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How Labor Supply and Health Insurance Coverage Affect Medicare Costs

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Abstract

Using survey and administrative data from the Medicare Current Beneficiary Survey, we analyze the effect of labor supply, health insurance coverage, and delays in Medicare enrollment on Medicare costs. We use our empirical findings to compute the average aggregate yearly savings linked to individuals working and insurance coverage that translates into Medicare being a secondary payer, at around $5.37 billion per year in the 1999-2010 period. We also quantify average aggregate yearly savings of another $10.17 billion per year, in the same time period, resulting from the delays in enrollment into the Medicare system.

JEL Classification: H51, I13, J22

Keywords: Medicare Costs, Labor Supply, Medicare Secondary Payer Effect, Delays in Medicare Enrollment

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1 Introduction

Medicare, which has over 59.8 million beneficiaries as of 2018, is one of the largest federal social insurance programs in the United States. The Medicare costs accounted for 3.7% of U.S. gross domestic product (GDP) in 2018 (and 15% of the Federal budget) and are projected to reach 6% of the GDP by 2043.[1] The evolution of the costs of Medicare is important to the long-term fiscal balance of the Federal Government, and to the very future of the program.

The aggregate statistics (see Figure 1) show that the labor force participation rate (LFPR) of those 65 years and older has increased during the 1995-2016 period, from 12% to 19%. Notice in particular that the LFPR among individuals aged 65 to 69 is fairly high, and that is true even for people aged 70 to 74. Interestingly, in the same graph and over the same period, we show that the LFPR of prime age workers is decreasing.[2] If a large proportion of older Americans decide to work in jobs covered by Current Employer-Provided Health Insurance (CEPHI), and then either decide to enroll in Medicare as their secondary payer or delay their enrollment into the system, the expenditures paid by Medicare will likely be lower on average per individual, as well as in total, than predicted without increases in LFPR. The population of workers, in millions, who are also

[1] The Trustees Report of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds (2019) also projects that it will reach 6.5% of GDP by 2093.

[2] Schirle (2008) presents the evidence of these increases up to 2006 for the US, the UK and Canada for individuals in the 55-64 age bracket. Li (2010) focuses on the labor supply effects of the reforms to the Old-Age retirement benefits system, and Leonesio et al. (2012) center their attention on older Americans aged 62 to 69 and how wages are a higher proportion of total income because of the increases in participation. Aísa et al. (2012) present evidence of the changes in OECD countries up to 2006, and emphasize the role of raising longevity in the increases in participation. It is important to mention that the unemployment rates for these age groups are very low, and therefore LFPR is a good indicator of labor supplied to the labor market.

Medicare Beneficiaries, covered by CEPHI, either through their own employers or their spouses employers, has more than doubled from 1999 to 2010, from 0.53 million to 1.14 million.[3]

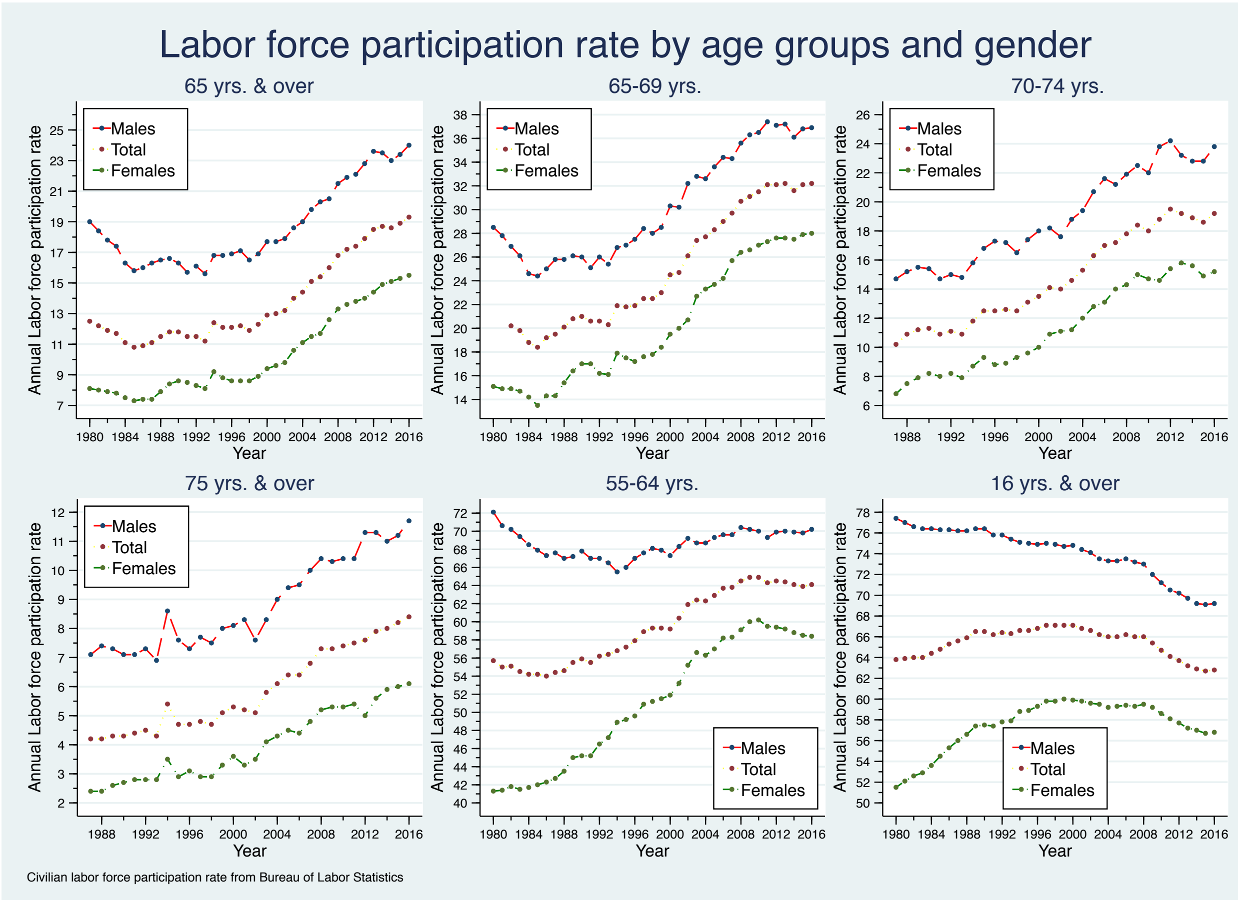
Meanwhile, a non-trivial proportion of older Americans delay their Medicare enrollment, and generate savings to the Medicare system during the years in which they are not enrolled. Using the Medicare Current Beneficiary Survey (MCBS), Figure 2 shows the evolution over the 1999 to 2010 period of the proportion of Medicare enrollees who delay Medicare Part A (which covers hospitalizations, other facilities care, and home health care), as well as those who delay Medicare Part B (which covers doctor visits, surgeries, lab tests, and other services), broken down by gender.[4] As we can see, a small (and declining in this time period) proportion of individuals delay Part A, and there are more female delayers in percentage terms than male delayers. This should not come as a surprise given that for most Americans Medicare Part A is free, and for those who do not have enough quarters of coverage is only accessible through high premiums.

More interesting is the evolution of delays in Medicare Part B, which has increased considerably in the period to 8.38% in 2010 from 4.56% in 1999 for male enrollees (3.96% in 2010 and

[3]The percentage of workers covered by CEPHI and Medicare does not follow a particular trend after increasing in 2000 and 2001 from the 1999 levels, and it varies between 13% and 20% from 1999 to 2010. There are a number of reasons why individuals might hold this type of dual insurance coverage. The first one has to do with coverage of dependents, especially older children, which might be covered under CEPHI but not under Medicare. So if the insured individual were to drop their employer provided coverage they would lose coverage. Second, having Medicare as secondary payer might be of value to some individuals depending on their health care needs, for example if they need (limited) nursing home care, or need out-of-network care. Third, once an individual receives Old-Age retirement benefits, they are automatically enrolled into Medicare and the premiums deducted automatically from their paycheck. While it is possible for someone to drop their Medicare coverage, this requires an active decision, and individuals might be concerned about the implications for the future of dropping the coverage.

[4]Due to data limitations, we do not study Medicare Part D costs, and the delay behavior into Medicare Part D.

Figure 1: Civilian Labor Force Participation Rate

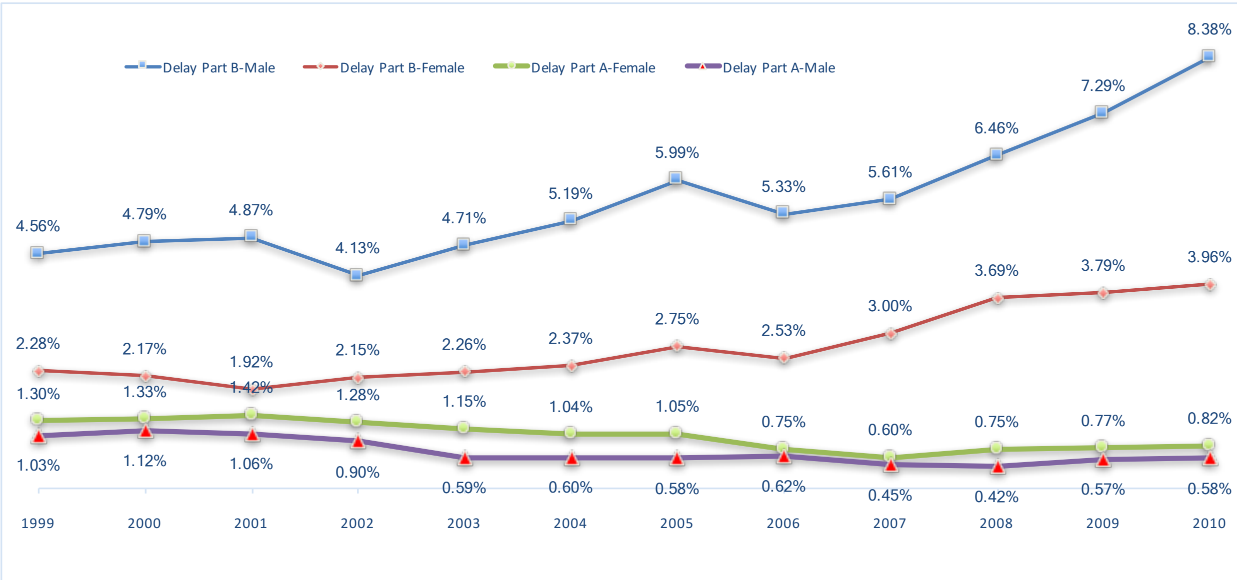


2.28% in 1999 for female enrollees). Notice that Part B is not free and requires a premium that is $135.5 a month (as of 2019), and therefore those who are covered by CEPHI could rationally consider the delay of Part B without affecting in a substantial way the level of care they would receive.[5] This increase is likely linked with the increases in labor supply among older Americans, which have been repeatedly linked with the reforms resulting from the 1983 Amendments to the Social Security system. At the same time the labor supply increases can be linked to the delays in

[5]A small number of Medicare beneficiaries are subject to the "hold harmless" provision to protect older Americans' standard of living. This group pays a lower premium per month.

retirement benefits claiming we have been observing in the last decade.

Figure 2: Proportion of Individuals who Delay Medicare in a given year (MCBS 1999-2010)



Source: Authors' calculations using the MCBS, using cross-sectional sample weights

While the evidence on the fact that a non-trivial proportion of Americans are delaying Medicare, especially Part B, is compelling, the overall proportions might seem small and only marginally in line with the shift in claiming to the new full retirement age (FRA). However, a key aspect of the Medicare choice, which makes it very different from Old-Age (OA) benefits claiming, is that the government imposes penalties to those who delay Medicare enrollment but are not covered by CEPHI. While Social Security allows Americans to claim OA benefits at any time between their 62^{nd} and 70^{th} birthday, only using actuarially fair adjustment factors to account for the expected number of years on the rolls, the Medicare system imposes penalties to anyone who enrolls in Medicare more than 12 months after the end of the initial enrollment period (IEP). The 7-months IEP ends when the individual reaches age 65 and three months. The rationale for these penalties has not been carefully discussed in the literature (or by the government), but it is easy to conjecture that it is linked with the desire of preventing individuals from generating higher Medicare costs (once they enroll) if they delay their Medicare enrollment, with the result that their health deteriorates due to lack of access to health care, or presumably to guard against adverse selection from individuals waiting until a negative health shock to decide on a plan.

Given the linkage between individuals' withdrawal from the labor market, health insurance coverage, and their Medicare costs, an important question, therefore, is whether the employment and health insurance coverage of older Americans significantly affect Medicare costs. This question is crucial given that the LFPR is high and the trend is rising, and likely to continue to rise given the increases in the FRA and the delayed retirement credits (DRC) from the Social Security Amendments of 1983, the increasing number of older Americans with increasing balance of debt, as well as other socio-economic or socio-demographic trends. However, there is little research on the Medicare costs response to work and health insurance coverage for individuals 65 and older.

In this paper we empirically analyze the Medicare costs of individuals aged 65 and older as a function of their health insurance coverage and their labor supply. We also study the evolution of delays in Medicare enrollment, as well as how that affects the Medicare costs using the 1999-2010 waves of the MCBS. In doing so, we are able to quantify the effects on Medicare costs of working, of the health insurance coverage of workers through the secondary versus primary payer effect, and the effect of delay enrollment. Finally, we are also able to calculate the aggregate yearly savings resulting from individuals working beyond age 65, relying on Medicare as secondary payer, as well as the delays in enrollment into Medicare.

Our empirical findings indicate that the aggregate savings linked to individuals working, the Medicare secondary payer effect, and their joint effects are around $5.37 billion per year from 1999-2010, with most of the changes over time linked with the increase in the number of people aged 65 and over and the evolution of labor force participation of older Americans. We also quantify savings of another $10.17 billion per year resulting from the delays in Medicare enrollment. In doing so, this research makes two contributions to the literature. First, to our knowledge, it is the first paper to address the relationship between labor supply, employer-provided health insurance, as well as delay enrollment into Medicare and Medicare costs. Second, it is the first paper to address the issue of Medicare cost savings due to three aspects: 1) the role of Medicare as secondary payer versus primary payer, which comes into play when individuals are covered by Medicare and CEPHI from his own employer or his spouse's employer; 2) the Medicare cost savings from individuals working, 3) the Medicare cost savings from individuals delaying enrollment into Medicare. Interestingly, our analysis brings positive news to the discussion of the Medicare system, providing, at least from these sources, cost savings instead of ever growing cost increases.

The reminder of the paper is organized as follows: Section 2 presents a summary of the related literature; Section 3 discusses the policies and incentives that affect Medicare costs; Section 4 describes the MCBS data and how we empirically identify Medicare delayers; Section 5 provides the empirical analysis of the determinants of Medicare costs and our main empirical findings; Section 6 shows our aggregate Medicare savings calculations; Section 7 provides the sensitivity analysis of our results; and Section 8 presents our conclusions.

2 Related Literature

Lubitz et al.(1995) and Miller (2001) examine the relationship between increasing longevity and Medicare expenditures. Lubitz et al.(1995) estimate the lifetime Medicare costs according to the age at death for Medicare beneficiaries. They find that both the average annual Medicare costs as well as the increase in lifetime Medicare costs associated with one additional year of life decrease as the age at death increases. They conclude that compared with the increase in longevity, the increase in the number of older people has a more significant effect on Medicare total expenditures. This point is actually connected with our findings on the evolution of our estimated yearly savings due to the decision to work and hold CEPHI. Most of the changes in those savings over time are related to changes in the number of older individuals, which in our case make the savings for the Medicare system higher. Miller (2001) forecasts Medicare costs and finds that the potential Medicare cost savings from postponement in morbidity, associated with increase in longevity, are not large enough to offset the increase in Medicare costs associated with increase in the number of Medicare enrollees. Again, our findings are in line with the insights on the importance on the number of older Americans in the analysis of Medicare cost savings.

Wennberg et al. (2002), Fisher et al.(2003a and 2003b), and Zuckerman et al.(2010) address the existing geographical differences in Medicare spending. In order to take these differences into account, we include regional controls in our analysis, aggregating States into 4 regions. We also include sets of health controls to account for health differences.

Link et al.(1980), McCall et al.(1991), Cartwright et al.(1992), Hill et al.(1992), Christensen and Shinogle (1997), Ettner (1997), Hurd and McGarry (1997), and Khandker and McCormack (1999) have examined the relationship between Medicare supplemental insurance and Medicare expenditures. These studies are related to our paper in terms of focusing on the role of health insurance coverage on Medicare costs. A consistent finding across these studies is that supplemental insurance choices are associated with increased Medicare expenditures, although there is no consensus on the causes (See Atherly (2001)). Some studies point to the role of adverse selection in insurance choices, and others to the moral hazard effect coming from the extra insurance coverage. Interestingly, that literature focused on the additional coverage which maintained Medicare as primary payer, while our focus is on the type of coverage (CEPHI) which makes Medicare a secondary payer. As we will see we find evidence that this different type of supplemental coverage (linked with employer provided coverage) is not associated with significantly higher total health expenditures or with higher out-of-pocket (OOP) expenditures, and through the secondary payer effects is in fact associated with lower costs to the Medicare system.[6]

None of those papers address the role of labor supply by older Americans on Medicare costs, and they do not focus on the difference for the system of having Medicare as secondary payer versus Medicare as primary payer, nor on the likely Medicare cost savings from individuals delaying Medicare enrollment.

3 Policies and Incentives that affect Medicare Costs

3.1 Social Security Reform, Debt, and Labor Supply

The phased implementation that started in the year 2000 of the 1983 Amendments to the Social Security System has been showed to explain part of the increase in the labor supply of older Americans we highlighted in the introduction. However, the literature has not linked those reforms and

[6]French and Jones (2004) model the dynamics of out-of-pocket health expenditures using self-reported data from the Health and Retirement Study. On top of the fact that our data is administrative in nature and therefore with minimal measurement error, their out-of-pocket variable is quite different from ours since it includes premia from the chosen coverage(s). Given the kind of controls we will include in our specifications, we believe it is better not to include premia since coverage indicators are then essentially measures of the dependent variable. De Nardi, French and Jones (2010) estimate a structural model of savings among older Americans who are exposed to uncertain health expenditures. These two studies do not account for the key phenomena we emphasize in this paper; namely that Medicare can be a secondary payer for those who have dual coverage along with CEPHI, and that many Americans delay their enrollment into Medicare.

those labor supply effects to the Medicare program, which happens to be the key focus of our research. As it is well documented in the literature, the key components of the Social Security reform increased the FRA for those born after 1938, reducing substantially the nominal benefits that individuals could expect at every age before the FRA (as described in Munnell (2003) and Munnell and Sass (2007), reduced replacement rates), and also increased considerably the DRC, which increased the actuarial adjustment for those claiming beyond the FRA and below the Maximum Retirement Age. Our results indicate that these effects have affected the Medicare system as well, and the same is to be expected of future reforms to the social insurance system which are likely to happen in the near future given the deteriorating situation of the Social Security and Medicare Trust Funds.

The trends in labor supply among older Americans, has also been linked with the increasing number of Americans entering old age with outstanding debt. For example, the share of adults aged 65 and older with some debt going from 30% to 43% between 1998 and 2010, which coincides with our period of analysis (see Karamcheva (2013). At the same time, the median value of outstanding debt grew from $13,586 to $21,165 over the same period, and the overall debt ratio, which is total debt as a percentage of total household assets, doubled in the same period from 6.4% to 13%. A significant part of that debt is in the form of mortgages, which account for about half the value of all debt held by older Americans, but a growing component of that debt is in the form of student loans, which has grown from about $2.8 billion in 2005 to about $18.2 billion in 2013. Although compared to mortgage debt as well as credit card debt, student loan debt is only carried by a small percentage of older Americans. Notice, however, that unlike other types of debt, student loan debt generally cannot be discharged in bankruptcy. GAO (2014) shows that borrowers 65 and older hold defaulted federal student loans at a much higher rate, which can leave some retirees with income below the poverty threshold. Also, among those 65 and older, the number of individuals whose Social Security benefits were offset due to defaulting on their student loans, grew from about 6,000 to about 36,000 over the same period. As discussed by Butrica and Karamcheva (2013), and more recently in Lusardi, Mitchell and Oggero (2017), the increase of debt as well as the changing debt structure of older Americans means they have a strong incentive to continue employment after age 65 in order to meet their needs, and also claim retirement benefits later.

3.2 Labor Supply, Health Insurance Choices, and Late Enrollment Penalties

Usually Medicare pays first the medical expenses of beneficiaries when they are covered by multiple health insurances including Medicare. The only case in which Medicare will be a secondary payer is when an individual is covered by CEPHI, a group health plan through his current employer or the current employer of a spouse of any age. If due to the changes in the Social Security system, increasing debt, or any other socio-demographic or socio-economic factor, affected cohorts decide to work in jobs covered by CEPHI, and decide to enroll in Medicare when they reach age 65, Medicare becomes their secondary payer, and the per person, as well as total Medicare costs, will probably be lower compared with the case in which Medicare was the primary payer. The second possible mechanism which affects Medicare costs, is the so called "crowd out" effect, namely, healthy individuals will delay Medicare enrollment when they reach age 65, and Medicare would be left covering a higher percentage of unhealthy individuals, which would drive up the per person Medicare costs (among beneficiaries), but lower total Medicare costs.

The Medicare system has been studied in detail from many perspectives, but researchers have rarely discussed Medicare late enrollment penalties and their link with CEPHI. Beginning in 1985, premium-paying individuals who do not purchase Part A coverage beyond their IEP because of age are subject to a 10% premium penalty for each 12 months they are late in enrolling. The 10% premium penalty is limited to twice the number of years enrollment is delayed. Therefore, if enrollment were to be delayed 1 year, the penalty would be assessed for 2 years. Individuals who are eligible for premium free Part A can enroll in Part A anytime once their IEP starts without paying a Part A late enrollment penalty.

The Part B delayed enrollment penalty is an increase of 10% in the standard Part B premium for each 12-month period the individual delays enrollment. The individual carries this penalty with his Medicare costs for as long as he has Medicare Part B. Effective November 1984, a Special Enrollment Period (SEP) is available for individuals aged 65 and over who did not enroll in Medicare Part A and/or Part B when first eligible. If individuals are covered by CEPHI, they have a SEP to sign up for Part A and/or Part B any time as long as they or their spouse is working, and they are covered by a group health plan through the employer or union based on that work. They also have an 8-month SEP to sign up for Part A and/or Part B that starts the month after the employment ends or the group health plan insurance based on current employment ends, whichever happens first. Individuals do not pay a late enrollment penalty if they sign up during a SEP. In Appendix A we provide a quick overview of the Medicare system and costs of Medicare Part A and B, the focus of this research.

4 Data and Summary Statistics

We use the MCBS, which is a nationally representative dataset set up by the Centers for Medicare & Medicaid Services (CMS), which has two modules: MCBS Access to Care and MCBS Cost and Use. MCBS produces data for both cross-sectional and longitudinal analysis. For the purpose of this research, we are using the Cost and Use series.[7] The Cost and Use data provides complete expenditure and source of payment data on all health care services, including those not covered by Medicare. It also provides information on individual level premiums, health insurance coverage and usage, Medicare entitlement information, health status and functioning, date of death, Medicare status and Medicare claims for survey participants. In this research, we will only focus on aged Medicare beneficiaries, which account for 85.43% of Medicare beneficiaries as of 2018. Medicare entitlement start-and end-dates help identify when an individual enrolls in Medicare and how long that individual stays in Medicare. A great advantage of Cost and Use files is that the data match survey-reported events with true Medicare claims, adjusting for underreporting of the use of health care services by survey respondents and correcting any recall mistakes in the survey expenditure data. The MCBS is therefore considered as the best possible source of information on Medicare costs. Details of our sample selection criteria, variable definitions, descriptive statistics, and a description of the mutually exclusive health insurance categories are in Appendix B.

Table 1 presents unconditional evidence that both working and health insurance are correlated with Medicare costs. We summarize Medicare costs, total health expenditures, as well as OOP expenditures, by working status as well as CEPHI status, also conditional on a particular age range and health status. The full estimation sample is divided into 4 subgroups: (working, no CEPHI), (working, CEPHI), (not working, no CEPHI), (not working, CEPHI). Four aspects require attention. 1) Both working and CEPHI lower the average Medicare costs. For individuals 65 to 69 years old, and in good health, the weighted average Medicare costs is $1,404 for workers with CEPHI and $3,245 for non-workers with CEPHI, this difference can be understood as the effect

[7] The Access to Care file contains information on Medicare beneficiaries' access to health care, satisfaction with care, and usual source of care.

of working on Medicare costs, controlling for CEPHI as well as age and health status. If we try to infer the effect of CEPHI on Medicare costs, we compare across columns two by two, and we can see that the effect is much larger among workers, and especially large among those in bad health. 2) Among workers, those covered by CEPHI generate less Medicare cost, but they have slightly higher total health expenditures as well as OOP expenditures regardless of health status. This suggests that workers covered by CEPHI are not necessarily low medical costs generators. It is the result of Medicare appearing only as secondary payer. We will argue that this is evidence of exogeneity of the CEPHI variable in our econometric specifications. 3) Non-workers tend to generate higher Medicare and total health expenditures, especially when in bad health. 4) OOP expenditures are very similar for workers and non-workers as well as for those with or without CEPHI, the main difference appears across health status categories. This finding suggests that individuals seem to be making their decisions in order to minimize OOP costs, navigating the complexity of the system and its interactions fairly well.

Table 1: Medical Expenditures, by CEPHI and Work Status

		Not Working		Working	
		No CEPHI	CEPHI	No CEPHI	CEPHI
Age = 65 $\sim$ 69, Good Health					
Medicare Costs	Mean	\$3,555	\$3,245	\$3,102	\$1,404
	S.D.	\$8,766	\$10,481	\$6,943	\$3,258
Total Health Expenditures	Mean	\$6,444	\$6,206	\$5,285	\$5,503
	S.D.	\$11,551	\$11,925	\$8,367	\$9,722
OOP Expenditures	Mean	\$1,425	\$1,157	\$1,285	\$1,412

	S.D.	\$3,127	\$2,049	\$2,079	\$2,094
Age = 65 ∼ 69, Bad Health					
Medicare Costs	Mean	\$12,504	\$6,250	\$8,778	\$2,598
	S.D.	\$27,167	\$11,820	\$19,570	\$3,240
Total Health Expenditures	Mean	\$17,095	\$12,481	\$11,236	\$12,976
	S.D.	\$37,580	\$19,018	\$21,540	\$36,894
OOP Expenditures	Mean	\$1,939	\$1,806	\$2,224	\$3,048
	S.D.	\$2,987	\$2,739	\$5,672	\$11,051

Note: All expenditures are in 2009 dollars. Weighted average medical expenditures are over full estimation sample.

4.1 Empirically Identifying Medicare Delayers

The decision of individuals to delay their access to Medicare has not been studied in much detail, and it has been rarely modeled by economists. However, as discussed in the introduction, a non-trivial proportion of Americans delay their access to Medicare, in particular Part B, and as discussed in Section 3.2, the government imposes considerable penalties (through higher premiums) to those who delay their access to Medicare, unless they are covered by CEPHI. In the following sections we will analyze how we can then use the information on delay behavior to calculate the savings for Medicare resulting from these delays.

It is important to discuss the empirical challenges linked with identifying in the MCBS those individuals who delay their access to Medicare. Notice that while other definitions are possible (given the way the government defines enrollment periods), we consider that someone has delayed their access to Medicare if they have reached age 66 without yet being enrolled in any part of the program, or if they are currently enrolled in only one part of the program and they are 66 years of age or older.

Our efforts focus on three aspects of the measurement of delay behavior: 1) Among those currently enrolled, we have to be able to identify who is delaying their access at this time. We call these individuals current delayers. By definition we can only observe current delayers if they are actually already enrolled in one part of the program and delaying another one. This also means that those who are completely delaying their entrance into Medicare will not be observed in the periods in which they are doing it, so a retrospective perspective will be needed. 2) Once an individual is enrolled and observed in the data, we can retrospectively assess whether he or she was a previous delayer, and pin down during which period, by comparing their initial enrollment date with their age at the time. However, we will not always be able to exactly observe what the individual was delaying, unless we can use their current enrollment status to impute their likely delay behavior. For example, if someone is currently enrolled in both Part A and Part B of the system, and we observe they enrolled in the system at age 67, so they delayed when they were 65 and 66, we will assume that they delayed both parts during that period. On the other hand, if they are currently enrolled only in Part A, and they enrolled in the IEP, we will assume they delayed only Part B in those years. We are essentially ruling out the possibility of switching Medicare coverage (as well as the possibility of dropping their Medicare coverage), since we cannot precisely observe the coverage before the person appears in the MCBS. This retrospective calculation is quite tedious, and requires that we look back year by year of the data taking a retrospective perspective back to 1999. 3) Delaying their access to Medicare could have consequences for the Medicare system in the future, if we believe individuals lack of access to this program could have delayed certain treatments or worsened a particular health condition. This means that we need to be able to identify who was a delayer in the past, even if they are not current delayers, and we need to analyze whether their previous status has a differential effect on current costs to the system.

5 Medicare Costs: An Empirical Analysis

5.1 Empirical Challenges and Model Specifications

The estimation of Medicare costs brings two important challenges which need to be taken into account to consistently estimate the role of work and CEPHI. The first is that there is a potential selection problem given that nearly 19% of observations in our sample have Medicare costs equal to zero. These true zeros either come from some individuals not generating any expenditure in any given year, or from a situation in which they generate health expenditures but health coverage(s) other than Medicare, paid for them.[8] Notice that the true zero Medicare costs is not a direct choice of individuals, in other words, individuals can not choose to have zero Medicare costs, but it can be the product of work decisions and health insurance coverage decisions. If individuals self-select into certain jobs with certain CEPHI coverage, then Medicare becomes a secondary payer. Under the regulations of multiple payers, the government might end up paying nothing for them in a given year. It could be that the people who have zero Medicare costs are not a random sample of the population, and there could be a potential correlation between the choices that lead to zero Medicare costs and the level of the costs. As a result, we need to take into account the potential selection problem.

The second issue is the possible endogeneity of the *Work* indicator: workers are different from non-workers, and workers are not randomly selected into working nor do they randomly decide to

[8] Among the 19% individuals who have zero Medicare costs, 2.1% of them are not generating any expenditure in any given year because they also have zero total health expenditures.

keep working after age 65. Given that individual characteristics affect individuals' labor decision after 65, if some of these characteristics are unobserved (for example, income shocks or health insurance benefits shocks), and these are correlated with the *Work* indicator, then the estimated coefficient β_w could be biased.

In order to estimate how a number of observable characteristics, including insurance plans, affect medical expenditures, several models have been proposed and used in the literature. Ordinary Least Squares (OLS) estimation is simple and easy to interpret but can be problematic to use when the data contains a relatively large number of zeros. The Two-Part model (TPM) (Duan et al.(1983), Dow and Norton(2003), Albouy et al. (2010)), has all the advantages of the OLS while still acknowledging that the zeros are not the product of choice but are actual absence of expenditures, but there is also no correction for the possible correlation between the probability of having zero Medicare costs and the level of the costs. TPM is the most widely used model when analyzing Medicare costs, and in particular using the MCBS (Khandker and McCormack(1999), Atherly(2001)). Heckman's sample selection model (following Heckman (1979), presented by Dow and Norton (2003), Chaze (2005), Albouy et al. (2010)) has also been proposed. In contrast with the TPM, the Heckman's sample selection model allows the censoring function and the uncensored expenditure function to have different coefficients and allows correlated unobservables across the two processes.

Panel data specifications and Instrumental Variable (IV) specifications help to directly address the possible endogeneity concerns. The panel component of the MCBS (4 years, at most) allows us to deal with the endogeneity problem by including individual fixed effects to control for any fixed, time invariant, individual unobserved factor. For IV estimation, finding robust and exogenous exclusion restrictions is crucial. These exclusion restrictions should be correlated with individuals' working decision captured in our case by the *Work* dummy, such as marital status and education indicators, and should not be correlated with the error term in the Medicare cost equation.

Heckman's sample selection model will be our preferred model specification because the inverse Mills ratio is statistically significant, but section 7 will discuss in detail the results of a sensitivity analysis that presents other specifications.

In Heckman's sample selection model, there are two separate equations - first, an equation that estimates the probability to have positive health expenditures $\Pr(Y_{it} \succ 0)$, and second, a specification that estimates the level of expenditures, conditional on those being positive $E(\ln Y_{it}|Y_{it} \succ 0)$. Usually, the first equation will use a probit specification to estimate the dichotomous event of having zero or positive expenses, and the second equation is a linear model on the log scale for positive expenditures.

We investigate the effect of health insurance coverage and working decisions on individuals' Medicare costs, total health expenditures, and OOP expenditures by running the specifications below. Equation (1) is used in the first stage of Heckman's sample selection model, and equation (2) is used in the second stage:

$$\Pr(y_{it} = 1|\mathbf{x}_{it}) = \Phi(\mathbf{x}_{it}\delta_2) \tag{1}$$

$$\begin{aligned} \ln(Y_{it}|Y_{it} \succ 0) = \beta_0 + \beta_w Work_{it} + \beta_{cr} CEPHI_{it} + \beta_{int} wepc_{it} \\ + \beta_h \mathbf{H}_{it} + \beta_x \mathbf{X}_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

where y_{it} is a dummy equals to 1 when medical expenditures are greater than 0. $\mathbf{x}_{it}$ is a vector of regressors, including the *Work* dummy, the *CEPHI* dummy, the *wepc* dummy, health controls, demographic controls, as well as $\mathbf{DRC}_i$ dummies.

In this specification, $\mathbf{DRC}_i$ dummies are used as an exclusion restriction which only appears in the first stage of Heckman's sample selection model to add non-parametric identification to the model, which is originally parametrically identified through the non-linearity created by the probit assumptions. We construct $\mathbf{DRC}_i$ dummy variables indicating the effects of DRC and/or FRA for each respondent in the sample according to their birth year, the DRC and the FRA rules. Cohorts born in 1925 and 1937 are only affected by DRC, and $DRC3.5$ is a dummy indicating cohorts born in 1925 and 1926 with 3.5% DRC. Cohorts born in 1938 and after are affected by both DRC and FRA. $DRC6.5\_FRA2$ is a dummy indicating a cohort born in 1938 with 6.5% DRC and FRA of 65 and 2 months. Similarly, $DRC7.0\_FRA4$ represents cohorts born in 1939 with 7% DRC and FRA of 65 and 4 months. Due to data limitations, the youngest cohort we are able to observe in MCBS is for individuals born in 1945, with DRC of 8% and FRA of 66.

Differently from the IV specification, there are no standard tests of the robustness and exogeneity of the exclusion restrictions assumed in Heckman's sample selection model, since that model is already identified and we are just adding non-parametric identification to it. As discussed in Vella (1998), it is customary to add this non-parametric identification, but there is some contention on whether these exclusion restrictions should even be used. In any case, we will see in the results in Table C.1 in Appendix C, that the DRC/FRA indicators are positive and significant in the probit equation, and if we estimate a model without those exclusion restrictions, meaning a "just parametrically identified" sample selection corrected model, our results are quite similar to those reported. As also discussed in Vella (1998), if the independent variables we use in the probit specification have a large range (as we believe they do), the concerns with the "just parametrically identified model" are ameliorated, since more tail behavior is expected in the inverse Mills ratio. We obtain the probit estimate $\hat{\delta}_2$ from equation (1) using the full estimation sample. Then, obtain the estimated inverse Mills ratio $\hat{\lambda}_{it} = \lambda(\mathbf{x}_{it}\hat{\delta}_2)$.

In equation (2), Y_{it} is one of the outcomes of interest (e.g., Medicare costs, total health expenditures, and OOP expenditures) for individual i in year t, while the dependent variables lnY_{it} is the natural logarithm of one of the outcomes of interest for individual i in year t. The explanatory variables in equation (2) are the same as in equation (1), the only difference is that the $\mathbf{DRC}_i$ dummies only appear in equation (1). $Work_{it}$ is a dummy variable that represents those who are working. $CEPHI_{it}$, refers to an individual i who is covered by current employer provided health insurance plan at time t regardless of his own working condition, and captures the effect of Medicare as secondary payer.[9] We also add an interaction term, $wepc_{it}$, between work and the CEPHI indicator to more clearly show the differential effects between insurance and work. These two measures are correlated, but there are individuals who work without CEPHI, and there are individuals who have CEPHI and do not work.

$\mathbf{H}_{it}$ is a list of health controls.[10] $\mathbf{X}_{it}$ is a list of demographic controls–e.g., gender, race, individual level income, marital status, education, census regions, age, age square, and number of kids. Finally, ε_{it} is the unobservable component. The base group in the estimation include those who are not working, who are not covered by CEPHI, whose census region is north-east, whose annual household income is less than \$10,000 (in 2009 dollars), who are married, who are white, and with high school degree, and whose health status is excellent or very good.

[9]There are weighted 1.99% observations in estimation sample who have health insurance coverage through spouse's current employer. 29.18% of those are working and the rest 70.82% are not working.

[10]Following Fang et al. (2008), we include self-reported health status; ever smoker; current smoker; diagnoses of arthritis, high blood pressure, diabetes, cancer, lung disease, heart attack, chronic heart problems, stroke, psychiatric illness, Alzheimer's disease, broken hip; treatment of cataract surgery or a hearing aid; we also include ADLs and IADLs.

5.2 Results from the Sample Selection Corrected Specification

Table 2 shows the marginal effects from the first stage of Heckman's sample selection model for Medicare costs (column 1), total health expenditures (column 2), and OOP expenditures (column 3), which estimates a probit specification.

Table 2: The Effects of Work and CEPHI on the Probability of Observing Positive Medical Spending

Variables	Medicare Costs (1)	Total Health Expenditures (2)	Out-of-Pocket Expenditures (3)
Work	-0.055***	0.001	0.000
	(0.005)	(0.002)	(0.002)
CEPHI	-0.075***	-0.001	0.004
	(0.014)	(0.005)	(0.007)
wepc	-0.080***	0.001	-0.002
	(0.017)	(0.007)	(0.009)
Obs.	95,146	95,103	95,146

Notes: All regressions also contain (but are not reported in the table but can be found in Table C.1): ghost indicator, age, age square, health dummies, gender, smoking indicators, number of kids, income level dummies, health controls, race, education, marital status, census region dummies, and **DRC** dummies. Robust Standard errors are in parentheses.

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent.

Table 3 shows the results of the second stage of Heckman's sample selection model. The inverse Mills ratio is significant and negative across the board, indicating that the Sample Selection model is appropriate, and the error terms in the selection and primary equations are negatively correlated.

Table 3: The Effects of Work and CEPHI on the Level of Medical Spending

Variables	Medicare Costs (1)	Total Health Expenditures (2)	Out-of-Pocket Expenditures (3)
Work	-0.076***	-0.116***	0.046***
	(0.021)	(0.021)	(0.013)
CEPHI	-0.108*	0.074	0.006
	(0.055)	(0.057)	(0.036)
wepc	-0.281***	0.006	-0.024
	(0.076)	(0.074)	(0.046)
Lambda	-0.806***	-1.871***	-0.364***
	(0.058)	(0.134)	(0.084)
Obs.	78,827	93,499	92,417

Notes: All regressions also contain (but are not reported in the table but can be found in Table C.2): ghost indicator, age, age square, health dummies, gender, smoking indicators, number of kids, income level dummies, health controls, race, education, marital status, census region dummies.

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent.

5.2.1 The Role of Working and Medicare Secondary Payer Effect

From Table 2, we can see that the *Work* dummy significantly lowers the probability of observing positive Medicare costs. Now, conditional on having positive Medicare costs, as shown in Table 3, workers generate 7.6% less Medicare costs compared with non workers, after conditioning for health insurance coverage. Since we conditioned on health indicators as well as other demographic measures and observables, the possible explanation for workers generating less cost mainly comes down to the opportunity costs, and therefore unobservables. For example, workers have less time and less availability to go to Medicare services compared with non-workers, so workers tend to have less Medicare usage compared with non-working individuals, resulting in less per person Medicare cost on average. Interestingly, the *Work* dummy is also negative and significantly correlated with total health expenditures (but not OOP expenditures) in Table 3, suggesting a possible concern for the endogeneity of this measure, since workers might be generating systematically lower health costs. The "just parametrically identified" sample selection corrected estimates of the *Work* variable, meaning those resulting from estimating the 2-Step Heckman model without exclusion restrictions, are quite similar to those reported. In Table 2 the coefficient changes from an estimated reduction in the probability of observing positive Medicare Costs of 5.5% to 5.3%. On the other hand, in Table 3, the reduction in the level of Medicare Costs goes from the reported 7.6% to 8.8%. Overall, the specification that adds non-parametric identification is more conservative in terms of the overall effects of the *Work* dummy.

Given the definitions of the variables discussed in the previous subsection, Medicare will be secondary payer only when the individual is covered through his current employer or the current employer of a spouse of any age. This is captured by the variable *CEPHI*, which significantly reduces the probability of observing positive Medicare costs (Table 2), and also significantly reduces Medicare costs, conditional on them being positive (Table 3). On average, individuals with Medicare as secondary payer generate 10.8% less Medicare costs compared with individuals with Medicare as primary payer. Notice that in this case the $CEPHI$ indicator affects total health expenditures and OOP expenditures positively (although the coefficients are small and not significant), likely indicating that for this variable the endogeneity concerns are minor, since it does not seem that those covered by CEPHI are the low cost generating individuals. For the "just identified" specification the $CEPHI$ negative effect in Table 3 goes up to 13%.

Table 3 also shows the negative effect on Medicare costs of the interaction term $wepc$, indicating that those who work and have CEPHI are generating nearly 28.1% less cost to the Medicare system (31.7% in the "just parametrically identified" specification), compared with those who do not work and do not have CEPHI. As with the $CEPHI$ indicator, endogeneity concerns are not of great importance with this indicator given its either positive or non-significant effect on the other health expenditure measures.

5.2.2 Delay Enrollment and Medicare Costs

In this section we focus on two of the three aspects of delay that we emphasized at the end of Section 4.1. Namely, the estimation of the effect of currently delaying one part of the Medicare program (either Part A or Part B) on Medicare costs, and the effect of having delayed before on current Medicare costs.

Table 4 shows the second stage estimation results using Heckman's sample selection model (first stage results are presented in Table C.3 in Appendix C), after including delay enrollment dummies in the Medicare costs regression. The left panel shows the results conditioning on health status, the right panel are the results without any health controls. The reason why we also present the results without health controls has to do with the idea that the effects of delays in Medicare enrollment on health care costs is connected with a deterioration of health due to delaying the access to care, and therefore, not controlling for health status could be the more appropriate specification to capture the effects of delays in Medicare enrollment. The Lambda in all cases are significant, indicating that the sample selection corrected specification is the appropriate one to use.

The results are quite striking. First, the key results we showed in Table 3 are magnified in absolute terms, once we control for whether some of the respondents are currently enrolled in only one part of Medicare, meaning that some are delaying the other part. The negative effect of working on Medicare costs increases by about a third, and the increases are even larger for the *CEPHI* indicator and the *wepc* variable. This likely means that the delay indicators are strongly correlated with the work and insurance indicators. Second, those who are currently delaying Part A ($Delay-A-current$ variable in the table), and therefore are currently enrolled in Part B, generate substantially lower Medicare costs, as well as lower total health expenditures and lower OOP expenditures. More surprising are the results that show that those who currently delay Part B ($Delay-B-current$ variable in the table) generate higher Medicare costs, other things equal, but lower total and OOP costs. This means that these individuals generate comparatively higher Part A costs, but are not necessarily the high cost generating individuals, and certainly are optimizers in terms of the OOP resources generated. The Part B result is better understood if we take a look at the first stage results in the Appendix C (Table C.3). There we can see that delaying Part B has a negative effect on the probability of observing positive Medicare costs, which means that Part B delayers are more likely to generate zero cost to the Medicare system. This effect is magnified among those who have CEPHI and delay Part B ($CEPHI-B-current$ variable in the table). Notice that these effects are exactly reversed for Part A, which increases the probability of observing positive Medicare costs, but reduces the average costs conditional on a positive value. We will use these results in the next section to compute the savings to the system derived from the current delayers' decision not to join one part of the program.

Table 4: The Effects of Delay Enrollment on the Level of Medical Spending

	(1) With Health Controls			(2) Without Health Controls		
	Medicare	Total	OOP	Medicare	Total	OOP
Work	-.102***	-.106***	.0507***	-.146***	-.135***	.0356***
	(0.020)	(0.021)	(0.013)	(0.021)	(0.021)	(0.013)
CEPHI	-.194***	.0896	.0174	-.191***	.0868	.0146
	(0.055)	(0.056)	(0.036)	(0.055)	(0.059)	(0.036)
wepc	-.415***	.0367	-.00695	-.396***	.0542	.00369
	(0.076)	(0.073)	(0.047)	(0.076)	(0.077)	(0.047)
Delay-A-current	-.238***	-.135**	-1.07***	-.193***	-.114*	-1.06***
	(0.061)	(0.066)	(0.049)	(0.062)	(0.069)	(0.049)
Delay-B-current	1.14***	-.369***	-.285***	1.11***	-.366***	-.286***
	(0.119)	(0.045)	(0.030)	(0.121)	(0.047)	(0.030)
CEPHI-B-current	-.399	.144	.127**	-.431	.145	.129**
	(0.274)	(0.090)	(0.059)	(0.279)	(0.095)	(0.059)
Lambda	-.722***	-1.81***	-.378***	-.664***	-1.9***	-.378***
	(0.054)	(0.127)	(0.081)	(0.055)	(0.136)	(0.082)
Obs.	78,827	93,499	92,417	78,827	93,499	92,417

Notes: All regressions in table 4 and table 5 also contain (but are not reported in the table): ghost indicator, age, age squared, health dummies, smoking status, number of kids, income level dummies, health controls, race, education, marital status, and census region dummies.
* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent.

Table 5 focuses on the effect of having delayed before, captured by the $Delay - past$ variable, on current Medicare costs (first stage results are presented in Table C.4 in Appendix C), with and without health controls, knowing that individuals in their decisions to delay are responding to the structure of penalties set up by the government. The rationale for the penalties is likely the concern that those who delay, and who do not have alternative primary coverage, will end up generating higher costs once they enroll in Medicare. The results show that the $Delay - past$ variable has a positive, but small and statistically insignificant, effect on Medicare costs, suggesting that after individuals optimize their delay decisions accounting for the penalties, regardless of whether we control for their health, there is no statistical effect regarding Medicare costs.

Table 5: The Effects of Current and Past Delay Enrollment on the Level of Medical Spending

	(1) With Health Controls			(2) Without Health Controls		
	Medicare	Total	OOP	Medicare	Total	OOP
Work	-.102***	-.106***	.0519***	-.146***	-.135***	.0368***
	(0.020)	(0.020)	(0.013)	(0.021)	(0.021)	(0.013)
CEPHI	-.194***	.0896	.0173	-.191***	.0868	.0145
	(0.055)	(0.056)	(0.036)	(0.055)	(0.059)	(0.036)
wepc	-.415***	.0365	-.00553	-.396***	.0539	.00504

	(0.076)	(0.073)	(0.047)	(0.076)	(0.077)	(0.047)
Delay-A-current	-.236***	-.132**	-1.08***	-.19***	-.111	-1.07***
	(0.061)	(0.066)	(0.049)	(0.062)	(0.069)	(0.049)
Delay-B-current	1.15***	-.368***	-.289***	1.11***	-.365***	-.29***
	(0.119)	(0.045)	(0.030)	(0.121)	(0.047)	(0.030)
CEPHI-B-current	-.4	.143	.126**	-.432	.144	.128**
	(0.274)	(0.090)	(0.059)	(0.279)	(0.094)	(0.059)
Delay-past	.0253	.035	-.151***	.0275	.0366	-.148***
	(0.036)	(0.039)	(0.025)	(0.037)	(0.040)	(0.025)
Lambda	-.722***	-1.81***	-.389***	-.664***	-1.89***	-.392***
	(0.054)	(0.127)	(0.080)	(0.055)	(0.136)	(0.082)
Obs.	78,827	93,499	92,417	78,827	93,499	92,417

* Significant at 10 percent.** Significant at 5 percent. *** Significant at 1 percent.

6 Medicare Savings

Given the estimation results from Section 5, and using additional back of the envelope calculations regarding delay of Medicare, we can quantify the yearly Medicare savings resulting from the fact that workers generate less cost to the Medicare system compared with non workers, the fact that Medicare is a secondary payer for individuals covered by CEPHI, and finally due to the fact that they delay enrollment into one part of the program or the complete program. The savings linked to work and the Medicare secondary payer effect come from two sources. First, working and Medicare as secondary payer decrease the probability of a positive Medicare cost in the first stage of our preferred sample selection corrected specification. Second, for those with a positive amount of Medicare costs, we observe a decline in the average expenditures due to working and due to Medicare being a secondary payer.

To compute the effect of work and CEPHI on the probability of observing a positive Medicare costs, we can take the results directly from Table 2. From the marginal effects of *Work*, and *CEPHI*, as well as the predicted weighted average probability of having positive Medicare costs, which is 81%, we find that the *Work* variable decreases the average probability of observing a positive Medicare costs by around 6.79% (5.5% divided by 81%), while the *CEPHI* variable decreases the average probability of observing a positive Medicare costs by around 9.26% (7.5% divided by 81%). We additionally have to take into account the interaction term, *wepc*, which further decreases the probability of observing a positive Medicare costs by around 9.88% (8% divided by 81%). From the results of the second stage, shown in Table 3, the coefficients of *Work* and *CEPHI* are also negative and statistically significantly correlated with the level of Medicare costs. We find that workers spend 7.6% less than non-workers. Those who are covered by CEPHI and therefore have Medicare as secondary payer spend on average 10.8% less compared with those with Medicare as primary payer. Finally, those who work and have CEPHI further decrease the average Medicare costs by 28.1%.

6.1 Medicare Savings from Work and the Medicare Secondary Payer Effect

In order to compute the total Medicare savings from the fact that an individual works, requires us to first calculate the average Medicare costs in a given year for those with positive costs. We then calculate the average yearly number of individuals who are working, and then compute the breakdown between those with zero Medicare costs and those with positive Medicare costs.

Table 6: Weighted Population (in Millions) of Workers and those with CEPHI Coverage

Year	2004	2005	2006	2007	2008	2009	2010
Workers	4.48	4.47	4.67	4.82	5.03	5.22	5.61
Medicare $\succ 0$	63.54%	63.19%	76.13%	77.65%	75.67%	73.96%	69.47%
Medicare = 0	36.46%	36.81%	23.87%	22.35%	24.33%	26.04%	30.53%
Prob(Medicare $\succ 0$)	68.17%	67.79%	81.67%	83.31%	81.18%	79.34%	74.53%
Diff of Prob.	4.63%	4.60%	5.55%	5.66%	5.51%	5.39%	5.06%
CEPHI	1.22	1.34	1.29	1.37	1.27	1.30	1.64
Medicare $\succ 0$	60.06%	54.76%	62.26%	60.95%	60.51%	62.00%	47.85%
Medicare = 0	39.94%	45.24%	37.74%	39.05%	39.49%	38.00%	52.15%
Prob(Medicare $\succ 0$)	66.19%	60.34%	68.61%	67.17%	66.69%	68.33%	52.73%
Diff of Prob.	6.13%	5.59%	6.35%	6.22%	6.18%	6.33%	4.88%
Workers with CEPHI	0.79	0.91	0.87	0.91	0.89	0.88	1.14
Medicare $\succ 0$	46.14%	47.06%	55.83%	51.41%	51.91%	52.92%	38.59%
Medicare = 0	53.86%	52.94%	44.17%	48.59%	48.09%	47.08%	61.41%
Prob(Medicare $\succ 0$)	51.20%	52.22%	61.95%	57.04%	57.60%	58.72%	42.82%
Diff of Prob.	5.06%	5.16%	6.12%	5.64%	5.69%	5.80%	4.23%
Avg. Medicare Costs	$7,291	$7,308	$7,159	$7,253	$7,007	$6,702	$6,673
Medicare Beneficiaries	29.70	29.90	30.14	30.87	31.93	32.81	33.90

Note: Statistics are calculated using cross-section sample weights.

The top panel in Table 6 shows the weighted population of workers in selected years. For example, in 2004, the number of workers is 4.48 million and is 5.61 million in 2010. The average population of workers in the estimation sample, which covers 12 years, is 4.58 million. We then look at the percentage of individuals among these 4.48 million in 2004 who have positive Medicare costs, and we find that it is 63.54%. Since the working effect reduces the probability of observing a positive Medicare cost by 6.79%, if the *Work* variable were to have a zero effect on the probability of observing a positive Medicare cost, the breakdown between positive and zero Medicare costs would show that people with positive expenditures would be 68.17% instead of 63.54%. This means that *Work* is responsible for an reduction of 4.63 percentage points in the proportion of those who have positive Medicare costs. With all these information we are ready to compute the aggregate savings from the pure working effect.

The 4.48 million workers in 2004 generate two sets of savings. First, given that we now have more individuals with zero Medicare costs, the Medicare system saves $1.51 billion, which results from multiplying the average expenditure in 2004 of $7,291.5 (rounded in the table) times the 4.48 million individuals times the 4.63% who change from the average to zero. Then we have additional savings for those who have positive Medicare costs and see their average costs reduced due to the effect of working. Those savings are $1.58 billion (4.48 million times $7,291.5 per individual times the coefficient of the *Work* indicator in Table 3, times the 63.54% who have positive Medicare costs). These two effects add up to $3.09 billion in 2004. For 2010 savings are 3.87 billion. The average yearly savings during the 1999 to 2010 period are $3.25 billion, which represent savings of 0.73% of the total net outlays of the Medicare program in 2010.[11]

We also calculate the total Medicare savings due to the fact that for some individuals Medicare

[11] The total net mandatory outlays in 2010 were 446.3 billion dollars as shown in CBO (2011).

is secondary payer using the same method as we used to calculate the savings from working effect. The average yearly savings during the 1999 to 2010 period is $1.04 billion. Finally, Table 6 also shows the third part of the Medicare cost savings from workers covered by CEPHI, which is captured by the interaction indicator: *wepc*. The average yearly savings are about $1.08 billion.

To sum up, the aggregate average yearly savings related to individuals work, Medicare as secondary payer, and their joint effects are about $5.37 billion, which represent savings of 1.2% of the total net outlays of the Medicare program in 2010.[12]

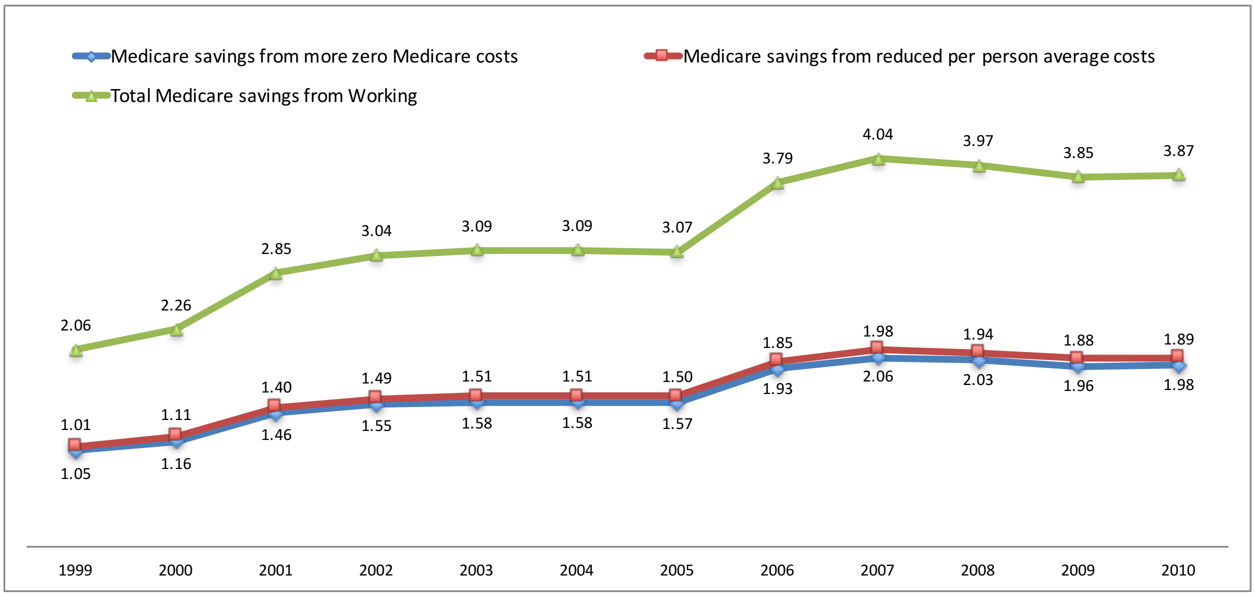


Figure 3: Medicare Cost Savings from Work (in Billions of Dollars)

Figure 3, 4 and 5 plot the Medicare savings from working, from Medicare as secondary payer, as well as from their joint effects, correspondingly. We can see an increasing trend of the savings in all figures. Comparing with Medicare as secondary payer and the joint effects, working generates higher savings to the Medicare system. The aggregate savings from all three sources were $3.45

[12] If instead of this preferred sample selection corrected specification we use the "just parametrically identified" specification, the total average yearly savings are slightly higher at $5.77 billion.

billion in 1999, and $6.12 billion in 2010.

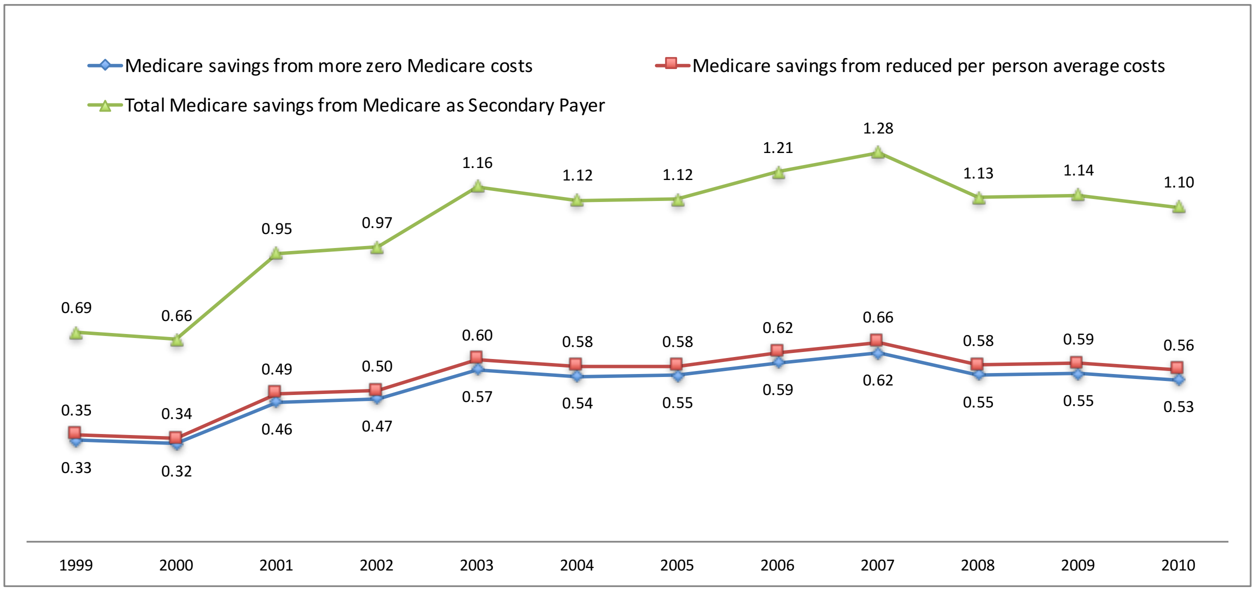


Figure 4: Medicare Cost Savings from Medicare as Secondary Payer (in Billions of Dollars)

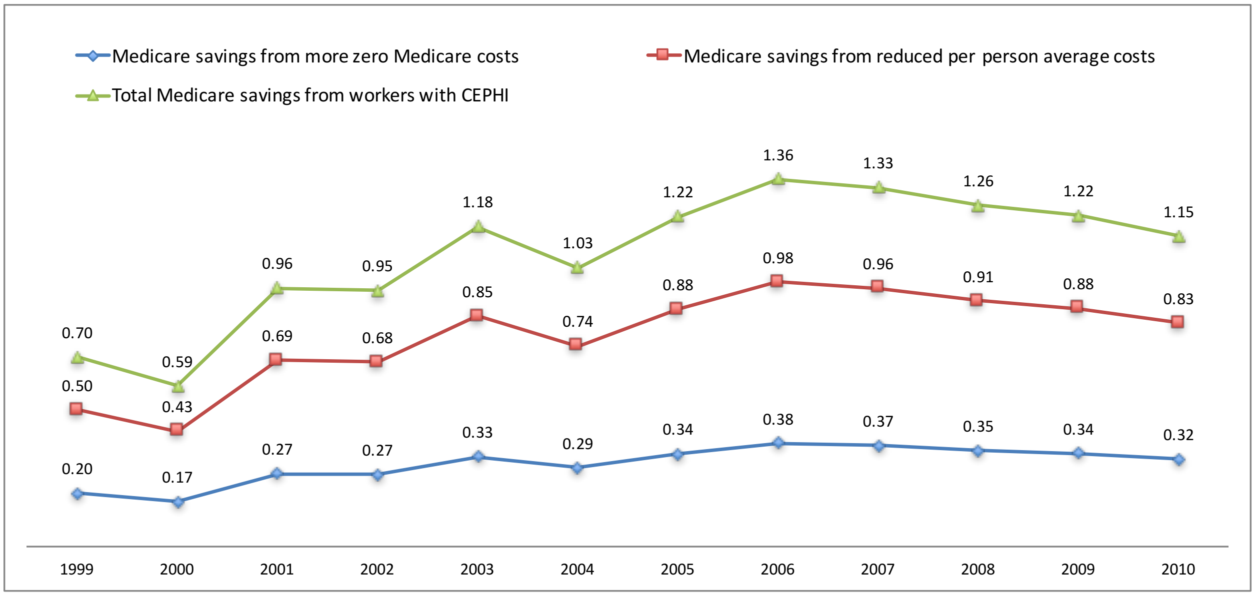


Figure 5: Medicare Cost Savings from Workers with CEPHI (in Billions of Dollars)

We have investigated whether this trend is just the product of the increased aged population, the increased labor force participation, or the increases in average Medicare costs, and we find that most of the changes are explained by a combination of the increase in the number of older Americans and the increase in labor force participation, which in many years account together for between 70% and 80% of the changes in savings.

6.2 Medicare Savings from Delay Medicare Enrollment

As shown in Table 4 and Table 5, indicators of Medicare past and current delayers in each year are used when estimating the Medicare cost savings. The total savings are the sum of savings from past delayers, current Part A or Part B delayers as well as from Part B delayers covered with CEPHI. Table D.1 in the Appendix D shows the detailed breakdown of delayers from year 2004 to 2010. Using similar calculations to those described in Section 6.1, we can compute the Medicare cost savings from delays in Medicare enrollment. Similarly, we use both the results from the first and second stage to calculate the corresponding savings, and the first stage of Table 4 and Table 5 are included in Appendix C. Notice that not all the coefficients on delay dummies are negative, as a result, instead of generating Medicare cost savings, those positive coefficients generate more costs to the Medicare system. Our calculations using information in Table D.1 in the Appendix take that into account. The average yearly Medicare savings from past delayers during the 1999 to 2010 period are about $0.23 billion, the corresponding Medicare savings from current Part A delayers, current Part B delayers as well as Part B delayers covered by CEPHI are $0.16 billion, $0.12 billion, and $0.07 billion, respectively.

Table 7 shows the retrospective counting of Medicare cost savings from delay enrollment. As discussed in Section 4.1, we retrospectively count the number of individuals who have delayed either part or both Part A and Part B in each year starting in 1999, using all of the information regarding enrollment available in the MCBS. We then times the number of delayers in each year

Table 7: Medicare Cost Savings (in USD of 2009) from Delay Enrollment: Retrospective Counting

Year \ Savings	Part A	Part B	Part A+B	Total
1999	2,508,887,296	4,243,138,048	4,660,755,456	11,412,780,800
2000	2,313,744,384	4,583,156,736	4,340,261,888	11,237,163,008
2001	2,538,497,280	4,899,589,120	4,858,211,840	12,296,298,240
2002	2,320,211,200	5,201,255,936	4,854,670,848	12,376,137,984
2003	1,979,582,976	5,410,360,320	3,875,293,696	11,265,236,992
2004	1,730,988,416	5,908,411,392	2,985,637,376	10,625,037,184
2005	1,316,721,792	5,755,548,160	1,963,387,648	9,035,657,600
2006	1,126,692,480	5,247,505,920	1,758,030,592	8,132,228,992
2007	995,435,840	5,421,378,560	1,044,982,144	7,461,796,544
2008	806,216,000	5,601,479,680	371,533,472	6,779,229,152
2009	488,684,576	4,304,261,120	184,595,936	4,977,541,632

Note: Statistics are calculated using cross-section sample weights.

with the corresponding average Medicare costs to get the numbers shown in Table 7. The details are as follows: we first count the number of individuals who have delayed Part A in 1999, we then use the cross-section sample weights to get the population corresponding to the raw counting. Finally, we times the population with the average Medicare Part A costs in 1999 to calculate the savings from those have delayed Part A in 1999, which are about $2.51 billion. As we can see from Table 7, the Medicare cost savings from retrospective counting are quite large, especially for those who have delayed Part B or delayed both parts. The aggregate Medicare cost savings are around $11.4 billion in 1999 and are about $4.98 billion in 2009. The average yearly Medicare cost savings are around $9.59 billion during the 1999-2009 period. The $9.59 billion is about 2.15% of the net mandatory outlays of the Medicare system in 2010. It is important to emphasize that the lower estimated savings in recent years is an artifact of the retrospective perspective, so for example to compute those delaying in 2008, we only have data on those who delayed in 2008 and finally enroll in 2009 or 2010, but not on those who delayed in 2008 and continue to do so in 2009 and 2010. This means that for earlier years, say up to 2004 or 2005, our retrospective calculations are likely accurate, but for recent years our estimated savings are probably a fairly large underestimation of the true savings due to delays in enrollment. This means that large as the estimated effect of delay is, the true savings are likely larger, and access to future data will allow us to verify this hypothesis.

7 Sensitivity Analysis of the Results

Table 8 presents the results of several specifications of the log of individuals' Medicare costs as the dependent variable. Column 1 presents the results of the OLS regression including the true zeros in the sample. The result is that the coefficients of interest are larger in absolute terms compared with our preferred specification, reflecting the likely bias of the estimated effect of the *CEPHI* and *Work* variables due to the fact that we are not separating the process that delivers the zero cost from the one that generates positive Medicare costs. From the data we know that around 43% of those covered by CEPHI have expenditures equal to zero, therefore the OLS coefficients have to be negative and large to account for this.[13] Column 2 presents the results of the IV specification of Medicare costs, allowing for the endogeneity of the *Work* indicator. The exclusion restrictions used are marital status and whether the individual acquired some college education (but do not have a BA degree). The Kleibergen Paaprk Wald F-statistics and Hansen J-Statistic show that the exclusion restrictions are robust and exogenous. Although the quantitative results of IV are somewhat sensitive to the exclusion restrictions that we use, the ones presented represent qualitatively the overall results from several IV specifications. The IV estimate of the *Work* indicator are more negative, indicating a larger effect than in the OLS specification, but it is not significant. However, the *CEPHI* indicator is similar to the OLS estimate, just slightly smaller and statistically significant, and the interaction term between *Work* and *CEPHI* is a third of the size (in absolute value) of the OLS estimator but not significant. Overall, the IV estimates are not very different from the OLS results. Column 3 shows the results of Fixed Effect (FE) specification of Medicare costs. Given that the FE estimator is able to remove the time-invariant unobserved individual components from the estimation, while allowing for correlation between the independent variables and the error term, this helps us address the possible endogeneity issues linked with the *Work* indicator without resorting to exclusion restrictions. In this case the size of the coefficients go down considerably, but the *Work* and *CEPHI* indicator are still negative and significant while the interaction term is very small and insignificant. These results suggest that in the presence of biases due to endogeneity concerns the FE estimator seems to work better.[14] Column 4 presents the results from the second

[13]We have also estimated a Tobit specification using the same sample and the results are very similar to the OLS estimates, in fact the estimates are slightly larger in absolute value.

[14]We have also estimated a Random Effects panel data specification. The results show coefficients considerably larger than those from FE estimator for the variables of interest, meaning the effect of *Work*, *CEPHI*, and their interaction. The estimates are more in line with those from OLS.

stage of the TPM. The first stage of TPM is not presented because it is identical to the first stage of Heckman's sample selection model shown in Table 2. TPM does separate the zero and positive Medicare costs, but does not allow correlation between the error components of the specification of the probability of having positive Medicare costs and the level of the costs. In this case the size of the *Work* coefficient goes down further, while the *CEPHI* is similar to that of the FE estimator. The interaction term is again negative and significant in this specification. Finally, column 5 shows the results from the second stage of Heckman's sample selection model, which are the same as in Table 3. For the *Work* and *CEPHI* estimates, this specification is the one that estimates the smallest (in absolute terms) effects, while the interaction term is smaller (in absolute terms) than for the OLS, IV, and TMP specifications, but larger than in the FE case.

Table 8: The Results from Multiple Model Specifications on Medicare Costs

	OLS (1)	IV (2)	FE (3)	TPM (4)	Sample Selection (5)
Work	-0.539***	-1.161	-0.244**	-0.133***	-0.076***
	(0.046)	(0.890)	(0.044)	(0.023)	(0.021)
CEPHI	-0.735***	-0.709***	-0.176*	-0.189***	-0.108*
	(0.131)	(0.190)	(0.099)	(0.067)	(0.055)
wepc	-1.153***	-0.344	0.081	-0.419***	-0.281***
	(0.168)	(0.856)	(0.134)	(0.093)	(0.076)
F Stat.		66.59			
J test		0.589			
p value		(0.443)			
Lambda					-0.806***

						(0.058)
Obs.	95,146	95,198	80,995	78,827		78,827

Notes: All regressions also contain (but are not reported in the table): age, age square, gender, smoking status, number of kids, income dummies, health controls, race, education, marital status, and census region dummies. The **DRC** dummies are only included in the OLS and IV specifications (they drop from the FE specification), since they are exclusion restrictions in the first stage of the TPM and the sample selection corrected specifications. The first stage of the IV specification also includes the exclusion restrictions discussed in the text: marital status and some college. Robust Standard errors clustered at the individual level are in parentheses.

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent.

Overall our sensitivity analysis suggests that choosing the sample selection corrected specification as our preferred one avoids the chance of upward biases in our coefficients (in absolute terms), while still controlling for sample selection which seems warranted by the significance of the inverse Mills ratio. Since we use the results of Column 5 in the calculations of the savings in Section 6, it is important to notice that Heckman's results show the lower bound (in absolute terms) among all the estimates for the effects of the *Work* and *CEPHI* indicators, and for the effect of the interaction term the sample selection corrected specification is the second smallest (in absolute terms) after the FE.

8 Conclusions

In this research we use the MCBS individual level data to analyze the relationship between labor supply, employer-provided health insurance coverage and Medicare costs. We also study the evolution of delay enrollments into Medicare, as well as the role of delays in Medicare enrollment on

Medicare costs, taking into account the existence of enrollment penalties and the recent evolution of labor supply among older Americans. This endeavor is not only innovative but also essential to understand how a number of recent developments affecting older Americans influence the Medicare system. Changes in the Social Security system, such as increases in the FRA and the DRC, in the debt structure of older American households, as well as in the increased longevity of Americans, have led to considerable increases in labor supply in the last couple of decades. Given the connection of work with employer-provided health insurance coverage, it has become even more important to understand how work and health insurance coverage affect Medicare costs. Another important effect of individuals' working longer on Medicare finances, is through the Medicare Tax, which would increase revenue to the Medicare system. The quantification of this effect is beyond the scope of this paper, but will be a part of our future research.

Our findings, using a variety of econometric specifications, show sizable negative and significant effects of work and health insurance coverage (as well as their interaction) on Medicare costs, and significant effects of delays in Medicare enrollment on Medicare costs. The estimation results allow us to compute aggregate estimated savings resulting from the significant number of Americans who work and are covered by CEPHI while on Medicare. The richness of MCBS allows us to observe the current delayers in each year, and we are able to quantify the aggregate effect that comes from delaying enrollments into Medicare, which is correlated with work and health coverage.

The Medicare savings in a given year resulting from the fact that around 4.58 million older Americans keep working after age 65 are \$3.25 billion. The savings from the fact that Medicare is secondary payer versus primary payer for around 1.23 million Americans every year is around \$1.04 billion. The savings from the joint effect of working and Medicare is the secondary payer for around 0.80 million Americans every year is around \$1.08 billion. Most of the changes in these savings over time are linked with the increases in age-eligible population, and the increases in their labor force participation.

On the other hand, the Medicare savings in a given year resulting from individuals delaying Medicare enrollment are \$10.17 billion, in which 94% of the savings emerge thanks to our ability to perform retrospective calculations using Medicare enrollment information.

We should mention that we do not include in our calculation of savings due to delayed enrollment, the fact that some individuals die before even enrolling in Medicare, providing a cost saving silver lining to the government. We have not tried to compute these possible savings because to truly tackle the problem we would have to expand our research to compute the savings or costs linked to early death as well as longer than expected longevity among those never enrolled and also among those eventually enrolled. A careful analysis of the effects of mortality on Medicare costs is out of the scope of this research, but part of our future research. Notice that our empirical analysis is conditional on current delay enrollment penalties. Also, health evolves differently for those who delay and those who don't, since health is a function of delay enrollment decisions. In order to fully understand the delay enrollment penalties, the delay enrollment decisions as well as the underlying evolution of health linked to both, we would need a structural model. That analysis is again out of the scope of this research but part of our future research.

Given our findings, any of the following will affect Medicare costs through the effects we have described in this research: reforms to the Social Security system, the health insurance system, or the tax code; changes in the debt structure of older American households; and any developments that affect labor supply and/or health insurance coverage.

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