Health Care Spending Growth under the Prospective Payment System: Evidence from Medicare Home Health Care

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Abstract

This paper explores the causes of the dramatic rise in total Medicare home health spending under the prospective payment system. In 2000, Medicare home health care introduced the prospective payment system to control the spending growth that had occurred under the fee-for-service payment system. However, total spending under the new system has continued to increase significantly. I examine the underlying forces behind the growth in the three factors that contributed to this spending increase: 1) the number of Medicare home health patients, 2) the number of episodes per patient, and 3) the payment amount per episode. Using the Medicare Claims and Provider of Services File from 1999 to 2009, I find strong empirical support that the prospective payment system provided unintended incentives for home health agencies to adjust their service provision patterns to increase profits. This led to an increase in all three factors, independent of the health needs of patients. In particular, the number of Medicare home health patients contributed the most to the total spending increase. In addition, many profit maximizing behaviors were most evident among for-profit home health agencies. Furthermore, the incentives built into the prospective payment system attracted to the market a substantial number of for-profit agencies. These new agencies pursued profitable home health provision patterns more aggressively than agencies established prior to the prospective payment system. Overall, the increase in the for-profit market share accounts for about one-third of the increase in total Medicare spending between 2001 and 2009.

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1 Introduction

Escalating Medicare spending has become a major concern in the United States over the last few decades, increasing from 0.7 percent of GDP in 1970 to 3.4 percent in 2010 (CMS, 2011). One of the strategies employed by policymakers to curb this rising spending has been to implement new reimbursement systems. However, this sometimes results in unintended consequences due to a supply-side moral hazard problem. The moral hazard problem arises with the reimbursement policy because the government cannot directly observe the health status of patients, forcing Medicare to rely on health care providers to supply appropriate levels of care. Yet, health care providers will strategically pursue their own interests, which can significantly increase Medicare spending independent of the health needs of patients. Thus, policymakers must pay special attention to the incentives embedded in their reimbursement systems.

This study addresses this issue in the context of a change in the Medicare home health care reimbursement system. In October 2000, Medicare home health care adopted the prospective payment system (PPS)—which made pre-determined payments based on patient health status—to control the rapidly increasing Medicare home health spending. Despite this change, total Medicare home health spending rose by 7.79 percent annually in real terms over the next nine years, which was significantly higher than the 3.68 percent annual growth rate in the aggregate Medicare spending during the same period (CMS, 2011). Medicare failed to achieve its stated goal of controlling costs.

This study examines the failure by focusing on underlying forces behind the growth in the three factors that contributed to the significant increase in aggregate Medicare home health spending: 1) the number of Medicare home health patients, 2) the number of episodes per patient (an episode is the unit of a payment period used by Medicare home health care, which is 60 days), and 3) the payment amount per episode. Furthermore, I examine how each home health agency’s ownership status and establishment year affected its response to the supply-side incentives embedded in the PPS.
This study makes several important contributions. First, it is one of few studies to examine empirically how the supply-side incentives built into a reimbursement system increased health care spending, using three specific factors of total spending. This analysis informs policy makers about optimal Medicare reimbursement system designs that promote efficient health care. Second, recognizing the supply-side incentives inherent in the Medicare home health PPS may have broader implications for other health services that operate under the PPS, such as Medicare inpatient, Medicare skilled nursing, Medicare hospice care, state Medicaid programs, and private insurance programs. Third, this study expands the understanding of for-profit and non-profit health care providers by addressing their responses to the supply-side incentives of the PPS. Fourth, this study is the first to address distinct behaviors between entrants and incumbents in the context of Medicare home health care.

Using the Medicare Claims and Provider of Services File from 1999 to 2009, I find that the Medicare home health PPS provided incentives that led to unintended increases in all three factors, independent of the health needs of patients. In particular, among the three factors, the number of Medicare home health patients contributed the most to the total spending increase. Relatively generous prospective reimbursement rates encouraged home health agencies to increase the number of patients they treated. The PPS also allowed patients to receive home health services over multiple renewable episodes, but provided vague guidelines about recertification decisions. Thus, agencies could easily recertify another episode of care and increase the number of episodes per patient to serve a profit-maximizing motive. Home health agencies also clearly adjusted service provision practices, which increased the payment amount per episode. For example, the non-linear pricing for therapy visits led to a predictable clumping at 10 therapy visits or more because the marginal revenue of the tenth visit, roughly $2,000, was almost twenty times higher than the marginal cost. This dynamic caused agencies to shift their service provision toward therapy visits and away from relatively less profitable services such as home health aide visits.

I also find that most of these profit maximizing behaviors were significantly more
evident among for-profit home health agencies than among non-profit agencies. Furthermore, the incentives built into the PPS continued to attract a number of for-profit home health agencies to the market. Compared to counterpart for-profit agencies established prior to the PPS, those new for-profit agencies that entered the market under the PPS were more likely to pursue profitable service provision patterns. The aggressive profit-seeking behaviors of new agencies further contributed to Medicare home health spending growth, and partially explain why home health service provision patterns of agencies changed gradually over time under the PPS. Overall, the increase in the for-profit market share under the PPS accounts for about one-third of the increase in total Medicare spending increase between 2001 and 2009.

2 Medicare Home Health PPS

Medicare home health spending has fluctuated significantly under the different reimbursement systems over the last two decades. Medicare home health greatly expanded during the 1990s under the fee-for-service payment system. The fee-for-service payment system reimbursed home health agencies for full costs incurred for treating patients and did not limit the number of annual Medicare home health visits per patient (see Table 1 for a brief description of each reimbursement system). Thus, agencies had a weak incentive to provide efficient care, which led to a significant increase in total home health expenditure under the fee-for-service payment system. Home health care expenditure grew from $5.0 billion (This study expresses all payment amounts in 2001 dollars) in 1990 to $18.9 billion in 1996 (see Figure 1) (CMS, 2011; McKnight, 2006).

Faced with the radical growth of Medicare home health care, the government decided to adopt the PPS. However, it took the government three years to revamp the payment system. In the meantime, the interim payment system (IPS) was implemented on a temporary basis with the goal of immediately curbing home health care spending (MedPAC, 2012). The IPS

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1In this paper, I do not consider government agencies because of their relatively small number.
introduced an agency-specific limit on the annual per-patient reimbursement amount, which was a weighted average of 75 percent of each agency’s 1994 average per-patient costs and 25 percent of the 1994 regional average per-patient costs (Choi and Davitt, 2009). This weighted average formula was highly restrictive for three reasons. First, the average reimbursement amounts were greatly reduced to 1994 levels. Second, the weighted average formula harshly punished agencies that provided cost-effective services in 1994 and thus incurred lower costs in 1994 (Choi and Davitt, 2009; McKnight, 2006). Third, the reimbursement amount was based on not only each agency’s cost but also the cost of other agencies in the same region. Thus, agencies whose incurred per-patient costs were higher than regional per-patient costs in 1994, received lower reimbursement amounts than their per-patient costs in 1994. The restrictive IPS led to the bankruptcy of about 30 percent of home health agencies in the late 1990s, and as shown in Figure 1, home health care expenditures dropped from $18.4 billion in 1997 to $7.4 billion in 2000 (CMS, 2011; MedPAC, 2012).

In 2000, the Center for Medicare and Medicaid Services (CMS) introduced the PPS. Like the IPS, the PPS made predetermined payments, but the amount of payments varied based on patient health condition. Each year, the PPS set the home health base reimbursement rate at the amount that would be paid per episode for an average home health patient residing in an average market (MedPAC, 2007). The PPS also classified all Medicare home health patients into 80 groups based on patients’ health conditions and needs at admission to care, and assigned specific case-mix weight to each group. The PPS then determines the payment amount per episode for each patient every 60 days based on home health base reimbursement rate, a patient’s case-mix weight, and each region’s wage index reflecting regional differences in the input-price level (MedPAC, 2007). Because the payment amounts were fixed, home health agencies had to bear the full cost of extra treatments, and thus the PPS was expected to control rising spending.

Although the Medicare home health payment system was termed a “prospective” system, the Medicare home health PPS had several important retrospective features that
caused reimbursement amounts to vary depending on actual treatment levels. For instance, the PPS made a significant amount of extra payments for episodes with 10 or more therapy visits. It also made extra payments (known as high-cost outlier payments) in addition to the prospective payments if each episode’s imputed treatment cost was higher than a threshold amount for each case-mix group (HCFA, 2000). These two retrospective features encouraged agencies to increase the amount of care for extremely ill patients given that the fixed reimbursement rate under the PPS could lead agencies to avoid patients whose health care costs were significantly higher than reimbursement amounts. In addition, if a patient received four or fewer visits per episode, the PPS would make a per-visit low-utilization payment by service type that was the same for all patients, regardless of health status. This retrospective feature saved Medicare money by making a smaller amount of payments instead of standard prospective payments for patients who require a low number of service visits.

The main intention behind the introduction of the PPS was to curb the rising home health spending that had occurred under the fee-for-service payment system. For this reason, Medicare set the home health base rate each year such that home health spending under the PPS stays the same as the drastically reduced level of spending under the IPS. Surprisingly, however, just the opposite occurred. Under the prospective payment scheme, the number of patients, the number of episodes per patient, and the payment amount per episode increased, leading to a significant increase in Medicare home health care spending, from $8.51 billion in 2001 to $15.46 billion in 2009 (see Table 2) (CMS, 2011).

Despite the dramatic increase in Medicare home health spending under the PPS, no studies have so far examined the underlying forces behind the increase in three components of total Medicare home health spending. Instead, previous studies have examined the implications of the PPS on other health care costs. Among those studies, McClellan (1997) and Grabowski, Afendulis, and McGuire (2011) are most relevant to this study because they examined Medicare PPS implemented in inpatient and skilled nursing facility care, respectively, both of which had retrospective features embedded in the PPS. Both studies
attributed retrospective features built in the PPS to health care spending growth.

More specifically, McClellan (1997) recognized that the Medicare hospital PPS had retrospective features, such as high-cost outlier payments and treatment-based diagnosis-related group (DRG) payments. He found that hospitals manipulated retrospective features built into the PPS to increase profits, which might have important implications for medical expenditure growth. However, his study did not address how the PPS influenced the number of patients and the length of hospital stay, which are also important components of total health care spending.

Grabowski and colleagues (2011) focused on Medicare skilled nursing care that experienced a significant spending growth under the PPS, and examined how the PPS affected the number of Medicare residents in a facility, the average length of stay, and the intensity of care. They found that skilled nursing facilities clearly adjusted service provision patterns in response to retrospective features built into the PPS, contributing to the growth in skilled nursing home spending. However, their findings are potentially limited in that they used data from the state of New York only in order to understand changes in the service provision intensity. Given that large geographical differences in health care practice for post-acute sector services, their findings may not be generalizable.

Taking a similar approach to Grabowski and colleagues (2011), but using nationally representative panel data across 11 years, my study addresses the increase in the number of patients, the number of episodes, and the payment amount per episode under the PPS, but in the context of Medicare home health care. Furthermore, I go beyond the prior literature by examining how the ownership status and establishment year of home health agencies affected their response to the retrospective features built into the PPS.
3 Model of Agency Response to PPS

Changes in demographics and substitutable health services have affected demand for home health services to a certain degree. For example, an aging population increases the demand for home health care. Hospitals also tend to discharge Medicare patients earlier in response to the inpatient PPS, thus further increasing the demand for home health care (Doman, 2011). However, the demand for home health services has not been influenced by price shocks created by the PPS because Medicare home health services are free to all patients. For this reason, this paper focuses on the supply-side response to the PPS, not the demand-side response.

In this section, I present conceptual models that explain how agencies responded to the PPS. The models show how agencies adjusted their decisions about the number of patients to treat (the extensive margin), the number of episodes of care per patient, and the number of service visits per episode to provide (the intensive margin) under the PPS. Finally, I illustrate how new agencies that entered the market under the PPS made different decisions on the intensive margin from existing agencies.

3.1 The Number of Medicare Home Health Patients

This section illustrates how agencies increased the proportion of Medicare beneficiaries utilizing home health service under more generous reimbursement rate under the PPS. Specifically, I show that for-profit agency market share in each state was positively associated with the state’s price elasticity of home health supply. That is, the proportion of home health patients increased to a greater degree in states with more for-profit agencies and fewer non-profit agencies. This suggests that agencies increased the proportion of home health patients to increase profits under relatively generous prospective reimbursement rates.

There has been large state variation in for-profit home health agency market share.

\textsuperscript{2}The PPS drove reimbursement rates higher than they had been under the interim payment system by adding new features, including case-mix adjustments and the provision of the extra payments for intensive treatments.
Certain states have had a more business-friendly environment—for example, low state corporate tax rates or more lenient regulations (e.g. no certificate of need (CON) program for home health agencies)—and thus have attracted more for-profit agencies. For example, in the state of Texas—which had relatively low corporate tax rates and no CON—81.94 and 93.35 percent of the agencies were for-profit in 2000 and 2009. In contrast, New Jersey with relatively high corporate tax rates and CON had 14.81 and 23.53 percent of for-profit agencies in the corresponding years.

Interestingly, the state variation in for-profit market share leads to state-level variation in the reimbursement growth rate between the IPS and PPS. Prospective reimbursement rates were the same across the nation. In contrast, the interim payment rates on average varied across states because the interim reimbursement rates were determined based on each state’s 1994 average per-patient cost (McKnight, 2006; MedPAC, 2011). For-profit agencies were more likely to provide a higher number of visits for each patient in 1994, under the fee-for-service payment system (Grabowski, Huskamp, Stevenson, & Keating, 2009). As a result, states with more for-profit agencies, such as Texas, had a higher average per-patient cost in 1994, which led to a higher interim reimbursement rate and thus a smaller reimbursement growth rate between the IPS and PPS.

The state variation in for-profit market share also results in differences in the slopes of the state-level market supply curves. To explain this, I first start with a for-profit and non-profit agency’s short-run supply curve. A for-profit agency has a more elastic supply curve because for-profit agencies tend to be more responsive to changes in government reimbursement rates (FitzGerald et al., 2006; Sloan, 2000) (see Figure 2a). Therefore, states with a higher for-profit market share end up having a flatter market supply curve. That is, the market supply curve in Texas is more elastic than that in New Jersey (see Figure 2b).  

*I assume that 1) the demand curve for home health service is completely inelastic with respect to reimbursement rates because Medicare does not require home health patients to make any payments, and 2) there is always excess demand for home health care.*

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margins which attracted new agencies to the market (MedPAC, 2011). In particular, states with a higher for-profit market share experienced more entries of new agencies due to their business-friendly environment. Thus, the market supply curve in Texas shifted to the right to a greater degree (see Figure 2c).

3.2 The Number of Episodes Per Patient

Another factor that contributed to the total spending increase was the increase in the number of episodes per patient. The PPS allowed patients to receive services over an unlimited number of renewable episodes as long as agencies obtained a physician’s permission for the recertification of an additional episode of care. However, there were only vague guidelines about recertification decisions (i.e., a patient had to be home-bound and in need of skilled care) and physicians relied on information provided by agencies in making these decisions (Henkemeyer, 2012; MedPAC, 2012). Thus, home health agencies could easily increase the number of episodes for each patient. This tendency might have been stronger for relatively profitable patients because agencies found it more profitable to recertify less costly patients, given their limited resources. This tendency might be also stronger among for-profit agencies.

3.3 The Payment Amount per Episode

The PPS also affected agency decisions about the type and number of service visits to provide, thereby increasing the payment amount per episode.

3.3.1 Types of Service Visits

A home health agency adjusts which type of services to provide—skilled nursing visits, therapy visits, or home health aide visits, considering each service’s profitability and effect on patient health.

The agency has a strong incentive to provide therapy visits for an increasing number of episodes if the agency foresees the opportunity to provide 10 or more therapy visits
because the marginal benefit of the 10th therapy visit is high. Therapy visits can also have a significant influence on patient health. By contrast, home health aide visits are not compensated for the extra number of visits. In addition, agencies do not perceive home health aide services, which involve non-medical assistance related to eating, dressing, and bathing, as directly relevant to patient health status. Agencies thus have a strong incentive to refrain from providing home health aide visits as they seek to maximize profits. Skilled nursing visits are also uncompensated for extra visits, but can have a significant effect on patient health. Therefore, agencies have only a moderate level of incentive to provide skilled nursing visits. For-profit agencies may be more likely to provide therapy visits and less likely to provide home health aide visits, because of these services’ profitability and effect on patient health.

3.3.2 Number of Service Visits

In this section, I explain how agencies adjust the number of service visits under the PPS, using a graphical illustration of an agency’s optimal choice regarding the number of home health service visits per episode (Ellis and McGuire, 1986). For simplicity, I make several assumptions in this illustration. First, a patient receives therapy visits only, but an agency’s optimal therapy visits derived from this model should also work for a patient who receives therapy visits along with other types of home health services. An agency chooses the optimal number of therapy visits for a single patient, without consideration of the patient composition (in terms of their severity of illness) within the agency. In addition, a home health agency cares about both its profits and patient health status at the end of an episode of care in its utility.

My graphical illustration of an agency’s decision starts with a Medicare home health reimbursement schedule for a patient who received therapy visits only. As discussed above, the Medicare home health PPS had retrospective features and thus the reimbursement amount per episode changed as the number of therapy visits increased (see Figure 3a).
Refer to Appendix A for a more detailed explanation about how the reimbursement schedule was determined.

The agency’s profits per episode also changed as the number of therapy visits increased (see Figure 3b). The profit curves slope down more because the cost of one therapy visit was $105 and I subtract $105 \times V^T$ from Medicare reimbursement amounts (HCFA, 2000).

Next, I add the agency’s indifference curve, which is convex to the origin because the agency cares about both its profit and patient health status at the end of an episode of care (which is a positive linear function of the number of therapy visits) (see Figure 3c). The agency chooses the number of therapy visits that maximizes its utility given its profit function. Therefore, the agency chooses to provide a number of therapy visits that corresponds to point $E$, the equilibrium point.

The profit incentives built into the reimbursement system encourages the agency to provide a certain number of therapy visits. For example, the agency enjoys a higher level of utility when it provides 5 therapy visits rather than 4, and 10 visits rather than 9, regardless of its preference for profit relative to patient health status (see Figure 3d).

For-profit and non-profit agencies make different decisions in terms of the number of therapy visits per episode provided. If a for-profit agency prioritizes profit more than a non-profit agency does, then the for-profit agency has a flatter indifference curve. Therefore, a for-profit agency provides fewer service visits (closer to 10/ closer to 5) than a non-profit agency does (see Figure 3e).

### 3.4 Service Provision among New Home Health Agencies

Many home health agencies, mostly for-profits (95.73 percent), entered the market under the PPS (see Figure 4). New agencies might adopt profitable service provision patterns more aggressively (i.e., a higher likelihood of recertifying another episode of care and adjusting the number of service visits to increase the payment amount per episode) than existing agencies established prior to the PPS. I suggest two reasons for this phenomenon. First, new agencies
might have entered the home health market under the PPS because they knew the PPS would enable them to achieve high profit margins. Thus, new entrants would pursue profits more aggressively. Second, existing home health agencies might have more stable budget sources (Choi and Davitt, 2009) given that they survived the restrictive payment rates under the IPS. Therefore, financial incentives built into the PPS might be less attractive to existing agencies than to new ones.

Given that many agencies continued to enter the market under the PPS, if new agencies pursued profitable service provisions more aggressively than did existing agencies, the entry of new agencies would make a significant contribution to Medicare home health spending growth. In addition, aggressive profit-seeking behaviors among new agencies may partially explain why home health service provision patterns changed gradually over time under the PPS.

### 3.5 Hypotheses

The conceptual framework leads to four testable hypotheses. First, agencies increased the proportion of home health patients to increase profits. Second, agencies treated their patients for a higher number of episodes of care to increase profits, and this tendency was stronger among for-profit agencies. Third, agencies adjusted the types and number of service visits, which increased the payment amount per episode, and the degree of the adjustment was greater among for-profit agencies. Fourth, agencies that entered the market under the PPS, mostly for-profits, were more likely to pursue profitable service provision patterns than existing agencies.

### 4 Data

This study uses data from: 1) the CMS 5% Limited Data Set-Denominator File from 1999 to 2009, 2) the CMS 5% Limited Data Set-Home Health Agency File from 1999 to 2009, 3) the
CMS Provider of Services File-Home Health Agency from 1999 to 2009, and 4) the Integrated Public Use Microdata Series-Current Population Survey (IPUM-CPS) from 1994, and 1999 to 2009 (King et al., 2010). The first dataset, which was extracted from Medicare claims, is a panel of 5% of Medicare beneficiaries and contains basic demographic information such as age, race, gender, and date of death, as well as Medicare HMO enrollment status. The second dataset, which was also taken from Medicare claims, is also a panel of 5% of Medicare home health patients and contains administrative information about each patient’s Medicare home health care service use (CMS, 2012b). The third dataset was extracted from the Online Survey and Certification Reporting System/Quality Improvement Evaluation System collected by the CMS Regional Offices (Choi and Davitt, 2009; CMS, 2012a). It is a panel of all Medicare/Medicaid-certified home health agencies across the nation and includes their basic agency information such as location, ownership type, and initial date of Medicare certification. The last dataset, extracted from the Current Population Survey, contains sampled individuals’ basic demographic information not available in the CMS 5% Limited Data Set-Denominator File, such as marital status, residence with any child, and living below poverty lines each year.

I combine the first two datasets using each beneficiary’s ID number, and create a complete Medicare claim dataset. The home health agency provider number enables me to merge the combined Medicare claim dataset and the CMS Provider of Services File, resulting in a patient-agency linked, unbalanced panel data set. Each observation in this dataset corresponds to a patient’s unique episode of care. I use the merged dataset for my analysis of the number of episodes per patient and the payment amount per episode. For my analysis of the number of patients, I use both a dataset of patient-episode level data and IPUM-CPS data.

I limit my sample to Medicare beneficiaries who were 65 or older. I drop beneficiaries who were enrolled in Medicare HMOs because Medicare HMOs were not directly influenced by Medicare reimbursement system changes. In addition, I exclude those beneficiaries who
had zero Medicare payments, received zero Medicare home health service visits, or had any positive non-Medicare payment amount. I also exclude beneficiaries who resided in Puerto Rico, the U.S. Island Areas, or unidentified counties. Medicare home health patients whose agency information was not found in the CMS Provider of Services File-Home Health Agency were also dropped. Additionally, I exclude one of the records in cases in which two episodes had the same service start and end date and referred to the same episode, but had separate records due to significant changes in the patient’s health condition or the existence of an unclean claim. Furthermore, I drop episodes of care for beneficiaries who died earlier, but received home health visits after their date of death. I further exclude episodes in which home health care was interrupted because a patient was readmitted to a hospital, entered a nursing home, died, and so on. Finally, I drop observations with missing values for the variables used in my analysis.

I use data from 1999 through 2009 for my analysis of the number of Medicare patients and collapse the data to a higher level of aggregation (state-year cells). I use data from 2001 through 2009, for my analysis of the number of episodes per patient and the payment amount per episode because the concept of episode was introduced with the implementation of the PPS in 2001. This unbalanced panel data set had 1,778,368 patient-episode observations, which translates to 614,779 unique patients.

5 Empirical Strategy

Each of the following empirical models corresponds to one of my hypotheses.

5.1 The Number of Patients

*Hypothesis 1*: Agencies increased the proportion of home health patients to increase profits.

To address this hypothesis, I examine whether 1) states with a relatively high for-profit market share had a higher interim reimbursement rate and thus a smaller reimbursement
growth rate between the IPS and PPS and 2) states with a relatively high for-profit market share had higher price elasticity of home health supply. Given the assumption that for-profit agencies are more likely to prioritize profit maximization than non-profits, both 1) and 2) indicate that agencies increased the proportion of home health patients with the intention of increasing profits under the PPS.

First, I test whether states with a relatively high for-profit market share in 1994 had a higher interim reimbursement rate, using regression (1),

\[ IPS_s = \alpha + \delta_1 N_s + X_s B + \varepsilon_s \]  

where \( IPS_s \) represents the interim payment rate in state \( s \) and \( N_s \) can refer to the number of for-profit agencies per 1,000 beneficiaries, the number of non-profit agencies per 1,000 beneficiaries, or for-profit agency market share\(^4\) in state \( s \) in 1994. In particular, I focus on home health market ownership structure in 1994 because the interim payment rate in each state was determined based on each state’s 1994 average per-patient cost. \( X_s \) includes various demographic characteristics of each state’s beneficiaries in 1994, including gender and age (65-69, 70-74, 75-79, 80-89, and 90+) distribution, race composition (white, black, and others), the proportion of married beneficiaries, the proportion of dual-eligible beneficiaries, the proportion of beneficiaries who resided with any child, and the proportion of beneficiaries who died. \( \delta_1 \) measures how each state’s home health market ownership structure in 1994 influenced the interim payment rate across states. \( \delta_1 \) is expected to be positive when \( N_s \) is the number of for-profits per capita and for-profit agency market share in each state in 1994.

I then test whether differences in the price elasticity of home health supply across states are explained by each state’s home health market ownership structure, which I measure by the number of per-capita for-profit agencies, the number of per-capita non-profit agencies, for-profit agency market share, for-profit hospital market share, and the presence of a CON.

\(^4\)I compute for-profit market share by dividing the number of all agencies by the number of for-profit agencies in each state.
program for home health agencies in each state in 2000. No state experienced a change in the presence or absence of CON programs for home health agencies during the PPS. In particular, I pick the year 2000 to avoid possible endogeneity problems, in which an increase in the proportion of home health patients drives the increase in for-profit agencies during the PPS. In the same vein, I examine how for-profit hospital market share is associated with price elasticity of home health supply. Grabowski and Hirth (2003) argued that non-profit hospital market share (and thus for-profit hospital market share) is likely based on historical factors such as each city’s age, voluntarism, and charitable provision. Likewise, for-profit home health agency market share is likely to depend on each region’s historical factors, and thus be highly correlated with for-profit hospital market share that might not be directly influenced by changes in the number of home health patients. However, each state’s unobservable heterogeneity might have simultaneously affected the state’s price elasticity of home health supply and home health market dynamics in 2000. Thus, there could still remain an endogeneity problem, and results are suggestive. The basic estimating equation takes the following form:

\[ Y_s = \alpha + \gamma_1 M_s + X_s B + \varepsilon_s \] (2)

where \( Y_s \) refers to price elasticity of home health supply in state \( s \) \((%\Delta User_s/%\Delta P_s)\), measuring the proportional change in the fraction of Medicare beneficiaries utilizing home health services in each state \( s \) divided by the proportional change in reimbursement rate in that state \( s \) between 2000 and 2009. \( M_s \) can represent the number of for-profit agencies per 1,000 beneficiaries, the number of non-profit agencies per 1,000 beneficiaries, for-profit agency market share, for-profit hospital market share, or the presence of a CON program for home health agencies in each state in 2000. \( X_s \) includes various demographic characteristics of each state’s beneficiaries in 2000. \( \gamma_1 \) measures how each state’s home health market ownership structure influenced price elasticity of home health supply. \( \gamma_1 \) is expected to be positive in cases when \( M_s \) is the number of for-profits per capita, for-profit agency market
share, or for-profit hospital market share.

5.2 The Number of Episodes Per Patient

*Hypothesis 2:* *Agencies treated their patients for a higher number of episodes of care to increase profits, and this tendency was stronger among for-profit agencies.*

To address this hypothesis, I examine whether the profitability of treating a patient influenced an agency’s recertification decision. It may seem ideal to run a regression of each patient’s likelihood of recertification on his/her profitability. However, this relationship is endogenous. This is because the unreported patient health status becomes confounded with patient profitability and likelihood of recertification. In essence, I do not have access to detailed enough information about patient health status to control for it in my regression. For example, no information was available regarding changes in patient health status during the middle or end of an episode of care or the presence of specific health conditions not categorized by CMS. However, both of these factors affect patient profitability and likelihood of recertification. A decline in patient health status during an episode, for instance, generally requires an agency to provide extra service visits not reflected in the case-mix group rate assigned at the time of admission, thus lowering the profitability of that patient during that particular episode.

To address this endogenous relationship, I focus on low-cost outlier patients whose Medicare payments were much lower than standard prospective payment rates, and thus were generally perceived as largely unprofitable. To be eligible for low-cost outlier payments, patients had to receive fewer than five home health visits, regardless of service type. Because those low-cost outlier patients were relatively healthy, I expect to see little variation in their unobservable heterogeneous health conditions and therefore endogeneity is not a significant concern. I estimate regression (3) and then compute the marginal effect of low-cost outlier patients on the likelihood of recertification each year, which measures how each low-cost outlier patient’s likelihood of recertification changed over time compared to a non low-cost
outlier patient’s. The marginal effect is expected to be negative.

\[
Pr(recertified)_{ijkt} = \Phi(\beta_0 + \sum_{t=2002}^{2009} \beta_1 \text{year}_t + \beta_2 \text{lupa}_{ijkt} + \sum_{t=2002}^{2009} \beta_3 \text{year}_t \times \text{lupa}_{ijkt} + XB + state_s)
\]  

where \(i, j, k\) and \(t\) refer to a patient, agency, episode, and year. \(Pr(recertified)\) is a dummy variable indicating whether a patient was recertified for a subsequent episode of care. \(\text{year}\) is year dummy variables (2001—reference group). \(\text{lupa}\) represents a dummy variable indicating whether a patient was a low-cost outlier patient. \(X\) refers to each patient and agency’s basic characteristics, Herfindahl-Hirschman Index (the measure of level of market concentration), and seasonality. I also include state fixed effects \(state_s\) because each state might have different regulations that influence Medicare home health service provision. (Refer to the Appendix B for more specific explanation of each control variable.)

In addition, I check whether for-profit and non-profit agencies exhibited different trends in recertification of low-cost outlier patient. For the simplicity of the analysis, I estimate equation (4) conditional on the subsample of low-cost outlier patients. I then compute the marginal effect of non-profit agencies on each low-cost outlier patient’s likelihood of recertification each year. This marginal effect measures how each low-cost outlier patient’s likelihood of recertification in non-profit agencies differed over time compared to for-profit agencies. The marginal effect is expected to be positive.

\[
Pr(recertified)_{ijkt} = \Phi(\beta_0 + \sum_{t=2002}^{2009} \beta_1 \text{year}_t + \beta_2 \text{ownership}_{jt} + \sum_{t=2002}^{2009} \beta_3 \text{year}_t \times \text{ownership}_{jt} + XB + state_s)
\]

where \(\text{ownership}_{jt}\) refers to each agency’s ownership structure (for-profit—reference group,
and non-profit).

5.3 The Payment Amount Per Episode

Hypothesis 3: Agencies adjusted the types and number of services, which increased the payment amount per episode, and the degree of the adjustment was greater among for-profit agencies.

5.3.1 Types of Service Visits

Payment incentives built into the PPS encouraged agencies to adjust the type of home health services. To examine this hypothesis, I run regression (5) where \( outcome_{ijkt} \) represents dummy variables which indicate whether each patient received at least one skilled nursing, therapy, and home health aide visit in each episode. I then compute the marginal effect of year dummy variables on outcome variables, which measures how each patient’s likelihood of receiving any skilled nursing, therapy, and home health aide visits per episode changed over time. The marginal effect is expected to be positive if \( outcome_{ijkt} \) is the likelihood of receiving any therapy visits, but negative for the likelihood of receiving any home health aide visits. I also examine whether for-profit and non-profit agencies exhibited different trends in adjusting the type of home health service by computing the marginal effect of non-profit agencies compared to for-profit agencies on outcome variables each year.

\[
Pr(outcome_{ijkt}) = \Phi(\beta_0 + \sum_{t=2002}^{t=2009} \beta_{1t}year_t + \beta_{2}ownership_{jkt} + \sum_{t=2002}^{t=2009} \beta_{3t}year_t \times ownership_{jkt} + XB + state_s) \tag{5}
\]
5.3.2 Number of Service Visits

The non-linear pricing for home health service visits led agencies to target a certain number of service visits. To address this hypothesis, I investigate whether agencies targeted 5 or more skilled nursing visits (for patients who only received skilled nursing visits) and 10 or more therapy visits (for patients who received at least one therapy visit) under the PPS. I also examine whether this tendency was greater among for-profit agencies.

For this examination, I utilize the Dinardo, Fortin, and Lemieux’s (hereafter “DFL”) decomposition (1996). The use of the DFL method is ideal because it enables to check changes in the entire distribution of the number of service visits over time (Dinardo, 2002). The DFL method visually decomposes the difference in the distribution of the number of service visits between 2001 and 2007 into two parts: differences attributable to changes in 1) the observable variables affecting the number of service visits (composition effects) and 2) the number of service visit determination mechanism (structure effects)(Olson, 1998). In particular, I focus on structure effects that measure the agencies’ response to the payment incentives and examine whether agencies intentionally increased the provision of 5 or more skilled nursing visits or 10 or more therapy visits between 2001 and 2007.

I also use the DFP method to address how for-profit and non-profit agencies were different in their adjustment in the number of service visits in 2001 and 2007. The differences in the distribution of the number of service visits between for-profit and non-profit agencies are decomposed into composition and structure effects. Structure effects address whether for-profit agencies were more likely to target 5 or more skilled nursing visits or 10 or more therapy visits, taking into account the observable variables. (Refer to Appendix C for more specific information of the use of the DFL method.)

Medicare would make a per-visit payment for an episode with fewer than five service visits, regardless of service type. Thus, agencies would try to provide at least five visits, regardless of service type, per episode. Here, I specifically examine whether agencies attempted to provide five or more “skilled nursing” visits because agencies might try to provide at least 10 therapy visits to benefit from a significantly high marginal revenue at the 10th therapy visit, rather than trying to provide at least 5 visits. By limiting my sample to episodes with only skilled nursing visits provided, I can avoid this potential confounding effect.
To provide a comparison with the DFL semiparametric models, I also estimate regression (5) with $outcome_{ijkt}$ representing dummy variables indicating whether a patient received 1-4 skilled nursing visits, 5-7 skilled nursing visits, 7-9 therapy visits, or 10-13 therapy visits per episode of care. Given that agencies cannot significantly change the number of visits for each patient, I restrict the sample to episodes with 1-10 skilled nursing visits and to episodes with 1-15 therapy visits. The cut points for the number of visits are based on the distribution of the number of visits, by service type. I then compute the marginal effect of year dummy variables on these outcome variables. The marginal effect is expected to be positive if $outcome_{ijkt}$ is the likelihood of receiving 5-7 skilled nursing visits or 10-13 therapy visits, but negative for the 1-4 skilled nursing visits or 7-9 therapy visits. I also examine whether for-profit and non-profit agencies exhibited different trends in adjusting the number of service visits by computing the marginal effect of non-profit agencies on the outcome variables over time.

5.4 The Service Provision among New Home Health Agencies

**Hypothesis 4:** Agencies that entered the market under the PPS were more likely to pursue profitable service provision patterns than existing agencies.

New home health agencies might have started their businesses under the PPS because they recognized that the incentives built into the PPS would enable them to achieve high profit margins. Furthermore, existing agencies might have enjoyed more stable budget sources, which would have provided weaker incentives for following profitable home health service provision patterns. Consequently, new agencies would have been more likely than existing agencies to follow the specific home health provision patterns that lead to high profits. To examine this hypothesis, I limit my sample to home health episodes that occurred in 2007, and I examine how home health service provision patterns (i.e., likelihood of recertification, providing 7-9 therapy visits per episodes, providing 10-13 therapy visits per episode, providing 1-4 skilled nursing visits per episode, and providing 5-7 skilled nursing
visits per episode) differed depending on the starting year of each home health agency, by agency ownership type. As a robustness check, I also limit my sample to home health episodes that occurred in 2005 and 2006, and conduct the same analysis. The basic estimating equation takes the following form:

\[
Pr(outcome_{ijk}) = \Phi(\beta_0 + \sum_{n=2001}^{2007} \beta_{1n} establishingyear_{jn} + XB)
\] (6)

where establishingyear_{jn} is a vector of dummy variables that represent the starting year (n) of each home health agency (reference group: n ≤ 2000, i.e., agencies that entered the market prior to the PPS).

I estimate regression (6) and compute the marginal effect of each agency’s establishment year, which measures how each new agency’s home health service provision patterns varied depending on the establishment year. The reference group for this measurement is agencies established prior to the PPS. The marginal effect is expected to be positive when outcome_{ijk} is a profitable home health service provision pattern and vice versa.

6 Empirical Results

6.1 The Number of Patients

States with more for-profit agencies had a higher per-patient expenditure in 1994 and thus a higher interim payment rate. In particular, each state’s interim payment rate was positively associated with the number of for-profit agencies per 1,000 beneficiaries, for-profit home health agency market share, and for-profit hospital market share in each state in 1994. The number of non-profit agencies per 1,000 beneficiary was negatively associated with each state’s interim payment rate, but the relationship was not significant (see Table 3).

As my conceptual model predicted, states with more for-profit agencies also tended to have a relatively high price elasticity of home health supply. Each state’s price elasticity of
supply was positively associated with the number of for-profit agencies per 1,000 beneficiaries, for-profit home health agency market share, and for-profit hospital market share in each state in 2000 (see Table 4, columns (1) (3) and (4)). In contrast, the number of non-profit agencies per 1,000 beneficiaries was negatively associated with the elasticity (see Table 4, column (2)). That is, the proportion of Medicare beneficiaries using home health services increased to a greater degree in states with more for-profit agencies and fewer non-profit agencies. States with no CON program had a higher price elasticity of home health supply (see Table 4, column (5)). This suggests that without a state’s control over the establishment of new home health agencies, new for-profit agencies were more likely to enter the market under the PPS, increasing the proportion of Medicare beneficiaries using home health services to a greater degree (Choi and Davitt, 2009).

6.2 The Number of Episodes Per Patient

Agencies tried to increase profits by decreasing the likelihood of recertification of less profitable patients. The likelihood of recertifying a subsequent episode for a low-cost outlier patient (whose reimbursement rates were significantly lower) decreased gradually over time as compared to patients who were not eligible for low-cost outlier payments. Specifically, the discrepancy in the probability of recertification between low-cost outlier and “non” low-cost outlier episodes was 2.93 percentage points in 2002, but increased to 8.19 percentage points in 2007, and to 13.11 percentage points in 2009 (see Figure 5a). This finding confirms my hypothesis that agencies had a weaker incentive to recertify an additional episode for a less profitable patient.

A low-cost outlier patient’s likelihood of recertification among non-profit agencies was not that different from that of for-profit agencies (see Figure 5b). This finding does not support my hypothesis that for-profit agencies—which were more likely to prioritize profit—had a lower probability of recertifying an additional episode of care for a low-cost outlier patients.
6.3 The Payment Amount Per Episode

6.3.1 Types of Service Visits

Agencies sought to maximize each patient’s payment amount per episode by adjusting the types of home health service provided. For example, each patient’s likelihood of receiving any home health aide visits (which were not compensated for extra visits provided) decreased gradually under the PPS, whereas the likelihood of any therapy visits (which promised a substantial marginal benefit for the 10th therapy visit) increased (see Table 5). Furthermore, each patient’s likelihood of receiving any skilled nursing visits (a core service that agencies did not receive compensation for extra visits provided) increased only slightly until 2005, and in fact has started to decrease since then (see Table 5, column (1)). However, this slight change in the predicted likelihood was not significant most years, which might be due to a ceiling effect. That is, the proportion of episodes with any skilled nursing visit is already close to 1, and there is little room left for the proportion to increase or decrease. Thus, it is hard to examine an agency’s actual adjustment of skilled nursing visit provision in response to the PPS.

The influence of an agency’s ownership status on its adjustment of the type of services provided was not in line with my hypothesis. The likelihood of providing any therapy, home health aide, and skilled nursing visit did not differ among for-profit and non-profit agencies during most years of the PPS (See Figure 6). This is inconsistent with my hypothesis that for-profit agencies would seek to provide more therapy visits but less home health aide visits than non-profit agencies. One possible explanation for these unexpected results is that there might be unobservable differences between for-profit and non-profit agencies in patient health conditions. For instance, for-profit agencies might be more likely to serve patients who had unmeasured needs for home health aide visits. If so, the regression estimate could be biased.
6.3.2 Number of Service Visits

Home health agencies adjusted the number of service visits provided per episode in order to maximize payment per episode. First, agencies gradually increased the likelihood of providing 10-13 therapy visits under the PPS, which set the marginal benefit for the 10th therapy visit substantially high while the marginal benefit for all other numbers of therapy visits was zero. The DFL decomposition result illustrates that there is a big bump in the distribution at 10-13 therapy visits and the bump became more significant between 2001 and 2007 (see Figure 7a). The counterfactual distribution shows what the distribution of the number of therapy visits would be in 2001 with observable characteristics of the year 2001, holding the number of therapy visit determination mechanism (agencies’ response to payment incentives) in 2007 fixed. Comparing the actual distribution in 2001 and the counterfactual distribution, I find that agencies intentionally decreased provisions with fewer than 10 and more than 15 therapy visits, while increasing provisions with 10 to 13 therapy visits between 2001 and 2007. However, this targeting of 10-13 therapy visits suddenly disappeared in 2008 when Medicare modified the way the number of therapy visits was factored into reimbursement amounts (see Figure 7b). Interestingly, the actual distribution in 2008 and the counterfactual distribution (which illustrates what the distribution would be in 2007, assuming the observables of the year 2007 and the number of therapy visit determination mechanism of the year 2008) are almost the same, indicating that the huge change in the actual distribution between 2007 and 2008 was mostly due to agencies’ response to the change in the reimbursement schedule, not changes in observables. The probit regression results suggest the same. Agencies gradually increased the likelihood of providing 10-13 therapy visits per episode, but decreased the likelihood of providing 7-9 therapy visits. In 2008, this tendency disappeared (see Table 6, columns (3) and (4)).

Agencies also targeted 5 skilled nursing visits. The DFL decomposition result shows that there is a bump in the distribution at 5 skilled nursing visits, which became conspicuous over time (see Figure 8). Agencies decreased the likelihood of providing 1-4 skilled nursing
visits such that agencies did not receive a per-visit low-cost outlier payment whose rates were much lower than standard prospective payment rates. They also gradually increased the likelihood of providing 5 skilled nursing visits per episode. The distribution has a bump at 8-9 skilled nursing visits. This is because agencies followed guidelines in the number of skilled nursing visits to provide. That is, agencies were increasingly more likely to provide one skilled nursing visit per week—which translates into 8-9 visits per episode. The probit regression results suggest the same. Agencies gradually decreased the provision of 1-4 skilled nursing visits, but increased the likelihood of providing 5-7 skilled nursing visits per episode (see Table 6, columns (1) and (2)).

I find clear differences in the number of therapy visits provided between for-profit and non-profit agencies. Comparing the actual distribution of non-profit agencies and the counterfactual distribution (which illustrates what the distribution of therapy visits would be among non-profit agencies, assuming the observables of non-profits and the number of therapy visit determination mechanism of for-profits) in the DFL decomposition, I find that for-profit agencies were generally more likely to provide 10-13 therapy visits and less likely to provide fewer than 10 therapy visits than for-profits (see Figure 9). These findings indicate that, as my conceptual model predicted, for-profits were more likely to target 10-13 therapy visits per episode to benefit from the high marginal benefit of the 10th therapy visit. Probit regression results suggest the same (see Figure 11a and 11b).

By contrast, the difference between for-profits and non-profits was not apparent in the number of skilled nursing visits provided. Non-profits were more likely to provide 1-4 skilled nursing visits than for-profits, but this tendency became less significant over time (see Figure 10, 11c, and 11d). However, the difference between for-profits and non-profits in terms of their likelihood of providing 5-7 skilled nursing visits did not have a clear pattern (see Figure 10, 11c, and 11d). This might be because for-profit agencies were more likely to follow guidelines in the number of service visits to provide: one or two skilled nursing visits per week—which translates into 8-9 or 16-18 visits per episode. However, non-profit
agencies did not seem to follow such rules as strictly.

6.4 The Service Provision among New Home Health Agencies

For-profit home health agencies that entered the market under the PPS pursued profits more aggressively than their for-profit counterparts established prior to the PPS (see Figure 12). For example, those new for-profit entrants were more likely to recertify another episode of care and provide 10-13 therapy visits per episode, but less likely to provide 1-4 skilled nursing visits and provide 7-9 therapy visits per episode. They were not more likely to provide 5-7 skilled nursing visits per episode perhaps because for-profits tended to provide 8-9 or 16-18 visits per episode as I discussed above. However, new non-profit agencies behaved the same as existing counterparts. These results stayed essentially the same when I limit my sample to 2005, 2006, or 2007. Given that a number of home health agencies, mostly for-profits, continued to enter the market throughout the PPS, the aggressive profit-seeking behavior of new for-profit agencies not only contributed to Medicare home health spending growth but also explains the gradual adjustments in home health service provision patterns under the PPS.

7 Decomposition

7.1 Contribution of Each of the Three Factors to Spending Growth

All three factors—the number of home health patients, the number of episodes per patient, and the payment amount per episode—contributed to the aggregate home health spending increase under the PPS. This section briefly examines the extent to which each of these three components contributed to the total spending increase between 2001 and 2009 using the Oaxaca-Blinder decomposition method. This method estimates how much of the spending increase was attributable to increases in each of the factors (explained variation) and how much was attributable to changes in the relationship between each factor and total spending.
(unexplained variation) (Barrera-Osorio, Garcia-Moreno, Patrino, & Porta, 2011; Fortin, Lemieux, & Firpo, 2011). I focus on the explained variation and analyze the relative contribution of each of the three factors to the total spending increase. (Refer to Appendix D for a more detailed explanation of how I apply this decomposition method to the context of Medicare home health spending increases). The decomposition results suggest that the increase in the proportion of Medicare beneficiaries utilizing home health services contributed the most to the total spending increase under the PPS. The number of episodes per patient and the payment amount per episode contributed the second most and the least to the total spending increase between 2001 and 2009, respectively.

7.2 Contribution of For-Profit Market Share Increase to Spending Growth

The for-profit agency market share increased from 48 percent to 60 percent between 2001 and 2009. This increase in for-profit market share further accelerated total home health spending growth because new for-profit agencies that entered the market under the PPS were more likely to adopt profitable service provision patterns than existing agencies. This phenomenon leads to the following question: how much did the increase in the for-profit market share contribute to the increase in total Medicare home health spending?

To answer this question, I collapse the 2001 to 2009 data into the state level (N=459) and run a regression of four different dependent variables (home health spending per Medicare beneficiary, proportion of home health patients, number of episodes per patient, and payment amount per episode in each state in each year. These four terms are represented in the following equation, 

\[
\text{Total Spending} = \frac{\text{Patients}}{\text{Medicare Beneficiary}} \times \frac{\text{Episodes}}{\text{Patient}} \times \frac{\text{Payment}}{\text{Episode}}
\]

on each state’s for-profit market share in each year. I also control for each state’s basic demographic characteristics, state indicators, and year dummy variables. The coefficient of for-profit market share is then obtained in each of the four separate regressions (see Table 7, column (1)). I also compute the change in the value of the four factors between 2001 and 2009 (see
Table 7, column (2)). Then the implied contribution of the increase in for-profit market share to the actual change in the four factors from 2001 to 2009 is calculated. This calculation is equal to the coefficient estimates in the first column times the change in the for-profit market share between 2001 and 2009 (12 percent increase) (see Table 7, column (3)). In the last column, I show how much the for-profit market share increase contributed to the increase in each of the four factors by dividing the implied contribution in the third column by the change in each factor in the second column.

This approach suggests that the increase in the for-profit market share explains about one third of the increase in total spending between 2001 and 2009. For the same period, the for-profit market share increase explains roughly 34, 42, and 19 percent of the increase in the proportion of home health patients, the number of episodes per patient, and payment amount per episode, respectively. However, this result is suggestive because the causal influence of for-profit share on each of the four factors might not be clear.  

\[ \text{8 Conclusion} \]

The Medicare home health PPS—the system that was introduced to curb rising Medicare home health spending—provided unintended supply-side incentives that contributed heavily to an increase in the number of Medicare home health patients, the number of episodes per patient, and the payment amount per episode, all of which led to a significant increase in total Medicare home health spending. In particular, the rising number of Medicare home health patients contributed the most to the total spending increase.

The proportion of Medicare beneficiaries utilizing home health services dramatically increased under relatively generous prospective reimbursement rates. This increase was more salient in states with a relatively high number of for-profit agencies per capita and a relatively

\[ ^{6}\text{It is plausible that for-profit market share is relatively strongly associated with the four terms in only a few states, which would affect coefficients in column (1) of Table 7. To assess how much each state affects the overall results, I ran the same regressions with only 50 states, excluding a different state from the analysis each time.} \]
high for-profit market share. This suggests that home health agencies increased the number of patients to increase profits in response to relatively generous prospective reimbursement rates. In addition, limited guidelines on eligibility criteria for Medicare home health care enabled agencies to admit patients who might not have needed home health care, contributing to the increase in the number of patients.

Total Medicare home health spending was also significantly inflated by the increasing number of episodes per patient. Agencies increased profits by providing a greater number of episodes of care for more profitable patients. In addition, loose CMS guidelines about recertification decisions allowed agencies to easily recertify an additional episode of care and thus increase their profits. Although regulations stipulated that a physician be involved in the recertification decision process, anecdotally, most physicians made these decisions based on information provided by agencies via phone conversations (Brega et al., 2002).

Agencies also manipulated the system by adjusting the type and number of service visits to raise the payment amount per episode. For instance, agencies targeted 10-13 therapy visits per episode to benefit from the high marginal benefit of the 10th therapy visit. This dynamic also caused agencies to shift their service provision toward therapy visits and away from relatively less profitable home health services such as skilled nursing or home health aide visits.

Throughout this study, I find that for-profit agencies adopted profitable service provision patterns more aggressively under the PPS. Given that the start-up cost of a home health agency is relatively low, it is likely that the incentives built into the PPS attracted an increasing number of for-profit agencies. This is important because new for-profit agencies prioritized profits more strongly and thus contributed significantly to the increase in total Medicare home health spending. Overall, the for-profit market share increase under the PPS accounts for about one third of the total spending increase. Had the home health industry been dominated by non-profit agencies, the increase in total spending might have been lower.

Interestingly, an increase in all three components of total Medicare home health spending
could be viewed as desirable. Medicare home health care holds the potential to create savings in total Medicare spending because it is substitutable with more costly health care services. Home health care can replace more expensive skilled nursing home or inpatient care by allowing patients to receive necessary medical care at home. This substitution would lower health spending, an important benefit given the current anti-spending political environment (Benjamin, 1993). While such an expansion of home health care spending may be beneficial, an increase in home health spending caused by the inadvertent inclusion of improper incentives is undesirable and wasteful of resources. Future reimbursement policies must be carefully structured to encourage home health agencies to effectively balance cost efficiency and quality of care.
References


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Dinardo, J. (2002). Propensity score reweighting and changes in wage distribution.


Figure 1: Medicare Home Health Spending under the Different Reimbursement Systems: 1990-2009

Source: Medicare & Medicaid Research Review, 2011 Statistical Supplement

Note: 1) Medicare home health care was under the fee-for-service payment system until September, 1997; the interim payment system between October, 1997-September, 2000; and has been under the prospective payment system since October, 2000. 2) All numbers are in 2001 real dollars.
Figure 2: The Increase in the Proportion of Medicare Beneficiaries Utilizing Home Health Services under the PPS

(a) For-Profit and Non-Profit Agency’s Short-Run Supply Curve: a for-profit agency has a more elastic supply curve because for-profit agencies tend to be more responsive to changes in government reimbursement rates.

(b) State-Level Market Supply Curve (1): Texas with a higher for-profit market share, had a higher interim payment rate and a more elastic supply curve than did New Jersey.

(c) State-Level Market Supply Curve (2): Texas attracted more new agencies to the market and thus Texas’ supply curve shifted to the right to a greater degree.
Figure 3: The Number of Therapy Visits per Episode in 2001

(a) Medicare Prospective Reimbursement Schedule

(b) Profit

(c) Number of Visits

(d) Number of Visits: 4 vs 5 and 9 vs 10

(e) Number of Visits: For-Profit vs Non-Profit
Figure 4: The Number of Medicare-Certified Home Health Agencies, by Ownership Type between 1995 and 2010

Source: The CMS Provider of Services File-Home Health Agency 1995-2010

Note: 1) Medicare home health care was under the fee-for-service payment system until September, 1997; the interim payment system between October, 1997-September, 2000; and has been under the prospective payment system since October, 2000. 2) Home health agencies in Puerto Rico and the U.S. Island Areas are excluded.
Figure 5: The Influence of Each Patient’s Profitability on the Likelihood of Recertification between 2001 and 2009

(a) Marginal Effects (and 95% Confidence Intervals) of Low-cost Outlier Patients (Reference Group: Non Low-cost Outlier Patients) on the Likelihood of Recertification of Each Episode of Care

(b) Marginal Effects (and 95% Confidence Intervals) of Non-Profit Ownership (Reference Group: For-Profit) on the Likelihood of Recertification of Each Episode of Care among Low-Cost Outlier Patients

Note: 1) ● p ≤ 0.001; □ p ≤ 0.01; △ p ≤ 0.05; × p > 0.01 2) I restrict the sample to episodes eligible for low-cost outlier payments in Figure 5b.
Figure 6: Marginal Effects (and 95% Confidence Interval) of Non-Profit Ownership (Reference Group: For-Profit) on the Likelihood of Providing Any Skilled Nursing, Therapy, or Home Health Aide Visits per Episode between 2001 and 2009

(a) The Likelihood of Any Skilled Nursing Visits

(b) The Likelihood of Any Therapy Visits

(c) The Likelihood of Any Home Health Aide Visits

Note: 1) • p ≤ 0.001; □ p ≤ 0.01; △ p ≤ 0.05; × p > 0.01 2) In Figures 6a, 6b, and 6c, I restrict the sample to episodes ineligible for low-cost or high-cost outlier payments.
Note: 1) In Figure 7a, ‘YR=2001’ and ‘YR=2007’ represent the actual distribution of the number of therapy visits in 2001 and 2007, respectively. ‘Counterfactual’ illustrates what the distribution of the number of therapy visits would be in 2001 with observable characteristics of the year 2001, holding the number of therapy visit determination mechanism in 2007 fixed. 2) In Figure 7b, ‘YR=2007’ and ‘YR=2008’ represent the actual distribution of the number of therapy visits in 2007 and 2008, respectively. ‘Counterfactual’ illustrates what the distribution of the number of therapy visits would be in 2007 with observable characteristics of the year 2007, holding the number of therapy visit determination mechanism in 2008 fixed. 3) In Figures 7a and 7b, I restrict the sample to episodes with at least one therapy visit provided and to episodes ineligible for low-cost or high-cost outlier payments.
Figure 8: PDF of the Number of Skilled Nursing Visits by Year: 2001 vs 2007

Note: 1) ‘YR=2001’ and ‘YR=2007’ represent the actual distribution of the number of skilled nursing visits in 2001 and 2007, respectively. ’Counterfactual’ illustrates what the distribution of the number of skilled nursing visits would be in 2001 with observable characteristics of the year 2001, holding the number of skilled nursing visit determination mechanism in 2007 fixed. 2) I restrict the sample to episodes with only skilled nursing visits provided and to episodes ineligible for high-cost outlier payments.
Figure 9: PDF of the Number of Therapy Visits by Ownership Type

(a) Year: 2001

(b) Year: 2007

Note: 1) 'NonProfit' and 'ForProfit' represent the actual distribution of the number of therapy visits among non-profit and for-profit agencies, respectively. 'Counterfactual' illustrates what the distribution of the number of therapy visits would be among non-profit agencies, assuming the observable characteristics of non-profit agencies and the number of therapy visit determination mechanism of for-profit agencies.  2) In Figures 9a and 9b, I restrict the sample to episodes with at least one therapy visit provided and to episodes ineligible for low-cost or high-cost outlier payments.
Figure 10: PDF of the Number of Skilled Nursing Visits by Ownership Type

Note: 1) 'NonProfit' and 'ForProfit' represent the actual distribution of the number of skilled nursing visits among non-profit and for-profit agencies, respectively. 'Counterfactual' illustrates what the distribution of the number of skilled nursing visits would be among non-profit agencies, assuming the observable characteristics of non-profit agencies and the number of skilled nursing visit determination mechanism of for-profit agencies. 2) In Figures 10a and 10b, I restrict the sample to episodes with only skilled nursing visits provided and to episodes ineligible for high-cost outlier payments.
Figure 11: Marginal Effects (and 95% Confidence Interval) of Non-Profit Ownership (Reference Group: For-Profit) on the Likelihood of Providing a Certain Number of Service Visits per Episode between 2001 and 2009

Note: 1) \( p \leq 0.001; \square p \leq 0.01; \triangle p \leq 0.05; \times p > 0.01 \) 2) In Figures 11a and 11b, I restrict the sample to episodes that provided 1-15 therapy visits and to episodes ineligible for low-cost or high-cost outlier payments. 3) In Figures 11c and 11d, I restrict the sample to episodes that provided 1-10 skilled nursing visits with no other types of services and were ineligible for high-cost outlier payments.
Figure 12: Marginal Effects (and 95% Confidence Interval) of Establishment Year (Reference Group: before 2001) on Service Provisions in 2007: For-Profit Home Health Agencies

(a) Recertification

(b) Providing 7-9 Therapy Visits

(c) Providing 10-13 Therapy Visits

(d) Providing 1-4 Skilled Nursing Visits

(e) Providing 5-7 Skilled Nursing Visits

Note: 1) The reference group is agencies that entered the market prior to the PPS (i.e. before 2001) 2) ● p ≤ 0.001; □ p ≤ 0.01; △ p ≤ 0.05; × p > 0.01 3) In Figures 12b and 12c, I restrict the sample to episodes that provided at least one therapy visit and were ineligible for low-cost or high-cost outlier payments. 4) In Figures 12d and 12e, I restrict the sample to episodes that provided only skilled nursing visits and were ineligible for high-cost outlier payments.
Table 1: Summary of Major Changes to the Medicare Home Health Reimbursement System

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Fee For Service Payment System</th>
<th>Interim Payment System</th>
<th>Prospective Payment System</th>
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<td></td>
<td>1965 (Medicare Establishment Year)-Sep, 1997</td>
<td>Oct, 1997-Sep, 2000</td>
<td>Oct, 2000- Present</td>
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<tr>
<td>The Payment Amount</td>
<td>Actual costs with the service-specific per-visit limit, but not with per-beneficiary limits</td>
<td>The lowest of 1) actual cost 2) new per-visit limits or 3) annual per-patient limit which was the weighted average of each agency’s 1994 average per-patient cost and the census region’ 1994 average per-patient cost¹</td>
<td>The fixed payment corresponding to patient’s case mix with additional adjustment for low number of visits or unusually high-cost outliers</td>
</tr>
<tr>
<td>Payment Period</td>
<td>Every 60 days</td>
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</tbody>
</table>

¹Most agencies fell under the annual per-patient limit which was the same across all patients regardless of their health condition or duration of care.
Table 2: Trends in Number of Patients, Number of Episodes, and Payment Amount per Episode by Year of Service between 2001 and 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Patients (in 1,000s)</th>
<th>Number of Patients per 1,000 Medicare Beneficiaries</th>
<th>Number of Episode per Patient</th>
<th>Payment Amount per Episode ($)</th>
<th>Total Spending in Billions ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>2,402.5</td>
<td>71</td>
<td>not available</td>
<td>not available</td>
<td>8.51</td>
</tr>
<tr>
<td>2002</td>
<td>2,544.4</td>
<td>73</td>
<td>1.6</td>
<td>2,340</td>
<td>9.40</td>
</tr>
<tr>
<td>2003</td>
<td>2,681.1</td>
<td>75</td>
<td>1.7</td>
<td>2,134</td>
<td>9.69</td>
</tr>
<tr>
<td>2004</td>
<td>2,835.6</td>
<td>78</td>
<td>1.7</td>
<td>2,227</td>
<td>10.69</td>
</tr>
<tr>
<td>2005</td>
<td>2,975.6</td>
<td>81</td>
<td>1.8</td>
<td>2,174</td>
<td>11.59</td>
</tr>
<tr>
<td>2006</td>
<td>3,026.2</td>
<td>84</td>
<td>1.8</td>
<td>2,248</td>
<td>12.22</td>
</tr>
<tr>
<td>2007</td>
<td>3,099.5</td>
<td>87</td>
<td>1.9</td>
<td>2,272</td>
<td>13.30</td>
</tr>
<tr>
<td>2008</td>
<td>3,171.6</td>
<td>90</td>
<td>1.9</td>
<td>2,320</td>
<td>13.88</td>
</tr>
<tr>
<td>2009</td>
<td>3,281.1</td>
<td>92</td>
<td>2.0</td>
<td>2,362</td>
<td>15.46</td>
</tr>
</tbody>
</table>

Note: 1) The increase in the payment amount per episode was small because the government cut the Medicare home health prospective payment base rate by 16.22% between 2002 and 2009. To set the payment amount per episode, Medicare sets the home health base rate at “the amount that would be paid for an average home health patient residing in an average market per episode” and adjusts it based on patient health conditions and each region’s wage index (MedPAC, 2007). Thus, as CMS intended, the lower base rates prevented a large increase in the average payment per episode. Taking into account the government-cuts, the adjusted percent increase in the payment amount per episode was 16.46% during this period (HCFA, 2000, 2001; CMS, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009; MedPAC, 2012).

Table 3: Factors Associated with State Variation in Interim Payment Rate

<table>
<thead>
<tr>
<th>Covariate (in 1994)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP/1,000 beneficiaries</td>
<td>4892.25(1214.16)***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NFP/1,000 beneficiaries</td>
<td>-354.63(2943.34)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FP HHA mktshr(0-100)</td>
<td>20.70(7.63)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FP HOSP mktshr(0-100)</td>
<td>48.95(11.23)***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>51</td>
</tr>
</tbody>
</table>

Note: Other control variables include age distribution(65-69-reference group, 70-74, 75-79, 80-89, and 90+), race composition(white-reference group, black, and others), the proportion of female beneficiaries, the proportion of married beneficiaries, the proportion of dual-eligible beneficiaries, the proportion of beneficiaries who resided with any child in 1994. Equations are estimated using an ordinary least squares regression.

* p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01

Table 4: Factors Associated with State Variation in Price Elasticity of Home Health Supply

<table>
<thead>
<tr>
<th>Covariate (in 2000)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP/1,000 beneficiaries</td>
<td>.064(.015)***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NFP/1,000 beneficiaries</td>
<td>-0.081(.029)***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FP HHA mktshr(0-100)</td>
<td>.0052(.0016)***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FP HOSP mktshr(0-100)</td>
<td>.010(.0030)***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CON</td>
<td>-12(.066)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>51</td>
</tr>
</tbody>
</table>

Note: Other control variables include age distribution(65-69-reference group, 70-74, 75-79, 80-89, and 90+), race composition(white-reference group, black, and others), the proportion of female beneficiaries, the proportion of married beneficiaries, the proportion of dual-eligible beneficiaries, the proportion of beneficiaries who resided with any child, the proportion of beneficiaries who died in 2000. Equations are estimated using an ordinary least squares regression.

* p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01
Table 5: The Likelihood of Providing Any Skilled Nursing, Therapy, and Home Health Aide Visits per Episode between 2001 and 2009

<table>
<thead>
<tr>
<th>Year (1)</th>
<th>Pr(Skilled Nursing)</th>
<th>Pr(Therapy)</th>
<th>Pr(Home Health Aide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>-.0013 (.0014)</td>
<td>.030 (.0026)***</td>
<td>-.020 (.0026)***</td>
</tr>
<tr>
<td>2003</td>
<td>.00050 (.0025)</td>
<td>.049 (.0028)***</td>
<td>-.038 (.0030)***</td>
</tr>
<tr>
<td>2004</td>
<td>.0067 (.0032)*</td>
<td>.060 (.0037)***</td>
<td>-.051 (.0040)***</td>
</tr>
<tr>
<td>2005</td>
<td>.0072 (.0038)</td>
<td>.069 (.0054)***</td>
<td>-.067 (.0048)***</td>
</tr>
<tr>
<td>2006</td>
<td>.0041 (.0050)</td>
<td>.082 (.0086)***</td>
<td>-.077 (.0049)***</td>
</tr>
<tr>
<td>2007</td>
<td>.0011 (.0054)</td>
<td>.090 (.011)***</td>
<td>-.090 (.0051)***</td>
</tr>
<tr>
<td>2008</td>
<td>-.015 (.0063)*</td>
<td>.12 (.012)***</td>
<td>-.10 (.0070)***</td>
</tr>
<tr>
<td>2009</td>
<td>-.016 (.0068)*</td>
<td>.13 (.013)***</td>
<td>-.11 (.0083)***</td>
</tr>
</tbody>
</table>

Pseudo R2 | .17 | .079 | .048
Observations | 1,534,813 | 1,534,813 | 1,534,813

Note: I restrict the sample to episodes ineligible for low-cost or high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state.

*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001
Table 6: The Likelihood of Providing a Certain Number of Service Visits per Episode between 2001 and 2009

<table>
<thead>
<tr>
<th>Year (1)</th>
<th>Skilled Nursing Visit</th>
<th>Therapy Visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>-.013(.0043)**</td>
<td>.022(.0031)</td>
</tr>
<tr>
<td>2003</td>
<td>-.037(.0061)***</td>
<td>.022(.0032)***</td>
</tr>
<tr>
<td>2004</td>
<td>-.054(.0076)***</td>
<td>.027(.0056)***</td>
</tr>
<tr>
<td>2005</td>
<td>-.069(.0071)***</td>
<td>.036(.0057)***</td>
</tr>
<tr>
<td>2006</td>
<td>-.080(.0096)***</td>
<td>.037(.0056)***</td>
</tr>
<tr>
<td>2007</td>
<td>-.091(.010)***</td>
<td>.037(.0057)***</td>
</tr>
<tr>
<td>2008</td>
<td>-.086(.011)***</td>
<td>.037(.0080)***</td>
</tr>
<tr>
<td>2009</td>
<td>-.099(.0099)***</td>
<td>.043(.0079)***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year (2001)</th>
<th>Pr(1≤V≤4)</th>
<th>(2) Pr(5≤V≤7)</th>
<th>(3) Pr(7≤V≤9)</th>
<th>(4) Pr(10≤V≤13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>-.012(.0024)***</td>
<td>.013(.0043)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>-.025(.0031)***</td>
<td>.020(.0049)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>-.031(.0034)***</td>
<td>.039(.0055)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>-.035(.0038)***</td>
<td>.048(.0070)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>-.035(.0042)***</td>
<td>.051(.0068)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>-.034(.0043)***</td>
<td>.056(.0071)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>.043(.0037)***</td>
<td>-.051(.0094)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>.060(.0056)***</td>
<td>-.071(.012)***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pseudo R2 | .10   | .011 | .022 | .050 |
Observations | 441,809 | 441,809 | 679,075 | 679,075 |

Note: In columns (1) and (2), I restrict my sample to episodes that provided 1-10 skilled nursing visits with no other types of services and were ineligible for high-cost outlier payments. In columns (3) and (4), I restrict my sample to episodes that provided 1-15 therapy visits and were ineligible for low-cost and high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state. *p≤0.05, **p≤0.01, ***p≤0.001
Table 7: The Contribution of the For-Profit Market Share Increase to the Total Spending Increase between 2001 and 2009

<table>
<thead>
<tr>
<th>Factor</th>
<th>(1) For-Profit Market Share (0-100)</th>
<th>(2) Change from 2001 to 2009</th>
<th>(3) For-Profit Contribution (= (1) × (2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of Home Health Patients</td>
<td>.00049 (.00017)**</td>
<td>.017</td>
<td>.0058</td>
</tr>
<tr>
<td>Episodes per Patient</td>
<td>.0046 (.0020)**</td>
<td>.13</td>
<td>.055</td>
</tr>
<tr>
<td>Payment per Episode (in Thousand Dollars)</td>
<td>.0035 (.0021)*</td>
<td>.22</td>
<td>.042</td>
</tr>
<tr>
<td>Total Spending per Beneficiary (in Thousand Dollars)</td>
<td>.0032 (.0010)**</td>
<td>.12</td>
<td>.039</td>
</tr>
</tbody>
</table>

Note: *p ≤ 0.1, **p ≤ 0.05, ***p ≤ 0.01
Appendix A  Medicare Home Health Reimbursement Schedule

This section provides more detailed explanation about how a Medicare home health care reimbursement schedule is determined. To illustrate an example of a home health reimbursement schedule, let’s imagine a patient who lived in Ann Arbor, MI in 2001 and received physical therapy services from a home health agency. His home health agency assessed his health status and assigned him to the case-mix group C1F1S0 (his clinical severity was low; functional severity was low; and service severity was minimal). This case-mix group was translated to a case-mix weight 0.7169 and its corresponding reimbursement amount $1,691.25 that had been adjusted according to the Ann Arbor wage index. The patient’s case-mix group stayed as C1F1S0 for his first 9 therapy visits. However, once the number of therapy visits reached 10, his payment group automatically switched to C1F1S2. That is, his service severity increased from minimal to moderate while his clinical and functional severity stayed low. This new case-mix group pushed his case-mix weight up to 1.6752 and his reimbursement amount to $3,951.98. This retrospective feature built into the prospective reimbursement schedule provided a strong incentive for the patient’s agency to provide at least 10 therapy visits such that it could make $2,260.73 ($3,951.98 - $1,691.25) of additional revenue compared to 9 or fewer visits.

The Medicare home health reimbursement system contained further retrospective features, low-cost and high-cost outlier payments. In terms of low-cost outlier payments, for patients who received 4 or fewer visits per episode, the CMS would make a per-visit low-utilization payment by service type that was the same for all patients, regardless of health status. Thus, in this patient case, if he received 4 or fewer physical therapy visits, his agency would have received $116.81 for each visit instead of the lump-sum payment. In terms of high-cost outlier payments, for patients who required more service visits such that their estimated incurred per-episode cost exceeded a threshold amount, the CMS would make a high-cost
outlier payment equal to 80 percent of the estimated incurred per-episode cost beyond the threshold amount. In John’s example, once his therapy visit number reached 57, John would become eligible for high-cost outlier payments. Thus, his agency would receive an additional $93.45 for each therapy visit beyond visit 56 in addition to $3,951.98.

Appendix B  Control Variables

This section provides more specific explanation about the vector of control variables $X$ that refers to each patient and agency’s basic characteristics, Herfindahl-Hirschman Index (the measure of level of market concentration), and seasonality.

Each patient’s basic characteristics include both demographic and health characteristics. Demographic factors include age, race/ethnicity, gender, and an indicator of participation in the Medicare buy-in program. Participation in the Medicare buy-in program is a proxy of being low-income given that the program helps pay Medicare premiums for low-income Medicare beneficiaries (Families USA, 1999). Patient health conditions include indicators for most frequent major health diagnoses (diabetes, hypertension, heart failure, chronic ulcer of skin, osteoporosis, cardiac dysrhythmias, stroke, dementia, pneumonia, other forms of chronic ischemic heart disease, cancer, mental disorders, arthritis).

Each home health agency’s basic characteristics include the number of patients treated by each agency and an indicator of whether each agency was free-standing or facility-based. Unfortunately, the dataset provides no variable that measures the number of patients in each agency. Instead, I use the count of patients treated by each agency in the dataset as a proxy. Because the dataset samples 5% of all Medicare home health patients, the relative actual number of patients across agencies should be consistent with the measure constructed from my dataset. I also take into account whether each agency was free-standing or facility-based. Facility-based agencies are operated as part of a hospital, rehabilitation facility, or skilled nursing home. The distinction is important because facility-based agencies would enjoy
benefits unavailable to free-standing agencies such as referrals of more profitable patients through the affiliated system and a more stable budget source (Choi and Davitt, 2009).

The Herfindahl-Hirschman Index (HHI) measures level of market concentration. HHI is calculated as the sum of the squares of each agency’s share of total episodes within each Hospital Referral Region in each year, and thus it ranges between 0 and 1. A higher value of HHI indicates a higher concentration of agencies, but less intense within market competition.

Seasonality includes indicators of four quarter of each year (the first—reference group, second, third, and last quarter of each year).

Appendix C   DFL decomposition

This section illustrates how the DFL method decomposes the change in the distribution of the number of therapy visits between 2001 and 2007 (Dinardo, 2002; Fortin, Lemieux, & Firpo, 2011). The actual distribution of the number of therapy visits in 2001 and 2007 is expressed as followings, respectively.

\[
\int f^{2001}(V^T)dV^T \equiv \int f^{2001}(V^T|x)h(x|t = 2001)dx
\]  \hspace{1cm} (7)

\[
\int f^{2007}(V^T)dV^T \equiv \int f^{2007}(V^T|x)h(x|t = 2007)dx
\]  \hspace{1cm} (8)

where \(V^T\) represents the number of therapy visits per episode, \(t\) refers to year, and \(x\) represents other characteristics affecting the number of therapy visits including patient and agency characteristics, seasonality, and state indicators. \(f^{2001}(V^T|x)\) is the therapy visit number determination mechanism in 2001 that maps observables to the number of therapy visit distribution. The density \(h(x|t = 2001)\) is the probability density function of observables in 2001.

I then decompose the difference between equations (7) and (8):

58
\[ \int f^{2007}(V^T)dV^T - \int f^{2001}(V^T)dV^T = \left[ \int f^{2007}(V^T|x)h(x|t = 2007)dx \right] \\
- \left[ \int f^{2007}(V^T|x)h(x|t = 2001)dx \right] \\
+ \left[ \int f^{2007}(V^T|x)h(x|t = 2001)dx \right] \\
- \left[ \int f^{2001}(V^T|x)h(x|t = 2001)dx \right] \tag{9} \]

The DFL method computes the counterfactual distribution, weighting the actual distribution of the 2007 with the following variable \( \omega_i \).

\[ \int f^{2007}(V^T|x)h(x|t = 2001)dx \equiv \int \omega_i f^{2007}(V^T|x)h(x|t = 2007)dx \tag{10} \]

where

\[ \omega_i = \frac{h(x|t = 2001)}{h(x|t = 2007)} \tag{11} \]

\[ = \frac{Pr(t = 2001|x)_i/Pr(t = 2001)}{Pr(t = 2007|x)_i/Pr(t = 2007)} \]
Pr(\(t = 2001|X\))_i \text{ and } Pr(\(t = 2007|X\))_i \text{ are computed for each observation } i \text{ based on a probit model for the probability of the sample for the year 2001. } Pr(t = 2001) \text{ and } Pr(t = 2007) \text{ are the unconditional probabilities that the sample is from 2001 or 2007.}

**Appendix D  Oaxaca-Blinder Decomposition**

This section provides a more detailed explanation of how I apply the Oaxaca-Blinder decomposition method to examine how much each of the three factors (proportion of home health patients, number of episodes per patient, and payment amount per episode) contributed to the total spending increase between 2001 and 2009.

First, I collapse the 2001 and 2009 data to the state level (N=102)\(^7\) and run regression (12) by year.

\[
Y_s = \beta_0 + \beta_1 X_{1,s} + \beta_2 X_{2,s} + \beta_3 X_{3,s} + \varepsilon_s
\]

where \(s\) represents each state. \(Y\), \(X_1\), \(X_2\), and \(X_3\) refer to Total Spending \(\#\) Medicare B (home health spending per beneficiary), \(\#\)Patients \(\#\)Medicare B (proportion of Medicare beneficiaries utilizing home health services), \(\#\)Episodes \(\#\)Patient (number of episodes per patient), and Payment \(\#\)Episode (payment amount per episode), respectively.

Second, using coefficient estimates in regression (12) and the value of \(X_1\), \(X_2\), and \(X_3\) in 2001 and 2009 (see Table A.1), I decompose the total spending increase between 2001 and 2009 into explained and unexplained components:

\[
Y_{2009} - Y_{2001} = (X_{1,2009} - X_{1,2001})\beta_{1,2001} + (X_{2,2009} - X_{2,2001})\beta_{2,2001}
\]

\(^7\)In this decomposition, I use state-level variation to be consistent with my approaches in other sections of this paper where I use state-level variation in the analysis of the increase in the proportion of home health patients.
\begin{align*}
+(X_3,2009 - X_3,2001)\beta_3,2001 \\
+\{(\beta_1,2009 - \beta_1,2001)X_1,2009 \\
+(\beta_2,2009 - \beta_2,2001)X_2,2009 \\
+(\beta_3,2009 - \beta_3,2001)X_3,2009 \\
+(\beta_0,2009 - \beta_0,2001)\}
\end{align*}

where 2001 and 2009 subscripts are identifiers of years 2001 and 2009. The first three terms
(explained variation) represent the total spending increase per capita due to changes in each
of the three factors, evaluated at the 2001 relationship between total spending per capita
and each of the three factors. The next three terms (unexplained variation) represent the
total spending increase per capita due to changes in the relationship between total spending
per capital and each of the three factors, evaluated at the 2009 value of each of the three
factors.

I can also decompose the total spending increase between 2001 and 2009 as follows:

\begin{equation}
Y_{2009} - Y_{2001} = \{(X_1,2009 - X_1,2001)\beta_1,2009 \\
+(X_2,2009 - X_2,2001)\beta_2,2009 \\
+(X_3,2009 - X_3,2001)\beta_3,2009\} \\
+\{(\beta_1,2009 - \beta_1,2001)X_1,2001 \\
+(\beta_2,2009 - \beta_2,2001)X_2,2001 \\
+(\beta_3,2009 - \beta_3,2001)X_3,2001 \\
+(\beta_0,2009 - \beta_0,2001)\}
\end{equation}

where the first three terms (explained variation) represent the total spending increase per
capita due to changes in each of the three factors, evaluated at the 2009 relationship between
total spending per capita and each of the three factors. The next three terms (unexplained variation) represent the total spending increase per capita due to changes in the relationship between total spending per capita and each of the three factors, evaluated at the 2001 value of each of the three factors.

In this decomposition approach, I focus on the explained variation and analyze the relative contribution of each of the three factors to the total spending increase. When I decompose using equation (13), I find the proportion of home health patients, the number of episodes per patient, and the payment amount per episode contributed approximately 52 (=.047/.092), 28 (=.026/.092), and 20 (=.019/.092) percent to the total spending increase between 2001 and 2009, respectively (see Table A.2 column (a)). When I decompose using equation (14), the corresponding contribution percentage of the three factors are 43 (=.053/.123), 31 (=.038/.123), and 26 (=.032/.123) percent. In sum, the increase in the proportion of home health patients contributed the most to the total spending increase between 2001 and 2009. The number of episodes per patient and the payment amount per episode contributed the second most and the least to the total spending increase during the same period.

Table A.1: Means and OLS regression coefficients from home health spending per beneficiary regressions for the years 2001 and 2009

<table>
<thead>
<tr>
<th></th>
<th>(1)Mean in 2001</th>
<th>(2)Mean in 2009</th>
<th>(3)Year 2001 Regression Coefficient</th>
<th>(4)Year 2009 Regression Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Spending per Beneficiary</td>
<td>.24</td>
<td>.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three Factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prop of HH Patients</td>
<td>.076</td>
<td>.092</td>
<td>2.85(.097)</td>
<td>3.20(.22)</td>
</tr>
<tr>
<td>Episodes per Patient</td>
<td>1.41</td>
<td>1.54</td>
<td>.20(.010)</td>
<td>.29(.018)</td>
</tr>
<tr>
<td>Payment per Episode</td>
<td>2.17</td>
<td>2.39</td>
<td>.086(.0055)</td>
<td>.15(.014)</td>
</tr>
<tr>
<td>Constant Term</td>
<td>-.44(.017)</td>
<td>-.74(.041)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. R-Square</td>
<td>.99</td>
<td>.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample Size</td>
<td>102</td>
<td>102</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Total spending per beneficiary and payment per episode are in 1,000 dollars.
Table A.2: Oaxaca-Blinder Decomposition: Contribution of Each of the Three Factors to the Total Spending Increase between 2001 and 2009

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Explained</td>
<td>(b) Unexplained</td>
<td>(c) Explained</td>
<td>(d) Unexplained</td>
</tr>
<tr>
<td>Prop of HH Patients</td>
<td>0.047 (0.015)</td>
<td>0.032 (0.023)</td>
<td>0.053 (0.017)</td>
<td>0.026 (0.019)</td>
</tr>
<tr>
<td>Episodes per Patient</td>
<td>0.026 (0.013)</td>
<td>0.143 (0.032)</td>
<td>0.038 (0.019)</td>
<td>0.131 (0.029)</td>
</tr>
<tr>
<td>Payment per Episode</td>
<td>0.019 (0.005)</td>
<td>0.148 (0.036)</td>
<td>0.032 (0.009)</td>
<td>0.134 (0.033)</td>
</tr>
<tr>
<td>Constant Term</td>
<td>-0.295 (0.044)</td>
<td>-0.295 (0.044)</td>
<td>-0.295 (0.044)</td>
<td>-0.295 (0.044)</td>
</tr>
<tr>
<td>Total</td>
<td>0.092 (0.026)</td>
<td>0.029 (0.008)</td>
<td>0.123 (0.034)</td>
<td>-0.003 (0.007)</td>
</tr>
</tbody>
</table>

Note: Explained and Unexplained Variation in columns (a)-(d) are computed based on the values in columns (1)-(4) of Table A.1. Specifically, Explained in (a) = (2) - (1) × (3), Unexplained in (b) = [(4)-(3)] × (2), Explained in (c) = [(2)-(1)] × (4), and Unexplained in (d) = [(4)-(3)] × (1).

Payment per episode are in 1,000 dollars.
Table A.3: Influence of Each Patient’s Profitability on the Likelihood of Recertification between 2001 and 2009

<table>
<thead>
<tr>
<th>Sample Year</th>
<th>All Patients (1) Pr(Recertification)</th>
<th>Low-Cost Outlier Patients (2) Pr(Recertification)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>-.011(.014)</td>
<td>-.0062(.012)</td>
</tr>
<tr>
<td>2002</td>
<td>-.029(.014)*</td>
<td>.0044(.013)</td>
</tr>
<tr>
<td>2003</td>
<td>-.020(.016)</td>
<td>.0011(.014)</td>
</tr>
<tr>
<td>2004</td>
<td>-.035(.016)*</td>
<td>.0059(.013)</td>
</tr>
<tr>
<td>2005</td>
<td>-.062(.021)**</td>
<td>-.0052(.0098)</td>
</tr>
<tr>
<td>2006</td>
<td>-.070(.025)**</td>
<td>.0024(.015)</td>
</tr>
<tr>
<td>2007</td>
<td>-.082(.026)**</td>
<td>-.018(.015)</td>
</tr>
<tr>
<td>2008</td>
<td>-.11(.029)**</td>
<td>-.0071(.017)</td>
</tr>
<tr>
<td>2009</td>
<td>-.13(.029)**</td>
<td>-.022(.016)</td>
</tr>
<tr>
<td>R-squared</td>
<td>.13</td>
<td>.090</td>
</tr>
<tr>
<td>Observations</td>
<td>1,778,368</td>
<td>185,650</td>
</tr>
</tbody>
</table>

Note: Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state. Column(1) shows the marginal effects of low-cost outlier patients (reference group: non low-cost outlier patients) on the likelihood of recertification. Column(2) shows the marginal effects of non-profit ownership (reference group: for-profit) on the likelihood of recertification among low-cost outlier patients.

*p≤0.05, **p≤0.01, ***p≤0.001
<table>
<thead>
<tr>
<th>Year</th>
<th>(1)Pr(Skilled Nursing)</th>
<th>(2)Pr(Therapy)</th>
<th>(3)Pr(Home Health Aide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>.00023(.0034)</td>
<td>.0022(.0089)</td>
<td>-.012(.0086)</td>
</tr>
<tr>
<td>2002</td>
<td>.0013(.0029)</td>
<td>-.012(.0093)</td>
<td>-.010(.0089)</td>
</tr>
<tr>
<td>2003</td>
<td>-.00023(.0030)</td>
<td>-.0035(.011)</td>
<td>-.0049(.0083)</td>
</tr>
<tr>
<td>2004</td>
<td>-.00092(.0039)</td>
<td>.0014(.0090)</td>
<td>-.0017(.0061)</td>
</tr>
<tr>
<td>2005</td>
<td>-.0037(.0045)</td>
<td>.0040(.0099)</td>
<td>.0038(.0068)</td>
</tr>
<tr>
<td>2006</td>
<td>-.011(.0050)*</td>
<td>.0074(.0099)</td>
<td>.0061(.0070)</td>
</tr>
<tr>
<td>2007</td>
<td>-.010(.0060)</td>
<td>.022(.013)</td>
<td>.011(.0085)</td>
</tr>
<tr>
<td>2008</td>
<td>-.017(.0078)*</td>
<td>.034(.014)*</td>
<td>.015(.0098)</td>
</tr>
<tr>
<td>2009</td>
<td>-.014(.0083)</td>
<td>.022(.017)</td>
<td>.025(.0089)*</td>
</tr>
</tbody>
</table>

Pseudo R2  .17  .079  .048  
Observations 1,534,813 1,534,813 1,534,813

Note: I restrict the sample to episodes ineligible for low-cost or high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state.

*p≤0.05, **p≤0.01, ***p≤0.001
Table A.5: Marginal Effects of Non-Profit Ownership (Reference Group: For-Profit) on the Likelihood of Providing a Certain Number of Service Visits per Episode between 2001 and 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>(1) Pr(Providing 7-9 Therapy Visits)</th>
<th>(2) Pr(Providing 10-13 Therapy Visits)</th>
<th>(3) Pr(Providing 1-4 Skilled Nursing Visits)</th>
<th>(4) Pr(Providing 5-7 Skilled Nursing Visits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>.0070 (.0050)</td>
<td>-.047 (.0086)***</td>
<td>.0083 (.0086)</td>
<td>.0039 (.0066)</td>
</tr>
<tr>
<td>2002</td>
<td>.018 (.0053)***</td>
<td>-.060 (.011)***</td>
<td>.016 (.010)</td>
<td>.0028 (.0064)</td>
</tr>
<tr>
<td>2003</td>
<td>.022 (.0064)***</td>
<td>-.074 (.010)***</td>
<td>.025 (.012)*</td>
<td>.0019 (.0065)</td>
</tr>
<tr>
<td>2004</td>
<td>.021 (.0037)***</td>
<td>-.070 (.0079)***</td>
<td>.025 (.0091)**</td>
<td>.0037 (.0066)</td>
</tr>
<tr>
<td>2005</td>
<td>.018 (.0046)***</td>
<td>-.076 (.010)***</td>
<td>.037 (.0077)***</td>
<td>-.0013 (.0069)</td>
</tr>
<tr>
<td>2006</td>
<td>.026 (.0053)***</td>
<td>-.080 (.0089)***</td>
<td>.052 (.0083)***</td>
<td>.010 (.011)</td>
</tr>
<tr>
<td>2007</td>
<td>.035 (.0039)***</td>
<td>-.088 (.0087)***</td>
<td>.067 (.011)***</td>
<td>.016 (.011)</td>
</tr>
<tr>
<td>2008</td>
<td>-.0087 (.0062)</td>
<td>.00026 (.012)</td>
<td>.087 (.012)***</td>
<td>.011 (.017)</td>
</tr>
<tr>
<td>2009</td>
<td>-.020 (.0075)**</td>
<td>.022 (.014)</td>
<td>.088 (.014)***</td>
<td>.023 (.011)*</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>.022</td>
<td>.050</td>
<td>.10</td>
<td>.011</td>
</tr>
<tr>
<td>Observations</td>
<td>679,075</td>
<td>679,075</td>
<td>441,809</td>
<td>441,809</td>
</tr>
</tbody>
</table>

Note: In columns (1) and (2), I restrict my sample to episodes that provided 1-15 therapy visits and were ineligible for low-cost and high-cost outlier payments. In columns (3) and (4), I restrict my sample to episodes that provided 1-10 skilled nursing visits with no other types of services and were ineligible for high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state.

*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001
Table A.6: Marginal Effects of Establishment Year on Service Provisions in 2007: For-Profit Home Health Agencies

<table>
<thead>
<tr>
<th>Establishment Year</th>
<th>(1) Pr(Recertification)</th>
<th>(2) Pr(Providing 7-9 Therapy Visits)</th>
<th>(3) Pr(Providing 10-13 Therapy Visits)</th>
<th>(4) Pr(Providing 1-4 Skilled Nursing Visits)</th>
<th>(5) Pr(Providing 5-7 Skilled Nursing Visits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(before 2001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>.020(.012)</td>
<td>-.028(.0089)**</td>
<td>.056(.024)*</td>
<td>-.033(.011)**</td>
<td>-.031(.017)</td>
</tr>
<tr>
<td>2002</td>
<td>.012(.016)</td>
<td>-.0074(.0097)</td>
<td>.049(.015)***</td>
<td>-.044(.013)***</td>
<td>.0024(.019)</td>
</tr>
<tr>
<td>2003</td>
<td>.041(.014)**</td>
<td>-.017(.0074)*</td>
<td>.067(.020)***</td>
<td>-.046(.0099)***</td>
<td>-.012(.010)</td>
</tr>
<tr>
<td>2004</td>
<td>.068(.023)**</td>
<td>-.036(.0062)***</td>
<td>.096(.019)***</td>
<td>-.059 (.010)***</td>
<td>-.016(.013)</td>
</tr>
<tr>
<td>2005</td>
<td>.050(.012)***</td>
<td>-.029(.0062)***</td>
<td>.079(.013)***</td>
<td>-.064(.0079)***</td>
<td>-.0066(.0082)</td>
</tr>
<tr>
<td>2006</td>
<td>.075(.028)**</td>
<td>-.031(.0085)***</td>
<td>.13(.017)***</td>
<td>-.067(.011)***</td>
<td>-.057(.0086)***</td>
</tr>
<tr>
<td>2007</td>
<td>.019(.037)</td>
<td>-.035(.012)**</td>
<td>.11(.036)***</td>
<td>-.046(.014)***</td>
<td>-.035(.025)</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>.18</td>
<td>.031</td>
<td>.047</td>
<td>.10</td>
<td>.017</td>
</tr>
<tr>
<td>Observations</td>
<td>129,031</td>
<td>68,635</td>
<td>68,635</td>
<td>50,631</td>
<td>50,635</td>
</tr>
</tbody>
</table>

Note: In columns (2) and (3), I restrict the sample to episodes that provided at least one therapy visit and were ineligible for low-cost or high-cost outlier payments. In columns (4) and (5), I restrict the sample to episodes that provided only skilled nursing visits and were ineligible for high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state.

*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001
Table A.7: Marginal Effects of Establishment Year on Service Provisions in 2007: Non-Profit Home Health Agencies

<table>
<thead>
<tr>
<th>Establishment Year</th>
<th>(1)Pr(Recertification)</th>
<th>(2)Pr(Providing 7-9 Therapy Visits)</th>
<th>(3)Pr(Providing 10-13 Therapy Visits)</th>
<th>(4)Pr(Providing 1-4 Skilled Nursing Visits)</th>
<th>(5)Pr(Providing 5-7 Skilled Nursing Visits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(before 2001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>.042 (.044)</td>
<td>.055 (.026)***</td>
<td>-.040 (.023)</td>
<td>-.039 (.096)</td>
<td>-.058 (.046)</td>
</tr>
<tr>
<td>2002</td>
<td>.060 (.055)</td>
<td>.097 (.028)***</td>
<td>-.079 (.026)**</td>
<td>-.043 (.034)</td>
<td>.029 (.045)</td>
</tr>
<tr>
<td>2003</td>
<td>.030 (.059)</td>
<td>-.0090 (.058)</td>
<td>-.027 (.044)</td>
<td>-.11 (.057)*</td>
<td>-.030 (.075)</td>
</tr>
<tr>
<td>2004</td>
<td>.047 (.084)</td>
<td>.18 (.035)***</td>
<td>-.091 (.022)***</td>
<td>-.044 (.047)</td>
<td>-.10 (.014)***</td>
</tr>
<tr>
<td>2005</td>
<td>.022 (.049)</td>
<td>.14 (.087)</td>
<td>.0061 (.046)</td>
<td>-.16 (.051)***</td>
<td>-.12 (.067)</td>
</tr>
<tr>
<td>2006</td>
<td>.10 (.095)</td>
<td>.077 (.061)</td>
<td>-.00026 (.044)</td>
<td>-.16 (.058)**</td>
<td>-.055 (.098)</td>
</tr>
<tr>
<td>2007</td>
<td>-.12 (.026)***</td>
<td>.024 (.071)</td>
<td>-.050 (.013)***</td>
<td>.25 (.087)**</td>
<td>.19 (.11)</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>.094</td>
<td>.013</td>
<td>.022</td>
<td>.054</td>
<td>.020</td>
</tr>
<tr>
<td>Observations</td>
<td>51,115</td>
<td>32,351</td>
<td>32,351</td>
<td>18,105</td>
<td>18,105</td>
</tr>
</tbody>
</table>

Note: In columns (2) and (3), I restrict the sample to episodes that provided at least one therapy visit and were ineligible for low-cost or high-cost outlier payments. In columns (4) and (5), I restrict the sample to episodes that provided only skilled nursing visits and were ineligible for high-cost outlier payments. Other control variables include each patient’s basic demographic characteristics and health conditions, each home health agency’s basic characteristics, the Herfindahl-Hirschman Index, state indicators, and seasonality indicators. All columns show marginal effects from Probit models. Standard errors shown in parentheses are clustered on state.

*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001