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## THE EFFECTS OF ESTATE AND INHERITANCE TAXES ON ENTREPRENEURSHIP

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March 05, 2018

## ABSTRACT

Despite its relatively small role in the federal taxation system—accounting for less than 1 percent of revenues—the estate and gift tax is controversial. This paper surveys evidence on the effect of estate and inheritance taxes on entrepreneurship and presents some new evidence. We use the Survey of Consumer Finances to examine how receipt of an inheritance affects the likelihood that an heir will own and manage a business and use the Health and Retirement Study to explore how the changing rules for wealth transfer taxation at the federal and state level affect the likelihood of continued self-employment. We find that receiving an inheritance increases the likelihood of owning and managing a business. The prospect of leaving an estate subject to taxation may reduce the likelihood of continued self-employment by encouraging retirement.

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## ACKNOWLEDGMENTS

The Tax Policy Center thanks the Ewing Marion Kauffman Foundation for their support of this work.

The views expressed are those of the authors and should not be attributed the Urban-Brookings Tax Policy Center, the Urban Institute, the Brookings Institution, their trustees, or their funders. Funders do not determine research findings or the insights and recommendations of our experts. Further information on Urban's funding principles is available at <http://www.urban.org/aboutus/our-funding/funding-principles>; further information on Brookings' donor guidelines is available at <http://www.brookings.edu/support-brookings/donor-guidelines>.

We are grateful to David Joulfaian, Donald Marron, Mark Mazur, Eric Toder, and Michael Marazzi for helpful comments and advice and to John Iselin for expert research assistance.

## INTRODUCTION

Although the estate and gift tax's role in the federal taxation system is small (accounting for less than 1 percent of revenues), it is controversial. Advocates for the tax point out that it is highly progressive, currently affecting less than 0.2 percent of estates, and may reduce large concentrations of wealth in a few families. Critics counter that estate taxes are a tax on virtue that penalizes hard work and thrift and that it amounts to a double tax because most wealth has already been subject to income taxation.

The federal estate tax has existed since 1916. Currently the tax applies only to estates larger than about \$11.2 million (\$22.4 million for a couple). Many states have their own taxes on estates or inheritance, in some cases applying to much smaller estates. There have long been concerns that estate, inheritance, and gift taxes might discourage entrepreneurship because successful entrepreneurs would be especially likely to accumulate enough wealth to be subject to the tax. The tax might discourage entrepreneurial individuals from starting a business in the first place or from taking risks. Even if the entrepreneur retains the business, the estate might need to sell it to raise cash to pay the tax. Entrepreneurs might accumulate additional assets, such as life insurance, so that the estate can meet tax obligations, but those assets are diverted from business investments.

The effects of estate and inheritance taxes on heirs are ambiguous, however. On one hand, the recipient of an inheritance might use an infusion of cash to fund a new business or expand an existing one. By reducing the size of after-tax bequests or the number of heirs, wealth transfer taxes might discourage this avenue for entrepreneurship. On the other hand, the knowledge that a large inheritance is coming might discourage heirs' effort—a disincentive that the estate tax might diminish.

This paper surveys evidence on the effect of wealth transfer taxes on entrepreneurship and presents some new evidence based on data from two sources. We use data from the Survey of Consumer Finances (SCF) to examine how receipt of an inheritance affects the likelihood that an heir will be self-employed.<sup>1</sup> The Health and Retirement Study (HRS) is a panel of older adults who might be especially sensitive to changes in wealth transfer tax policy. We use HRS data from 1992 to 2014 to examine how the changing rules for wealth transfer taxation at the federal and state level affect the probability of actively managing a business.

We find that receiving an inheritance increases the likelihood of owning and managing a business (the best proxy for entrepreneurship available in the SCF). Previous research has speculated that this might occur because would-be entrepreneurs face liquidity constraints (i.e., lenders are unwilling to lend seed capital to those without a track record of business success). Based on our preferred model specification, we estimate that beneficiaries of one or more bequests within the past 20 years are almost 13 percentage points more likely to

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<sup>1</sup> We use self-employment as an imperfect proxy for entrepreneurship because of data limitations. We discuss the limitations of this in the next section.

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own and manage a business and that every \$1 million of inheritance raises that probability by about 1 percent. Thus, by reducing the size of after-tax bequests, wealth transfer taxes might discourage entrepreneurship.

We also examine how estate and inheritance taxes might affect business owners whose estates would be subject to the tax upon their death. Using variation across states over time, we find evidence that being subject to estate or inheritance taxes reduces the likelihood of continued self-employment. Overall, the likelihood of self-employment compared with working for a wage or retiring among older workers falls about 8 percentage points. However, it appears that all of this occurs on the choice between working and retiring rather than between self-employment and wage and salary employment among those who continue working.

As we will discuss, our conclusions carry several caveats. Most important is that we cannot accurately measure entrepreneurship, which involves innovating and taking risks. Whether taxation has larger or smaller effects on entrepreneurs than other business owners is unclear. Further, receipt of an inheritance might be correlated with other factors related to entrepreneurship, such as having parents who are successful entrepreneurs or who have skills that contribute to successful entrepreneurship. To the extent that those attributes are transmitted between generations, the receipt of an inheritance might measure factors that are unlikely to be altered by changing wealth transfer tax rules.

## WEALTH TRANSFER TAXES IN THE UNITED STATES

In the United States, wealth transferred at death is taxed through the unified estate and gift tax. At the federal level in 2018, the first \$11.2 million of an estate is exempt from taxation for single filers; that amount is \$22.4 million for couples. The threshold is adjusted annually for inflation. Amounts above the threshold are taxed at 40 percent, but transfers to spouses are tax free. The exemption is portable between spouses, so any unused exemption by one spouse is available for the second spouse when she or he dies.

Because of the high exemption levels, very few estates are subject to federal tax. The Tax Policy Center estimates that 3,700 estate tax returns will be filed on behalf of those who die in 2018.<sup>2</sup> Estates with assets above the filing threshold may avoid or reduce estate tax liability through deductions. In addition to an unlimited spousal deduction, estates may deduct donations to charity, debts, funeral expenses, legal and administrative fees, and estate taxes paid to states. The taxable estate equals the gross estate (i.e., total assets) less these deductions.<sup>3</sup> The Tax Policy Center estimates that in 2018, 1,700 decedents will have taxable estates in excess of the exemption. The US Census Bureau projects that 2.7 million people will die in 2018. Thus, less than 0.2 percent of decedents' estates will be required to file, and less than 0.1 percent will owe any estate tax. The Tax Policy Center estimates that estate tax liability will total \$13.6 billion after credits, or about 0.4 percent of federal revenues.<sup>4</sup> Because the exemption level is so high, the tax leaves small business and family farms unscathed unless the estate also includes substantial amounts of other assets. Special provisions, such as valuation discounts for farms and family-owned businesses, often allow many businesses to substantially reduce the size of the gross estate. The Tax Policy Center estimates that only about 30 estates with small-business and family-farm assets had positive estate tax liability in 2017, when the thresholds were half as high as in 2018.<sup>5</sup>

To stem tax avoidance by means of gifts to heirs during life (also known as inter vivos giving), cumulative lifetime gifts in excess of \$14,000 per recipient per year (indexed to inflation) are subject to gift tax.<sup>6</sup> Total

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<sup>2</sup> See "T17-0308 – Estate Tax Returns and Liability under Current Law and the House and Senate Versions of the Tax Cuts and Jobs Act, 2018-2027," Tax Policy Center, published December 6, 2017.

<sup>3</sup> Technically, estates claim a tax credit equal to the tax on a taxable estate that just equals the exclusion level. Before 2007, progressive rates applied based on the size of the estate, so the credit was worth less than an exclusion (since a deduction's value depends on the marginal tax rate, which was higher for large estates than small ones). Since the current estate tax has a flat 40 percent tax rate, the credit is identical to an exclusion. For more information about the estate tax and its history, see Joint Committee on Taxation (2015).

<sup>4</sup> Fiscal year 2019 receipts are projected to be about \$3.3 trillion.

<sup>5</sup> See "Who Pays the Estate Tax?" Tax Policy Center Briefing Book, accessed February 13, 2018. See also a report from the Congressional Budget Office (2005), which found that only 485 family-owned businesses were required to remit estate tax in 1999 and 2000 when the estate tax exemption ranged from \$650,000 to \$675,000. The Congressional Budget Office estimated that if a \$3.5 million exemption had been in place in those years, fewer than 100 family-owned businesses would have been taxable. The small number of family-owned business estates that must pay estate tax may also benefit from the ability to pay the tax in installments over up to nearly 15 years (177 months) at very low interest rates (McEowen 2014).

<sup>6</sup> Wealthy individuals use several other techniques, mostly involving trusts, to reduce the burden of the estate tax (Senate Committee on Finance 2017). McCaffery (2000) called the estate tax a "voluntary tax" in the sense of being easily avoidable when the

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lifetime taxable gifts reduce the estate tax exclusion upon death or trigger estate tax if they exceed the threshold. In other words, the \$11.2 million estate and gift tax exclusion applies to the sum of bequests and inter vivos transfers in excess of the yearly exclusion. Another antiavoidance measure, the generation-skipping transfer tax, imposes a tax on gifts or bequests to grandchildren or great-grandchildren.

The estate tax threshold and rates have been subject to many changes in recent decades. In 1997, the estate tax exemption was \$600,000, and the tax rate on the largest estates was 55 percent.<sup>7</sup> The Taxpayer Relief Act of 1997 would have gradually increased the threshold to \$1 million by 2006, but the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) superseded that law and cut the estate tax rate while raising the exemption level until the tax was eliminated in 2010. A gift tax remained for that year (to deter income tax avoidance), and the unlimited step-up in basis for appreciated property was curtailed.<sup>8</sup> Because of Senate budget reconciliation rules, EGTRRA expired after 2010, meaning that prior law would have prevailed starting in 2011. Rather than permitting the exemption to revert to \$1 million and the top tax rate to 55 percent, Congress and President Obama agreed to a two-year extension of EGTRRA with the estate tax threshold set at \$5 million (indexed for inflation) and the tax rate at 35 percent. In 2012, a second agreement permanently increased the estate tax rate to its current level of 40 percent (figure 1). The Tax Cuts and Jobs Act, passed in December 2017, doubled the estate tax exemptions to \$11.2 million for singles and \$22.4 million for couples in 2018 (indexed to inflation thereafter). The estate tax cuts, like almost all of the provisions affecting individuals, expire after 2025. Barring further legislation, the estate tax thresholds will revert to the indexed value of \$5.6 million (\$11.2 million for couples) in 2026.<sup>9</sup>

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exemption levels were much lower than at present. Nonetheless, the tax yields substantial revenue (\$18.3 billion in 2016), so taxpayers are not taking full advantage of available avoidance techniques (See Internal Revenue Service, “Estate Tax Returns Filed for Wealthy Decedents, 2007–2016,” Statistics of Income Tax Stats, accessed February 13, 2018).

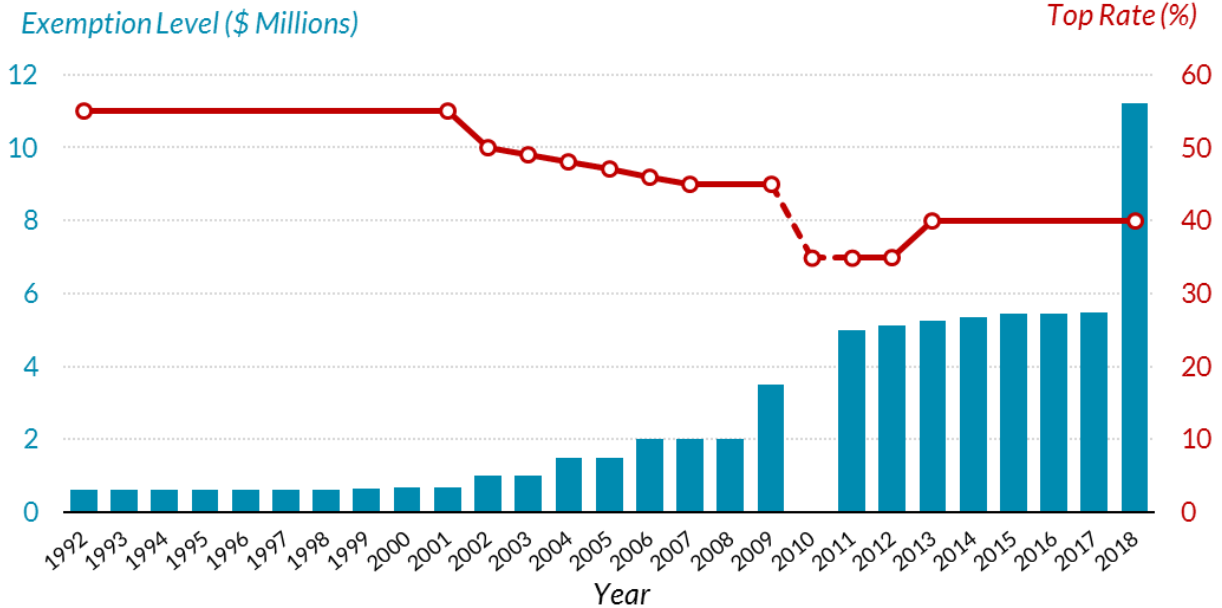
<sup>7</sup> The top effective marginal tax rate was actually 60 percent because the benefit of the rates below 55 percent was phased out for taxable estates between \$10 million and \$17.184 million (Joint Committee on Taxation 2001).

<sup>8</sup> In general, assets transferred at death benefit from “step-up in basis,” meaning that the heir’s tax basis becomes the value at the time of death. Accumulated capital gains at the time of death avoid income tax. EGTRRA implemented a provision called “carryover basis,” under which the heir claims the tax basis of the decedent. If the heir sells the asset, all capital gains, including those accrued during the decedent’s life, become taxable. EGTRRA allowed for the step-up of \$3 million of capital gains on transfers to a spouse and \$1.3 million to other heirs (for a total of \$5.6 million of tax-free transfers from a couple). However, some decedents would have paid higher tax under this regime than under the 2009 estate tax rules (\$3.5 million exemption), so estates had the option of paying estate tax in exchange for unlimited step-up in basis.

<sup>9</sup> A permanent provision of Tax Cuts and Jobs Act changes the index used for inflation adjustment from the consumer price index to the chained consumer price index, which generally rises more slowly. Consequently, the estate tax exemption in 2026 and beyond is set to be somewhat lower than it would be under prior law.



**FIGURE 1**  
Federal Estate Tax Exemption and Top Tax Rate,  
1992–2018



**Source:** Darien B. Jacobson, Brian G. Raub, and Barry W. Johnson, "The Estate Tax: Ninety Years and Counting," IRS, Statistics of Income Bulletin, Summer 2007.  
Tax Policy Center, "Exemption Level, 1999-2015." Urban-Brookings Tax Policy Center, May 2017. IRS, "Form 706 Changes." at <https://www.irs.gov/businesses/small-businesses-self-employed/whats-new-estate-and-gift-tax>.  
**Note:** In 2010, estate executors could opt out of the estate tax in exchange for taxing some capital gains of heirs. Exemption level for married couples is double that for singles after 2001.

The phaseout of the federal estate tax also marked the demise of most state estate and inheritance taxes. EGTRRA phased out the "state death tax credit," a credit against federal tax of up to 16 percent of taxable estate. Congress did not restore the credit when the federal estate tax was revived in 2011. Before EGTRRA, every state and the District of Columbia had a "pickup tax," which was a tax calibrated to be fully offset by the state death tax credit. Some states also had additional wealth transfer taxes that were not rebated through the federal credit. Many states' pickup taxes were designed to change with federal rules so that when the credit was eliminated, the state tax disappeared automatically. Others chose to eliminate their taxes. However, a minority of states retained wealth transfer taxes or reintroduced a tax after the state death tax credit disappeared.

As of 2015, a dozen states and the District of Columbia had their own estate taxes; five states had inheritance taxes.<sup>10</sup> Two states had both, under which the estate owed the greater of the two taxes rather than

<sup>10</sup> Unlike estate taxes, which depend only on the size of the entire estate, inheritance taxes are based on the size of individual bequests.

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their sum (Michael 2015). The state taxes often apply to much smaller estates than the federal tax (table 1.) Further, because the states phased their estate taxes in and out as their political and budget situations changed, such taxes have varied considerably across states since 2000.

**TABLE 1**  
**State Estate and Inheritance Tax Parameters, 2015**  
 Millions of dollars, 2013



State	Estate Tax Parameters		Inheritance Tax Parameters			
	Exemption (\$ thousands)	Top rate	Collateral Heirs		Lineal Heirs	
			Exemption (\$)	Top rate	Exemption (\$)	Top rate
Connecticut	\$2,000	12%				
Delaware	\$5,430	16%				
District of Columbia	\$1,000	16%				
Hawaii	\$5,430	15.7%				
Illinois	\$4,000	16%				
Iowa			\$0	15%		
Kentucky			\$500	16%		
Maine	\$2,000	12%	\$1,000	10%		
Maryland	\$1,500	16%				
Massachusetts	\$1,000	16%				
Minnesota	\$1,400	16%				
Nebraska			\$10,000	18%	\$40,000	1%
New Jersey	\$675	16%	\$500	16%		
New York	\$3,125	16%				
Oregon	\$1,000	16%				
Pennsylvania			\$0	15%	\$3,500	4.5%
Rhode Island	\$1,500	16%				
Tennessee			\$5,000,000	9.5%	\$5,000,000	9.5%
Vermont	\$1,000	16%				
Washington	\$2,054	20%				

**Source:** Michael (2015).

**Note:** "Lineal heirs are typically children, grandchildren, and parents, but practices vary as to whether their spouses (e.g., sons-in-law or daughters-in-law) are included. Collateral heirs typically are cousins, aunts, uncles, nephews, nieces, and unrelated individuals." (Michael 2015, 9)

## WHO IS AN ENTREPRENEUR?

Our analysis considers how federal and state wealth transfer taxes affect entrepreneurship decisions, but the definition of entrepreneurship is not entirely clear. Toder (2017) suggests following Joseph Schumpeter's (1947) definition of entrepreneur as "...an innovator who brings together 'existing productive resources in new ways or for new purposes'" (p.2). An entrepreneur is a creative innovator who takes risks, not the proprietor of a corner store or a hot dog stand.

That definition is challenging for empirical studies because surveys typically do not define risk-taking or innovation. Instead, previous studies have used self-employment status or small business ownership (Gentry and Hubbard 2004; Bruce and Deskins 2012; Schuetze and Bruce 2004; Garrett and Wall 2005). Grossmann and Strulik (2010) include family-owned firms in the definition.

We use the more expansive definition because of data limitations, recognizing that much of the effect on entrepreneurship that we are measuring actually just applies to business ownership. An open question is how well findings based on these data apply to the kinds of risk-taking and entrepreneurship that make a material contribution to economic growth.

## EFFECT OF ESTATE TAX ON ENTREPRENEURSHIP

Wealth transfer taxes could affect entrepreneurship decisions in many ways. They could affect the decision to start a business or terminate it, or they could alter decisions within the business, in turn affecting investment, employment, and the rate of growth. These taxes might affect the decisions of investors (thereby affecting the availability of capital) in a new enterprise. They could affect the entrepreneur subject to estate or inheritance taxes, and they could affect the decisions of heirs.

### *Effects on Entrepreneurs*

The theoretical effects of the estate tax on entrepreneurs are unclear. They depend critically on the existence of a bequest motive. For many estates, bequests are essentially accidental—a consequence of saving against longevity risk (people do not want to run out of savings) and the risk of high expenses for medical care or long-term care combined with imperfect insurance markets, which make the cost of fully insuring against these risks appear prohibitive. Davies (1981), Abel (1985), and Hurd (1987) find evidence that most bequests are accidental.

Further support comes from studies that look for evidence of altruistic intent. If parents care about the well-being of their children, then bequests should compensate heirs for differences in ability (Becker 1974;

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Bernheim, Shleifer, and Summers 1985). McGarry and Schoeni (1995) find evidence that inter vivos transfers are compensatory, but Altonji, Hayashi, and Kotlikoff (1992) and Wilhelm (1996) find little evidence of intrafamily redistribution in bequest decisions. Bernheim and Severinov (2003) rationalize equal bequests because children view gift size as a signal of the intensity of affection and parents do not want to indicate favoritism in their wills. Francesconi, Pollak, and Tobasso (2015) provide a simpler explanation: almost 40 percent of decedents in the HRS died intestate, which typically leads to equal distribution of assets among surviving biological children. The lack of a will makes it hard to infer intentions, although it may suggest relatively little concern about bequests. Francesconi, Pollak, and Tobasso (2015) also find that unequal bequests were more common in complex families (favoring biological children over stepchildren or adopted children) and in cases where biological children had lost touch with the parents.

Other evidence, however, supports the existence of a bequest motive. Yaari (1965) shows that absent a bequest motive, people would fully annuitize their wealth to insure against longevity risk. The relative rarity of annuities suggests that parents might have a bequest motive or they might care about keeping the family business going after they die. The risk of uncertain health care and long-term care costs (Palumbo 1999; Dynan, Skinner, and Zeldes 2002, 2004) would also argue against fully annuitizing.

Kopczuk and Lupton (2007) develop a model of bequest motives as a function of family composition and other factors. People with children were more likely to have a bequest motive than people without children, and those with a bequest motive reduced their lifetime consumption compared with childless adults. Kopczuk and Lupton (2007) estimate that 75 percent of single elderly individuals have bequest motives.

Holtz-Eakin, Phillips, and Rosen (2001) find that business owners are more likely to purchase life insurance than others, although they do not fully insure against expected estate tax liability. The authors acknowledge that they may be overestimating estate tax liability because of tax avoidance measures that they cannot identify in their data, but they also raise the possibility that “contrary to the popular view that keeping a business in the family is very important to business owners, they make no special efforts in this respect” (p.63). However, purchasing life insurance only makes sense if purchasers care about their heirs.

Finally, Kopczuk and Lupton (2007), Slemrod (2000) and Gale and Slemrod (2000) conclude that wealthy people are the most likely to have a bequest motive because they have more than enough assets to sustain their required consumption through retirement. These are, of course, the people most likely subject to estate taxation.

Comparatively less evidence exists on how entrepreneurial activities respond to estate tax incentives. Holtz-Eakin (1999) treats the estate tax as equivalent to a surtax on capital and labor because it reduces the after-tax returns of both for households that would have estate values above the taxable threshold without taxation. The

theoretical effects are ambiguous because of income and substitution effects. The substitution effect—that is, how individuals respond to a change in the relative prices (for leisure, current, and future consumption) while adjusting income to leave them indifferent—would imply that people work and save less when the effective estate tax rate increases. The income effect, however, cuts the other way. If entrepreneurs have targets for bequests, for example, then an increase in the estate tax could actually encourage them to work and save more to increase the pretax estate value enough to offset some or all of the additional tax liability. It is unclear which of these contradictory incentives would dominate.

Holtz-Eakin (1999) reports evidence consistent with a larger substitution effect. Based on a survey of New York business owners, he found a negative correlation between estate tax rates and employment growth. Based on data from the HRS and the companion Asset and Health Dynamics among the Oldest Old dataset, he also found that the likelihood of being subject to the estate tax discouraged work effort by the entrepreneur. It is not clear, however, that either of these correlations imply a causal relationship.

Ample evidence suggests that the income tax affects entrepreneurs' decisions, but there is less evidence about the estate tax. One obvious incentive for entrepreneurs is to make inter vivos transfers up to the annual exclusion amount, but McGarry (2013), using HRS data from 1992 to 2006, reports that most people likely to be affected by the estate tax give less than the annual tax-free amount every year. Even among the very wealthy, whose estates would have faced tax rates of up to 55 percent before 2001, most "give far less than the amount they are potentially able to give tax free" (p.478) This suggests that the response of entrepreneurs to estate taxation might be relatively modest.

Cagetti and DeNardi (2009) take a different approach, developing a general equilibrium model of entrepreneurship and calibrating it to match data from the SCF. The authors conclude that the estate tax distorts decisions of large firms but not small ones. Although eliminating the estate tax in isolation makes all cohorts and wealth classes better off, in the more realistic case where the revenue must be replaced by other taxes, most of the young are actually worse off.

### *Effects of inheritance on business formation*

Estate and gift taxes affect heirs more directly. When wealth transfer taxes increase, after-tax bequests are smaller (and vice versa). The direct effect of bequests on heirs is unambiguous: by increasing wealth, bequests make more leisure and current consumption feasible; absent liquidity constraints, this income effect would be expected to reduce heirs' work effort and saving.

Industrialist and Treasury Secretary Andrew Carnegie thought this was a bad thing. In an 1891 essay, he wrote that "the parent who leaves his son enormous wealth generally deadens the talents and energies of the

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son, and tempts him to lead a less useful and less worthy life than he otherwise would."<sup>11</sup> In 1916, bipartisan consensus held that large accumulations of wealth across generations were undesirable. At that time, the estate tax was a comparatively uncontroversial revenue source for the country on the eve of World War I (Thorndike 2006).

Although the “Carnegie conjecture” prevailed as folk wisdom for several generations, it largely escaped careful scrutiny until Holtz-Eakin, Joulfaian, and Rosen (1993) used data from 1982 to 85 to study the effect of bequests on labor supply based on a sample of estate tax returns matched to the income tax returns of working-age adults in the four years after they received an inheritance. The authors found that families who receive a large inheritance are more likely to exit the labor force and report less labor income than those who receive little or no inheritance. The income response is somewhat ambiguous because income might fall if an entrepreneur earns little cash income in the early years of a business. Nonetheless, although the tax data have limitations (such as little demographic information and no information about choices that might have been made in the years before death), the findings are consistent with the Carnegie conjecture.

Another strand of research has focused on an indirect channel through which bequests might affect business formation or expansion: a substantial bequest could relax liquidity constraints that previously prevented the recipient from making major investments, such as a new business. Holtz-Eakin, Joulfaian, and Rosen (1994a), using tax data, conclude that the size of an inheritance has a big effect on likelihood of starting a business: “...the probability of becoming an entrepreneur and the amount of capital employed in the new enterprise are both affected by the size of the inheritance” (p.346). Blanchflower and Oswald (1998) provide an exhaustive survey of the evidence and seriously address endogeneity problems to search for evidence that a lack of capital limits self-employment (as opposed to unobserved personality traits that might be correlated with availability of capital). They conclude that liquidity constraints are statistically and quantitatively important and consistent with self-reports that a lack of capital is an impediment to entrepreneurship. Holtz-Eakin, Joulfaian, and Rosen (1994a and 1994b) also find evidence that bequests extend the longevity of new enterprises.

Thus, if estate taxes reduce the size of inheritances, that could indirectly deter business formation and the likelihood of success.

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<sup>11</sup> Quoted in Holtz-Eakin, Joulfaian, and Rosen (1993).

## THE SURVEY OF CONSUMER FINANCES

We use the SCF to examine the effect of inheritances (and hence the estate tax, which reduces their size) on business formation and ownership. The SCF is a cross-sectional survey conducted every three years. We pool samples from 1992 through 2010. Each survey contains detailed information on assets and income for several thousand households. For example, the 2007 survey contains 4,421 families, and the 2010 survey contains 6,492 families (Bricker et. al. 2012).

The SCF employs a multiple imputations method in the spirit of Rubin (1987) to account for nonresponse (Kennickel 1998). In each of five “implicates,” missing values are assigned based on the values of related nonmissing variables; each value includes a random component drawn from the empirical error distribution. For example, a missing value for a continuous variable is imputed as the expected value estimated from regressing that variable on related variables, plus a random error term. The Federal Reserve Board provides procedures to adjust statistical estimates for the imputation process. In essence, separate weighted regressions are estimated for each implicate, then the coefficients are averaged and the standard errors adjusted for the variation across the implicates.

We limit the sample to those who have never received an inheritance and those who received an inheritance within the 20 years before being surveyed. That reduces the sample from 161,850 to 153,465 observations, representing 30,493 families over surveys from 1992 through 2010. The 20-year limit is imposed for two reasons: because receiving inheritances in early childhood may offer little opportunity to start a business as an adult, and because inheritances received in the respondent’s distant past could, when inflated to current dollars, dominate the variation in the value of inheritances.<sup>12</sup>

Our dependent variable is a binary variable equal to one if the respondent owns and actively manages a firm, such as a partnership, a sole proprietorship, or a subchapter S corporation. This is the definition of entrepreneur used by Cagetti and De Nardi (2009). We include two inheritance measures: a binary variable equal to one if the respondent received an inheritance in the past 20 years and a continuous variable equal to the total value of the first three inheritances listed by the respondent that were received in the past 20 years.<sup>13</sup> We convert the values at the time of the inheritance to present values by inflating each inheritance by the

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<sup>12</sup> The estimates are not sensitive to this assumption. Removing the 20-year limit had virtually no effect on the estimate of the effect of receiving an inheritance; the estimate on the size of inheritance was larger without the constraint imposed, but it was qualitatively similar.

<sup>13</sup> Some respondents state that they received an inheritance without monetary value. In our analysis, the answers of these respondents are coded as “received no inheritance.” We also exclude inheritances for which no date is reported.

annual rate of return on 10-year Treasury bonds between the time the inheritance was received and the year the survey was conducted.<sup>14</sup>

To control for wealth, which could be correlated with both actively managing a business and receiving an inheritance, we include net worth minus the total value of inheritances received. We also test the sensitivity of our results to this definition by subtracting the value of business assets. In both cases, we use a spline with breaks at zero dollars and the 50th, 75th, 90th, 95th, 96th, 97th, 98th, and 99th percentiles of positive net worth. We use a spline with a focus on flexibility at the upper end of the wealth distribution rather than evenly spread across quintiles because both business owners and those receiving inheritances have higher than average wealth. Both inheritances and wealth are adjusted to 2016 dollars.

To control for several demographic characteristics of the respondent, we include age and its square and dummy variables for gender and marital status. Summary statistics for those variables for all observations and for those who received inheritances are presented in table 2.

About 12 percent of the population own and manage a business compared with nearly 20 percent of those who receive an inheritance. This suggests that receiving an inheritance is correlated with business ownership, although it may represent nothing more than the fact that business owners are more likely to leave inheritances and to have children who become business owners. About 4 percent of businesses are inherited in our data. Over the entire sample, the average inheritance was about \$56,000; among those receiving an inheritance, the average was about \$310,000 and the median was about \$67,000. The average respondent age was 49, but those receiving an inheritance tended to be slightly older, with an average age of 53.

Over the whole sample, the average net worth (excluding inheritance) was about \$411,000, with a median of \$85,000. Those who received inheritances had an average net worth (excluding inheritance) of about \$540,000, with a median of \$137,000. Those receiving inheritances have greater average and median net worth, but just as the relationship between business ownership and inheritance may reflect other factors, the relationship between inheritance and net worth may reflect other factors, such as receipt of inter vivos gifts. Subtracting business assets as well as inheritances, average net worth in the full sample falls to \$326,000, with a median of \$78,000. Those with inheritances had an average net worth without business assets of \$400,000 and a median net worth of \$120,000.

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<sup>14</sup> Alternatively, we might include a risk premium and calculate the after-tax rate of return, but both the appropriate risk premium and the effective tax rate are unknown. The two factors offset, at least partially, so given data limitations, discounting by the Treasury rate seems a reasonable middle ground.



## THE HEALTH AND RETIREMENT STUDY

The HRS is a panel dataset that follows four cohorts of older Americans (age 50 and over) every two years starting in 1992. The restricted version of the dataset includes information about respondents' state of residence, which allows us to measure the effect of variation in state wealth transfer taxes on entrepreneurs' decisions.<sup>15</sup>

Each wave of the panel contains detailed information on assets, income, and health status for respondents. We use the first 11 waves of the sample, through 2014. Because we include lagged values of income and wealth in estimation, we exclude the observations of each respondent's first entry. This yields a sample of approximately 147,000 observations, representing 26,000 respondents from 1994 through 2014. Among all observations, 44 percent were working during the survey year; 20 percent of workers were entrepreneurs. Overall, approximately 9 percent of the sample were entrepreneurs.

Our dependent variable is a binary variable indicating whether the respondent is self-employed. To identify the exact channel of the effect of estate tax on entrepreneurship, we build separate models using two other dependent variables. One is a binary variable indicating whether the respondent is working (including self-employment). The other is a binary variable defined among working respondents only: it equals one if the respondent is self-employed and zero if working as an employee.

The key independent variable is the expected taxable estate,  $p_{it} \cdot \max(W_{it} - T_{it}, 0)$ , calculated as the probability of person  $i$  dying in year  $t$  multiplied by the taxable estate (before deductions) in that year. The probability of dying,  $p_{it}$ , is estimated from a semiparametric Cox hazard model that is described in appendix A. The taxable estate in each year is the amount of wealth,  $W_{it}$ , in excess of the taxable threshold  $T_{it}$ . Wealth is measured as net family assets, and the threshold for each estate is set as the minimum of the threshold for the federal-level estate tax, the state-level estate tax, or the inheritance tax paid by children of the decedent in that year. The taxable estate is adjusted to 2016 dollars. Identifying variation in this variable comes from two sources. First, state-level estate and inheritance taxes vary across states and over time (table A.4). Those differences almost certainly are not affected by the rate of self-employment in each state and year. Second, the probability of death varies by individual and over time. That probability might be affected by self-employment. We attempt to remove this source of endogeneity by including many control variables, such as information on health, wealth, and income.

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<sup>15</sup> Our dataset is the Rand HRS data file (version P) matched with the Cross-Wave Geographic Information (State) file for 1992 to 2014. The sample was refreshed with new cohorts in 1998, 2004, and 2008. We did not include the companion panel, Asset and Health Dynamics among the Oldest Old.

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Health status and wealth (along with year and state of residence) determine the expected taxable estate variable but also exert independent effects of entrepreneurial decisions. For example, people might retire because of poor health (which also raises the probability of death and being subject to wealth transfer taxes). More wealth will tend to reduce labor market activity, including in entrepreneurship, if leisure is a normal good. To control for health, we include the same health status variables used to estimate the mortality hazard function. We allow for a flexible function of wealth by using a spline function. Wealth is lagged to avoid the reverse causality between wealth and entrepreneurship. In generating wealth splines, we have cutoffs at the 50th, 75th, 90th, 95th, 96th, 97th, 98th, and 99th percentiles of wealth in 2016 dollars. This focuses on the top of the wealth distribution, which is where most of the relevant variation exists.

**TABLE 2****Summary Statistics, Survey of Consumer Finances, 1992–2010**

	All Observations			With Inheritance		
	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Own and actively manage business	0.12	0	0.33	0.19	0	0.39
Received inheritance	0.18	0	0.38	1	1	0
Inheritance value (\$)	56,096	0	2,438,005	311,175	66,977	5,735,176
Age	48.7	47	17.0	52.6	52	16.0
Married	0.52	1	0.50	0.60	1	0.49
Net worth (\$)	411,530	84,985	3,603,826	543,294	137,018	6,341,923
Net worth less business assets (\$)	326,225	78,332	3,017,236	401,241	119,932	5,993,691
Sample size	155,568			33,015		

**Note:** Dollar amounts are measured in 2016 dollars. All results are weighted.

**TABLE 3.1****Selected Summary Statistics, Health and Retirement Study, by Wave**

Year	Sample size	Mean age	Mean probability of death	Proportion owning taxable estate <sup>a</sup>	Mean net worth (\$)	Mean nonbusiness net wealth (\$)
1994	11,237	57.4	0.006	0.10	465,984	412,003
1996	10,107	59.3	0.008	0.12	467,561	415,168
1998	9,821	61.1	0.013	0.15	584,882	517,421
2000	13,954	62.1	0.013	0.14	559,733	507,200
2002	13,581	64.0	0.016	0.10	556,474	506,310
2004	12,981	64.7	0.021	0.08	625,367	569,470
2006	15,205	63.5	0.022	0.13	669,382	598,372
2008	14,623	65.1	0.027	0.12	635,738	576,461
2010	13,843	66.9	0.034	0.09	615,462	555,907
2012	18,597	64.8	0.030	0.10	529,792	475,431
2014	17,446	66.3	0.031	0.04	568,543	513,591

**Note:** Dollar amounts are measured in 2016 dollars. All results are weighted.

<sup>a</sup> Taxable at the federal or state level (so thresholds for state estate and inheritance taxes apply where these taxes are in effect).

**TABLE 3.2****Summary Statistics, Health and Retirement Study, 1994-2014**

	All Observations			Entrepreneurs Only		
	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Self-employed	0.11	0	0.31	1	1	0
Working	0.47	0	0.50	1	1	0
Age	64.1	63	8.0	62.1	61	6.7
Probability of dying	0.023	0.009	0.045	0.014	0.007	0.023
Probability of having taxable estate	0.101	0	0.302	0.206	0	0.405
Real wealth	583,060	229,988	1,484,656	1,202,569	500,268	2,878,999
Real non-business wealth	525,470	219,052	1,266,480	936,393	403,521	2,168,898
Expected taxable estate	2,765	0	39,572	6,626	0	64,715
Among those with taxable estate	27,320	4,968	121,670	32,130	6,586	139,621
Real Income	23,802	0	58,004	22,138	0	106,285
Female	0.53	1	0.50	0.36	0	0.48
<b>Race</b>						
White	0.85	1	0.36	0.90	1	0.30
Black	0.10	0	0.30	0.05	0	0.23
Other	0.05	0	0.22	0.05	0	0.21
Widow/widower	0.12	0	0.32	0.06	0	0.23

# DATA

	All observations			Entrepreneurs Only		
	Mean	Median	Standard deviation	Mean	Median	Standard deviation
<b>BMI</b>						
Underweight (below 18.5)	0.01	0	0.11	0.01	0	0.08
Normal (18.5-25)	0.29	0	0.46	0.32	0	0.47
Overweight (25-30)	0.40	0	0.49	0.43	0	0.50
Obese (Above 30)	0.32	0	0.46	0.26	0	0.44
<b>High blood pressure</b>						
High blood pressure	0.56	1	0.61	0.44	0	0.62
<b>Diabetes</b>						
Diabetes	0.21	0	0.48	0.13	0	0.41
<b>Cancer</b>						
Cancer	0.13	0	0.38	0.10	0	0.34
<b>Smoke now</b>						
Smoke now	0.16	0	0.37	0.13	0	0.33
<b>Ever smoke</b>						
Ever smoke	0.59	1	0.49	0.57	1	0.50
<b>Self-report of health</b>						
Excellent	0.13	0	0.33	0.21	0	0.41
Very good	0.32	0	0.47	0.38	0	0.49
Good	0.31	0	0.46	0.28	0	0.45
Fair	0.17	0	0.38	0.11	0	0.31
Poor	0.07	0	0.25	0.02	0	0.14

**Note:** All dollar amounts are measured in 2016 dollars. All results are weighted.

## THE EFFECT OF RECEIVING INHERITANCE ON BUSINESS OWNERSHIP

We estimate a simple model of the effect of inheritance on entrepreneurial activity. The decision to own and manage a business depends on the relative benefits and costs of entrepreneurship versus wage-based employment. The basic model is

$$Y_i^e = X_i^e \beta^e + \varepsilon_i^e \quad (1)$$

$$Y_i^w = X_i^w \beta^w + \varepsilon_i^w \quad (2)$$

where  $Y_i^e$  and  $Y_i^w$  are the benefits and  $X_i^e$  and  $X_i^w$  are factors that affect preferences and success of entrepreneurship and wage employment, respectively, for each individual  $i$  in the sample.  $\varepsilon_i^e$  and  $\varepsilon_i^w$  are unobserved error terms.

Each individual chooses entrepreneurship if

$$Y_i^e - Y_i^w > C_i^e \quad (3)$$

where  $C_i^e$  are costs to entering entrepreneurship. We focus on liquidity constraints (i.e., lack of access to capital), which previous literature suggests is an important barrier to entrepreneurship. To proxy for those constraints, we use the presence and level of inheritance, as described earlier.

First, we define a criterion function,  $Z_i$ , which determines whether individual  $i$  chooses entrepreneurship:

$$Z_i \equiv Y_i^e - Y_i^w - C_i^e \quad (4)$$

Substituting from equations (1) and (2) into (4) yields

$$Z_i = X_i^e \beta^e + \varepsilon_i^e - X_i^w \beta^w - \varepsilon_i^w - C_i^e \quad (5)$$

Combining terms and defining  $X$  as the union of  $X^e$  and  $X^w$ , augmented to include the inheritance variables as proxies for  $C$ , and defining  $\varepsilon = \varepsilon_i^e - \varepsilon_i^w$ ,  $Z_i$  is simply

$$Z_i = X_i \beta + \varepsilon_i \quad (6)$$

If the errors in equations 1 and 2 are normally distributed, then  $\varepsilon_i$  will be also be normal and the parameters of equation 6 may be consistently estimated by the probit maximum likelihood method. Note that the inheritance variables, now subsumed in  $X$ , may affect  $Z$  through channels beyond liquidity constraints. The inheritance dummy captures the effect of receiving an inheritance as well as any variables correlated with receiving an inheritance and business ownership that are independent of the size of the inheritance. For example, business owners might be more likely both to leave inheritances and to have children who also own

and manage businesses. Those receiving inheritances might also have been more likely to receive inter vivos gifts from parents when they started their businesses. Further, more wealth may make an individual less interested in working (the Carnegie conjecture discussed earlier). The coefficients on the inheritance variables will thus capture the combined effect of the different incentives.

Table 4.1 shows the results of estimating equation 6. For comparison, the first two columns show the estimates from a linear probability model—an OLS regression with the dependent variable set to one if the individual owns and manages a business. Column 1 suggests a strong relationship between receiving an inheritance and business ownership: receiving an inheritance is associated with an 8 percentage-point increase in the probability of owning and managing a business.<sup>16</sup> We also include a variable representing the size of inheritance measured in millions of 2016 dollars. The resulting effect is very small and insignificantly different from zero.

In column 2, we add demographic variables to the X vector. We include age and age squared because older respondents have had more time than younger workers to establish a successful business and develop skills. We add dummy variables for sex and marital status and a set of education dummies. The effect of receiving an inheritance falls to 0.066, which is still a strong relationship, and it is significant at the 1 percent level.

The remaining columns show estimates for the full probit model. The estimates shown are the weighted average of marginal effects over the entire sample.<sup>17</sup> The results, in column 3, show a small change in the relationship between receiving an inheritance and owning and managing a business. More importantly, the marginal effect on the size of the inheritance is about six times larger in the probit and it is statistically different from zero. The magnitude, however, is small: an additional million dollars increases the probability of owning and managing a business by about 0.4 percentage points.

Omitted from these models is an important variable, wealth. Personal wealth can be correlated with both the probability of owning a business and the size of any inheritances, so its omission could bias the results. As described in the previous section, we control for wealth by using a spline for net worth minus the value of inheritances received that is flexible at the top of the wealth distribution.

<sup>16</sup> As noted, we include sole proprietors in our dependent variable although they may be less entrepreneurial than owners of other forms of businesses. Sole proprietors make up about half of all actively managed businesses. Including them has a material effect on the results. Omitting sole proprietors reduces both the effect of receiving an inheritance and the effect of the size of the inheritance. Without sole proprietors, the effect of receiving an inheritance is about 12 to 40 percent of the estimates reported here. Also, the estimated effect of inheritance size is only about 25 to 50 percent as large.

<sup>17</sup> If we define  $X^1$  as the indicator for receipt of inheritance and  $X^2$  as the amount of inheritance, then the estimates are the change in probability of being an entrepreneur given receipt of inheritance,  $F(X\beta|X^1 = 1) - F(X\beta|X^1 = 0)$ , and the marginal effect with respect to the level of inheritance  $\frac{dF}{dX^2} = \beta \cdot f(X^1)$ , where  $F$  and  $f$  are the normal distribution function and density function respectively. We separately estimate a weighted probit on each of five implicates pooled over all of the years in our sample, present the results averaged over the implicates, and correct the standard errors for variation across the implicates.



Adding a spline for wealth substantially improves the goodness of fit: the pseudo-R-squared for the regression increases from 0.084 to 0.19. The marginal effect of inheritance increases to 0.0085, meaning that an additional \$1 million in inheritance increases the probability of owning and managing a business by about 0.9 percentage points. However, the estimated effect of inheriting an additional million dollars could be biased because the control for wealth includes business assets. Thus, the coefficient on inheritances measures their effect on the probability of owning a business holding the sum of business assets and other assets fixed. A better estimate of the effect of inheritances would measure wealth absent any business assets. The results from using this definition of wealth are in column 5. The marginal effect of inheritances increases to 0.0106. As in all of the specifications, the estimate is significant at the 1 percent level. The pseudo-R-squared doubles to 0.38.<sup>18</sup>

Although we attempt to reduce the potential for bias from using data from different survey years by calculating the value of each dollar variable in 2016 dollars, surveys in different years could vary systematically. For example, national wealth has increased dramatically over the past few decades. We would expect, therefore, that respondents in later surveys would receive larger inheritances than those in earlier surveys. Further, the expanding economy and changes in tax law may also have created more opportunities for private ownership of businesses. We address this by adding dummy variables for each survey year (year fixed effects). As shown in column 6 of table 4.1, that has virtually no effect on the results. We also test for the possibility that the effect of inheritances varies across the survey years by adding interaction terms of real inheritance and year dummies (not shown). None of the interaction terms are significant, indicating that the response to inheritances does not significantly vary across survey years.

Finally, the relationship between wealth and owning a business may take a different form than can be reflected in our spline function. A common functional form for wealth is to express it in logarithms. The results are shown in column 7. The coefficient estimates for the inheritance variables are still statistically significant, but they are much smaller. However, the fit of this model is substantially worse than using the spline function. The inheritance coefficient estimates are likely capturing some of the nonlinearity in wealth effects that is not consistent with the log form.

We can estimate the effect of the estate tax on owning and managing businesses by treating the estate tax as a reduction in inheritances. For example, in 2007 the average estate tax paid was about \$1.3 million.<sup>19</sup> This amount of reduction in after-tax inheritance (assuming that there is only one heir) would have reduced the likelihood of business ownership by about 1.5 percentage points. Estates typically have multiple heirs, so the effect at the mean estate tax level would be smaller and, as noted above, evidence suggests that some entrepreneurs partially insure against estate tax liability, so the net effect on business formation would be much

<sup>18</sup> Table A.5 reports detailed results, including for control variables, for model 6.

<sup>19</sup> Calculated from data downloaded from the Statistics of Income division of the Internal Revenue Service. See the 2007 file from "SOI Tax Stats – Estate Tax Statistics Filing Year Table 1," Internal Revenue Service, accessed February 13, 2018.

smaller. Further, the federal exemption level is substantially higher now than it was in 2007, so many fewer would-be business owners would be affected at current levels.

Our analysis has some limitations. First, we are using data derived from a survey. Several questions we use, such as the dates inheritances were received and their amount, ask respondents to recall events in the distant past. Other questions ask respondents about the value of their homes and their business assets if sold. The responses are likely to be highly uncertain, and such measurement error biases parameter estimates (as it does other research based on survey data).<sup>20</sup> Second, our analysis uses cross-sectional data. Like all analyses using cross-sectional data, our results may still suffer from omitted variable bias even though we add an array of control variables. For example, respondents receiving large inheritances might be more likely to own and manage their own businesses because they followed in the footsteps of their parents, who were successful in owning and managing their own businesses and could thus provide large inheritances. Finally, we aggregate surveys conducted over 18 years. Although net worth, inheritances and business assets are all adjusted to 2016 dollars, the value of some assets likely increased by more than the overall rate of inflation while others increased by less. This could introduce an unknown amount of measurement error.

## THE EFFECT OF THE ESTATE TAX ON THE LIKELIHOOD OF REMAINING AN ENTREPRENEUR

We apply a similar methodology to measure the effect of federal and state estate and inheritance taxes on the likelihood of being self-employed. Using the HRS, a panel dataset, also allows us to control for unobserved unvarying individual characteristics (fixed effects). The dependent variable in most regressions is a binary variable equal to one if the respondent is self-employed and zero otherwise. The explanatory variable of interest is the expected taxable estate before deductions. The threshold for taxation varies over time and across states and the probability of death varies with individual characteristics (especially age, sex, and health). Control variables include lagged income, two measures of lagged wealth each entered as a spline, age and its square, demographic variables, and several health-status variables.

Column 1 of table 4.2 shows results from a simple linear probability model on the pooled data. In column 1, expected taxable estate has a very small, negative, and statistically insignificant effect on self-employment. Although total wealth is lagged by two years, it might still be endogenous because it includes business assets and is serially correlated. We address this in two ways. First, we subtract business assets from wealth. The results, shown in column 2, are a positive and statistically significant effect (at the 5 percent level) on

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<sup>20</sup> If the measurement error is purely random, it tends to bias estimates toward zero, which would mean that the effects might be larger than we estimate. However, if the measurement error is correlated with other explanatory variables (such as wealth) or with unobserved factors (the error term), the direction of bias is indeterminate.

employment. Second, we use wealth excluding business assets as an instrument for total wealth (column 3).<sup>21</sup> The expected taxable estate now has an insignificant effect on self-employment. Because the standard error is about the same in columns 2 and 3, the lack of significance is caused by the smaller coefficient. Column 4 shows the marginal effect of the expected taxable estate (calculated at the mean) estimated in the full probit model. The results all show a large, positive, and statistically significant effect.

The positive coefficient is surprising but plausible if the income effect of estate taxation dominates the substitution effect (i.e., people work harder to compensate for part or all of the additional estate tax liability). Another possibility, however, is that omitted variable bias distorts parameter estimates.

We may eliminate the bias caused by omitted time-invariant characteristics by estimating the linear probability model controlling for individual and time-fixed effects. Controlling for fixed effects in the base specification (column 5) reverses the sign of the coefficient on expected taxable estate, and it becomes statistically significant at the 1 percent level. Controlling for possible endogeneity of lagged wealth by using nonbusiness assets either as a proxy (column 6) or as an instrument (column 7) barely changes the coefficient estimate or its statistical significance. An additional \$1 million of expected taxable estate would reduce the probability of being self-employed by between 8.3 and 8.7 percentage points. Because we also include a spline of an exogenous definition of wealth as a control, the estimate of the expected taxable estate is unlikely to reflect a simple wealth effect. The estimate is also not likely to reflect a simple effect of age or health status, because we also add age, age squared, and dummy variables for health status.<sup>22</sup>

We next examine how the effect varies by marital status and the presence of children (table 4.3). As discussed, people with heirs are much more likely to be sensitive to estate taxes than those without. Because nearly 25,000 of the 26,405 households have children, it is not surprising that the results are very similar (although marginally smaller) for married people, single people, and people with children. The subset without children has a much larger point estimate (a reduction of 46 percentage points versus 7.8 percentage points for the subsample with children), which is counter to the prior expectation, but this estimate has a very large standard error. These equations have little explanatory power. The R-squared is on the order of 0.01 for all of them.

The estimates above may be confounding two decisions that could both be affected by the estate tax: working versus retiring and, for employed individuals, self-employment versus wage employment.

Examining the decision to work in table 4.4, the effect is approximately half the size for the overall sample and only statistically significant at the 5-percent level. An additional \$1 million of expected taxable estate would

<sup>21</sup> If wealth is the relevant variable, then using nonbusiness wealth as a proxy could bias other coefficients. We create splines from nonbusiness wealth and use them as instruments for all of the wealth splines in a two-stage least-squares procedure.

<sup>22</sup> Table A.6 reports detailed results for all variables in model 6.

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reduce the probability of working by 4 percentage points. Among the breakdowns by marital status and children, the subsample with children is only significant at the 10-percent level, and all the other subsamples produce statistically insignificant coefficients. The coefficients are negative, implying that the estate tax might discourage working, but the effects are small and statistically unreliable. Notably, however, the fit is much better in this model.

Table 4.5 shows that the expected taxable value of the estate has no measurable effect on the decision to be self-employed given that one is working. The coefficients are very small, statistically insignificant, and with varied signs.

Thus, it appears that if the estate tax affects entrepreneurs, it does so primarily by influencing the decision to retire, not the choice of self-employment for people who remain in the work force. Entrepreneurs may be prodded to retire earlier by the specter of estate taxes, but it does not seem to push them to switch from self-employment to wage employment.

**TABLE 4.1**

**Effect of Inheritance on the Probability of Owning and Managing a Business**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS w/ demographics	Probit w/ demographic s	Probit w/ wealth splines	Probit w/ nonbusiness wealth splines	Probit w/ year dummies	Probit w/ log wealth
Inheritance dummy	0.0788*** (0.0066)	0.0508*** (0.0065)	0.0439*** (0.0011)	0.0439*** (0.0011)	0.128*** (0.0012)	0.128*** (0.0011)	0.0382*** (0.0012)
Inheritance (\$ millions)	0.0119*** (0.0057)	0.0087** (0.0047)	0.0043*** (0.0004)	0.0085*** (0.0016)	0.0105*** (0.0038)	0.0106*** (0.0038)	0.0043*** (0.0004)
Observations	155,568	155,568	155,568	155,568	155,568	155,568	155,568
R-squared	0.009	0.052	0.084	0.190	0.380	0.381	0.124
Wealth control	No	No	No	Splines	Splines (nonbusiness)	Splines (nonbusiness)	Log (nonbusiness)
Year fixed effects	No	No	No	No	No	Yes	Yes

**Source:** Survey of Consumer Finances pooled datasets from 1992 to 2010.

**Notes:** Mcfadden pseudo-R-squared estimated for probit models.

\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

OLS is ordinary least squares regression.

**TABLE 4.2**

**Effect of Wealth Transfer Tax Liability on the Probability of Self-Employment**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Pooled OLS	Pooled OLS w/ nonbusiness wealth splines	Pooled 2SLS	Pooled probit w/ nonbusiness wealth splines	FE	FE w/ nonbusiness wealth splines	FE 2SLS
Expected taxable estate (\$ millions)	-0.00856 (0.0290)	0.0779** (0.0334)	0.0526 (0.0340)	0.068*** (0.0196)	-0.0874*** (0.0199)	-0.0830*** (0.0197)	-0.0842*** (0.0198)
Observations	139,976	139,976	139,976	139,976	147,263	147,263	147,263
R-squared	0.072	0.062	0.063	0.101	0.015	0.014	0.0627
Wealth control	Splines	Splines (nonbusiness)	IV	Splines (nonbusiness)	Splines	Splines (nonbusiness)	IV
Individual fixed effects	No	No	No	No	Yes	Yes	Yes
Year fixed effects	No	No	No	No	Yes	Yes	Yes
Respondents	26,405	26,405	26,405	26,405	26,405	26,405	26,405

**Source:** Health and Retirement Study, 1994–2014.

**Notes:** Robust standard errors are in parentheses. Table uses Mcfadden pseudo-R-squared estimated for probit models.

\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

OLS is ordinary least squares regression; FE is an OLS regression with fixed effects; 2SLS is two-stage least squares.

**TABLE 4.3****Effect of Wealth Transfer Tax Liability on the Probability of Self-Employment, by Marital Status and Presence of Children**

Variables	(1) All	(2) Married	(3) Single	(4) Has children	(5) No child
Expected taxable estate (\$ millions)	-0.0830*** (0.0197)	-0.0733*** (0.0211)	-0.0786 (0.0634)	-0.0775*** (0.0198)	-0.463 (0.296)
Observations	147,263	99,343	47,823	137,917	9,346
Respondents	26,405	19,130	11,403	24,597	2,409
R-squared	0.014	0.016	0.008	0.014	0.011
Wealth control	Spline	Spline	Spline	Spline	Spline
Individual FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

**Source:** Health and Retirement Study, 1994–2014.

**Notes:** Robust standard errors are in parentheses. Estimates are based on a linear probability model.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

FE is fixed effects.

**TABLE 4.4**

**Effect of Wealth Transfer Tax Liability on the Probability of Employment, by Marital Status and Presence of Children**

	(1) All	(2) Married	(3) Single	(4) Has children	(5) No child
Expected taxable estate (\$ millions)	-0.0414** (0.0192)	-0.0280 (0.0215)	-0.0258 (0.0628)	-0.0357* (0.0192)	-0.292 (0.337)
Observations	147,448	99,480	47,871	138,086	9,362
Respondents	26,405	19,130	11,403	24,597	2,409
R-squared	0.232	0.222	0.206	0.232	0.204
Wealth control	Splines	Splines	Splines	Splines	Splines
Individual FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

**Source:** Health and Retirement Study, 1994–2014.

**Notes:** Robust standard errors are in parentheses.

\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

FE is fixed effects.



**TABLE 4.5**

## Effect of Wealth Transfer Tax Liability on the Probability of Self-Employment for Employed People, by Marital Status and Presence of Children

Variables	(1) All	(2) Married	(3) Single	(4) Has children	(5) No child
Expected taxable estate (\$ millions)	0.0148 (0.0217)	0.0122 (0.0229)	-0.00349 (0.0293)	0.0179 (0.0233)	-0.130 (0.0895)
Observations	33,729	24,869	8,820	31,874	1,855
Respondents	11,316	8,584	3,403	10,661	714
R-squared	0.019	0.017	0.023	0.019	0.039
Wealth control	Splines	Splines	Splines	Splines	Splines
Individual FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

**Source:** Health and Retirement Study, 1994–2014.

**Notes:** Robust standard errors are in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

FE is fixed effects.

## CONCLUSION

This paper presents new evidence on the effects of estate and inheritance taxes on decisions of heirs and on entrepreneurs who may be subject to the tax. For the first question, we examine pooled cross-section data from the SCF from 1992 to 2010. For the second, we use panel data on older workers in the Health and Retirement Study, examining biennial data from 1994 to 2014.

The effects of inheritance on business formation are statistically significant and consistent with earlier evidence. Receipt of an inheritance raises the likelihood of having active business income. The amount of the inheritance is less important than the existence of the inheritance. Nonetheless, a \$1 million reduction in the size of an inheritance would reduce the likelihood of owning and managing a business about 1 percentage point. At current estate tax levels (an \$11.2 million exemption, \$22.4 million for couples), this is likely to affect decisions of very few would-be entrepreneurs.

We also find evidence that the specter of estate or inheritance taxes affects the likelihood of remaining self-employed, but this effect seems to primarily operate through the decision to retire: an estate tax makes retirement somewhat more attractive. That effect, however, is not specific to entrepreneurs.

We must attach several caveats to our conclusions. Notably, self-employment is not the same as entrepreneurship. Unfortunately, distinguishing entrepreneurs from business owners who do not innovate or take risks is not possible in our data.

We also do not know how entrepreneurs assess estate tax liability, which might be in the distant future, especially given that some laws change frequently. For example, the Tax Cuts and Jobs Act doubled the estate tax exemption from 2018 to 2025. Because of data limitations, we cannot measure expected federal and state wealth transfer tax liability accurately (which is why we use the size of the taxable estate as a proxy).

Finally, even if the estate tax is distortionary, raising other taxes to offset the revenue loss might create larger distortions. Cagetti and De Nardi (2009) concluded that replacing the federal estate tax with higher personal income or consumption taxes would cut overall social welfare.

Indeed, entrepreneurs might view the trade-off exactly this way. A recent *Wall Street Journal* survey found that business owners cared more about lowering business tax rates than repealing the estate tax.<sup>23</sup>

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<sup>23</sup> Ruth Simon, "For Small Businesses, Lower Tax Rates Top Estate Tax Repeal," *Wall Street Journal*, May 10, 2017.

To construct the key explanatory variable *expected taxable estate*, we must estimate the probability of dying (i.e., the individual hazard rate). We use a Cox proportional hazard model, with death being the event of interest (“failure event”),<sup>24</sup> to estimate respondent’s probability of dying between HRS waves (two years).

We start with a sample of 28,799 total respondents, in which there are 6,642 deaths.<sup>25</sup> After reorganizing the dataset to produce one record per person per survey time, we have 189,010 total person-time records.

**TABLE A.1**  
**Characteristics of the Survival-Time Dataset**



Category	Total	Per Subject			
		Mean	Minimum	Median	Maximum
Number of subjects	28,779				
Number of records	189,010	6.57	1	7	11
Entry time		1	1	1	1
Exit time		7.57	2	8	12
Subjects with gap	0				
Time on gap if gap	0				
Time at risk	189,010	6.57	1	7	11
Failures	6,642	0.23	0	0	1

**Source:** Authors' calculations and Health and Retirement Study, 1994–2014. .

**Notes:** Using a Cox proportional hazard model and the Health and Retirement Study, failures are defined as a person dying, the analysis time is the number of waves a respondent survives, and subjects are identified using their survey household ID person numbers.

*Study time* is defined as the number of waves after the respondent enters the sample that he or she survives. For example, if a person was first surveyed in 1998 and was alive through 2014, the study time is 9 (wave 4 through wave 12); if a person was first surveyed in 1998 and died in 2002, the study time is 3 (wave 4 through wave 6). Our measure of time starts when a respondent enters the sample and continues until the sample ends or the respondent exits the survey. For a respondent with study time of 9, the data include 9 person-time records (time = 1, 2, 3, ..., 8, 9, respectively). Table A.1 shows that in our sample the median respondent’s study time is 7.

If any values are missing for a respondent in a wave, we impute the missing data using the information from the previous wave. For example, if a person was first surveyed in 1998 at the age of 70, dropped out in 2000,

<sup>24</sup> Defined in in StataCorp (2013).

<sup>25</sup> Because selection bias exists in the first entry (almost everyone was alive to be surveyed), we estimate each respondent’s probability of dying for all entries except their first.

and was recorded dead in 2002, we impute age as 72 at time 2 and as 74 at time 3. For all other variables, we impute the same values as those at previous time.

The probability of death is estimated in a Cox proportional hazard model,<sup>26</sup> where the hazard is defined as

$$h(t|X) = h_0(t) * e^{X\beta}$$

where  $t$  is time,  $h_0(t)$  is the baseline hazard,  $X$  is a vector of explanatory variables, and  $e^{X\beta}$  is hazard ratio. We include two types of explanatory variables in our model. The demographic variables are the respondent's age, gender, race, marital status, and lagged log income. The health variables are the respondent's body mass index; being a smoker; self-reported health status; and indicators for having cancer, diabetes, or high blood pressure. We estimate the baseline hazard rate for each time ( $h_0(t)$ ), estimate the predicted hazard ratio ( $e^{X\beta}$ ) for each respondent, and finally predict the individual hazard rate as  $h(t|X)$ . We did not estimate the hazard rates the first time a respondent is in the survey because the respondent could not have died before the first interview. Table A.2 shows that out of 28,779 records, 552 died at time 2, and 394 died at time 12. The "net lost" is the number of records "lost" due to censoring. For example, at time 3 we lost 6,261 records, largely because many early baby boomer respondents first entered the survey at wave 10 and were still alive at wave 12, when the data were censored. A similar pattern occurred at time 6, time 9 and time 12. The cumulative hazard rises from 0.0192 at time 2 to 0.43 at time 12.

**TABLE A.2**

## The Nelson-Aalen Estimate of Cumulative Hazard Function across HRS Waves



Time	Begin total	Failures	Net lost	Cumulative hazard	Standard error	95% Confidence Interval	
1	-	-	-	-	-	-	-
2	28,779	552	320	0.0192	0.0008	0.0176	0.0208
3	27,907	624	6,261	0.0415	0.0012	0.0392	0.0440
4	21,022	597	126	0.0699	0.0017	0.0667	0.0733
5	20,299	702	168	0.1045	0.0021	0.1004	0.1088
6	19,429	679	3,208	0.1395	0.0025	0.1346	0.1445
7	15,542	645	158	0.1810	0.0030	0.1752	0.1869
8	14,739	695	184	0.2281	0.0035	0.2214	0.2351
9	13,860	695	3,375	0.2783	0.0040	0.2706	0.2862
10	9,790	551	126	0.3346	0.0046	0.3256	0.3438
11	9,113	508	75	0.3903	0.0053	0.3801	0.4007
12	8,530	394	8,136	0.4365	0.0058	0.4254	0.4479

**Source:** Authors' calculations and Health and Retirement Study, 1994–2014.

**Notes:** Using a Cox proportional hazard model and the Health and Retirement Study, failures are defined as a person dying, the analysis time is the number of waves a respondent survives, and subjects are identified using their survey household ID person numbers.

<sup>26</sup> See Cox (1992) and StataCorp (2013).

We present our estimated average hazard rates by age along with estimates from the Centers for Disease Control's Life Tables in table A.3. Overall our predictions are consistent with Centers for Disease Control (CDC) estimates, although our hazard model predicts a higher mortality rate for older men. The differences occur in part because the responses in our dataset spread across two decades from 1994 to 2014 (e.g., someone who was 80 in 1994 and someone who was 80 in 2014 are pooled together in the same group for tabulation), but we only use the 2003 data from CDC tables.

**TABLE A.3**

### Estimated Probability of Dying and CDC Life Tables, by Age and by Sex

Age	Hazard Model			CDC Table (2003)		
	Male	Female	All	Male	Female	All
52	0.0041	0.0037	0.0039	0.0066	0.0037	0.0051
53	0.0039	0.0041	0.0040	0.0070	0.0041	0.0055
54	0.0048	0.0046	0.0047	0.0075	0.0044	0.0059
55	0.0055	0.0049	0.0052	0.0080	0.0048	0.0064
56	0.0063	0.0057	0.0060	0.0086	0.0052	0.0069
57	0.0072	0.0065	0.0069	0.0093	0.0057	0.0074
58	0.0087	0.0076	0.0081	0.0101	0.0063	0.0081
59	0.0100	0.0086	0.0093	0.0110	0.0069	0.0089
60	0.0112	0.0098	0.0105	0.0121	0.0076	0.0098
61	0.0130	0.0111	0.0120	0.0133	0.0084	0.0108
62	0.0146	0.0118	0.0132	0.0146	0.0093	0.0118
63	0.0179	0.0145	0.0161	0.0159	0.0101	0.0128
64	0.0203	0.0155	0.0177	0.0171	0.0109	0.0139
65	0.0237	0.0183	0.0208	0.0185	0.0118	0.0150
66	0.0275	0.0206	0.0238	0.0200	0.0129	0.0162
67	0.0294	0.0237	0.0264	0.0218	0.0140	0.0176
68	0.0349	0.0252	0.0299	0.0238	0.0154	0.0193
69	0.0379	0.0295	0.0335	0.0260	0.0169	0.0211
70	0.0417	0.0283	0.0347	0.0283	0.0184	0.0229
71	0.0439	0.0307	0.0367	0.0306	0.0201	0.0249
72	0.0492	0.0315	0.0400	0.0334	0.0220	0.0271
73	0.0513	0.0338	0.0419	0.0366	0.0243	0.0297
74	0.0553	0.0333	0.0434	0.0403	0.0268	0.0327
75	0.0596	0.0358	0.0467	0.0442	0.0294	0.0358
76	0.0656	0.0389	0.0513	0.0482	0.0321	0.0389
77	0.0756	0.0427	0.0575	0.0526	0.0352	0.0425
78	0.0796	0.0435	0.0601	0.0574	0.0389	0.0465
79	0.0895	0.0468	0.0667	0.0629	0.0432	0.0512

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80	0.0869	0.0498	0.0663	0.0690	0.0479	0.0563
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**Source:** Author's calculations and Center for Disease Control (2003).

**TABLE A.4**

## Exemption Thresholds of Wealth Transfer Tax, 1992–2014

\$ Thousand

State	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014
AL	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
AK	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
AZ	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
AR	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
CA	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
CO	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
CT	600	600	600	625	675	1,000	1,000	2,000	2,000	2,000	2,000	2,000
DE	600	600	600	625	675	1,000	1,500	2,000	2,000	5,000	5,120	5,340
DC	600	600	600	625	675	1,000	1,000	1,000	1,000	1,000	1,000	1,000
FL	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
GA	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
HI	600	600	600	625	675	1,000	1,500	2,000	2,000	3,500	5,120	5,340
ID	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
IL	600	600	600	625	675	1,000	1,500	2,000	2,000	-	3,500	4,000
IN	600	600	600	625	675	1,000	1,500	100	100	100	100	5,340
IA	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
KS	600	600	600	625	675	700	850	1,000	1,000	-	5,120	5,340
KY	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
LA	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
ME	600	600	600	625	675	1,000	1,500	2,000	2,000	3,500	3,500	2,000
MD	600	600	600	625	675	1,000	1,000	1,000	1,000	1,000	1,000	1,000
MA	600	600	600	625	675	1,000	850	1,000	1,000	1,000	1,000	1,000
MI	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
MN	600	600	600	625	675	700	850	1,000	1,000	1,000	1,000	1,200
MS	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
MO	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
MT	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
NE	600	600	600	625	675	1,000	1,000	1,000	2,000	-	40	5,340
NV	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
NH	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
NJ	600	600	600	625	675	675	675	675	675	675	675	675
NM	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
NY	600	600	600	625	675	1,000	1,000	1,000	1,000	1,000	1,000	2,063
NC	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
ND	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
OH	600	600	600	625	675	1,000	1,500	338	338	338	338	5,340

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OK	600	600	600	625	675	700	850	1,000	2,000	-	5,120	5,340
OR	600	600	600	625	675	1,000	850	1,000	1,000	1,000	1,000	1,000
PA	600	600	600	625	675	1,000	1,500	3.5	3.5	3.5	3.5	5,340
RI	600	600	600	625	675	675	675	675	675	850	893	922
SC	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
SD	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
TN	600	600	600	625	675	1,000	1,500	1,000	1,000	1,000	1,000	2,000
TX	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
UT	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
VT	600	600	600	625	675	1,000	1,500	2,000	2,000	2,000	2,750	2,750
VA	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
WA	600	600	600	625	675	1,000	1,500	2,000	2,000	2,000	2,000	2,000
WV	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
WI	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340
WY	600	600	600	625	675	1,000	1,500	2,000	2,000	-	5,120	5,340

**Note:** Numbers are authors' calculations of the lowest threshold of federal estate tax, state estate tax, and state inheritance tax.



## APPENDIX

Table A.5 shows the entire set of coefficients for Model 6 in table 4.1, including all the control variables.

**TABLE A.5**

### Detailed Coefficients for Model 6 (SCF)

Variable	Coefficient	(Standard error)
Inheritance dummy	0.3806***	(0.0033)
Inheritance (\$ millions)	0.034***	(0.0124)
Lag Nonbusiness asset splines		
Spline 1 (0–50th percentile)	-1.6904***	(0.026)
Spline 2 (50–75th percentile)	0.6059***	(0.0165)
Spline 3 (75–90th percentile)	-0.1467***	(0.0059)
Spline 4 (90–95th percentile)	0.0999***	(0.0405)
Spline 5 (95–96th percentile)	-.0450	(0.0707)
Spline 6 (96–97th percentile)	-.0215	(0.0465)
Spline 7 (97–98th percentile)	.0012	(0.0133)
Spline 8 (98–99th percentile)	-.0016	(0.0039)
Spline 9 (above 99 percentile)	1.1972***	(0.0144)
Age	0.0392***	(0.0005)
Age squared	-0.0005***	(0)
Married	0.0418***	(0.0058)
Sex	-0.3747***	(0.0088)
Education		
High school	0.1258***	(0.0048)
Some college	0.2547***	(0.0054)
College	0.3948***	(0.0111)
Graduate school	0.3948***	(0.0111)
Year dummies		
1992	0.1356***	(0.0155)
1995	0.0728***	(0.0128)
1998	0.0573***	(0.0164)
2004	0.0496***	(0.0113)
2007	0.04***	(0.0144)
2010	0.1506***	(0.0077)
Intercept	-3.0766***	(0.015)
Observations	155,568	
R-squared	0.381	
Wealth control	Nonbusiness asset splines	
Individual FE	Yes	
Year FE	Yes	

**Source:** Survey of Consumer Finances pooled datasets from 1992 to 2010.

**Notes:** \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . FE is fixed effects.

## APPENDIX

Table A.6 shows the entire set of coefficients for Model 6 in Table 4.2, including all the control variables.

**TABLE A.6**

### Detailed Coefficients for Model 6 (HRS)

Variable	Coefficient (standard error)
Expected taxable estate (\$ millions)	-0.0830*** (0.0197)
Lag log income	-0.00173*** (0.000234)
Lag nonbusiness asset splines	
Spline 1 (0–50th Percentile)	-1.49e-08 (1.73e-08)
Spline 2 (50–75th Percentile)	9.45e-08*** (2.66e-08)
Spline 3 (75–90th Percentile)	-8.77e-08*** (2.17e-08)
Spline 4 (90–95th Percentile)	3.35e-08 (2.19e-08)
Spline 5 (95–96th Percentile)	-7.78e-08 (5.73e-08)
Spline 6 (96–97th Percentile)	7.17e-08 (7.38e-08)
Spline 7 (97–98th Percentile)	-5.50e-08 (5.24e-08)
Spline 8 (98–99th Percentile)	4.11e-08 (3.10e-08)
Spline 9 (Above 99th Percentile)	-6.88e-09 (9.62e-09)
Age	0.00975*** (0.00238)
Age squared	-9.36e-05*** (1.25e-05)
Wave dummies	
Wave 3	-0.00399 (0.00427)
Wave 4	-0.0131* (0.00728)
Wave 5	-0.0246** (0.0106)
Wave 6	-0.0255* (0.0142)
Wave 7	-0.0224

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Variable	Coefficient (standard error)
Wave 8	(0.0175) -0.0285
Wave 9	(0.0210) -0.0290
Wave 10	(0.0244) -0.0349
Wave 11	(0.0283) -0.0360
Wave 12	(0.0314) -0.0370
Intercept	(0.0347) -0.109
Observations	(0.106)
R-squared	147,263
Number of respondents	0.014
Wealth control	26,405
Individual FE	Lag nonbusiness asset splines
Year FE	Yes
	Yes

**Source:** Health and Retirement Study, 1994–2014.

**Notes:** Robust standard errors are in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

FE is fixed effects.

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