, 28.75,[26] respectively, an average of 21.25 visits per patient in the state. Therefore, even if, on average, the cap is not binding, one agency is constrained and has to comply with the cap by decreasing the number of visits per patient. All else equal, the result of the compliance with the cap is going to be a decline in the average number of visits per patient in the post policy period in state s.

Unfortunately, I do not have data at the state level that allow me to verify that in every state with a negative restrictiveness measure and with average utilization levels in 1996 below the caps there were constrained agencies. There are two facts that support the idea that this was the case. First of all, after the policy change in all states (included the 9 states that on average did not find the cap binding) there was a decline in the number of visits per user and in the number of users per 1000 beneficiaries that is consistent with the

idea that constrained agencies had to comply with the cap by reducing the average number of visits per user. Second, even if the cap was, on average, below utilization levels in 1996, average utilization levels were really close to the limit. For example, utilization levels in 1996 in Oregon were 4.9 visits below the cap, those in Montana were 1.6 visits below the cap, etc.[27] So it seems plausible to assume the existence of providers constrained by the cap. This suggests that in those states where average number of visits per user in 1996 was above the cap restricted providers had the largest share of the market,[28] whereas in those states where the average number of visits per user in 1996 was below the cap the constrained providers were those with the smaller share of the market.

I illustrate both the cross state component and the time series component of the policy change in Figures 2.2 and 2.3, figures that are similar to McKnight's (2004, 2006) graphs. To construct the Figures, I divided states in three groups based on the restrictiveness measure implied by Equation 1. States identified as low restricted states are states that have the lowest measure of restriction and where about 20% of the total population lives. States identified as high restricted states are those with the highest measure of restriction as defined by Equation 1 and where about 20% of the total population lives.[29] The remaining states are defined as medium restricted states.

Figures 2.2 and 2.3 show four facts. First, as previously discussed, in all states there was an increase in Medicare home health care utilization between 1994 and 1997. Moreover, the trends over this period were very similar in the three types of states.

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[26] 0.75*10+0.25*25=13.75, 0.75*20+0.25*25=21.25, 0.75*30+0.25*25= 28.75.

[27] The other states are: Nevada, 2 visits below the cap, Arkansas 3.5 visits below the cap, Kentucky 5 visits below the cap, Maryland 7 visits below the cap, North Carolina 4.2 visits below the cap and South Carolina 1.3 visits below the cap.

[28] In fact, it is plausible to imagine that even in the states where the average number of visits per user in 1996 is above the cap there are non constrained providers.

Also, all states experienced a decline in utilization in the post policy period. Finally, the drop in visits per user and the drop in the number of users per 1,000 Medicare beneficiaries in the post policy period are much more severe for the high restricted states. [30] The graphs are an approximate visual representation of the estimation strategy used by McKnight (2004, 2006) to study the impact of the Interim Payment System on the number of home care visits received by Medicare beneficiaries. This strategy is illustrated in more in detail in the next section.

2.3.2 Structural Framework

This section outlines the 3 equations that form the empirical framework of this paper. The first equation looks at the impact of the number of home health care visits on the fraction of elderly living in shared living arrangements (structural equation). The second equation, estimated by McKnight (2004, 2006), models the impact of the reimbursement change on the number of home health care visits received by Medicare beneficiaries (first stage equation). Finally, the reduced form equation, the main focus of this paper, estimates the impact of the reimbursement change on the fraction of elderly Medicare beneficiaries that live in shared living arrangements.

More formally, the first equation, the structural equation, in its baseline specification can be written as:

$$y_{ist} = c_1 + c_2 n_{ist} + c_3 State_s + c_4 Year_t + \varepsilon_{ist} \qquad (2)$$

[29] On average, according to March CPS data, during 1988-2001. A description of CPS data is provided in section 2.4.

[30] The hypothesis of absence of differential trends in visits has been addressed more formally by McKnight (2004, 2006).

where y_{ist} is a dummy equal to 1 when individual i in state s in year t lives in a shared living arrangement (Gruber, Engelhardt and Perry, 2005) . The definition of shared living arrangement for a married couple captures situations in which both spouses are frail enough that after the BBA they need to substitute the decline in the provision of Medicare home health care services with informal care provided by somebody that lives with them. My data do not allow me to identify married couples in this situation, so that I have to keep in my sample all married couples of elderly. In so doing, I am including observations on the elderly whose living arrangements are unaffected by the reimbursement change, but for whom substitution toward informal care happens in other ways. For instance, if only one spouse needs home health care and after the BBA home health care agencies refuse to provide their services to the frail elderly, the other spouse might provide the needed informal care. In this case it might not be necessary for this couple to live with another person. Because I can only measure changes in living arrangements as a proxy for changes in informal care, if the estimate of the impact of the policy change on living arrangements is statistically significant, it is likely underestimating the extent of substitution from formal to informal care.

The variable n_{ist} represents the number of Medicare home health care visits received by the elderly Medicare beneficiary i in state s in year t, $State_s$ and $Year_t$ are state and year dummies, respectively, and ε_{ist} is the individual specific random error term. In this paper, I am interested in testing whether c_2 is negative. If the structural Equation (2) is properly specified and estimated, a negative estimate on c_2 implies that home health care visits, by substituting for informal care, allow the elderly to live independently.

If the home health visits were randomly assigned in the population, then Equation 2 could be estimated with Ordinary Least Squares (OLS). However, it is plausible to think that omitted variables bias the OLS estimate of c_2. The direction of the bias is, in principle, unknown. A possible way to try to address this issue, and recover an unbiased estimate of c_2, is to use the impact of the policy change introduced by the IPS as an instrument for n_{it}. The exogenous variation created by the reimbursement change of Medicare home health Care in 1997 suggests that the law change variable, $Restrictiveness_{sc}$, interacted with a dummy variable equal to 1 in the post policy[31] period ($Post_t$) can be used as an instrument for the number of visits that an elderly receives.

There are two reasons that support the use of $Post_t$*$Restrictiveness_{sc}$ as an instrument for n_{ist}. First, it is plausible to assume that, once conditioning on other exogenous right hand side variables like state and year dummies, $Post_t$*$Restrictiveness_{sc}$ is orthogonal to the error term in Equation 2. This assumption seems appropriate in the context of the policy change studied in this paper. In particular, it seems unlikely that the reimbursement change affected living arrangements directly through a decline in the intensity of care per visit. In fact, discussed in the previous section, each home health agency was subject to a per-visit reimbursement limit even before the policy change studied here. Therefore, even before the introduction of the IPS every home health care agency had the incentive to minimize the intensity of care provided during each visit.

Moreover, $Post_t$*$Restrictiveness_{sc}$ seems a good candidate instrument for the number of Medicare home health care visits because the two variables are highly

[31] Years 1998-2001.

correlated. More precisely, McKnight (2004, 2006) finds that $Post_t$*$Restrictiveness_{sc}$ had a statistically significant negative impact on the number of visits received by Medicare beneficiaries. More formally, McKnight (2004, 2006) estimates the following baseline equation:

$$n_{ist} = h_1 + h_2\, Post_t * Restrictiveness_{sc} + h_3\, State_s + h_4 Year_t + \eta_{ist} \quad (3)$$

where n_{ist} is the number of Medicare home health care visits received by individual i in state s during year t, $State_s$ and $Year_t$ are state and year dummies, respectively, and η_{ist} is the individual specific random error term. The identifying assumption of McKnight's (2004,2006) model is that, absent the reimbursement change, and conditional on level differences in the number of visits, states with a higher restrictive measure and states with a less restrictive measure would have had the same trends in the number of visits provided to Medicare beneficiaries in the post-policy period.

McKnight (2006) states that, "…the parameter h_2 measures the impact of living- during the post policy period- in a state that provided an additional one visit per user above the regional (census division)[32] during the pre-policy period."

However, it is possible to interpret the parameter h_2 as the impact of not reimbursing 0.25 additional visits per user in the post policy period. An example might prove useful in illustrating the reasoning beyond this interpretation. I consider two states, in the same census division C. I assume that the average number of visits per user in census division C and in state 2 in 1994 is equal to N-1. I also assume that the average number of visits per user in state 1 in 1994 is equal to N. Because from 1997 onwards states face a cap that is based on 25% of the average number of visits in each

[32] The text in parenthesis is my addition.

state's census division, starting in October 1997 state 1 is reimbursed at most N- 0.25 visits.[33] In other words, state 1, relatively to its 1994 level, is not reimbursed for 0.25 visits. On the other hand, state 2, from 1997 onwards, is reimbursed at most N-1 visits, all the visits provided in 1994. Both states faced similar increasing trends in Medicare use compared to their respective 1994 levels. More formally, the identifying assumption of lack of differential trends implies that state 1 in the post policy period faces a limit, compared to its average utilization, that is more restrictive (by a factor of 0.25 visits) than the one faced by state 2. In other words, the parameter of interest gives the impact of precluding reimbursement of 0.25 additional visits per user, so, to recover the impact of not reimbursing one additional visit per user, h_2 must be multiplied by 4.

Unfortunately, there is not a single large dataset that contains information on both the number of visits received by Medicare Beneficiaries and living arrangement status. Because of this limitation, as explained more in detail in section 2.4, I need to use estimates coming from two different datasets. More precisely, in this paper I use March CPS data[34] to estimate the following reduced form equation:

$$y_{ist} = a_1 + a_2 \, Post_t * Restrictiveness_{sc} + a_3 \, State_s + a_4 Year_t + \upsilon_{ist} \qquad (4)$$

Then, I recover a structural estimate of c_2 by combining my estimate of a_2 with McKnight's estimate of h_2 obtained by estimating Equation 3 with the Medicare Current Beneficiary Survey[35] . Implicit in estimating the reduced form Equation 4 is the assumption I make in the structural Equations 2 and 3, that tighter reimbursement limits

[33] [0.75N+0.25(N-1)].
[34] Section 2.4 describes this dataset in more detail.
[35] A description of Medicare Current Beneficiary Survey Data can be found at: http://www.cms.hhs.gov/LimitedDataSets/11_MCBS.asp.

for Medicare home care visits affect living arrangements through the decline in the provision of home care visits.

For estimating Equation 4, I compare the change in living arrangements in states that faced a more restrictive reimbursement limit with changes in living arrangements in states that face less restrictive reimbursement limits using a difference in differences methodology. To do this, I rely on the assumption that, absent the policy change, states with more restrictive limits and states with less restrictive ones would have had the same trends in living arrangements.

To investigate the plausibility of the assumption, I restrict the sample to years 1988 to 1997 and run a regression where, controlling for state and year effects, I test for the existence of differential trends in shared living arrangements across states with different restrictiveness measures. Column 1 of Table 2.3 shows that the coefficient of interest on the linear trend interacted with the restrictiveness measure is very small and statistically insignificant. I estimate the model in Equation 4 using a linear probability model and clustering standard errors by state (Moulton 1990; Bertrand, Duflo and Mullainathan, 2004).

The parameter a_2 in the reduced form Equation 4 identifies the impact of not reimbursing 0.25 additional visits per user on the fraction of elderly that live in shared living arrangements. By using the same reasoning applied to the interpretation of the parameter h_2, it is possible to recover the impact of not reimbursing one additional visit per user on the fraction of elderly that live in shared living arrangements by multiplying a_2 by 4.

2.4 Data

In order to estimate the reduced form Equation 4, I merge data from March CPS from 1988 to 2001 with 1994 state level data on Medicare Home Care visits from the Health Care Financing Review Medicaid and Medicare Statistical Supplement. The CPS is a large nationally representative survey of 50,000 to 60,000 households that is conducted monthly by the Bureau of Labor Statistics. Every March, a demographic supplement is added to the basic monthly questionnaire. Respondents are in the CPS for four months, out for eight months, and then return to the sample for another four months, so there is a panel component in the CPS. Although the CPS does not contain detailed information for the full sample on health or health utilization (including the use of home health care), it is a very large sample that contains information on living arrangements.[36] It is in fact the availability of a large number of observations that makes the CPS the most suitable dataset to estimate the reduced form Equation 4. I focus on people at least 65 years of age because the vast majority of Medicare home health care users are at least 65 years old. For example, in 1996, the year before the policy change, 92.2 percent of Medicare home health care users were 65 years old or older. I focus on this group also because the aging of population makes the understanding of factors driving changes in living arrangements of the elderly an increasingly important issue (UN, 2005).

I begin my sample in March 1988, the year before the expansion occurred in 1989 and end it in March 2001. I use data until March 2001, despite the introduction of the Prospective Payment System in October 2000, because the living arrangements in

[36] It also allows me to identify the small fraction of elderly not enrolled in Medicare.

March 2001 have been affected for the majority of the previous year by the Interim Payment System.

Table 2.2 presents summary statistics for the pooled sample and different marital status categories, and shows that married individuals are much less likely to live in a shared living arrangement. Moreover, Table 2 highlights that married individuals are more educated on average than everybody except the never married. They also tend to be disproportionately white.

2.5 Reduced-Form Estimation Results

2.5.1 Estimation Results

Table 2.4 to Table 2.9 present estimates of Equation 4. The point estimate of the parameter of interest of the baseline regression 4 is shown in the first row of Table 2.4, and it is statistically significant at the 5 percent level, implying, under the identifying assumption of the model, that a decline in reimbursement of one visit per patient increases the fraction of elderly that live in shared living arrangement by 0.22 percentage points. Because 22.35 percent of the elderly in my sample live in shared living arrangements, the parameter estimate implies a 0.98 percent increase in the fraction of elderly that live in shared living arrangements.

An example might prove useful to understanding the decline in the number of visits reimbursed that a policy change like the one studied here might imply. For this purpose, I use the cross-state distribution implied by the restrictiveness measure of Equation 1 to compare the decline in visits reimbursed in Georgia, a state that experienced a very restrictive reimbursement cap, with Pennsylvania, a state in the

middle of the distribution. More specifically, Georgia in 1994 was providing 102 visits per user, 33 visits above the average number of visits per user in its census division. Pennsylvania, on the other hand, was providing 43 visits per user in 1994, the same average number of visits per user provided in its census division. Trends in the number of users per 1000 beneficiary and in the number of visits per user were very similar in the pre-policy period in Georgia and Pennsylvania, but Georgia from 1998 onwards is reimbursed for at most 93.75 visits per user,[37] implying a decline of 8.25 visits per user compared to its 1994 utilization level.

Pennsylvania, on the contrary, from 1998 onwards is reimbursed for all the 43 visits per user provided in 1994. Because utilization levels increased between 1994 and 1997 in both states, the reimbursement would be low for both states, but the decline in reimbursement would be more pronounced (by a factor of 8.25 visits per capita under the identifying assumptions) for Georgia. Within this framework, the point estimate of the parameter of interest in Table 2.4 suggests that a decline in reimbursement of 8.25 visits increases the fraction of elderly that live in a shared living arrangement by 1.82 percentage points,[38] an increase of 8.11 percent in the baseline fraction of elderly that live in a shared living arrangement. Is this a large effect? The effect is quite large. To give a sense of the magnitude of the effect, I use March CPS data for year 1970 and 2000. In 1970, 31.77 percent of the elderly lived in shared living arrangements but only 23.27 percent did so by year 2000, a decline of 26.75 percent. These numbers suggest

[37] 75 percent of the visits that it was providing in 1994 and percent of the visits that were provided on average in Georgia's Census division, 0.75*102+0.25*69=93.75.
[38] 0.0005516*4*100=0.22 gives the impact of not reimbursing one additional visit.0.22*8.25=1.82 gives the impact of not reimbursing 8.25 additional visits.

that an increase of 8.11 percent in the fraction of elderly that live in shared living arrangements in the most impacted state relative to the median state in the short post-policy period considered in this chapter is a relatively large number.

In column 2 of Table 2.4 I add marital status dummies,[39] as married individuals are less likely to live in shared living arrangements, perhaps because the spouse acts as the first provider of informal care (Norton, 2001). The coefficient of the parameter of interest is smaller in this specification and implies that a decline in reimbursement of one visit per user increases the fraction of elderly Medicare beneficiaries that live in shared living arrangements by 0.19 percentage points. Also, a decline in reimbursement of 8.25 visits increase the fraction of elderly that live in shared living arrangements by 1.57 percentage points. These numbers imply, respectively, an increase of 0.85 percent and 7 percent in the fraction of elderly that live in shared living arrangements. The inclusion of age dummies controls for different propensities to live alone by age as in Gruber, Enghelhardt and Perry (2005). The sex dummy controls for the sexual division of labor that suggests that men acquire lower human capital than women in the production of household goods (Becker, 1991) in younger ages and therefore, everything else equal, are more likely than women to depend on somebody else's work inside the house.

[39] It is possible to think that the policy change might impact marital status, as the decline in the provision of formal care creates an increased demand of informal care from the spouse. I tested for this possibility by running regressions with marital status categories as outcomes and I tried different specifications using as independent variables the $Post_t$*$Restrictiveness_{sc}$ and state and year dummies. Other specifications included age, education dummies and a race dummy. In no case I could reject the hypothesis of absence of impact of the policy change on marital status.

The race dummy is included to capture different cultural norms related to the choice of living arrangement.[40] In particular, Whites are less likely than Asians and Blacks to live in intergenerational households (Kamo, 2000). This variable is also capturing, at least in part, the effect of the higher income and wealth of whites when compared to all other races together. Column 3 of Table 2.4 adds age, sex and race dummies to the specification of column 2.

Because the literature on living arrangements of the elderly suggests that privacy is a normal good (Gruber, Engelhardt and Perry, 2005; Costa 1995, 1999), both the income effect and the cultural effect that the white dummy is picking up suggest that whites are less likely to live in shared living arrangements. Consistent with expectations, the coefficient on the white dummy in column 4 of Table 2.4 is negative and statistically significant at the 1 percent level, implying that whites are 18.2 percentage points less likely than others to live in shared living arrangements. The specification in column 4 of Table 2.4 controls for different intercepts by education. These variables are likely to pick up a direct positive effect of education on health (Cutler, Lleras-Muney, 2006) that increases an individual's ability to live independently and an indirect effect, due to the correlation between education and income, and education and wealth. The coefficients on the education dummies have the expected signs, although only the coefficient on people with a low education level (at most high

[40] I included only one race dummy to minimize measurement error. Measurement error in race coding in the period under study is a possibility because the CPS changed in 1997 the way used to record race. Before 1997 respondents could declare to be in one of the following categories: White, Black, American Indian or Aleut Eskimo, Asian or Pacific Islander, Other. Starting in 1996 the category Other has been suppressed. This might have impacted, for example, the race coding for people of mixed race in an unknown manner. It is a possibility that this has changed the correlation between race and living arrangement for the least numerous races, Asians, American Indian and Aleut Eskimo. However, it is unlikely that the change has affected the correlation of race and living arrangements of whites relative to all other races bundled together.

school) is statistically significant (and positive relative to those with at least a college education). The estimate of the parameter of interest is always statistically significant at the 5 percent level across all specifications, and its magnitude is not substantially altered. The most conservative estimate in column 4 of Table 2.4 suggests that a decline in reimbursement of one visit per user increases the fraction of elderly Medicare beneficiaries that live in shared living arrangement by 0.18 percentage points. Also, a decline in reimbursement of 8.25 visits per user increases the fraction of elderly that live in shared living arrangements by 1.48 percentage points. These numbers imply an increase of 0.8 percent and 6.64 percent in the fraction of elderly that live in a shared living arrangement, respectively.

In Table 2.5, I estimate the model specifications of Table 2.4 over people between 65 and 80 years old, because previous research (McKnight, 2004, 2006) suggested that heavy users of Medicare Home Care services are, on average, 76 years old.[41] The magnitude of the parameter of interest increases, implying that a decline in reimbursement of one visit per user increases the fraction of elderly Medicare beneficiaries between 65 and 80 that live in shared living arrangements between 0.23 and 0.26 percentage points, depending on the specification. In my sample, 21.84 percent of the elderly between 65 and 80 years old live in shared living arrangements, and therefore, the estimates of the parameter of interest in Table 2.5 imply an increase between 1.05 percent and 1.19 percent in the fraction of elderly that live in shared living arrangements.

[41] More precisely, McKnight (2004, 2006) tries to identify the potential heavy users of home health care services. To do so she uses pre policy data to regress home care expenditures on a variety of health measures and uses the coefficients from this regression to predict home care usage on the

In Table 2.6, I show estimates of the model on Medicare beneficiaries at least 80 years old. The parameter of interest is not statistically significant for any specification used. The point estimates are also quite different depending on the specification chosen. This result might be simply driven by the smaller sample size of the oldest elderly.

In Table 2.7, I estimate the model on unmarried people between 65 and 80 years of age because unmarried people in this age range are more likely than married people to be heavy users of Medicare Home care services (McKnight, 2004, 2006). The parameter of interest is statistically significant at the 5 percent level across all different specifications for this group of beneficiaries, implying that a decline in reimbursement of one visit per user increases the fraction of elderly in this group that live in shared living arrangements by 0.45 percentage points. Because the percentage of unmarried elderly between 65 and 80 years old that live in shared living arrangements in my sample is equal to 30.37 percent, this estimate implies an increase of 1.48 percent in the fraction of elderly that live in shared living arrangements. I also estimated the model separately for men and women. The parameter of interest shown in the first row of Table 2.8 is statistically significant only for the sample of women.[42] This result might be driven by the larger sample size of elderly women.[43]

The baseline model estimate of the parameter of interest for the sample of women shown in Table 2.8 implies that a decline in reimbursement of one visit per user increases the fraction of elderly women that live in a shared living arrangement by 0.25

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sample of all beneficiaries between 1992 and 1999. Those that are at the top quartile of predicted home care expenditures are defined "heavy users" of home health care services.

[42] Table 2.9 reports estimation results for the sample of elderly men.

[43] There are 137,843 women and 96,021 men 65+.

percentage points. Because 23.53 percent of elderly women in my sample live in a shared living arrangement, the parameter estimate implies a 1.06 percent increase in the fraction of elderly women that live in shared living arrangements.

2.5.2 Alternative Explanations: Changes in the Sample of Institutionalized Elderly

In this section I argue that my results are not driven by changes in the sample of non institutionalized elderly[44] caused by changes in utilization of skilled nursing facility services by long term and short term care patients. In particular, I focus on two possibilities: I first look at whether the use of long term skilled nursing services by Medicare patients has changed because of changes in reimbursement of Medicare home health care and then I look at whether it is plausible to assume that the Medicare reimbursement of skilled nursing services that occurred in 1997 has increased the fraction of long term care patients in the community.

Considering the first aspect, the BBA changed the price of home health care relative to institutional care for chronic patients that were the ones more likely to be denied Medicare Home health care after 1997 (McKnight, 2004,2006). Since long term institutional care became relatively more attractive after 1997 for long-term care patients, it is important to try to understand whether there was an increase in the use of institutional care in a manner correlated with the parameter in my estimates that

[44] Conversations with staff at the Census Bureau together with information found in the Census documentation at http://www.census.gov/prod/cen2000/doc/sf1.pdf clarified that institutionalized elderly that are not in the CPS sample are those that reside in a facility that provides 24 hours medical or nursing care. Those not residing in that type of facility are in the CPS sample recorded as living in group quarters. I have only 399 observations in the all sample that live in group quarters and therefore shifts from independent living to group quarters are unlikely to be driving my results.

captures the impact of the imposition of limits in reimbursement on Medicare Home Health care on living arrangements of the elderly.

This correlation would create trouble for my interpretation of the results presented in the previous section if those remaining in the community after the Medicare home care policy change are those that are more likely to live in a shared living arrangement independently of home care use. In fact, in this case my results would indicate a substitution between home care and institutional care instead of capturing the substitution between home care and informal care. However, previous literature suggests that skilled nursing facilities services and home health care are not substitutes (Cutler and Sheiner, 1993).

Moreover, even more pertinent for the policy change studied here, previous literature (McKnight, 2004, 2006) has shown that the change in reimbursement of Medicare home health care introduced by the BBA had no effect on the use of long-term nursing home care. This result held even when looking separately at the use of nursing home services by the unhealthiest Medicare beneficiaries.[45]

Considering the second aspect, the BBA of 1997, besides changing Medicare Home Care reimbursement, contains provisions that changed Medicare reimbursement for post-acute care facilities from a cost-based system to Prospective Payment. In contrast to the system in place before, the Prospective Payment System (PPS) limited payment to skilled nursing facilities to predetermined levels (Wodchis, Fries and Hirth, 2004). This change in reimbursement has led to shorter length of stay in rehabilitation

[45] Besides looking at utilization, it seems interesting to investigate whether Medicaid take-up changed after the BBA. I investigated this possibility using the self reported measure of Medicaid coverage during the previous 12 months. There is no correlation between self reported Medicaid coverage and $Post_t$*$Restrictiveness_{sc}$. Results are reported in Appendix III.

and physical therapy (Woodchis 2004; Yip, Wilber and Myrtle, 2002) and has increased the relative risk of discharge to home for Medicare patients compared to non Medicare patients (Wodchis, Fries and Hirth, 2004).

McKnight (2006)[46] has found that the variable $Post_t$*$Restrictiveness_{sc}$ was negatively correlated with the use of short term skilled nursing facility care. More specifically, McKnight (2006) found a negative correlation between $Post_t$*$Restrictiveness_{sc}$ and skilled nursing facility care only when looking at all Medicare beneficiaries. The negative correlation disappeared when the observations that had an inpatient hospital stay were excluded from the sample. Since Medicare covers skilled nursing facility care only after inpatient hospital care,[47] McKnight (2006) interpreted the negative correlation between $Post_t$*$Restrictiveness_{sc}$ and skilled nursing facility use as evidence of a correlation between the IPS and PPS for skilled nursing care.

In principle, if the Medicare reimbursement change for skilled nursing facilities has released from institutional care the patients that are more likely to live in shared living arrangements, my results could be driven by compositional shifts in the sample of non-institutionalized elderly other than by a causal effect of Medicare Home Care reimbursement change.

This scenario is implausible, however, because the CPS does not record people living in a household only temporarily as members of a household. For example, if a post-acute patient who was released prematurely from skilled nursing care covered by Medicare decided to live temporarily with someone who could take care of him/her

[46] McKnight (2006) explains that the dataset that she is using distinguishes the use of skilled nursing care in long term use and short term use.

until complete recovery, this patient would not be recorded as living in that household. This means that it is plausible to assume that the sample of non-institutionalized elderly that I am using is independent of the Medicare reimbursement change for skilled nursing facilities that occurred in 1997.

2.5.3 Alternative Explanations: Dynamics in the Medicaid Home and Community Based Care Services Market

A natural question to ask is whether my results are due to other market dynamics in the home care market and in particular in the Medicaid[48] home care market.

By federal mandate, states are required to provide Medicaid home health services to persons entitled to receive skilled nursing services under the state's Medicaid plan. These services include skilled nursing, home health aid, medical equipment and appliances to be used in the home. Moreover, states have the option of providing additional services like physical therapy, occupational therapy speech pathology and audiology services (United States House of Representatives, 2004).

Medicaid regulations allow states to provide home and community based services under two programs: personal care services and home and community based waiver programs. Since 1975, states have the option of providing personal care services that include help with bathing, dressing, eating, toileting, personal hygiene, light

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[47] And for a limited period of time.

[48] Medicaid is a joint federal-state program intended to provide medical services for the poor. Differently from Medicare, Medicaid varies greatly across states. Some elderly Medicare beneficiaries might also qualify for Medicaid if they meet eligibility requirements for Medicaid in the state where they live.
As a general rule, Medicaid is considered the payer of last resort, so that if a service is covered under both Medicare and Medicaid, Medicare is the first to pay for the cost of the service.

housework, laundry, meal preparation and grocery shopping. By 1998-1999, 26 states offered personal care services (Le Blanc, Tonner and Harrington, 2001).

Home and community based waiver programs, (authorized under Section 1915 c of the Social Security Act) authorized by Congress in 1981, allow states to request waivers for certain Medicaid requirements (such as geographical coverage, for example)[49] to provide care at home for people entitled to skilled nursing services .

These programs attract federal matching funds and can cover a wide variety of services such as personal care assistance, homemaker/home health aid services, adult day care, case management, and respite for caregivers, among others (United States House of Representatives, 2004). Every state except Arizona[50] had waivers in place in the years 1988-1999.

Aggregate data for the elderly in Figure 2.4 show that total expenditures for the mandatory Medicaid home health program and the two optional programs increased during the 90s (Hagen, 2004). Unfortunately, it is very difficult to obtain state expenditures on Medicaid home and community based services only for the population of elderly Medicaid beneficiaries. However, if my results are driven by changes in Medicaid policies, in aggregate, I should see a different pattern of change in the use of home care services between Medicare only patients and Medicaid-Medicare dually enrolled individuals.

This suggests comparing the change in the fraction of elderly on Medicare only receiving home care with the change in the fraction of Medicare-Medicaid dually

[49] Also, states may cover state-selected groups of persons, rather than all persons otherwise eligible, House of Representatives, 2004.
[50] Arizona operates on a 1115 managed care waiver. For an in depth description of The Medicaid Home and Community Based Services Waivers see Harrington et al., 1999.

enrolled that receives home care services. I can recover this information by using National Health Interview Survey[51] aggregate data that indicate that fraction of elderly Medicaid–Medicare enrolled that received home care visits between 1998 and 2001 decreased by 17.97 percent compared to a 15.91 percent decline in the fraction of Medicare only beneficiaries that received home care. The two numbers are remarkably similar, suggesting that it is unlikely that Medicaid policies might have been responsible for my results. To further the claim that Medicaid home and community based services changes are not responsible for my results, it is worth mentioning that McKnight (2006),[52] in a regression that had Medicaid home and community based expenditure as an outcome variable, found that the coefficient of Post*Restrictiveness$_{sc}$ was not statistically significant.[53]

2.6 A Structural Estimate

As CPS does not have information on the number of home care visits received by Medicare beneficiaries, I use the McKnight's (2006) first stage estimate of the parameters h_2 of Equation 3 and my estimate of the parameter a_2 of Equation 4 to recover a structural estimate of c_2. In fact, using the algebra of the Two Stages Least Square estimator,[54] the structural estimate of $\hat{c}_2$ in Equation 2 is equal[55] to:

$$\hat{c}_2 = (\hat{a}_2)/ (\hat{h}_2) \qquad (9)$$

[51] Appendix 2 briefly describes the National Health Interview Survey data used for this specification check.
[52] With Medicare Current Beneficiary Survey data between 1992 and 1999.
[53] Other control variables included state and year dummies, state trends, age group, gender, marital status and several other demographic variables, plus health condition variables. For a more detailed description see McKnight, 2006.
[54] Dee and Evans, 1997.

where $\hat{a}_2$ is the estimate of the law change parameter in the reduced form Equation 4 estimated with CPS data on years 1993- 2000, which is equal to 0.0003394 .[56] The estimate of $\hat{h}_2$ comes from McKnight's (2006) estimate of Equation 3 between years 1992 and 1999 with Medicare Current Beneficiary Survey data and is equal to -0.133.

Using these values and Equation 9, the structural estimate of c_2 is equal to -0.0025, suggesting that one additional visit of home health care decreases the fraction of elderly that live in shared living arrangements by 0.25 percentage points. This is a decrease of 1.2 percent in the fraction of elderly that live in shared living arrangements. To calculate the standard error of this estimate I follow Dee and Evans (1997). Under the reasonable assumption of independence between the CPS sample and the MCBS one, the covariance between the first stage estimate by McKnight and my reduced form estimate is 0. Using this assumption and a Taylor series expansion, it can be shown that the following equation holds:

$$(\text{est } t_{\text{structural}})^2 \approx 1/\left[(\text{est } t_{\text{reduced form}})^{-2} + (\text{est } t_{\text{first stage}})^{-2}\right] \qquad (10)$$

where est $(t_{\text{structural}})^2$ is the square of the estimated t statistics for the structural parameter and $(\text{est } t_{\text{reduced form}})^{-2}$ and $(\text{est } t_{\text{first stage}})^{-2}$ are the square of the inverse of the estimated t statistics for the reduced form parameter and the first stage parameter, respectively. The relation in 10 suggests that, when the first stage is precisely estimated, the estimated t statistics of the structural parameter can be approximated with the t statistics of the reduced form parameter, suggesting that when the reduced form parameter is statistically significant, the structural parameter should

[55] When the first stage is estimated with a dataset and fitted values are created in a second dataset to recover a structural estimate, this estimate corresponds to the Two Sample Instrumental Variable estimate proposed by Angrist and Kruger (1992, 1995).

also be statistically significant. Unfortunately, in this application, because the MCBS data are not available before 1992, in order to estimate the structural parameter $\hat{c}_2$ I had to restrict my sample to years 1993-2000, which caused me to lose 104,233 observations. The estimated t statistics of $\hat{a}_2$ using this reduced sample is equal to 1.35, and the estimated t statistic of the structural parameter $\hat{c}_2$ is equal to 1.2.

2.7 Conclusion

With the aging of populations governments are more and more concerned about the affordability of home health care policies. What will happen to the elderly should the support of publicly provided home health care decrease?

This chapter suggests that informal care can substitute for publicly provided home health care services. I use time and cross-state variation introduced by a sharp decline in reimbursement of Medicare home health services in the United States to estimate reduced form equations of the impact of tighter reimbursement changes on the fraction of elderly that live in shared living arrangements. This is the first study that uses a quasi-experiment to address the issue for virtually all the non-institutionalized population of elderly of a country and therefore it is less subject to selection than previous studies. I also argue that my results are not driven by changed pattern of institutionalization of the elderly or by changes in Medicaid expenditures for home and community based services.

Moreover, I use my reduced-form estimate, and McKnight's (2004, 2006) estimate of the impact of the reimbursement change on the number of Medicare home

[56] There is a temporal mismatch between CPS and MCBS, as year t MCBS data refer to the period January to December of year t. I use CPS March year t+1 data to proxy for MCBS year t data.

health care visits to provide a structural estimate of the impact of the number of Medicare home care visits on the fraction of elderly that live in a shared living arrangement.

The results presented here do not allow me to estimate the welfare costs on the elderly and their caregivers of the Medicare reimbursement change. However, there are margins other than living arrangements that may have been changed by the law change and which might potentially be measurable. For example, the increased demand for informal care might have sizable implications for the labor supply of the informal caregivers (Ettner, 1995, a; Ettner, 1995 b). Using March CPS from 1988-2001 I have estimated reduced form equations of labor supply (as measured by hours of work as well as participation in the labor force for women and men over 40) as the dependent variable and Post*Restrictiveness$_{sc}$ as main explanatory variable, controlling for state, year and demographic variables. I carried out this analysis also by refined age groups in 10 and 5 year intervals for men and women over 40. The estimate of the parameter of interest was never statistically significant. This might indicate a lack of any effect on labor supply following the imposition of limits in reimbursement to home health care, or instead it might be an indication of the inadequacy of the March CPS data to study this outcome. Ideally, I would like to run the reduced form equations of labor supply for people more likely to be impacted by the policy change, i.e. those with parents that are still alive and that are frail, but that is not known in the CPS. In general, future research on the effects of changes in formal care of the elderly on margins other than living arrangements may help in the assessment of the overall impacts of these changes on the welfare of the whole population.

Figure 2.1 Variability Implied by the Restrictiveness Measure

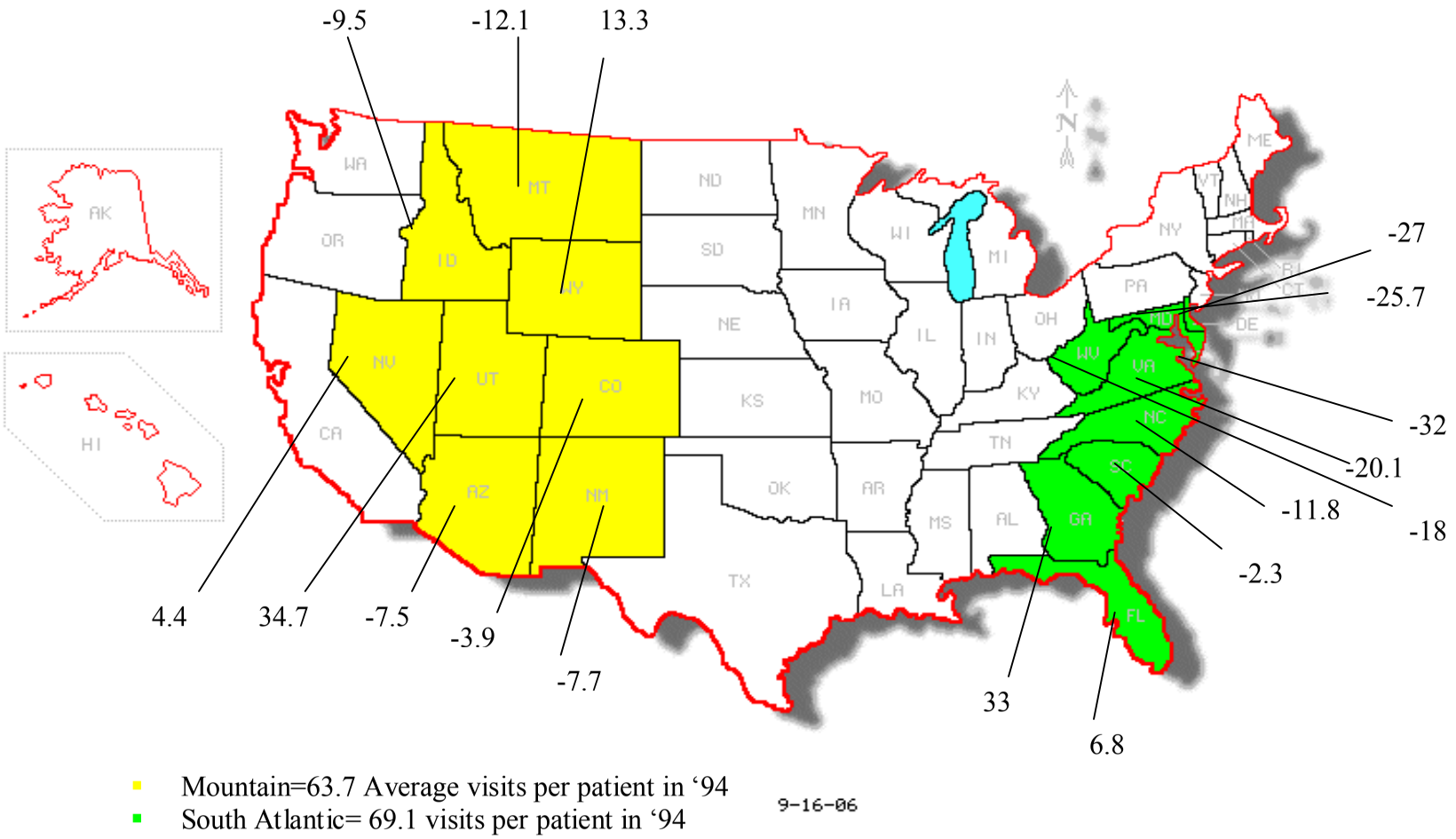
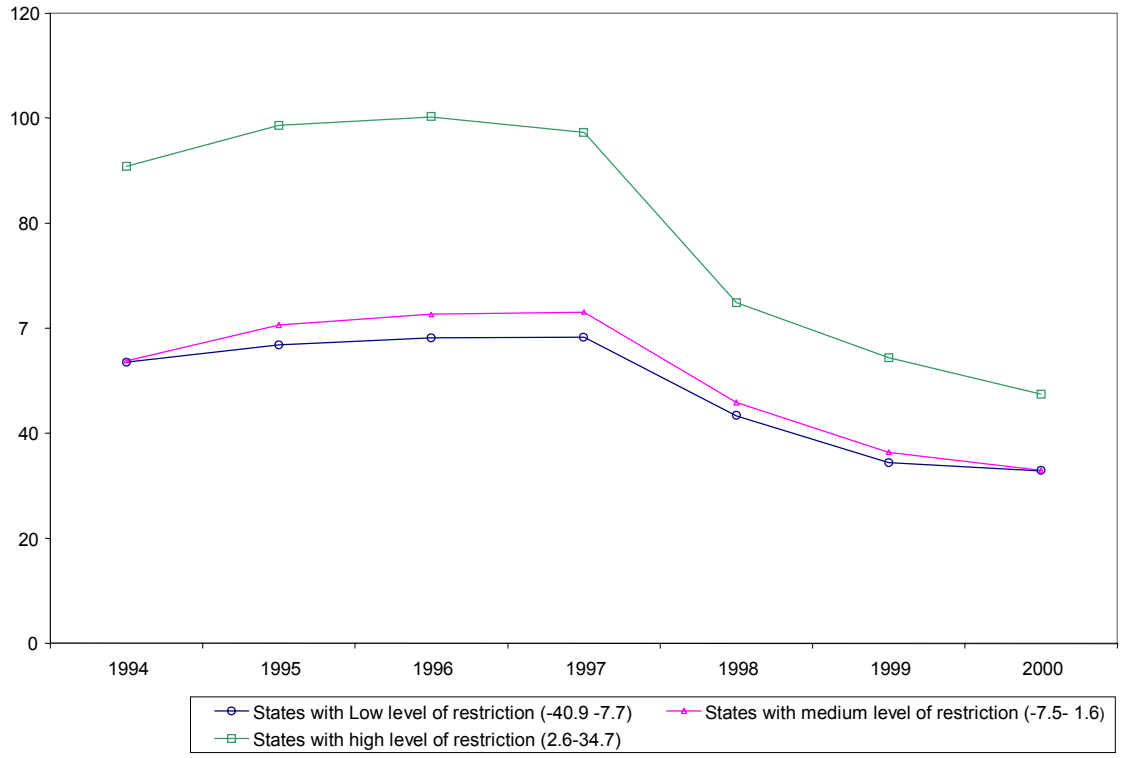
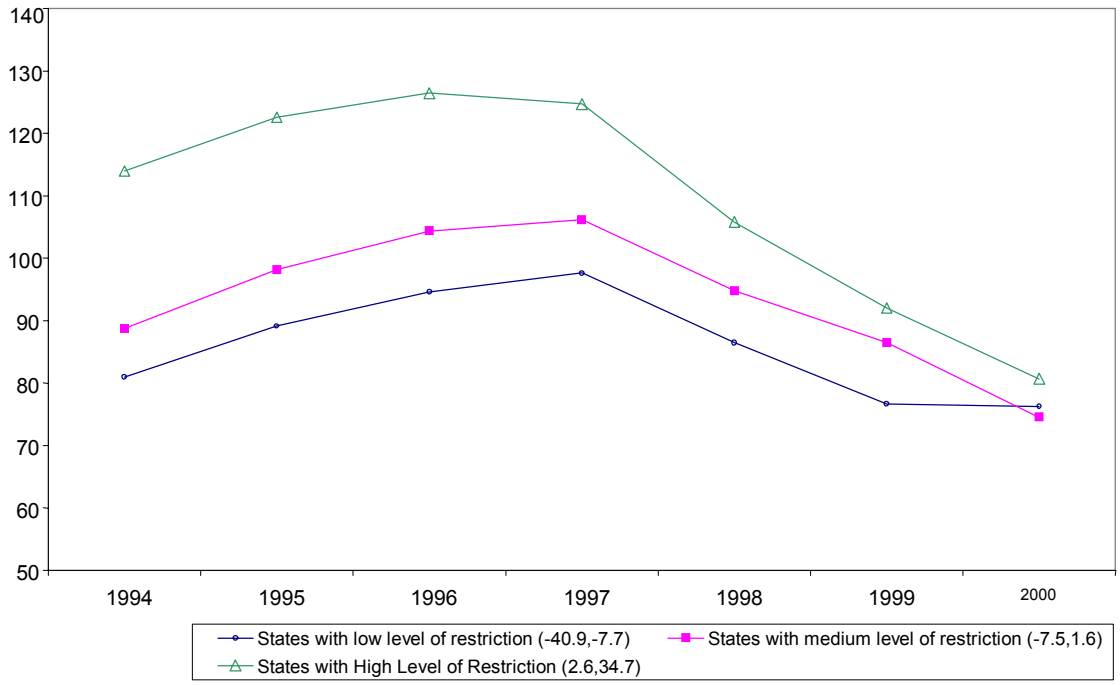


Figure 2.2: Medicare Home Health Care Visits per User



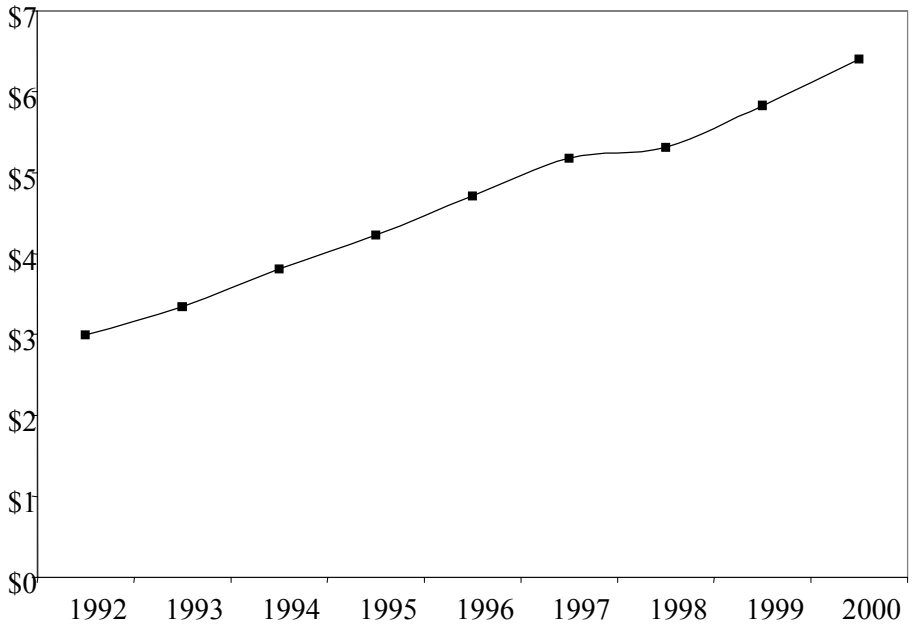
Source: Health Care Financing Review, Medicare and Medicaid Statistical Supplement, various years.

Figure 2.3: Medicare Home Health Care Users per 1000 Beneficiaries



Source: Health Care Financing Review, Medicare and Medicaid Statistical Supplement, various years.

Figure 2.4: Medicaid Expenditure on Home and Community Based Services for Elderly 65+ (in Billion Dollars)



Source: Hagen (2004) and personal conversation with staff at CBO

Table 2.1

Living Arrangements of the Elderly and Public Expenditure on Home Health Care, (as a Percentage of the GDP), Year 2000

	*Fraction of elderly 65+ living in shared living arrangements**	*Public Expenditure on Home Health Care as a % of the GDP*
Sweden	8.36	0.78
Germany	10.64	0.5
Switzerland	13.27	0.2
UK	15.09	0.32
Canada	20.64	0.17
US**	23.06	0.07
Spain	42.61	0.05

* Shared living arrangement means household size>2 if the respondent is married and living with the spouse, household size>1 otherwise. All data for the living arrangements of the elderly in European countries and Canada are from the Luxemburg Income Study, data for the United States are from March Current Population Survey,2000. Data on public expenditures for home health care are from OECD, 2005 for all countries except the US. **For the US, expenditures on Medicare Home Health Care in 2000 are from the Health Care Financing Review, Medicare and Medicaid Statistical Supplement. Data on the US GDP are from the Bureau of Economic Analysis.

Table 2.2

Summary Statistics for Selected Variables. 65+ or Older

	Pooled sample	Married, living with the spouse	Married, not living with the spouse	Separated	Divorced	Widowed	Never Married
Age	74.1	72.5	75.64	71.98	72.08	77.01	74.43
	(6.61)	(5.73)	(7.1)	(5.77)	(5.8)	(7)	(6.86)
living in a shared living arrangement*	.2235 (.42)	.156 (.36)	.30 (.46)	.39 (.49)	.30 (.46)	.29 (.46)	.37 (.48)
Less than high school	.34 (.47)	.29 (.45)	.44 (.5)	.53 (.5)	.33 (.47)	.41 (.49)	.35 (.48)
High school	.38	.40	.30	.3	.36	.38	.35
	(.49)	(.49)	(.46)	(.46)	(.48)	(.49)	(.48)
Some college	.14	.15	.14	.10	.18	.13	.12
	(.35)	(.36)	(.35)	(.30)	(.38)	(.33)	(.32)
College or more	.12 (.33)	.15 (.35)	.11 (.32)	.06 (.25)	.12 (.33)	.07 (.27)	.18 (.39)
Male	.41	.56	.45	.45	.37	.17	.38
	(.49)	(.5)	(.5)	(.5)	(.48)	(.38)	(.49)
White	.90	.93	.86	.64	.86	.88	.88
	(.3)	(.26)	(.34)	(.48)	(.35)	(.32)	(.32)
Observations	233864	127701	2321	2260	12751	78849	9982

* Shared living arrangement means household size>2 if the respondent is married and living with the spouse, household size>1 otherwise.

Table 2.3

Test for Differential Trends in pre Policy Years 1988-1997, All 65+

$Restrictiveness_{sc}$*trend	.00007	.00007	.000066	.000064
	(.000042)	(.00004)	(.000041)	(.00004)
Separated	-	.061**	.001	-.008
		(.0141)	(.016)	(.016)
Divorced	-	-.004	-.023	-.02
		(.012)	(.012)	(.012)
Married, spouse absent	-	-.013	-.026	-.027
		(.015)	(.0137)	(.0142)
Never Married	-	.082	.072**	.077**
		(.01)	(.01)	(.01)
Married	-	-.133**	.143**	-.138**
		(.007)	(.006)	(.006)
Male	-	-	.024**	.023**
			(.002)	(.002)
White	-	-	-.187**	-.168**
			(.0097)	(.008)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.088**
				(.0075)
high school	-	-	-	.033**
				(.004)
some college	-	-	-	-.006
				(.006)
Observations	173445	173445	173445	173445

**: significant at the 1 percent level. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.4

Estimation Results, 65+ Pooled Sample

$Post_t$*$Restrictiveness_{sc}$	.0005516*	.0004854*	.0004887*	.0004478*
	(.00023)	(.00021)	(.00021)	(.00021)
Separated	-	.08**	.023	.016
		(.013)	(.014)	(.013)
Divorced	-	.0046	-.015	-.011
		(.011)	(.011)	(.01)
Married, spouse absent	-	.0098	-.0031	-.0038
		(.014)	(.011)	(.012)
Never Married	-	.072**	.0612**	.067**
		(.01)	(.01)	(.01)
Married, spouse present	-	-.136**	-.147**	-.14**
		(.006)	(.006)	(.006)
Male	-	-	.023**	.021**
			(.002)	(.002)
White	-	-	-.182**	-.164**
			(.0078)	(.0069)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.092**
				(.0083)
high school	-	-	-	.037**
				(.0036)
some college	-	-	-	-.00075
				(.0056)
Observations	233864	233864	233864	233864

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.5

Estimation Results, 65-80 Pooled Sample

$Post_t$*$Restrictiveness_{sc}$	.0006505*	.0006121*	.0006453*	.0005869*
	(.0002881)	(.0002666)	(.0002663)	(.0002612)
Separated	-	.088**	.0254	.0176
		(.0145)	(.0152)	(.0145)
Divorced	-	.0118	-.012	-.0079
		(.0127)	(.012)	(.0118)
Married	-	-.125**	-.139**	-.133**
		(.0066)	(.0069)	(.0063)
Never Married	-	.084**	.069**	.073**
		(.01)	(.01)	(.01)
Married spouse absent	-	.0396*	.021	.02
		(.015)	(.013)	(.013)
Male	-	-	.0289**	.028**
			(.0022)	(.0024)
White	-	-	-.188**	-.17**
			(.007)	(.006)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.095**
				(.0097)
high school	-	-	-	.036**
				(.0036)
some college	-	-	-	.00019
				(.0058)
Observations	190643	190643	190643	190643

*, **: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.6

Estimation Results, 80+, Pooled Sample

$Post_t$*$Restrictiveness_{sc}$	.0003118	.0000625	-.0000215	5.07e-06
	(.0004028)	(.0004023)	(.0004034)	(.0004021)
Separated	-	.066*	.043	.0397
		(.03)	(.031)	(.032)
Divorced	-	-.013	-.0052	-.0019
		(.0196)	(.019)	(.019)
Married, spouse absent	-	-.064**	-.059**	-.059**
		(.019)	(.019)	(.019)
Never Married	-	.0446**	.0488**	.058**
		(.014)	(.014)	(.014)
Married	-	-.188**	-.169**	-.163**
		(.008)	(.007)	(.00651)
Male	-	-	-.004	-.006
			(.004)	(.0043)
White	-	-	-.159**	-.143**
			(.014)	(.013)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.082**
				(.009)
high school	-	-	-	.042**
				(.01)
some college	-	-	-	-.005
				(.01)
Observations	50908	50908	50908	50908

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.7

Estimation Results, 65-80 All but Married, Spouse Present

$Post_t$ *$Restrictiveness_{sc}$	.0011171*	.0010956*	.0011363*	.0011361*
	(.000443)	(.0004423)	(.0004513)	(.0004453)
Separated	-	.087**	.0387*	.0308*
		(.014)	(.0147)	(.014)
Divorced	-	.0085	-.0072	-.00057
		(.013)	(.013)	(.013)
Married, spouse absent	-	.038*	.027*	.028*
		(.015)	(.013)	(.014)
Never Married	-	.088**	.0803**	.087
		(.011)	(.011)	(.011)
Male	-	-	.0043	.0013
			(.0069)	(.0067)
White	-	-	-.167**	-.147**
			(.008)	(.0066)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.119**
				(.01)
high school	-	-	-	.061**
				(.007)
some college	-	-	-	-.0011
				(.013)
Observations	76484	76484	76484	76484

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.8

Estimation Results, Women 65+

$Post_t$*$Restrictiveness_{sc}$	.0006323*	.0005696*	.0005802*	.0005471*
	(.0002496)	(.0002419)	(.0002408)	(.0002422)
Separated	-	.118**	.066**	.057**
		(.015)	(.015)	(.014)
Divorced	-	-.0012	-.0108	-.0044
		(.011)	(.011)	(.011)
Married, spouse absent	-	.0074	.00565	.0054
		(.0168)	(.0154)	(.0156)
Never Married	-	.083**	.0802**	.091**
		(.011)	(.011)	(.011)
Married, spouse present	-	-.154**	-.152**	-.145**
		(.006)	(.006)	(.005)
White	-	-	-.183**	-.164**
			(.0082)	(.007)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.107**
				(.009)
high school	-	-	-	.047**
				(.004)
some college	-	-	-	.002
				(.007)
Observations	137843	137843	137843	137843

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Table 2.9

Estimation Results, Men 65+

$Post_t$*$Restrictiveness_{sc}$	.0004417	.0003664	.0003729	.000322
	(.00037)	(.0003)	(.00037)	(.00036)
Separated	-	.028	-.023	-.027
		(.015)	(.015)	(.015)
Divorced	-	.0097	-.0167	-.014
		(.015)	(.015)	(.015)
Married, spouse absent	-	.0075	-.0028	-.0033
		(.02)	(.019)	(.019)
Never Married	-	.048**	.034*	.034**
		(.014)	(.014)	(.014)
Married, spouse present	-	-.128**	-.135**	-.129**
		(.008)	(.008)	(.0076)
White	-	-	-.18	-.164
			(.0088)	(.008)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.078**
				(.009)
high school	-	-	-	.031**
				(.005)
some college	-	-	-	.002
				(.006)
Observations	96021	96021	96021	96021

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

Chapter 3: Ownership and Exit Behavior When Entry Costs Are Low: The Case of Home Health Agencies in California

3.1 Introduction

This chapter represents a preliminary investigation of a new dataset on home health utilization in California. California is a large state with a wealth of good health care data and perhaps both these reasons explain why California is such a popular choice for research in health economics.[57] Table 3.1 shows some measures of home health care utilization in California and in the United States as a whole for the period 1996-2000 from the Medicare and Medicaid Statistical supplement. The percentage change in the number of Medicare beneficiaries that used Medicare home health care between 1996 and 2000 and the percentage change in the number of visits per user between 1996 and 2000 are similar for California and the United States as a whole. In fact, columns 2 and 4 of Table 3.1 show that between 1996 and 2000 the number of users of Medicare home health care per 1000 beneficiary dropped by 32 percent in the United States as a whole. In California, during the same period, the number of users per 1000 beneficiaries dropped by 32.5. Table 3.1 also highlights that, between 1996 and 2000, in the United States as a whole the number of visits per user dropped by 50 percent and the number of visits per user during the same period dropped by 45 percent in California. When looking at level differences in the number of users of Medicare home health care for 1,000 beneficiaries between 1996 and 2000, Table 3.1 in columns 2 and 4 shows that, on average, beneficiaries in California received fewer

visits per user than the average visits per user received by beneficiaries in the United States as a whole. A possible explanation for this difference may be the better health of Medicare home health care users in California compared to the country as a whole.

In this chapter, I investigate the impact of the IPS on exit of for-profit and not-for-profit home health care agencies. Figures 3.1 and 3.2 suggest that the two types of providers exited at different rates during the period 1994-2000. Figure 3.1 shows the "survival function", i.e. the probability that an agency lasts at least until period t given that it lasted until period t-1. In Figure 3.1 ownership=1 means "for profit" and ownership=2 means "not-for-profit". Figure 3.1 shows that, after an initial period in which the two types of agencies seem to have the same probability of surviving, for-profit agencies have a lower probability of surviving than the probability of surviving for not-for profit agencies. Figure 3.2 shows the fraction of agencies that leaves the market in a given year. Figure 3.2 shows that, at any point in time, for-profit agencies exit at higher rates than not-for-profit agencies. It is also apparent that the difference in the exit rates between the two types of agencies is increasing over time.

The reimbursement change introduced by the BBA in the home health care market represents an interesting case to study differences in exit behavior between for-profit and not-for-profit providers because of the coexistence of five facts. First, home health care agencies face extremely low entry barriers which might contribute to a selection of providers that are different along a series of observable and unobservable characteristics. This raises the question of whether the greater

[57] Papers that have used health care data in California are numerous. For example, See Duggan (2000), Evans and Kim (2006) and Robinson (1996).

likelihood of provider heterogeneity in the home health care industry (relative to industries such as hospitals) translates into different responses by ownership type to the decreased profitability of Medicare home health care reimbursement.

Second, one might expect greater provider heterogeneity in the home health care market compared to other health care markets because government monitoring of home health agencies is more difficult than monitoring of other health care providers. In fact, all home health care agencies provide care in the home of their patients.[58] This means that surveyors need to have patients' authorization to inspect the home health care personnel during the visits. Anecdotal evidence suggests that such collaboration is not easy to obtain (Gao, 1997). In addition, home health services are provided in several different locations, various patients' homes, making it very costly to sample more than one visit and in fact, this sampling is very rarely done in practice (Gao, 1997). Thus, it is more likely that non-compliant providers exist in the home health care industry than in other markets and this, in turn, strengthens the hypothesis of greater provider heterogeneity in the home health care industry compared to other health care markets.

Third, home health care agencies receive most of their revenues from Medicare, making it less troublesome than in most other health care markets to identify the impact of government reimbursement on exit. Forth, the IPS allows me to combine in my analysis of exit time series variation and cross provider variation. Fifth, since Medicare reimbursement of home health agencies varies across localities, I can construct a precise measure of the market in which an agency operates and

[58] Hospices also can provide care in the home of their patients. However, a large fraction of hospice care is not provided in the home of the patients.

control for this measure in my estimate of the impact of the BBA. This last point represents the most novel contribution of this chapter.

3.2 Review of the Empirical Literature

My study adds to the literature that examines whether for-profit and not-for-profit providers respond differently to financial incentives. For example, authors that have studied hospitals have concentrated on differences by ownership type on the provision of uncompensated care (Lewin and Eckels, 1988; Norton and Staiger, 1994), market power (Gruber, 1994), cost and quality (Sloan et al., 2001), offer of unprofitable services (Gray, 1986; Mark et al., 1997) mortality (Hartz et al. 1989; Shortell and Huges,1988; Ettner and Hermann, 2001), charges (Gray, 1991; Hall and McGuire, 1987; Sloan et al, 2001), upcoding (Silverman and Skinner, 2001; Dafny, 2005), length of stay (Kuttner, 1996) and the care of the indigent after changes in the profitability of treating them (Duggan, 2000).[59] With the exception of Dafny (2005), these studies find little differences in the behavior of for-profit and not-for-profit hospitals. This trend does not appear when considering exit. For example, Chackravarty et al. (2005) find that for-profit hospitals are more responsive than not-for profit ones in their exit behavior following demand shifts proxied by changes in the fraction of the elderly population in the area where the hospital operates.

Several studies have focused on health care providers other than hospitals to investigate differences in behavior between for-profit and not for-profit entities. For

[59] The empirical literature on hospitals is quite extensive. For a recent review that uses meta analysis, See Eggleston et al. (2006).

example, Ozgen and Ozcan (2002) find that not-for-profit dialysis centers tend to be more inefficient than for-profit dialysis centers, but for-profit centers tend to behave more inefficiently than not-for-profit centers when the concentration of for-profit providers in a given market (measured by a Metropolitan Statistical Area or by a county for providers in rural areas) increases. Another study by Sindelar and Olmstead (2004) looks at the impact of managed care penetration on substance abuse treatment services and finds that managed care causes for-profit providers to offer four (out of 26) additional services, causes public to offer four fewer services, and has no impact on the number of services offered by not-for-profit providers. Lindrooth and Weisbrod (2007) examine hospices' response to changes in Medicare reimbursement and find that for-profit hospices are significantly less likely than not-for-profit hospices to admit patients with short, unprofitable length of stay.

Other studies on skilled nursing facilities have found behavioral differences between ownership types in nursing home utilization (Santerre and Vernon, 2005) and quality of care (Chou, 2001). A study by Dalton and Howard (2002) examined the impact of the introduction of a Prospective Payment System for Skilled Nursing Facilities in 1998 on exit patterns. The authors estimated an ordered probit of exit from a market for skilled nursing facilities controlling for state and county fixed effect. They did not find differences in exit behavior by ownership type.

The most relevant study for this chapter is the one by Horwitz (2005), that looks at whether for-profit hospitals are more likely than not-for-profit hospitals to exit from the home health care market after the introduction of the IPS in 1997. The author estimates a probit model that controls for the region in which a hospital

operates. She finds large differences in hospitals' responses to the change in the profitability of home health care. Horwitz is also interested in looking at whether there are spillover effects in behavior between for-profit and not-for-profit hospitals. To this end, she interacts ownership dummies with a measure of market defined as a metropolitan statistical area in which for-profit hospitals accommodate over 20 percent of all admissions. Although this study suggests that for-profit and not-for-profit providers might behave very differently when Medicare home health care is considered, the study by Horwitz (2005) did not control for the cross provider measure of restriction in reimbursement based on 1994 levels. The parameter that Horwitz estimates measures the percentage change in exit from the home health care market for for-profit and not-for-profit hospitals.

In this chapter, I provide an upper and lower bound to the estimate a parameter that quantifies the impact of a decline in reimbursement of one visit per user on the percentage change in the probability that an agency exits at time t given that it lasted until time t, taking into account the cross provider variation implied by the way the reimbursement limit is constructed. By considering the cross provider measure of variation together with the time series variation, I provide a more complete picture of the impact of the law on exit. Moreover, since entry barriers in the Medicare home health care market are quite low, many other providers besides hospitals are involved in the provision of such services. This observation implies that the market for Medicare home health care services is broader than the one considered by Horwitz. In the current analysis, I investigate a wider variety of providers. By using information based on 1993 data regarding whether agencies in the sample that I

am using were owned by an in-patient facility, I find that 68 percent of the agencies were free-standing and only 32 percent were hospital based. Finally, the measure of a market in which a hospital operates that Horwitz (2005) uses, contrary to the one that I propose, is not grounded in the institutions governing the Medicare Home Health Care market.

3.3 Review of the Theoretical Literature

Depending on the model considered, the theoretical literature on behavioral differences between for-profit and not-for-profit institutions yields different predictions on exit behavior of not-for-profit and for-profit agencies. There are several models that assume altruism of the not-for-profit institutions.[60] For example, Lakdawalla and Philipson (1998, 2006) argue that not-for-profit firms have a higher preference for output than for-profit firms. Because of this difference in objectives, not-for-profit firms facing declining profit opportunities should decrease the quantity of services provided, and therefore exit at lower rates than for-profit firms. Another model by Besley and Ghatak (2005) suggests that altruistic entrepreneurs and altruistic workers sort in "mission oriented institutions," identified with not-for-profit firms. In this context, the major virtue of private not-for-profit firms is that entrepreneurs (principals) and workers (agents) have similar mission preferences, thereby minimizing the agency problem and the use of compensation as an incentive. In this scenario, a not-for-profit agency might be able to better deal with decreased

[60] There are other authors that assume that not-for-profit entities are more altruistic than for-profit entities, See Malani et al. (2003) for a review. The models by Lakdawalla and Plilipson (1998, 2006) seems more complete, because the two authors make predictions about the market structure that should emerge for given distributions of preferences for profits, quality and quantity.

reimbursement generosity because entrepreneurs and workers might agree to continue pursuing their altruistic mission even with decreased monetary compensation.

Other models do not rely on altruism to predict differences in behavior between for-profit and not-for-profit firms. For example, Hansmann (1998) argues that not-for-profit organizations respond more slowly than for-profit organizations to changes in financial incentives, because not-for-profit firms face higher transaction costs. More specifically, because the not-for-profit firms have no owners, managers and workers at not-for-profit firms have more power than workers in for-profit ones and may successfully avoid closure of the firm even when the profitability of its services has decreased. The managers and workers at not-for-profit firms might, for example, resist closure because they are reluctant to lose their jobs and relocate to another firm.

Glaeser and Shleifer (2001) suggest that an entrepreneur that chooses to establish a not-for-profit firm gives up the appropriation of profits and, in so doing, gives the customer a credible signal that he will not cut on the quality of the services provided. This argument suggests that not-for-profit firms should be prevalent in those markets where the quality of the good is difficult to assess, as it is the case in the health care sector.

In the home health care market, the law states that doctors are responsible for referring patients to the home health care agencies. Thus, Glaeser and Shleifer's (2001) intuition applied to the response of for-profit and not-for-profit agencies to the cuts introduced by the BBA suggests that doctors might have perceived that for-profit home health agencies had a stronger incentive than not-for profit agencies to decrease

the quality of care provided to their patients after the cut in reimbursement introduced by the BBA. As a consequence, in order to avoid adverse health outcomes for their patients, doctors might have increased their referrals to not-for-profit agencies versus for-profit agencies. In this situation, for-profit agencies not only faced a cut in reimbursement, but also a decline in the volume of business induced by decline in referrals unlikely to have happened for not-for-profit firms and, as a consequence, for-profit agencies should exit the market at a faster rate than not-for-profit agencies.

Another model of hospital behavior by Pauly and Redish (1973) suggests that, since not-for-profit have no owners, they maximize the income of the most relevant stakeholders, identified as the physicians. In this context, the not-for-profit hospital, for a given number of medical staff, would produce the same quality and output produced by the not-for-profit hospital. Applied to the home health care market, the argument by Pauly and Redish (1973) suggests that the home health agency acts to maximize the income of the nurses, who, being the ones that admit the patients, play a role similar to the one that doctors play in the original model by Pauly and Redish (1973).

This proposition implies that one should not expect differences in behavior between for-profit and not-for-profit home health care providers when financial incentives change, as both providers care about profits and the only difference between the two types of agencies is that in the not-for-profit case the nurses receive a larger share of the total reimbursement.

3.4 Limit per-user

In this section, I illustrate how I constructed the cross-provider measure of reimbursement generosity implied by the IPS. The BBA states that, starting in October 1997, each agency is subject to an average per beneficiary limit that is a blend between the agency's 1994 per patient cost and the per patient's cost in the agency's census division. I define a "consolidated entity" a firm composed by a parent and at least one branch.[61] In this chapter, I use the following measure of cross-firm variation based on 1994 data:

visitperpatient94= $(V_i)/(N_i)$ (1)

where, for a stand alone entity, V_i is the number of Medicare visits for which Medicare is the primary payer for agency i and N_i is the number of people at least 65 years old that the agency has treated. When considering consolidated entities, V_i is the sum of visits for which Medicare is the primary payer across the parent and all branches and N_i is the sum of patients that are at least 65 years old across the parent and all branches. I use this approach with the consolidated entities to follow as closely as possible the Medicare home health care regulations that specify that parent and branches need to be considered as a single entity when computing the limit.[62] The per-beneficiary limit in the sample defined in the next section is between 1.25 and 298.12.

Since the above figure is blended for each agency with the same census division per patient limit, the higher is the variable **visitperpatient94** the more restrictive is the final blended limit faced by each agency. For example, consider two

[61] With this definition, I mimic the jargon used by OSHPD that calls "consolidated licenses" those licenses released to a parent and its branches.

agencies with a number of visits per user in 1994 equal to 10 and 11, respectively. Also, assume that the Census division average number of visits per user is 5. The limit per user faced by agency 1 from 1997 onwards is 0.75*10+0.25*5=8.75 and the limit per user faced by the second agency is 0.75*11+0.25*5=9.5. In this example, after the policy change, agency 1 is not reimbursed 1.25 visits per user compared to its 1994 level and agency 2 is not reimbursed 1.5 visits per user compared to its 1994 level. This finding implies that a one unit increase in the level of **visitsperpatient94** is a decrease in reimbursement per user of 0.25 visits compared to baseline 1994 levels. In the datasets for years 1995 to 2000 there are also agencies that were not in the market in 1994. The law states that these agencies are assigned the median limit assigned to the agencies available in the market in 1994. Unfortunately, from 1995 onwards, my data do not allow me to identify the number of patients 65 years of age or older.[63] This drawback prevented me from constructing for these agencies a reliable measure of cross agency variation. Thus, in the analysis below, I focus my attention on those agencies that were Medicare certified in 1994. In 1996, the year before the policy change, such agencies had 70 percent of the market share as measured by the number of Medicare visits.

3.5 Hazard Specifications

In this section, I present the econometric framework that I use to investigate the percentage change in the probability that an agency closes in year t given that it

[62] This is in general true both for cost reporting purposes and certification (Federal Register, 1998).
[63] The age breakdown is: patients less than 10 years of age, patients between 10 and 20, patients between 21 and 30,patients between 31 and 40, patients between 41 and 50, patients between 51 and

has been in the market until year t due to a decline in reimbursement of one visit per user.

More formally (Wooldridge, 2002), let T>=0 denote the random variable that indicates the duration in which a home health agency is in the market; let t be a particular value of T.

The cumulative density function of T can be defined as

$$F(t)= P(T<=t) \qquad t>=0 \qquad (2)$$

The survivor function, which denotes the probability that an agency lasts at least t periods, can be written as:

$$S(t)= 1-F(t) \qquad (3)$$

The hazard function, that is the probability that an agency closes at time t, given that it has lasted until t, can be written as:

$$\lambda(t)=\lim_{h\downarrow 0}\Pr(t\leq T<t+h|T\geq t)/h \qquad (4)$$

When covariates are included, the most common representation of the hazard function in the literature is the proportional hazard one. In formulas:

$$\lambda(t,x,\beta,\lambda_0)=\lambda_0(t)\phi(x,\beta) \qquad (5)$$

where $\lambda_0(t)$ is called the baseline hazard.

The key difference in the various models estimated in the literature is on the assumption made regarding how the hazard varies over time, a feature called duration dependence. Depending on whether the hazard increases, decreases or is constant over time it is said to have positive, negative or no duration dependence, respectively. The Kaplan Meyer curves displayed in Figures 3.1 and 3.2 seem to suggest that the

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60, patients between 61 and 70, patients between 71 and 80, patients between 81 and 90 and patients

hazard in this application might be monotonic. However, the Kaplan Meyer representation does not include covariates; thus, inferences to the case in which covariates are included might not be valid.

In this application, I first estimate (5) using a parametric model, more specifically a Weibull model that assumes that the hazard increases over time. More formally, the hazard function in this case has the following form:

$$\lambda(t;X)=\exp(X,\beta)\alpha t^{\alpha-1} \quad (6)$$

The most common alternative to assuming that the hazard has a specific functional form is to avoid assuming any functional form altogether and to estimate the parameters β using the Cox model. Unfortunately, the Cox model is not an attractive alternative when there are many ties (Kiefer, 1988). Because I have many ties, i.e. many agencies leaving the market at the same time, I have decided not to use the Cox model. In addition to estimating Equation (6) I also estimate a piece-wise-constant Exponential model. In this specification, the time axis is divided in intervals (in my case I use seven intervals, one per year) and it is assumed that the hazard rate is constant within each interval, but may vary between intervals. This specification has the advantage that the overall shape of the baseline hazard does not have to be specified in advance. The hazard has the form:

$$\lambda(\tau;X)= \lambda_{\tau} \exp(X,\beta) \quad (7)$$

where τ =1,2…7 denotes the intervals . The constant interval specific hazard rates are equivalent to having interval specific intercepts in the overall hazard (Jenkins, 2005).

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91 or older.

In my analysis, the main variable of interest is a time varying covariate that takes the value of 0 for the first three periods and is equal to **visitsperpatient94** for the remaining 4 periods.

To estimate (6) and (7) by maximum likelihood I need to assume ignorable censoring and strict exogeneity of the time varying covariates (Wooldridge, 2002). Ignorable censoring means that, once conditioning on the time in which each agency was first licensed and the market in which the agency locates, censoring is independent on the process determining the survival of the agencies in the market. In my application, I have right censoring since there are still agencies in the market after 2000 and for them I only know that they last in the market at least until 2000. Strict exogeneity of the time varying covariates means that the path of the covariate is independent on whether the observation leaves the initial state. Here, the path of the time varying covariate that captures the impact of the BBA is determined by a law change, so that this assumption seems reasonable.

Furthermore, in the piece-wise-constant Exponential model, the other time varying covariates, the dummies that shift the hazard each year, are defined independently on whether an agency is still in the market, so that the assumption of strict exogeneity holds for these variables as well.

3.6 Data

The data used for this study are the Annual Utilization Data for Home Health Agencies and Hospices for years 1994 to 2000 provided by the Office of Statewide Health Planning and Development (OSHPD) of the state of California. The datasets

contain information from two sources: a questionnaire filled out by each home health agency and administrative data added by the OSHPD.[64] The administrative information that is particularly useful for this study is a permanent identifier attached to each home health care agency which allows it to be traced over time; the date in which the agency was licensed for the first time; and information on whether the agency is licensed in any given year. The questionnaire also addresses whether an agency is a branch or a parent. I wanted to check that the dataset from OSHPD was somewhat reliable and to this end Table 3.2 reveals that the number of Medicare visits per year reported in the OSHPD dataset is not substantially different from administrative data contained in the Medicaid and Medicare Statistical supplement issued by the Center for Medicare and Medicaid services.

Information regarding whether an agency is a parent or a branch is useful because the Balanced Budget Act requires that the limit per user needs to be calculated with parent and branches considered as one single entity. In this section I explain how I identified the consolidated entities in my dataset.

Ideally, one would be able to determine for each year which agencies in the market are consolidated entities. Unfortunately, this information is not available and data pertaining to different years present various problems. For example, I am able to identify for each year between 1995 and 2000 which agencies received a consolidated license for the first time. Therefore, if an agency that was first licensed and certified for Medicare in 1970 opens a branch in 1996, the 1996 dataset contains a variable

[64] Conversations with the staff at the California Department of Health Services (DHS) clarified that failure to report should imply the revocation of the agency's license by the DHS. However, DHS personnel also clarified that the rule is so drastic that it has never been applied.

indicating that for the first time that year the two agencies received a consolidated license. However, if an agency that was first licensed in 1970 opened a branch in 1971 and both agencies were still open in the period under study, the information on the agencies being consolidated would be missing.

Moreover, the 1994 dataset does not contain information regarding which are the agencies that received a consolidated license for the first time during 1994. The information indicating which agencies had a consolidated license for the first time in year t is available in the electronic dataset for years 1996 to 2000 and also in the printed copy of the report that I found at the Library of Congress for the year 1995.

In this chapter, I try to recreate the needed information, namely which entities are consolidated on the market in each year. To achieve this, I first observe that for each year the agencies that presented a consolidated license for the first time that year had the same name. For example, the parent "Assisted Home Recovery" in 1996 opened a branch that was also called "Assisted Home Recovery". Since for each year I know the name of each agency and whether an agency is a parent or a branch, I recreated the agencies that were consolidated entities by matching them by name. This method relies on assuming that all agencies that are consolidated entities share the same name.

In most cases home health agencies were stand-alone firms or entities composed of only one agency that declared itself to be a parent and only one or several agencies with the same name that declared themselves to be branches. In some other cases there were several parents and branches that had the same name (for example Kaiser Home Health), so it was not possible to identify which were the

branches to attribute to a parent. I deleted these observations from the dataset. They represent 11.25% of the agencies in the 1994 data. This implies that my results do not consider the impact of the policy change on agencies that are part of a chain. Among these agencies, seventy percent are for-profit. Their median year of entry in the market is 1989 and 51 percent are located in a rural market area. Chakravarty et al., (2005) have found that being part of a chain significantly decreases exit for for-profit compared to not-for-profit hospitals, but does not have any impact on behavior of not-for-profit hospitals. This finding does not necessarily hold for home health agencies. In particular, it is reasonable to expect that in a market such as that of hospitals, in which investments are relatively substantial, chains that need to disinvest on a large scale might respond more slowly than hospitals that are stand-alone entities. In the home health care case, this is unlikely to occur as investments made to enter the market are negligible. Unfortunately, I cannot properly test whether agencies that belong to a chain behave differently from agencies that do not, as this would require me to be able to construct a cross agency measure of variation.

3.7 Sample and Summary Statistics

An important feature of the data is the administrative information regarding whether an agency is licensed in any given year. More precisely, even if every agency should send their data to the OSHPD and the OSHPD solicits the data several times before constructing the final datasets, some agencies fail to comply. Since the OSHPD is the entity that releases the licenses, it knows whether an agency has been licensed for the year but has not responded to the questionnaire. This information is

available in the dataset released by the OSHPD. [65] In my analysis, I consider an agency to be on the market in year t if it had been licensed in year t. I believe this to be a reasonable assumption, bearing in mind that an agency has to pay for the licensing process each year and it is doubtful that an agency would pay for a license and not use it at all.

Unfortunately, there is a non-response rate of 9.25 % among agencies that were in the market in 1994 and non-response is positively correlated with exit. In fact, 57% of non-respondents exited the market in the period under study. This pattern might be due to the fact that an agency has to fill in the questionnaire relative to year t in March of year t+1, so the questionnaire might be delivered to the agency once it has already closed even if it was in operation during year t. In order to use non-respondents in my analysis, I have to impute Medicare certification and ownership type in the year in which an agency does not respond. These two variables turn out to be remarkably stable among respondents and in the present scenario I am relying on the assumption that this pattern applies to non-respondents in any year t as well. So, for example, if agency j declared in 1994 to be "for-profit" and "Medicare certified" and in 1996 agency j does not answer the questionnaire sent by the OSHPD, I assume that the agency is still for-profit and "Medicare certified".

Table 3.3 displays the distribution of the variable **visitperpatient94** in 1994 on the sample of agencies in the market in 1994. In addition, the Table displays the

[65] Specifically, the categories are thirteen for each year t: "License in suspense, no report required", "license in suspense, data reported", "license in suspense, non responder", "Facility closed, data reported", "Facility closed, non responder", "Facility licensed, but not in operation", "Facility open, data reported", "Facility open, non responder", "Facility open, partial year data reported", "Facility open, data from 2 or more owners", "Facility closed data unavailable", "New, first licensed in year t, data reported", "New, first licensed in year t, non-respondent".

distribution of the variable **visitperpatient94** by ownership type. Finally, in the last 2 columns, the Table displays the distribution of the variable **visitperpatient94** among non respondents in any given year and among agencies that closed in any given year. Table 3.4 shows the distribution of the variable **visitperpatient94** for the entire sample and for the sample of for-profit and not for-profit agencies for year 2000.

Table 3.3 shows that agencies that closed and agencies that did not respond the questionnaire have a higher value of the variable **visitperpatient94**, suggesting that those agencies that were more restricted were the ones more likely to not respond the questionnaire by OSHPD. Since closure is positively correlated with non response, those agencies were also more likely to exit. Another way to look at the relationship between non-response and the level of visits per patients provided in 1994 is to run the following regression:

$$w_{it} = c_1 + c_2 Post_t + c_2 Post_t * Visitsperpatient_{i1994} + n_t + \varepsilon_{it} \quad (8)$$

where w_{it} is a dummy variable that is equal to 1 if agency i at time t does not respond to the questionnaire , $Post_t$ is equal to 1 for years 1997 to 2000 and it is equal to 0 for years 1994 to 1996. Estimation results of Equation (8) are shown in Table 3.5. It seems that the more restrictive the limit that an agency is supposed to face, the more likely it is that the agency will not respond, as the coefficient on c_3 is statistically significant at the 10 percent level.

Table 3.6 shows the distribution of for-profit and not-for-profit firms in the 26 markets defined by the different Medicare reimbursement indexes in 1994 and 2000. The Table shows that just over half of the agencies locate in the market defined as "rural" for reimbursement adjustment purposes. The Table also shows that for-profit

and not-for-profit agencies seem to locate in different areas. As a final note, for-profit and not-for-profit agencies differ in the year in which they were first licensed. The median year of first license for for-profit firms is 1990 and the median year of entry for not-for-profit firms is 1983.

3.8 Estimation Results

Tables 3.7 present estimation results of Equations (6) and (7). The law change variable is a time varying variable that is equal to 0 for years 1994-1996 and is equal to the variable **visitperpatient94** for years 1997-2000.The specifications in columns 2 and 4 of Table 3.7 add dummies indicating the year in which an agency was first licensed as additional controls. These variables capture the idea that firms have a life cycle and that different firms are at different stages of that life-cycle at every point in time in the market. As a consequence, these firms might react in a variety of ways to the same economic shock (Olley and Pakes, 1996; Campbell and Abbring, 2005). When considering the Weibull specification, the exponentiated coefficient on the law change variable displayed in columns 3 and 4 of Table 3.7 is positive, suggesting that the more restrictive the reimbursement limit is the higher is the probability that an agency exits at time t given that it lasted until t. However, the parameter is never statistically significant. On the contrary, the estimate of the exponentiated coefficient of the law change parameter with the piece-wise-constant Exponential model displayed in columns 4 and 5 of Table 3.7 is statistically significant at the 5 percent level. I provide a higher and lower bound to interpret the parameter using the distribution of the variable **visitsperpatient94** in 1994 and in 2000. The distribution

implied by the variable **visitsperpatient94** in 1994 suggests that moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile (See Table 3.3, column 2), which implies a decline in reimbursement of 5.1 visits per user, increases the hazard by 12.4 percent.[66] The distribution of the variable **visitsperpatient94** for year 2000 for the entire sample displayed in column 2 of Table 3.4 suggests a lower increase in the hazard because the most restricted providers, the ones with the highest values of **visitsperpatient94,** have exited the market by year 2000. Moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile in the 2000 distribution (Table 3.3 column 3) suggests that a decline in reimbursement of 3.68 visits per user increases the hazard by 8.9 percent.

Considering only for-profit agencies, the exponentiated coefficient of the law change parameter displayed in the first raw of Table 3.8 is statistically significant at the 5 percent level only when the proportional hazard assumes a piece-wise-constant Exponential model. The point estimate of the parameter of interest in columns 4 and 5 of Table 3.7 suggests that moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile in 1994 (See Table 3.3 column 3) for this sample, which implies a decline in reimbursement of 5.5 visits per user, increases the hazard

[66] The median value of **visitsperpatient94** is 33.37 and the 75th percentile is 53.79. When the variable **visitsperpatient94** increases by 1, the implied decline in reimbursement is equal to 0.25 visits, so that an increase in the variable **visitsperpatient94** equal to 20.42 is equivalent to a decline in reimbursement of 5.1 visits per user.

by 12.2 percent.[67] A closer look at the exponentiated coefficients on the interval specific intercepts reveals that, relative to the excluded category (period 1), the hazard declines in the second period and increases in all the other periods. Because I only have seven periods, the existence of one period in which the hazard is not increasing may be an important reason why the estimates obtained assuming the piece-wise-constant Exponential model are so different from the estimates obtained assuming the Weibull model. The distribution of the variable **visitsperpatient94** for year 2000 suggests that moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile (Table 3.4, column 3), i.e. a decline in reimbursement of 5.4 visits per user, increases the hazard by 11.9 percent.

Finally, Table 3.9 shows the estimates on the sample of not-for-profit agencies. The exponentiated coefficient on the law change variable is never statistically significant. Moreover, in this case the estimates of the exponentiated coefficient on the law change variable obtained assuming the Weibull model suggest that a decline in reimbursement of one visit per user decreases the hazard, a result that is rather counterintuitive. On the contrary, the exponetiated coefficient on the law change variable obtained using the piece-wise constant Exponential model suggests that moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile in 1994 (See Table 3.3, column 4) for this sample, i.e. a decline in reimbursement of 2.6 visits per user increases the hazard by 3.9 (using the estimate in Column 4 of Table 3.9) or 5.2 percent (using the estimate in Column 5 of Table 3.9). The more

[67] See the previous footnote.

conservative estimate obtained by using the distribution of the variable **visitsperpatient94** in 2000 suggests that moving from the value of the variable **visitsperpatient94** for the median provider to the value of the variable **visitsperpatient94** for the provider in the 75th percentile (column 4 of Table 3.4), i.e. a decline in reimbursement of 1.55 visits per user, increases the hazard by 2.38 percent using the estimate in column 3 of Table 3.9 or 3.2 percent using the estimate in column 4 of Table 3.9.

Moreover, for this sample, a closer look at the estimates of the exponentiated coefficients for the dummies suggest that, relative to the excluded category, the dummy in period 1, the hazard increases until the third period, declines in the forth period (the year of the policy change) and increases again in the remaining periods. Because the hazard increases, decreases and increases again, for this sample the Weibull model does not seem particularly appropriate.

3.9 Conclusion and Directions for Future Research

In this chapter, I have used a policy change to study the exit patterns of home health care agencies by using a novel dataset provided by the OSHPD in California.

I have estimated the impact of the introduction of limits in reimbursement on exit for both for-profit and not-for-profit home health agencies. When using the piece-wise-constant Exponential model, my results show statistically significant responses of all providers to government reimbursement behavior. However, when conducting the analysis separately for for-profit and not-for-profit agencies, for-profit present statistically significant results and not-for-profit do not.

This chapter represents the first preliminary step of a larger research project that will examine the differences between for-profit and not-for-profit home health care agencies. In particular, two lines of research may be worthwhile to pursue. First, I would like to test the theory advanced by Arrow (1963) that suggests that not-for-profit firms place a higher weight on patients' health than for-profit entities. Previous theoretical work by McKnight (2004) has formally modeled that the policy change studied in this dissertation created the incentive for home health agencies to treat only the acute patients and to dump the long term care patients who became less profitable to treat after the implementation of the Interim Payment System. In the contest of the policy change studied here, Arrow's theory leads to the testable prediction that not-for profit home health care agencies would be less likely to decrease their fraction of long term care patients compared to their acute care ones than for profit agencies.

In addition to this line of research, I plan to further employ the novel definition of market that I proposed in this chapter by exploiting the role of competition within each market to study differences in exit behavior and services offering between for-profit and not-for-profit home health agencies.

Figure 3.1

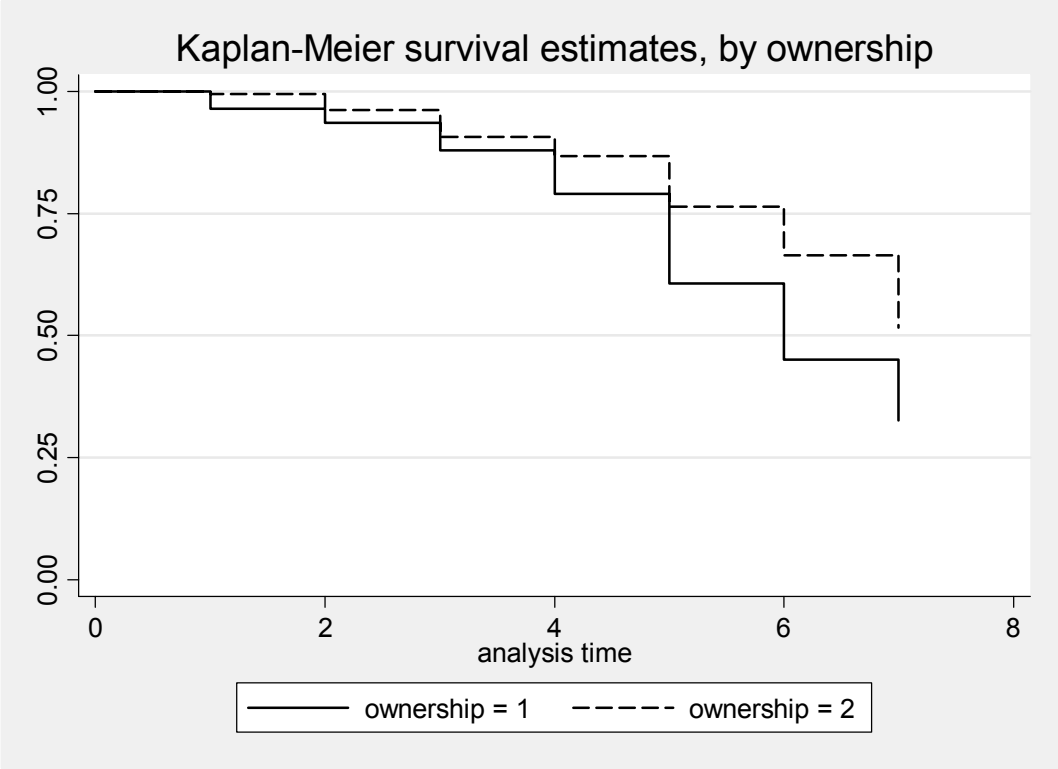
Kaplan-Meier survival estimates, by ownership
1.00
0.75
0.50
0.25
0.00
0
2
4
6
8
analysis time
ownership = 1
ownership = 2

Figure 3.2

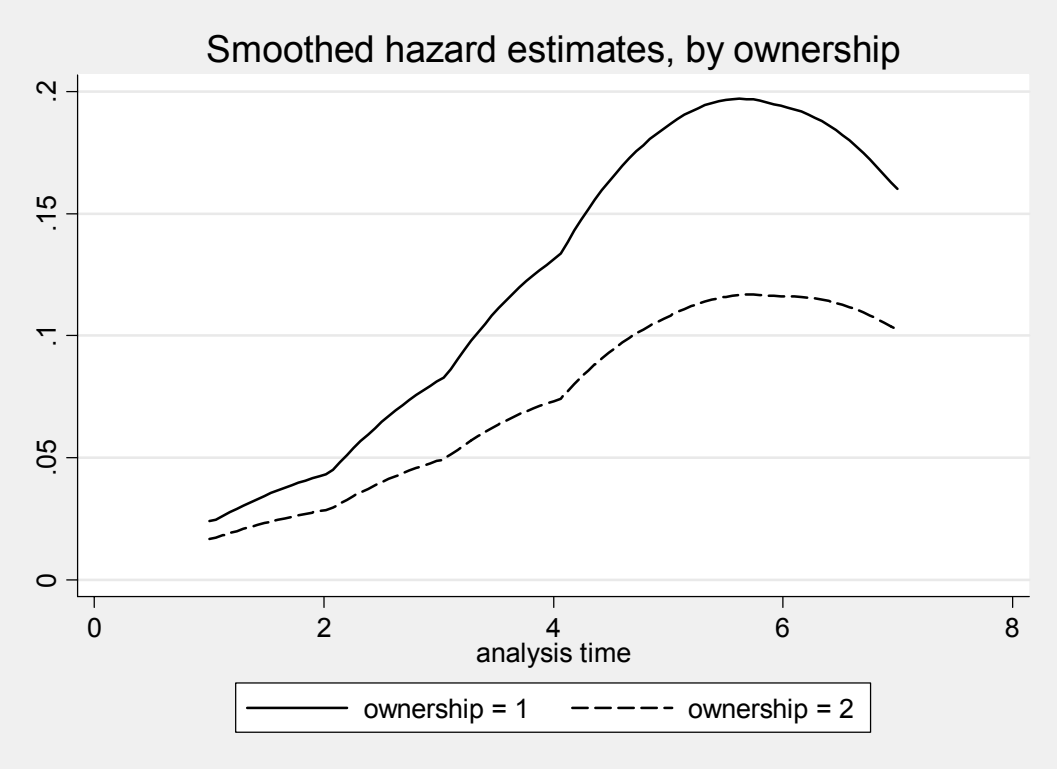
Smoothed hazard estimates, by ownership
0
.05
.1
.15
.2
0
2
4
6
8
analysis time
ownership = 1
ownership = 2

Table 3.1 Persons Served by Medicare Home Health Care and Visits per Person Served in the United States as a Whole and in California

	United States		California	
	Persons served per 1000 enrollees	**Visits per person served**	**Persons served per 1000 enrollees**	**Visits per person served**
1996	108	74	111	52
1997	109	73	110	49
1998	96	51	97	36
1999	86	42	88	31
2000	74	37	75	29

Source: Medicare and Medicaid Statistical Supplement, various years.

Table 3.2 Medicare Visits

Year	Number of Medicare Home Care visits received by Medicare Beneficiaries (From Statistical Supplement) as a percentage of the Number of visits provided for which Medicare is the primary source of reimbursement (OSHPD data)
1994	99.19
1995	106.9
1996	103.14
1997	108.02
1998	99.11
1999	97.42
2000	85.25

Table 3.3

Average of the Variable Visitsperpatient94 at Different Percentiles

percentiles	entire sample	for profit	not-for-profit	non respondents	agencies that closed
1%	3.16	1.4	7.42	1.17	3.5
5%	8.49	8	12	8.04	8.04
10%	12.8	11.9	16.47	12.94	12.3
25%	21.52	21	21.76	22.43	23.65
50%	33.37	42	29.38	39.87	44.04
75%	53.79	64.26	39.8	74.06	65.58
90%	74.06	78.96	50.3	91.66	74.62
95%	83.99	99.11	64.96	107.42	88.94
99%	148.12	166.54	90.37	190.69	149.80

Columns 2 3 and 4 display the distribution of the variable visitsperpatient94 for the agencies in the market in 1994 for year 1994. The last 2 columns display the distribution of the variable visitsperpatient94 for non respondents and for agencies that closed in any given year.

Table 3.4

Average of the Variable Visitsperpatient94 at Different Percentiles for Different Sub-Samples for Year 2000

percentiles	entire sample	for profit	not-for-profit
1%	2.93	1.4	8.77
5%	10.32	5.7	12.59
10%	12.38	11.83	16.16
25%	20.77	19.77	21.56
50%	30.47	35.09	28.48
75%	45.19	56.75	34.7
90%	64.26	74.53	46.31
95%	74.53	88.94	52.06
99%	115.87	122.71	64.96

Table 3.5
Outcome is non Respondent

Post* Number of visits per patient 65+ in 1994	.0011204* (.0005799)	.000961* (.0005487)	.0009612* (.0005351)
Post	Yes	Yes	Yes
Year first licensed dummies	No	Yes	Yes
Market dummies	No	No	No
N	2739	2739	2739

Table 3.6 Agencies in Each Market as a Percentage of the Agencies in the Market that Year

Market	For Profit	Not-for-Profit	For Profit	Not-for-Profit
Bakersfield	0.88	0.66	1.46	0.36
Chico-Paradise	0.66	0.44	0.73	0.73
Los Angeles, Long-Beach	5.27	1.98	4.38	1.82
Mercedes	0.44	0	0.36	0.36
Modesto	0.66	0.66	0.73	0.36
Oakland, Alameda, Contra Costa	1.76	1.32	2.19	1.46
Orange County	1.1	0.44	0.73	0
Redding	0.22	0.22	0.36	0.36
Riverside, San Bernardino	1.1	1.1	1.82	0.73
Sacramento, El Dorado, Placer	2.64	0.88	2.55	1.09
Salinas	0.22	0.44	0	0.36
San Diego	2.64	1.76	2.9	1.82
San Francisco, Marin, San Mateo	1.54	1.98	1.09	2.55
San Jose	0.66	0.66	1.82	0.36
San-Luis Obispo-Atascadero-Paso Robles	0.22	0.22	0.36	0
Santa Barbara, Santa Maria, Lompoc	0.22	0.88	0.36	0.73
Santa Cruz, Watsonville	0.22	0.88	0.36	0.36
Santa Rosa	0.66	0.22	0.36	0
Stockton, Lodi	1.32	0.66	0.73	1.09
Fresno, Madera	1.32	1.32	0.73	1.46
Vallejo, Fairfield, Napa	0.22	0.44	0.72	0.73
Ventura	0.66	0.33	0.74	0.36
Visalia, Tulare, Porterville	0.88	0.22	0.36	0.36
Yolo	0.22	0.44	0	0.36
Yuba City, Sutter	0.66	0	0	0
Rural	34.2	21.5	31.6	24.53
	1999		**2000**	

For each year, every cell displays the following figure: N_{is}/N, where N_{is} is the number of firms of type s= for- profit, not-for-profit in each market and $N= \sum_i N_{i\ \text{for-profit}} + \sum_i N_{i\ \text{not-for-profit}}$

Table 3.7: Entire Sample, Log Relative Hazard Form

	Weibull		**Piece-wise constant-Exponential**	
Law Change Variable*	1.001146 (.0023581)	1.000749 (.0024777)	1.00608** (.0024396)	1.006277** (.0025512)
Year first licensed dummies	Yes	Yes	Yes	Yes
Market dummies	No	Yes	No	Yes
d2	-	-	1.308254 (.5271268)	1.312744 (.5289669)
d3	-	-	2.511342*** (.9033362)	2.531422*** (.9106369)
d4	-	-	2.603145*** (.9561643)	2.609845*** (.961958)
d5	-	-	6.404137*** (2.188368)	6.424589*** (2.204069)
d6	-	-	7.255034*** (2.493794)	7.402324*** (2.556369)
d7	-	-	9.515207*** (3.257587)	9.839829*** (3.385915)
Number of Failures	278	278	278	278
N of subjects	464	464	464	464

*The law change variable is equal to 0 for the first three periods and it is equal to visitsperpatients94 for the remaining 4 periods. The symbols ** and *** mean statistically significant at the 5 and 1 percent level, respectively.

Table 3.8: For-Profit Log Relative Hazard Form

	Weibull		**Piece-wise constant-Exponential**	
Law change variable*	1.002031	1.001395	1.005481**	1.005502**
	(.002509)	(.0026655)	(.0026421)	(.0027851)
Year first licensed dummies	Yes	Yes	Yes	Yes
Market dummies	No	Yes	No	Yes
d2	-	-	.8383282	.9380346
			(.3977619)	(.4560617)
d3	-	-	1.727585	1.928649
			(.696707)	(.8042152)
d4	-	-	2.227634**	2.478955**
			(.8834436)	(1.022253)
d5	-	-	5.289998***	5.9559***
			(1.946381)	(2.291813)
d6	-	-	6.216877***	7.327631***
			(2.310537)	(2.851785)
d7	-	-	7.072146***	8.399622***
			(2.669999)	(3.318571)
Number of Failures	190	190	190	190
N of subjects	282	282	282	282

*The law change variable is equal to 0 for the first three periods and it is equal to visitsperpatients94 for the remaining 4 periods. The symbols ** and *** mean statistically significant at the 5 and 1 percent level, respectively.

Table 3.9: Not-for-Profit Log Relative Hazard Form

	Weibull		**Piece-wise constant-Exponential**	
Law change variable*	.9854864	.9821914	1.003833	1.005146
	(.0077918)	(.0090844)	(.0083844)	(.0093727)
Year first licensed dummies	Yes	Yes	Yes	Yes
Market dummies	No	Yes	No	Yes
d2	-	-	6.04346	6.337858
			(6.526606)	(6.852947)
d3	-	-	10.46283	12.84472
			(10.97186)	(13.62033)
d4	-	-	7.492709	9.377019
			(8.287254)	(10.56278)
d5	-	-	22.88386	28.98661
			(24.37035)	(31.50428)
d6	-	-	26.61428	33.82114
			(28.40562)	(36.832)
d7	-	-	50.80431	66.98146
			(53.74466)	(72.18319)
Number of Failures	88	88	88	88
N of subjects	182	182	182	182

*The law change variable is equal to 0 for the first three periods and it is equal to visitsperpatients94 for the remaining 4 periods.

Chapter 4: Conclusion

Demographic trends that shape modern economies make the financing of long-term care an increasingly important issue. On the one hand, the proportion of elderly people is increasing in most of the developed world and families are becoming smaller and smaller, causing the pool of potential caregivers to shrink. On the other hand, governments facing skyrocketing health care costs are being forced to adopt pricing policies aimed at minimizing expenditures.

This dissertation evaluates the impact of a pricing scheme that imposes a limit on the reimbursement of home health care, a form of long term care that has become increasingly popular in many countries.

In the first essay, I show that imposing limits in reimbursement for home health care services has effects that go well beyond the health care sector, affecting transfers in the form of changed living arrangements for the elderly and their caregivers.

In the second essay, I examine the impact of the imposition of limits in reimbursement on exit behavior of home health care providers. Home health care agencies are providers with very low entry barriers and very few assets, and the majority of their revenues come from public sources. These characteristics make them likely to be particularly responsive to any reimbursement change. I show that home health care agencies respond very quickly to changes in the profitability of home health care services.

There are still many important issues that need to be addressed. First, a restriction on government reimbursement of home health care services can affect the labor supply of informal caregivers. Therefore, future research should try to identify whether there is a direct link between the public provision of home health care services and labor supply of caregivers.

Second, since people that require care generally prefer to be taken care of by women (OSHPD, 2005) and most care giving does not require skilled labor, changes in the public provision of long term care services may imply changes in labor market opportunities for unskilled women relative to unskilled men. Therefore, it will be interesting to investigate whether changes in the public provision of long term care services have an impact on the labor force participation and hours of work of unskilled women compared to unskilled men.

Additionally, it seems worthwhile investigating the impacts of the changing age structure of care givers. According to Smith (1997), between 1966 and 1996 the fraction of the oldest old (people 85 years of age or older) in the population has increased by 300 percent compared to an increase of 104 percent in the fraction of people at least 65 years old. This increase in the fraction of the oldest elderly suggests that the children of the oldest elderly, the most likely caregivers, are elderly as well. The literature on care giving has looked at the impact of informal care giving on the health of the caregivers, finding that care giving has an adverse effect on the health of the caregiver (Witlatch, Feinberg and Sebesta, 1997; Whitlach, Feinberg and Stevens, 1997). It seems interesting to study whether the effect on health of the caregivers is

heterogeneous, i.e. it is more pronounced for the group of elderly who take care of the oldest old.

Another research topic for the future research agenda focuses on the cost effectiveness of home improvement interventions aimed at keeping the elderly in the community. For example, investments aimed at modifying the homes of the elderly to make them more suitable for people with impaired mobility might be a relevant channel for the prevention of falls, a common cause of hospitalization and long term care use among the elderly (OECD, 2005,b).

Finally, further work is needed to identify differences in behavior by ownership type of home health care agencies on other outcomes such as the patients' agency selection, charity care, and staffing both in the United States as well as in health care environments characterized by universal health insurance coverage.

Appendices

Appendix I

This appendix motivates the use of the average number of visits per user as an appropriate measure of cost to construct the cross state measure of restrictiveness used in the empirical framework in chapter 1. Another possible measure to use is the Medicare payment per user in 1994. I have access to this measure at the state and census division level.

However, Medicare payments, included the per patient limit cap, are adjusted across different localities to take into account the different wages existing in different areas. The areas used for adjustment purposes are defined by the Medicare program and do not correspond to standard geographic classifications[68]. So, for example, 2 areas can have a high per patient cost in 1994 in dollar terms for two distinct reasons (or a combination of the two): either wages are high or the number of visits provided is high. In the first case, the blended per patient limit is adjusted upward to take into account the high wages, but it is not adjusted in the second case. I cannot adjust the per -patient cap, because I have only data aggregated at the state level.

As a consequence, if I were to use a restrictiveness measure in dollar terms like the following,

R_{sc}=Per patient $ cost of providing the services in 1994 in state s- Per patient $ cost of providing the services in 1994 in state s' census division,

[68] For a more in depth illustration of the areas as well as the adjustment factors see, for example, Federal Register, 1999.

I would introduce measurement error in the cross state measure. In fact, without being able to adjust for wage levels, the restrictiveness measure could look the same for 2 states that after the adjustment could actually face a very different cap. Because of this, the number of visits gives a measure that captures use across states and therefore, even if not perfect, is less subject to the type of measurement error illustrated above.

Appendix II: National Health Interview Survey Data

National Health Interview Survey did not ask a specific question on home health care for years before 1997. Since 1997 questions on home care have been asked in the person level file and the sample adult file (composed of a randomly selected adult in respondent households).

In the sample adult file respondents are asked whether they received home from a nurse or other health care professional in the previous 12 months, while in the person level file respondents are asked whether they received care at home from a nurse or other health care professional during 2 reference weeks in the previous 12 months.

Because the question asked in the sample adult file seemed more comprehensive and less subject to measurement error, in section 2.5.3 I use the sample adult file to identify the weighted fractions of Medicare only elderly and Medicaid –Medicare dually eligible beneficiaries that received home health care in the previous 12 months. I recovered from the person level file the information on health insurance and I merged the person level files health insurance data with the adult file data by using the household, family and the person Identification numbers to make the merge.

Appendix III

Table A1: Estimation Results, 65+ Pooled Sample, Outcome is "Was Covered by Medicaid in the Previous 12 Months"

$Post_t$*$Restrictiveness_{sc}$* 100	.019 (.026)	.015 (.024)	.017 (.023)	.011 (.022)
Separated	-	.179** (.016)	.155** (.017)	.146** (.016)
Divorced	-	.042** (.004)	.0169** (.004)	.05** (.003)
Married, spouse absent	-	.024* (.011)	.026* (.01)	.025* (.01)
Never Married	-	.048** (.009)	.053** (.009)	.058** (.008)
Married, spouse present	-	-.08** (.005)	-.066** (.0045)	-.058** (.004)
Male	-	-	-.014** (.0015)	-.0183** (.002)
White	-	-	-.144** (.012)	-.121** (.011)
Age dummies	-	-	Yes	Yes
less than high school	-	-	-	.108** (.011)
high school	-	-	-	.019** (.002)
some college	-	-	-	-.0003 (.003)
Observations	233864	233864	233864	233864

*,**: significant at the 5 and 1 percent level, respectively. $Restrictiveness_{sc}=A_s-A_c$ where A_s is the average number of Medicare home care visits per user in state s in 1994 and A_c is the average number of Medicare home care visits per user in state's census division c. State and year dummies are included in every specification. Standard errors are clustered by state and are shown in parenthesis.

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