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# Household Response to Government Debt: Evidence from Life Insurance Holdings

We use state-level panel data on life insurance in force in the United States and find that a $1 increase in government debt, at either the state or federal level is associated with a $0.96 increase in the face value of the average life insurance holdings per capita for a household in the average state. This increase represents an intention to save that would almost completely offset the government debt in specific states of the world (i.e., if the insured dies). Because this state of the world is rare, the immediate increase in actual savings is only about $0.03, the cost of the additional insurance. We find, in addition, that this response occurs mainly on the intensive margin, meaning that the size of the average life insurance policy increases when government debt increases. Along the extensive margin, we find the number of policies in force falls slightly with federal debt, and rises slightly with state debt increases. The results show altruistic planning in response to changes in government debt that are consistent with Ricardian Equivalence and the long-run neutrality of government debt.

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THE LONG-RUN MACROECONOMIC effects of government debt depend upon the savings response of households. This savings response is linked to the time horizon of those households. In a standard overlapping generations framework, increases in government debt lead to a crowding out of investment and a smaller steady-state capital stock due to the finite time horizon of households. Barro (1974)

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shows, in contrast, that even if all individuals are finitely lived, altruism toward future generations will lead households to save as if they are infinitely lived. If so, then government debt is neutral in the long run.

Existing empirical studies of the immediate consumption response to changes in taxes are informative about the short-run stimulative ability of tax cuts, but they do not provide information on whether household's savings plans extend beyond their own lifetime.[1] As such, they do not provide evidence on the long-run neutrality of government debt. Looking at overall bequests directly, which make up as much as 80% of wealth (Kotlikoff and Summers 1981, 1988, Kotlikoff 1988), is also problematic in that bequests can be driven by several different motives, and may simply be the accidental result of poor planning or early death.[2]

Our paper instead examines a direct measure of household's intent to transfer assets to the future in response to changes in government debt—life insurance holdings. We use life insurance in force, the face value of life insurance policies to be paid upon the death of the insured, as the measure of household intent to transfer assets to future generations. Life insurance purchases are a direct indicator of this intent, even if by the end of life other means have been found to make such transfers or if the insurance expires prior to the insured individual.[3] Life insurance is a direct indicator of households' altruism and their plans for bequests, as it has no other function than to pass resources on to others in any future state of the world in which the insured has passed away.[4] In addition, the purchase of life insurance is not accidental. It hence reflects an explicit intent to pass on resources to the future, even if the state of the world in which it is paid out is unlikely to be realized. We use state-level data from 1970 to 2006 in the United States and estimate how holdings of life insurance change in response to both state and federal government debt and find that, in aggregate, households act to neutralize government debt, increasing life insurance in force by roughly \$1 for each \$1 increase in government debt. We believe this is the first direct evidence that the intergenerational planning horizon is valid.[5]

1. Poterba (1988) finds that 75% to 82% of a 1975 tax rebate was saved, a number similar to the high-end estimate of Johnson, Parker, and Soules (2006) with respect to the 2001 tax cut. Souleles (1999) documents a savings rate of about 36% out of income tax refunds, while Gale and Orszag (2004) find that households save 54% to 70% of a decrease in federal taxes. Parker (1999) finds that household expenditures had an elasticity of around one-half with respect to expected changes in Social Security taxes.

2. See Seater (1993) for a summary of several studies of bequests, finding no clear evidence pointing toward their motivation.

3. For example, a working household may buy term life insurance but accumulate enough assets later in life to allow term insurance to lapse. Regardless, the purchase of life insurance reflects a desire to pass resources to future generations.

4. Strictly, this statement is only true for term insurance, as whole and universal life policies may function as a savings vehicle as well. If the savings in life insurance are not for future generations, we should not expect life insurance purchases to fluctuate with government debt.

5. Note that \$1 in additional life insurance does not necessarily imply households fully offset additional government debt. The face value of life insurance is the precise amount that would be paid out upon the death of the insured individual. If that occurs in the future, then the \$1 in coverage will be less than the \$1 plus accumulated interest on the additional debt. The standard errors on our results imply that additional coverage of \$1.00–\$1.10 cannot be rejected.

Is this estimated effect reasonable? First, our results show that life insurance in force—the death benefit—rises by roughly $1 for every $1 increase in government debt. This does not mean that households spend $1 on new life insurance when government debt rises by $1. Given the low probability that an individual will actually die during their coverage period, most pay only about $0.03 per $1 of coverage (American Council on Life Insurance 2010). Thus, while greater life insurance in force is closely associated with higher government debt, suggesting a strong intent to transfer resources to future generations, this implies only a small immediate effect on savings. Our results are thus entirely consistent with the literature on immediate consumption responses to changes in government debt.

Second, our results speak to the intent to save, not to actual saving. Over the period 1970–2006, life insurance in force was equal to roughly 28% of total household assets.[6] This value does not, of course, mean 28% of the assets passed to future generations is paid through life insurance, as many policies will expire without the insured having died. In the same way, an increase of $1 in life insurance in response to $1 in government debt does not mean that $1 will necessarily be passed on to beneficiaries. Regardless, holdings of life insurance, and our results here, do indicate the presence of a strong intent to save. Whether the increased life insurance holdings associated with government debt ever pay off is not relevant for this question. Higher life insurance holdings show that assets are, in expectation, higher in the state of the world in which the insured passes away. Some mix of life insurance and standard savings vehicles would allow a household to increase assets in all states of the world—alive or dead. The advantage of looking specifically at life insurance is that it clearly defines a benefit for *others* and allows us to establish that households have a time horizon beyond their own lifetime when responding to changes in government debt.

Last, it is perfectly reasonable for total life insurance in force to respond $1 for $1 with government debt even though not all households hold life insurance. Models of heterogeneity in altruism, such as in Michel and Pestieau (1998), Smetters (1999), or Mankiw (2000), suggest that only the most altruistic people will end up leaving bequests (e.g., buy life insurance). These models imply that savings by altruists are sufficiently high to offset the entire increase in government debt (or future tax increases). As part of our empirical investigation, we examine both the intensive and extensive margins of life insurance holdings in response to government debt. We find, consistent with these papers on heterogeneity in altruism, that virtually all of the aggregate response occurs on the intensive margin as the size of life insurance holdings change, where there is virtually no change on the extensive margin indicated by the number of policies.

Figure 1 provides an introduction to the relationship between government debt and aggregate life insurance holdings. In this figure, the solid line tracks the ratio of federal and state government debt to gross domestic produce (GDP), with federal debt representing about 80% of the total. The dotted line tracks the ratio of life

6. Authors' calculations using data from the American Council of Life Insurers (ACLI) and the Federal Reserve Flow of Funds report

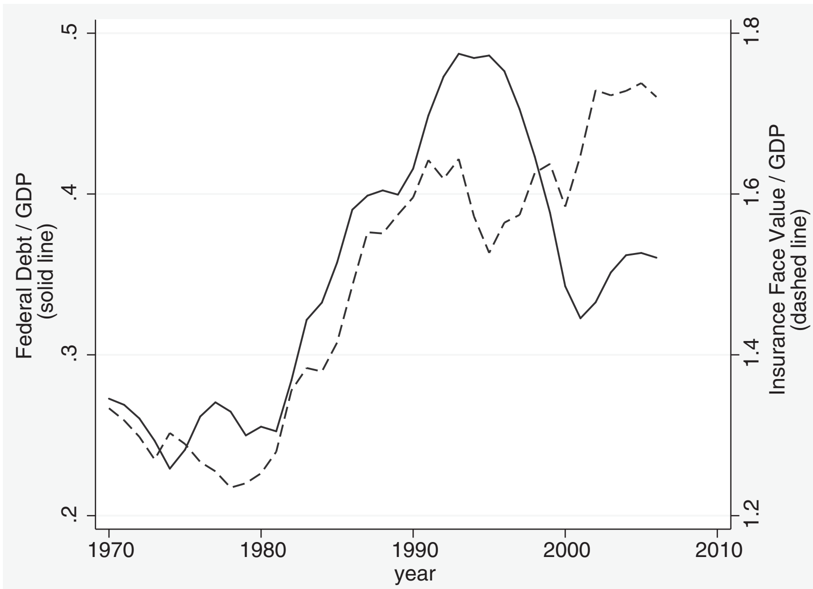


FIG. 1. Government Debt and Life Insurance, Relative to GDP, 1970–2006.

NOTES: Government debt data are from the Congressional Budget Office (CBO), in nominal terms, relative to nominal GDP, reported by the Bureau of Economic Analysis (BEA). The face value of all life insurance is from the American Council of Life Insurers (ACLI), in nominal terms, relative to nominal GDP.

insurance in force to GDP over time. The figure shows that government debt grew steadily during the 1980s after a relatively flat period, and peaked in the early 1990s. A relatively steep decline followed in the mid 90s, until 2000, when government debt resumed its growth as a share of the economy. While the face value of life insurance is roughly three times total government debt, the changes in the two ratios track relatively closely. As can be seen, as debt rises in the 1980s, the face value of life insurance increases just as rapidly after the relatively flat period in the late 1970s. The growth in life insurance flattens out as debt growth stops in the 1990s, and growth in life insurance in force does not resume until the growth in government debt picks up after the year 2000. Figure 1 thus suggests the relationship that our empirical work will examine more carefully, that life insurance purchases by households respond to the levels of government debt. One component of that will be to examine lagged effects of life insurance, and we will establish that the response is strongest 3–5 years after a change in government debt.

Our econometric model estimates how life insurance in force responds to changes in both federal and state government debt. Our data are based on aggregates by state; thus, our estimates showing how life insurance fluctuates with government debt come from a panel of states from 1970 to 2006. Life insurance in force is the face value of a policy and represents the amount to be paid to heirs if the insured person dies. Since the current face value of life insurance represents household demand to pass assets to the future, we include in addition to measures of government debt other demographic controls that might affect demand, such age structure, education, and income levels (Li et al. 2007, Gutter and Hatcher 2008, Liebenberg, Carson, and Dumm 2012). Our primary statistical method is to use long panels, so that we estimate the change in life insurance over 5-year periods as a function of the change in debt over the same time frame. In this way, we are able to capture long-run responses to changes in debt, consistent with the view that demand to pass assets to future generations does not necessarily require immediate action, but is nonetheless a considered decision. We also reestimate our model using differences over shorter periods than 5 years and find that the estimated response of life insurance to changes in government debt is muted but consistent.

Our regression results show that for a given 10% increase in federal debt per capita, life insurance in force also increases by approximately 2.3% per capita. A similar 10% increase in state debt is associated with a smaller but still statistically significant increase in life insurance holdings of 0.9% per capita. To translate these results into dollar terms, we evaluate the response for the mean state in terms of life insurance holdings per capita to a \$1 increase in debt at the mean value for federal debt. This calculation shows a \$0.96 increase in the face value of life insurance per capita for a \$1 increase in federal debt per capita. There is variance in this response, though, depending on the state examined. For those with the lowest amount of life insurance holdings (Arkansas, Mississippi, and West Virginia), the response to a \$1 increase in federal debt is only about \$0.70, while for those with the highest amount of life insurance (Connecticut, Illinois, and New Jersey), the response is about \$1.30. Similarly, evaluated at the mean of state debt, our elasticities imply that life insurance holdings rise by \$1.01 for the mean state when state government debt increases by \$1. The results again vary by state, with effects ranging from \$0.80 to \$1.20. These results are consistent with the work of Bernheim (1991) who finds altruistic behavior in life insurance purchases, but our findings go beyond his by establishing that the size of the aggregate response of life insurance purchases is consistent with households acting to neutralize government debt in the long run.

When we break down changes in debt into changes in spending versus changes in taxes, we find that households respond equivalently to both. That is, a \$1 drop in taxes is associated with a roughly \$1 increase in life insurance holdings, and a \$1 increase in spending is associated with a roughly \$1 increase in holdings as well. Thus, households respond in a manner consistent with the concept of Ricardian Equivalence. Beyond that, though, the response of life insurance to spending increases suggests that households do not perceive any long-run gain from the spending that would offset the higher tax liabilities higher debt entails.[7]

7. This occurs even with respect to state debt, despite the fact that state governments generally are prohibited from issuing debt for current expenses, and thus most new state debt is nominally for the construction of new assets. Our finding is consistent with recent work, which finds even local governments expand until the marginal value of expenditure is close to zero (Houghwout et al. 2004).

While households in aggregate are found to build real assets that potentially offset increments to governmental debt, we also attempt to determine the extent to which this aggregate response is borne by a subset of households. We therefore break down the aggregate response of life insurance into an intensive margin (the size of the average policy) and an extensive margin (the number of policies held per capita). There are some data issues that affect this disaggregation, but nonetheless we find that the positive response of life insurance is due entirely to the intensive margin, with a 10% increase in federal debt leading to an increase of 3.4% in the size of the average policy (which is sufficient to offset the entire increase in debt). On the other hand, we find the extensive margin is actually negative, with an increase in federal debt of 10% leading to a 0.5% decline in the number of policies per capita. The aggregate amount of life insurance thus appears not only to increase in response to federal debt, but to become more concentrated into a smaller set of policies.[8] With respect to state debt, there is a similar positive effect on the intensive margin, but in contrast we find some evidence of a positive effect on the extensive margin.

Section 1 of the paper presents the life insurance industry, and discusses the data available by state that we use to obtain our panel estimates. Section 2 presents the empirical model, which includes a discussion of how heterogeneity among households in the degree of altruism will lead to an expectation that the aggregate economy may offset the total government debt by savings, but that not all individual households will necessarily save or be altruistic to the next generation. Section 3 presents the empirical results in aggregate, including both the intensive and extensive margins. We also discuss the implications that households save as much to offset additional state and local government debt as they save to offset federal debt. A final section summarizes and concludes.

## 1. LIFE INSURANCE DATA FOR THE UNITED STATES

Table 1 presents the means of the raw data we use in the analysis of how government debt affects life insurance purchases. State-level panel data on life insurance in force for the years 1970–2006 come from the *Life Insurance Fact Book* published by the ACLI.[9] These reports provide information on the number of life insurance policies as well as their face value, broken down into several broad categories. Individual life insurance encompasses standard term life policies, which pay off upon the death of the insured, but do not accumulate any savings that are available if the term expires with the insured still alive.[10] In addition to the term life policies, whole, variable,

8. There are data issues with respect to whether more individuals are covered, and there appear to be secular trends in the life insurance industry of fewer but larger policies on average.

9. We would like to thank Jiangmei Wang at ACLI for providing us with these data.

10. Even if households allow their term insurance to expire, we believe it is a good indicator of the intent to save, where the accumulation of real assets is what allows households to allow their term insurance to expire.

TABLE 1
SUMMARY STATISTICS

| Variable | Observations | Mean | Std. dev. |
|---|---|---|---|
| *Dependent variables* | | | |
| Life insurance in force per capita (1998$, 1970–2006) | 1,776 | 42,140 | 14,755 |
| Life insurance in force per policy (1998$, 1970–93) | 1,152 | 22,036 | 6,882 |
| Life insurance in force per extrapolated policy (1998$, 1970–2006) | 1,776 | 28,551 | 12,785 |
| Individual life insurance in force per policy (1998$, 1970–2006) | 1,776 | 38,717 | 22,882 |
| Total policies per capita (1970–93) | 1,152 | 1.68 | 0.39 |
| Extrapolated total policies per capita (1970–2006) | 1,776 | 1.58 | 0.39 |
| Individual policies per capita (1970–2006) | 1,776 | 0.75 | 0.31 |
| *Government debt variables* | | | |
| State per capita (1998$) | 1,776 | 3,764 | 1,559 |
| Federal per capita (1998$) | 1,776 | 10,074 | 3,252 |
| *Government tax variables* | | | |
| State per capita (1998$) | 1,776 | 2,270 | 617 |
| Federal per capita (1998$) | 1,776 | 5,035 | 857 |
| *Government spending variables* | | | |
| State per capita (1998$) | 1,776 | 4,578 | 1,278 |
| Federal per capita (1998$) | 1,776 | 3,850 | 598 |
| *Control variables*: | | | |
| Gross domestic product per capita (1998$) | 1,776 | 28,250 | 4,198 |
| Gross state product per capita (1998$) | 1,776 | 26,342 | 5,968 |
| Poverty rate (%) | 1,776 | 13 | 4.2 |
| Fraction of the population under the age of 18 | 1,776 | 0.28 | 0.04 |
| Fraction of the population over the age of 64 | 1,776 | 0.12 | 0.02 |
| Fraction of the population $\geq$ 25 years old w/h.s. degree | 1,776 | 0.76 | 0.11 |
| Fraction of the population that is white | 1,776 | 0.87 | 0.10 |
| *Social Security* | | | |
| Contributions per capita (1998$) | 1,776 | 1,397 | 459 |
| Benefits per capita (1998$) | 1,776 | 1,186 | 290 |

NOTES: Panel data for U.S. states (excluding Alaska and Hawaii) cover 37 years from 1970 to 2006. Life insurance per policy and Policies per capita only cover the years 1970–93. The number of total policies consist of individual, group, and credit policies. However, the number of group policies is unavailable after 1993. The total number of policies for the period 1970–2006 is extrapolated using a method described in Appendix B. Each variable and their source are discussed in Appendix A.

and universal policies are included in the category of individual life insurance. The distinction from term life is that whole, variable, and universal policies contain accumulated savings available at the end of the term even if the insured has not died. The other main category is group life insurance, which is generally provided in term policies, and is made available to members of a specified group, which is typically employees of a firm where enrollment by employees may or may not be voluntary. A final minor category is credit life insurance, which in the event of death of the insured pays off a given debt, typically a mortgage, as opposed to making a direct transfer to a beneficiary. This category is extremely small relative to the others, has declined rapidly in recent years, and is not discussed separately.

The life insurance industry has been changing over the time period of our study. Specifically, the face value of the average policy has been getting larger, but there are fewer numbers of policies, and their composition has changed somewhat. Figure 2 plots the trends in the actual number of policies. In 1970 life insurance policies of all types (term, whole, variable, and universal) were very prevalent, with nearly 1.7 policies per person, including almost as many individual policies as people, plus

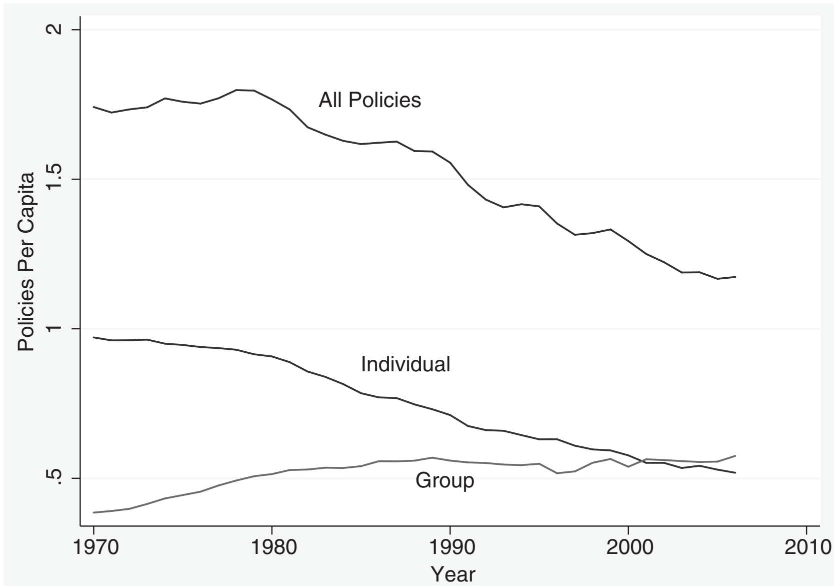


Fig. 2. Life Insurance Policies per Capita, 1970–2006.

Notes: Data on the state aggregate number of total policies (individual + group + credit) covering the years 1970–2006, obtained from the American Council of Life Insurers (ACLI). Each policy type is available by state and year, with the exception of group policies where state details are not reported after 1993. State-level data for all policies and group policies are thus extrapolated based on the procedure explained in Appendix B.

group policies.[11] The number of individual policies declined steadily through the period under review, dropping to roughly 0.5 per capita by the end of our data. At the same time, the number of individual policies issued through group insurance has grown, from about 0.4 per capita in 1970 to 0.55 in 2006.[12] We nonetheless treat all life insurance as benefiting individual households. Unfortunately, there are no data on the number of unique people or households covered by the set of these policies. Individuals may have more than one policy, and may be covered by both an individual and a group policy. Nonetheless, LIMRA International is reported to have found that 78% of individuals were covered by some type of life insurance in 2004 (ACLI 2010).

Another problem with the ACLI data is that they stopped reporting the number of group policies by state after 1993, although they continue to report the national total. To study the extensive margin, we therefore extrapolate the total number of policies using the predicted values from a regression of total policies on the number

11. This does not necessarily imply that every individual was insured. People may have several policies outstanding at once, but data are not available on the number of insured individuals.

12. Strictly, it is possible that some policies, especially in groups, are paid by employers rather than households. Presumably, however, firms would only do so if households benefit (excepting a small share where households are not even aware insurance has been bought).

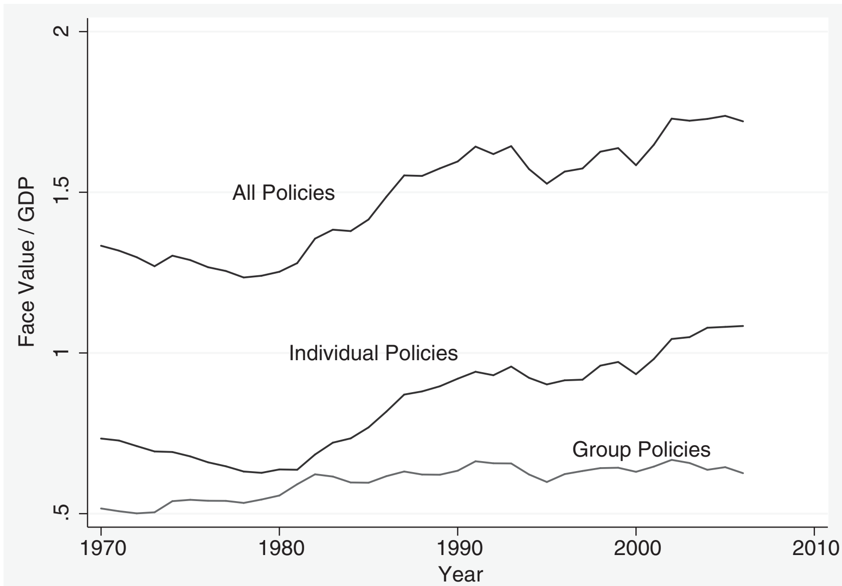


FIG. 3. Face Value of Life Insurance Relative to GDP, by Type, 1970–2006.

NOTES: GDP data are in nominal terms, from the Bureau of Economic Analysis (BEA). The face value of both individual and group life insurance is from the American Council of Life Insurers (ACLI); both are in nominal terms. All policies is the combination of the individual and group data, along with an additional category, credit insurance, that is not shown in the graph due to its very small size.

of individual and credit policies, on fixed effects for states, the national total of group, individual, and credit policies, the number of individual policies, a time trend, and a quadratic time trend (see Appendix B for details).

While the number of policies was not rising relative to the population, the face value of life insurance rose substantially over this period. Figure 3 plots the nominal face value of life insurance by type relative to nominal GDP over the years 1970–2006. Over the entire period, the face value of all life insurance has been at least 125% of GDP, and this has risen to a value of nearly 172% of GDP by 2006. Much of this increase was driven by an increase in individual policy face values relative to GDP, which increased from about 70% of GDP to over 100% of GDP by 2006. Group policies, reflecting a smaller absolute number of policies, have remained at about 60% of GDP for much of the period under study.

## 2. LIFE INSURANCE AND FISCAL POLICY

The model we test is whether in aggregate, households in the economy desire to transfer additional assets to future generations through purchases of life insurance to offset increases in government debt. While there have been many reasons advanced for why households might offset government debt with the accumulation of assets, prior research has not discussed the potential role of life insurance in shaping a household's response to government debt (see Elmendorf and Mankiw 1999). The advantage of new empirical research into this issue using life insurance, though, is that intentions to hold life insurance reflect long-run behavior. As seen in Figure 3, life insurance purchases are quite substantial with total face values larger than GDP. The amounts vary over time, and they vary considerably by state as well. Thus, if households in aggregate have concern over future tax burdens, life insurance is a potentially viable way of expressing intergenerational altruism through planning to set aside assets for the next generation.

One concern that arises in our panel model of aggregate behavior is whether, in addition to federal debt, households may also be concerned by the level of state and local government debt. Most states are prohibited from borrowing for current account deficits (Poterba 1994), and so to a great extent state governments borrow to purchase real assets.[13] Hence, households may not change their savings plans in response to state debt to the extent that state governments have constructed physical assets where residents have a willingness to pay equal to the debt. Another reason why state and local debt may have no effect on life insurance is if households assume they can escape state debt by moving to another state.

On the other hand, households may plan to respond to state debt with increased savings if they are not willing to pay the borrowed cost of the government-constructed assets. Equivalently, if households believe the debt is used to pay current expenses rather than create physical assets, irrespective of the law, intergenerationally concerned households may respond by planning for increased bequests. This behavioral response is more likely, where households treat state debt as similar to federal debt, when households believe all other states are also raising debt without creating valuable assets. If all state governments behave similarly, mobility will not succeed in allowing households to escape state and local government future taxes. Thus, our model includes a measure of combined state and local debt, as well as federal debt, as a potential explanation for current life insurance purchases.[14]

Another potential part of the financial environment that may affect life insurance purchases, as suggested by Bernheim (1991), is the provision of Social Security. Berheim suggests that an increase in expected Social Security benefits may distort the optimal household allocation of assets between annuities as represented by Social Security, and actual assets. To achieve their optimal asset mix, therefore, households may purchase increased life insurance to offset the additional annuity holdings represented by Social Security, a prediction that Bernheim confirms in his data.

13. That is, states are generally permitted to borrow for capital spending.

14. Adding local government debt avoids complications with the different assignment of public expenditures between state and local governments, and with different accounting conventions as to whether it is the state or local government, which backs repayment.

We are unable to estimate the response of life insurance purchases to Social Security wealth, however, primarily due to the mobility of households. While we do not have data on Social Security wealth by state, we do include current Social Security taxes and benefits paid. These controls do not actually capture the impact of the Social Security program, however, because the variation by state in current Social Security taxes paid and in current benefits received primarily reflects demographic variation by state as it is translated by the Social Security tax and benefit schedules. Thus, we include Social Security taxes and benefits in each state to capture national policy variation over time, as well as the demographic components represented by the Social Security variables. Nonetheless, we include additional demographic variables in an attempt to fully include household asset allocation demands. Unfortunately, this procedure precludes using our model to understand Social Security's impact on private life insurance purchases, as demographic differences not only capture differences in expected Social Security wealth, but other differences in mobility, savings, income, and private wealth.

The empirical analysis is based around the following specification:

$$\Delta \log LIF_{it} = \beta_1 \Delta \log D_t^F + \beta_2 \Delta \log D_{it}^S + \beta_3 \Delta X_{it} + \gamma_1 t + \gamma_2 t^2 + \delta_i + \epsilon_{it}. \quad (1)$$

The dependent variable is the difference in log life insurance in force ($\log LIF_{it}$) in state $i$ at time $t$. Our initial model includes all types of life insurance, including individual, group, and credit, although we run our model for individual life insurance alone as well.

The difference in log life insurance is regressed on the difference in logs of combined state and local debt ($D_{it}^S$) and the difference in logs of federal debt ($D_t^F$). As federal debt is not state specific, we do not include time dummies in the specification.[15] Instead, we have included both linear and quadratic time trends to control for common changes in both life insurance and the government debt variables. We have experimented with using higher order polynomial terms for time as well, but these do not yield results that are significantly different from what we report. We further include national GDP, which does not vary by state but only over time. In addition to the common time trend, the inclusion of state dummy variables, $\delta_i$, in the differenced specification allows for state-specific time trends in life insurance. Finally, we cluster our standard errors by year.[16]

The set of additional control variables, $X_{it}$, include various measures to capture factors influencing the demand for life insurance, as well as the Social Security variables as discussed earlier. We include the fraction of population under the age of 18, the fraction over 65, the fraction of the population over 25 with at least a high school degree, the poverty rate, and the percentage of the population that is white.

15. We explored allocating out the federal debt to individual states based on their share of the tax burden, and then including time dummies, but this specification did not change the qualitative results markedly.

16. The resulting standard errors with this process are uniformly larger than robust standard errors.

Gross state product (GSP) is included to capture all potential sources of state income. We deflate the dollar values to 1998 dollars using the CPI. The data means are shown in Table 1 and they are described in more detail in Appendix A.

In our baseline specification, we use observations for each state at 5-year intervals to smooth over short-run fluctuations and to allow for the idea that life insurance holdings may adapt to changes in fiscal policy with some lag. These lags may arise because households formulate their decisions on a multiyear basis, because of the cost of adjustment for life insurance, or because of the possibility federal policy will reverse itself. Using 5-year intervals means that we have 336 total observations over 48 states, excluding Alaska and Hawaii due to missing data for some years.[17] We present the results later using each of the 5 potential starting years for the empirical analysis. We also present sensitivity results using shorter time differencing, with the advantage of more data being offset by whether there is sufficient time for households to fully adjust in aggregate.

## 3. THE EFFECT OF GOVERNMENT DEBT ON LIFE INSURANCE

Table 2 presents the baseline results showing the impact of federal and state government debt on aggregate life insurance purchases. The first four columns show the results of estimating the model with a single source of government debt, while the results presented in columns (5) and (6) show that life insurance purchases respond to both changes in debt by state and local governments, and by the federal government. Using the column (6) results, we see that for every 1% change in federal debt over 5 years, the face value of life insurance held by households increases by a statistically significant 0.23% over the same period. Similarly, for every 1% change in state and local government debt over the 5-year earlier period, households increase their life insurance in force by a statistically significant 0.09%.[18]

We use the 5-year differencing to accentuate that household behavior with respect to life insurance is a long-run decision. For sensitivity analysis about the extent to which long differencing is needed to illustrate adjustment by households to changes in government debt, however, equation (1) is reestimated with both 3- and 1-year differences in both government debt and life insurance. Table 3 presents results from using single-year differences in column (1), and from using 3-year differences in column (2). We find that differencing over shorter time periods results in smaller, although nonetheless statistically significant, changes in life insurance in force in response to changes in government debt relative to the 5-year differencing shown in column (3). Looking only at the results for 1-year changes in debt in column (1), we now see only a 0.09% increase in life insurance associated with a 1% increase in federal government debt, and a 0.06% increase in response to a 1% increase in state

17. Using data at 5-year intervals has the additional advantage of avoiding induced autocorrelation in the first differences as could occur if we combine the data for all years in one regression.

18. We discuss later how estimates of these percentage effects are translated into dollar terms.

TABLE 2

BENCHMARK RESULTS FOR CHANGE IN LOG LIFE INSURANCE IN FORCE

| | Dependent variable: $\Delta \log LIF_{it}$ | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Government debt* | | | | | | |
| $\Delta \log D_t^F$ Federal debt | 0.27*** | 0.27*** | – | – | 0.23*** | 0.23*** |
| | (0.03) | (0.04) | – | – | (0.04) | (0.04) |
| $\Delta \log D_{it}^S$ State debt | – | – | 0.13*** | 0.13*** | 0.09*** | 0.09*** |
| | – | – | (0.01) | (0.01) | (0.02) | (0.02) |
| *Control variables* | | | | | | |
| Δ log Gross domestic product | 2.79*** | 2.80*** | 2.04** | 2.12** | 2.56*** | 2.57*** |
| | (0.64) | (0.64) | (0.73) | (0.67) | (0.53) | (0.53) |
| Δ log Gross state product | 0.22* | 0.22* | 0.38** | 0.34** | 0.26* | 0.26** |
| | (0.11) | (0.11) | (0.14) | (0.13) | (0.11) | (0.10) |
| Δ log Poverty rate | −0.04 | −0.03 | −0.00 | −0.00 | −0.04* | −0.04* |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Δ log Fraction of population under 18 | 0.30** | 0.31** | 0.16 | 0.17 | 0.29** | 0.30** |
| | (0.11) | (0.11) | (0.18) | (0.16) | (0.10) | (0.10) |
| Δ log Fraction of population over 64 | 0.13 | 0.14 | 0.63* | 0.58* | 0.22 | 0.23 |
| | (0.32) | (0.31) | (0.29) | (0.28) | (0.31) | (0.29) |
| Δ log Fraction of population white | −0.23 | −0.22 | 0.52 | 0.47 | −0.18 | −0.17 |
| | (0.17) | (0.16) | (0.32) | (0.29) | (0.16) | (0.16) |
| Δ log Fraction of population ≥ 25 w/h.s. | −0.16 | −0.15 | −0.35* | −0.36** | −0.20 | −0.20 |
| | (0.10) | (0.10) | (0.15) | (0.15) | (0.12) | (0.12) |
| Δ log Social Security contrib | – | −0.003 | – | 0.05 | – | 0.004 |
| | – | (0.03) | – | (0.05) | – | (0.03) |
| Δ log Social Security benefits | – | −0.02 | – | −0.03 | – | −0.02 |
| | – | (0.03) | – | (0.02) | – | (0.02) |
| $R^2$ | 0.58 | 0.58 | 0.53 | 0.53 | 0.61 | 0.61 |

NOTES: Clustered standard errors by year in parentheses. Significance levels: *10%; **5%; ***1%. There are 336 total observations. All variables are differenced over 5 years and span the years 1970–2006. All nominal variables have been converted to real per capita terms using the CPI. Life insurance in force is the face value of all individual, group, and credit policies, as reported by the ACLI. State fixed effects, and linear and quadratic time trends are included in the specification.

and local debt. The 3-year differencing produces effects that are between the 1- and 5-year differencing. A 1% change in federal debt is associated with a 0.17% change in life insurance compared to the 0.23% change in 5-year differencing, while changes in state debt are found to have equivalent effects to the 0.09% 5-year differencing result in column (3), although greater than the 1-year differencing results in column (1). We interpret these results as saying that adjustment to government debt in the demand for bequests is not instantaneous, but instead takes between 3 and 5 years to fully manifest itself.[19]

19. Longer term differencing than 5 years did not produce results statistically different from 5-year differencing, although the reduction in the number of observations causes the standard errors to rise substantially.

TABLE 3

Benchmark Specification Using Difference Intervals of 1, 3, and 5 Years

| | Dependent variable: $\Delta$ log $LIF_{it}$ | | |
|---|---|---|---|
| Interval: | (1) 1 year | (2) 3 years | (3) 5 years |
| *Government debt* | | | |
| $\Delta$ log $D_t^F$ Federal debt | 0.09 | 0.17*** | 0.23*** |
| | (0.07) | (0.04) | (0.04) |
| $\Delta$ log $D_{it}^S$ State debt | 0.06*** | 0.10* | 0.09*** |
| | (0.02) | (0.05) | (0.02) |
| *Control variables* | | | |
| $\Delta$ log Gross domestic product | 0.37** | 0.18** | 2.57*** |
| | (0.14) | (0.08) | (0.53) |
| $\Delta$ log Gross state product | 0.11* | 0.15** | 0.26** |
| | (0.05) | (0.05) | (0.10) |
| $\Delta$ log Poverty rate | −0.01 | −0.02 | −0.04* |
| | (0.01) | (0.02) | (0.02) |
| $\Delta$ log Fraction of population under 18 | −0.14 | −0.19 | 0.30** |
| | (0.19) | (0.21) | (0.10) |
| $\Delta$ log Fraction of population over 64 | 0.17 | 0.03 | 0.23 |
| | (0.22) | (0.30) | (0.29) |
| $\Delta$ log Fraction of population white | 0.46** | −0.60 | −0.17 |
| | (0.17) | (0.94) | (0.16) |
| $\Delta$ log Fraction of population $\geq$ 25 w/h.s. | −0.01 | −0.02 | −0.20 |
| | (0.05) | (0.13) | (0.12) |
| $\Delta$ log Social Security contrib | 0.01 | 0.01 | 0.004 |
| | (0.01) | (0.03) | (0.03) |
| $\Delta$ log Social Security benefits | 0.003 | 0.02 | −0.02 |
| | (0.01) | (0.02) | (0.02) |
| $R^2$ | 0.17 | 0.35 | 0.61 |
| Observations | 1,728 | 576 | 336 |

Notes: Clustered standard errors by year in parentheses. Significance levels: *10%; **5%; ***1%. The benchmark specification is differenced over 1, 3, and 5 years and spans the years 1970–2006. All nominal variables have been converted to real per capita terms using the CPI. Life insurance in force is the face value of all individual, group, and credit policies, as reported by the ACLI. State fixed effects, and linear and quadratic time trends are included in the specification.

The other result to note in both Tables 2 and 3 is that the coefficients on the Social Security contributions (taxes) and benefits are essentially zero. As discussed, we do not believe that current values paid out to current residents correspond very well to expected Social Security wealth, and thus the coefficients are probably more reflective of the demographic characteristics of the population.

### *3.1 The Marginal Effect of Debt on Life Insurance*

While the estimated elasticities mentioned above are less than 1, the dollar value changes on the margin illustrate that households intent to save—as indicated by life insurance—is approximately enough to offset government debt. Table 4 uses the results of the baseline regression from column (6) in Table 2 to represent the response of life insurance holdings in dollars per capita. The results in Table 4 depend on the exact amount of life insurance holdings per capita, as well as the exact

TABLE 4

THE EFFECT OF GOVERNMENT DEBT ON LIFE INSURANCE IN FORCE IN DOLLARS ($)

| | Increase in life insurance associate with a: | |
|---|---|---|
| | Dollar increase in federal government debt per capita | Dollar increase in state government debt per capita |
| Mean for United States | $0.96 | $1.01 |
| *States below 10th percentile* | | |
| Arkansas | $0.69 | $1.20 |
| Mississippi | $0.71 | $1.20 |
| West Virginia | $0.69 | $0.79 |
| *States above 90th percentile* | | |
| Connecticut | $1.43 | $1.09 |
| Illinois | $1.14 | $1.19 |
| New Jersey | $1.30 | $1.13 |

NOTES: Calculations are based on the results obtained in Table 2, column (6). The first row reports results using the mean of life insurance in force per capita ($42,140) and mean of federal government debt per capita ($10,074). For state government debt per capita, the mean is $3,764 in the last column. The lower panels show the dollar response in states below the 10th, or above the 90th percentiles in life insurance. The means of life insurance in force per capita and state government debt capita for the states in those sections are: (Arkansas: $30,212; $2,262), (Mississippi: $31,151; $2,341), (West Virginia: $30,060; $3,419), (Connecticut: $62,817; $5,182), (Illinois: $49,733; $3,751), and (New Jersey: $56,897; $4,527). The variables are in 1998 dollars. Federal government debt per capita in both bottom panels is $10,074.

size of federal debt per capita. As a baseline, we compute the dollar change in life insurance for the mean value of life insurance holdings ($42,140) and for the mean value of federal debt per capita ($10,074). This is reported in the first row of the table.

As can be seen, if the federal government increases its issuance of debt by $1 per person over a 5-year period, households will adjust the face value of their life insurance policies by $0.96 per person over the same 5-year interval. We can do a similar calculation for state government debt, using the mean real level of state and local debt per capita ($3,764) as the debt measure and the mean value of life insurance holdings per capita. The effect is similar, with a $1.01 in increased life insurance holdings per capita over the same 5-year period.

The bottom two panels of Table 4 show the marginal dollar effects for three states near the bottom of the ranking of states by life insurance per capita, consisting of Arkansas, Mississippi, and West Virginia, and for three states near the top of the ranking, consisting of Connecticut, Illinois, and New Jersey. The point of this panel is in part to show the range of debt and life insurance by state, and in part to show the range of potential results as the log difference results are translated into absolute dollar values. Even for these states at the extreme ends, the dollar values show that households acquire an amount of life insurance nearly identical to the amount of additional debt.

Figure 4 provides a summary of how the different coefficient estimates translate into dollar changes in insurance holdings for $1 increases in either federal or state and local debt for the average household in this period. When we examine short-term responses as estimated with the 1-year differencing, our results indicate that households respond to 1-year changes in federal debt by approximately 40 cents

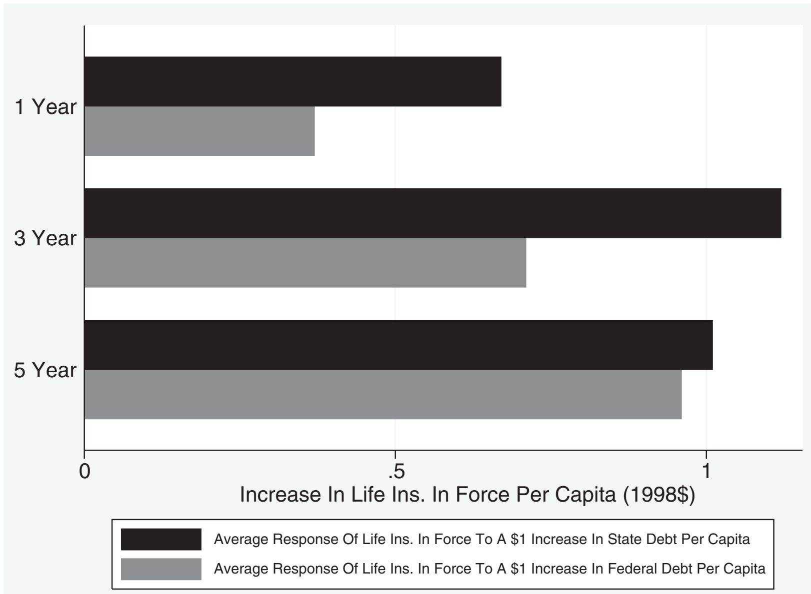


FIG. 4. The Effect of Government Debt on Life Insurance in Force in Dollars ($) for 1-, 3-, and 5-Year Differences.

NOTES: The black bars indicate the average response of life insurance in force per capita to a $1 dollar increase in state government debt per capita for 1-, 3-, and 5-year difference intervals for all U.S. states excluding Alaska and Hawaii. The gray bars indicate the average response of life insurance in force per capita to a $1 dollar increase in federal government debt per capita for 1-, 3-, and 5-year difference intervals for all U.S. states excluding Alaska and Hawaii. Calculations are based on the results obtained in Table 3.

in increased life insurance, while the response to 1-year changes in state and local government debt is approximately 65 cents in the face value of life insurance per person. Using the 3-year differencing the household response is estimated to be larger, as the response to federal government debt is estimated to be about $0.65, while the household response to state and local government debt is estimated at about the entire $1 increase. In contrast, however, the 5-year differencing windows show that households increase their life insurance holdings by very close to the full $1 response to an increase in either source of government debt. It would appear that, in the aggregate, the response of planned bequests in the form of life insurance is consistent with the existence of intergenerational altruism and the long-run neutrality of government debt.

A separate issue is that, in order to maximize the number of observations, we have begun our analysis with data from 1970, but we could alternatively begin in any of the years from 1971 to 1974. This simply shifts the lags forward, but at the cost, given our end date of 2006, of losing observations when using a start date of 1972, 1973, or 1974. Regardless of the starting year, we cannot reject the hypothesis that the response of life insurance to a $1 increase in federal debt is equal to $1 at any common significance level. For state debt, the results are similar, although the results using 1972 as the start date do show a statistically marginally larger difference from a $1 response in life insurance to a $1 increase in debt.[20]

Note that these results do not mean that households holding insurance actually spend $1 immediately on new life insurance premiums. The results are for life insurance in force, meaning that the death benefit has increased by $0.96 or $1.01 for each dollar of either federal or state government debt. As of 2006, according to the ACLI, $1 in coverage cost on average approximately 3 cents. The important fact is that current households are expressing a demand to transfer resources to future generations. The interesting evidence presented by the analysis of life insurance holdings is that the amount people plan to transfer to future generations in the event of a death changes in response to changes in government debt.

The results show that life insurance responds in a similar manner to both federal and state and debt. One may have expected that state debt would have led to smaller responses, both because state debt is often used for funding capital projects that may actually increase future income (e.g., schools and transportation projects), but also because individuals are mobile and so can potentially avoid future state taxation by moving. Houghwout et al. (2004) find that local governments, which presumably are more attuned to residents' demands than the state or federal governments, nonetheless set tax rates close to the expenditure maximizing level. If state governments behave similarly for capital spending, then the marginal benefit of the last unit of capital goods built by states will have approximately zero marginal benefit, and individuals will neither perceive any distinct change in future income, nor will they experience a change in real net of tax utility, from changes in state or local government debt.[21]

As a confirmation that the baseline results are not due to nonlinearities in the relationships, Table 5 shows estimation results where the data have been split at the median of four of the control variables, state GSP, the share of the population under 18, the population share over 64, and state government debt. The results on how life insurance purchases respond to changes in both federal and state level debt are quite similar to the baseline findings for states both above and below the median.

### *3.2 The Intensive and Extensive Margins*

We have established a general relationship of life insurance holdings to changes in fiscal policy, but this has been in terms of aggregate life insurance in force over the whole population. The adjustments in life insurance, though, can operate on both an intensive margin (changes in the life insurance in force for those insured) and an extensive margin (changes in the number of people with life insurance). While the ACLI data we have are imperfect, in this section we present results to show that

20. Results for these alternate start dates are included in the replication data available for this paper available either through the journal website or from the authors upon request.

21. Note that the results here imply no difference in perception from state and local or federal debt, but do not say anything about the mechanism that would lead to zero marginal benefits.

TABLE 5

HETEROGENEITY RESULTS: BELOW MEDIAN AND ABOVE MEDIAN U.S. STATES

| | Panel A | | Panel B | | Panel C | | Panel D | |
|---|---|---|---|---|---|---|---|---|
| Median sample: | Frac. of pop under 18 | | Frac. of pop over 64 | | State government debt | | Gross state product | |
| Dependent variable: $\Delta \log LIF_{it}$ | Below (1) | Above (2) | Below (3) | Above (4) | Below (5) | Above (6) | Below (7) | Above (8) |
| *Government debt* | | | | | | | | |
| $\Delta \log D_t^F$ Federal debt | 0.24*** | 0.27*** | 0.25*** | 0.20*** | 0.21*** | 0.22*** | 0.20*** | 0.23** |
| | (0.04) | (0.04) | (0.04) | (0.05) | (0.04) | (0.05) | (0.03) | (0.07) |
| $\Delta \log D_{it}^S$ State debt | 0.09 | 0.06* | 0.04 | 0.12** | 0.05** | 0.14*** | 0.05 | 0.16** |
| | (0.06) | (0.02) | (0.03) | (0.05) | (0.02) | (0.03) | (0.03) | (0.06) |
| *Control variables* | | | | | | | | |
| $\Delta$ log Gross domestic product | 2.61*** | 2.69*** | 2.94*** | 2.32*** | 2.46*** | 2.69** | 2.56*** | 2.76*** |
| | (0.52) | (0.39) | (0.46) | (0.42) | (0.36) | (0.74) | (0.26) | (0.68) |
| $\Delta$ log Gross state product | 0.32** | 0.21 | 0.22 | 0.25* | 0.23* | 0.24* | 0.37*** | 0.16 |
| | (0.11) | (0.13) | (0.12) | (0.11) | (0.11) | (0.12) | (0.07) | (0.13) |
| $\Delta$ log Poverty rate | −0.02 | −0.05** | −0.03 | −0.05* | −0.02 | −0.05 | 0.03 | −0.07** |
| | (0.02) | (0.02) | (0.06) | (0.02) | (0.04) | (0.03) | (0.02) | (0.02) |
| $\Delta$ log Fraction of pop. under 18 | 0.31** | 0.37** | 0.48* | 0.37 | 0.03 | 0.37* | 0.61* | 0.02 |
| | (0.12) | (0.14) | (0.21) | (0.22) | (0.38) | (0.18) | (0.26) | (0.18) |
| $\Delta$ log Fraction of pop. over 64 | −0.13 | 0.72 | 0.53 | 0.21 | 0.32 | 0.20 | 0.69* | 0.06 |
| | (0.26) | (0.38) | (0.38) | (0.25) | (0.40) | (0.29) | (0.36) | (0.35) |
| $\Delta$log Fraction of pop. White | −1.77 | 0.08 | −0.16 | 0.02 | 0.01 | −0.43 | 0.23 | −0.74 |
| | (1.20) | (0.09) | (0.09) | (0.74) | (0.12) | (0.44) | (0.13) | (0.51) |
| $\Delta$ log Fraction of pop. $\geq$ 25 w/h.s. | 0.02 | −0.20 | -0.08 | −0.22 | −0.20 | −0.19 | −0.25 | 0.11 |
| | (0.14) | (0.16) | (0.15) | (0.17) | (0.17) | (0.16) | (0.18) | (0.24) |
| $\Delta$ log Social Security contrib | 0.07 | −0.00 | 0.01 | 0.09 | 0.01 | 0.04 | −0.01 | 0.11 |
| | (0.10) | (0.02) | (0.02) | (0.13) | (0.02) | (0.09) | (0.02) | (0.10) |
| $\Delta$ log Social Security benefits | −0.02 | −0.39** | −0.38* | −0.02 | −0.03 | −0.02 | −0.23 | −0.02 |
| | (0.02) | (0.12) | (0.18) | (0.02) | (0.03) | (0.02) | (0.12) | (0.02) |
| $R^2$ | 0.60 | 0.70 | 0.62 | 0.63 | 0.67 | 0.60 | 0.66 | 0.64 |

NOTES: Clustered standard errors by year in parentheses. Significance levels: *10%; **5%; ***1%. There are 168 total observations. All variables are differenced over 5 years. Sample is separated into below median and above median states for four different categories: the fraction of the population under 18, the fraction of the population over 64, state government debt per capita, and gross state product per capita. All nominal variables have been converted to real per capita terms using the CPI. State fixed effects, and linear and quadratic time trends are included in the specification.

the observed aggregate adjustments are primarily on the intensive margin by savers rather than on the extensive margin of people switching in and out of life insurance.

Based on models of population heterogeneity such as by Michel and Pestieau (1998), Smetters (1999), and Mankiw (2000), we would expect most of the adjustment to be on the intensive margin. Their work suggests a subset of the population, consisting of the most altruistic households, will be induced to save by other changes in the economy such that the reduced form results yield a long-run aggregate steady-state capital stock that is unchanged by changes in government debt. Our data do not show the number of individuals that are covered by life insurance, but instead reports the number of policies. The two problems with policies are that some people may be covered by multiple policies, and group policies in particular may cover a large number of individuals. Our use of the data on number of policies therefore assumes that the extent to which these two possibilities occurs is constant over time.

The data that exist to investigate the two margins consist of the number of life insurance policies by type (individual + group + credit) by state from 1970 to 1993. Data also are available for the number of individual and credit policies for the entire period 1970–2006, but data on the number of group policies are not available after 1993. We therefore extrapolate values for the number of group policies (and hence for the total number of policies) for the years 1994–2006. Combined with total life insurance in force, and using three different measures of life insurance policies, we examine the number of policies and dollars per policy using the specification in equation (1).

Table 6 shows the regression results for how the aggregate results presented earlier can be disaggregated into changes in dollars per life insurance policy, and changes in policies per capita.[22] The first three columns of Panel A use data from 1970 to 1993 for all types of policies, the three columns of Panel B use solely individual policies for which we have data over the entire period 1970–2006 but that exclude group and credit policies. The final three columns, Panel C, use the extrapolated data over the entire 1970–2006 period, and thus consist of all three types of policies (individual, group, and credit). To replace the missing number of group policies, we extrapolate the missing data from the predicted values of a regression of the state-level number of total policies on state fixed effects, a time trend and a quadratic time trend, state-level individual policies and credit policies, national total policies and the national total numbers of individual policies, group policies and credit policies (see Appendix B for details).[23] When we add this new series to the existing data on the number of policies, we obtain estimates broadly consistent with those reported in the first six columns in Table 6, and results that are informative to the relative importance of the intensive and extensive margins.

In particular, the results in Table 6 consistently show that the preponderance of household response to government debt occurs on the intensive margin through the size of the life insurance policies held by households, and not on the extensive margin consisting of the number of policies. For example, the coefficient on federal debt in column (1) of Panel A suggests that using data through 1993, each 1% of federal government debt growth is met by a weakly significant 0.09% of growth in dollars per capita. This amount, however, is shown in column (2) to be composed of a

22. Due to the 5-year differencing approach and the low number of observations, we exclude linear and quadratic time trends but include state fixed effects in the specifications used to estimate columns 1–3. For columns 4–9, however, we include linear and quadratic time trends along with state fixed effects in the specifications.

23. We experimented with other forecasting methods, such as only extrapolating the state-level number of group policies after 1993 based on the national figures on group policies. When we used this series in the estimations we found the results to be not different.

TABLE 6

Effects of Government Debt on Policy Size versus Population Coverage

| | Panel A | | | Panel B | | | Panel C | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample: | All policies, 1970–93 | | | Ind. policies, 1970–2006 | | | All policies (extr.), 1970–2006 | | |
| Dependent variable: | Δ log LIF p.c. (1) | Δ log LIF/Pol (2) | Δ log Pol p.c. (3) | Δ log LIF p.c. (4) | Δ log LIF/Pol (5) | Δ log Pol p.c. (6) | Δ log LIF p.c. (7) | Δ log LIF/Pol (8) | Δ log Pol p.c. (9) |
| *Government debt* | | | | | | | | | |
| Δ log $D_t^F$ Federal debt | $0.09^{*}$ | $0.31^{***}$ | $-0.22^{***}$ | $0.38^{***}$ | $0.49^{***}$ | $-0.11^{***}$ | $0.23^{***}$ | $0.34^{***}$ | $-0.12^{***}$ |
| | (0.03) | (0.04) | (0.02) | (0.06) | (0.06) | (0.03) | (0.04) | (0.02) | (0.03) |
| Δ log $D_{it}^S$ State debt | $0.09^{**}$ | 0.03 | $0.06^{*}$ | $0.07^{**}$ | $0.05^{*}$ | 0.02 | $0.09^{***}$ | $0.06^{**}$ | $0.03^{*}$ |
| | (0.02) | (0.02) | (0.02) | (0.03) | (0.02) | (0.03) | (0.02) | (0.02) | (0.02) |
| *Control variables* | | | | | | | | | |
| Δ log Gross domestic product | $2.16^{***}$ | $2.56^{***}$ | −0.39 | $3.10^{***}$ | $4.03^{***}$ | $-0.92^{***}$ | $2.57^{***}$ | $3.14^{***}$ | $-0.57^{*}$ |
| | (0.30) | (0.36) | (0.23) | (0.61) | (0.51) | (0.15) | (0.53) | (0.31) | (0.24) |
| Δ log Gross state product | 0.18 | $0.12^{*}$ | 0.06 | $0.28^{*}$ | 0.15 | 0.13 | $0.26^{**}$ | $0.20^{**}$ | 0.06 |
| | (0.08) | (0.05) | (0.10) | (0.12) | (0.10) | (0.10) | (0.10) | (0.08) | (0.07) |
| Δ log Poverty rate | $-0.08^{**}$ | −0.05 | −0.03 | $-0.02^{*}$ | 0.01 | $-0.04^{**}$ | $-0.04^{*}$ | −0.01 | −0.03 |
| | (0.02) | (0.04) | (0.03) | (0.01) | (0.01) | (0.01) | (0.02) | (0.04) | (0.03) |
| Δ log Fraction of pop. under 18 | $0.71^{***}$ | $1.08^{***}$ | $-0.37^{**}$ | 0.28 | $0.80^{**}$ | −0.52 | $0.30^{**}$ | $0.98^{***}$ | $-0.68^{**}$ |
| | (0.12) | (0.06) | (0.12) | (0.16) | (0.25) | (0.29) | (0.10) | (0.22) | (0.19) |
| Δ log Fraction of pop. over 64 | 0.01 | −0.15 | 0.16 | 0.06 | −0.18 | 0.24 | 0.23 | 0.01 | 0.22 |
| | (0.31) | (0.18) | (0.24) | (0.22) | (0.15) | (0.25) | (0.29) | (0.22) | (0.11) |
| Δlog Fraction of pop. white | −0.05 | 0.22 | −0.27 | −0.11 | −0.11 | 0.01 | −0.17 | 0.07 | −0.23 |
| | (0.10) | (0.31) | (0.38) | (0.13) | (0.26) | (0.21) | (0.16) | (0.19) | (0.25) |
| Δ log Fraction of pop. ≥ 25 w/h.s. | $-0.27^{*}$ | −0.16 | −0.11 | −0.06 | −0.15 | 0.09 | −0.20 | $-0.22^{**}$ | 0.02 |
| | (0.09) | (0.07) | (0.07) | (0.16) | (0.08) | (0.15) | (0.12) | (0.08) | (0.12) |
| Δ log Social Security contrib | 0.01 | 0.01 | 0.001 | −0.02 | 0.01 | −0.04 | 0.004 | −0.01 | 0.02 |
| | (0.01) | (0.01) | (0.01) | (0.03) | (0.04) | (0.02) | (0.03) | (0.02) | (0.02) |
| Δ log Social Security benefits | 0.01 | 0.01 | −0.01 | 0.01 | 0.01 | 0.02 | −0.02 | −0.02 | −0.002 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.00) | (0.02) | (0.02) | (0.01) |
| $R^2$ | 0.77 | 0.90 | 0.59 | 0.75 | 0.68 | 0.24 | 0.61 | 0.69 | 0.47 |
| Observations | 192 | 192 | 192 | 336 | 336 | 336 | 336 | 336 | 336 |

Notes: Clustered standard errors by year in parentheses. Significance levels: *10%; **5%; ***1%. There are 336 total observations. All variables are differenced over 5 years. Columns (1)–(3) use total life insurance policies (individual + group + credit) and span the years from 1970 to 1993. Columns (4)–(6) use individual life insurance policies and span the years 1970 to 2006. Columns (7)–(9) use an extrapolated measure of total life insurance policies (individual + group + credit) and span the years 1970–2006. The extrapolated measure is further described in Appendix B. All nominal variables have been converted to real per capita terms using the CPI. Columns (1)–(3) are estimated from specifications using state fixed effects. Columns (4)–(9) are estimated from specifications using state fixed effects and linear and quadratic time trends.

large (0.31%) increase in dollars per policy, and an actual decrease in policies per capita as shown in column (3) of −0.22%. This same pattern holds when we use the individual policy data in Panel B despite the longer panel data. The 0.38% increase in life insurance per capita is found to be composed of a 0.48% increase in dollars per policy and a decrease of 0.11% in policies per capita. While Panel A does not exploit data over the entire time period, and Panel B does not exploit data from all types of insurance, Panel C nonetheless demonstrates the same pattern of results. We see that the change in dollars of life insurance per capita, which is found to increase in aggregate by 0.23% for each 1% growth in federal debt per capita, consists of growth in dollars per policy of 0.34%, while the number of policies is actually found to shrink by 0.12% in response to a 1% increase in federal debt per capita.

Table 6 shows a slightly different pattern of results for life insurance responses to state and local government debt, although the main conclusion still holds. Specifically, we see in all three panels that the aggregate results are quite similar for all three data sets. In all cases for increases in state debt, life insurance per capita is found to increase by about 0.09% for each 1% increase in state and local government debt. While the total change is generally concentrated in dollars per policy as shown in the second column of each vertical panel, we also see that the number of policies per capita is more likely to grow as debt increases. In contrast, the top row shows that growth in federal debt is more likely to result in a decline in the number of policies, but despite that the change in dollars per capita of life insurance in force is sufficient to offset the entire increase in government debt. The growth in the number of policies in response to state debt is neither statistically very precise nor as large as the growth in dollars per policy. Thus, we conclude that in contrast to federal debt, state debt is likely to be partially neutralized by an increase in the number of savers with an apparent bequest motive, although the dollars per policy owned by savers grows more quickly.

It is interesting to speculate why the extensive margin is estimated to be positive with increases in state and local government debt, and negative with respect to federal debt. It is possible that our controls to isolate the time series and cross-sectional variation are inadequate in some way, although we estimate the model in changes with state effects, we control for a time trend and time squared, and we include other demographic controls. One possible explanation is that each state may be small relative to the financial markets, and thus increases in state or local debt have no consequence for prevailing rates of return on savings, while this assumption may not be true for federal debt. In the federal case, increased debt may be seen as implying a lower long-run return to capital, due to distortionary taxation and/or a tendency for future taxes to be more progressive. As modeled in Michel and Pestieau (1998), Smetters (1999), and Mankiw (2000), if the expected future return on savings falls, a smaller fraction of households will find it worthwhile to leave bequests. If this is the process that is occurring, we see a declining fraction of households holding life insurance in response to federal debt. As states are unlikely to significantly influence the overall return to savings through their future taxation plans, this effect may be muted at the state level.[24]

### *3.3 Differential Effects of Taxes and Spending*

The estimation results in Table 7 take the basic results in Table 2 and disaggregates the debt variables separately into taxes and spending. We expect expenditures to increase life insurance purchases, as increased expenditures without an increase in taxes leads to more debt, and thus in planned individual asset offsets. Similarly, an increase in taxes is expected to lead to the opposite finding, as debt falls with more revenue without a corresponding expenditure increase. We use our baseline 5-year differencing model for all of the regressions in this table, as well as the 1970 start

24. A more esoteric possibility is that state and local debt may change the distribution of income in a manner that increases the number of savers, even though the net economic benefit may be zero.

TABLE 7

DIFFERENTIAL EFFECTS OF TAXES AND SPENDING ON CHANGE IN LOG LIFE INSURANCE IN FORCE

| Dependent variable: $\Delta \log LIF_{it}$ | Coeff. (1) | $t$-statistic[a] $\beta_{Spending} = -\beta_{Taxes}$ (2) | Dollars \$ (3) | $t$-statistic[b] $\beta_{Dollars} = 1$ (4) |
|---|---|---|---|---|
| *Taxes and spending* | | | | |
| $\Delta \log G_t^F$ Federal spending | 0.27 | | 2.96 | [0.78] |
| | (0.23) | [0.10] | (2.52) | |
| $\Delta \log T_t^F$ Federal taxes | −0.33 | | 2.76 | [0.87] |
| | (0.24) | | (2.02) | |
| $\Delta \log G_{it}^S$ State spending | 0.33*** | | 3.07 | [2.80] |
| | (0.08) | [1.30] | (0.74) | |
| $\Delta \log T_{it}^S$ State taxes | −0.26*** | | 4.83 | [2.59] |
| | (0.06) | | (1.48) | |
| *Control variables* | | | | |
| $\Delta$ log Gross domestic product | 3.11*** | | | |
| | (0.62) | | | |
| $\Delta$ log Gross state product | 0.30** | | | |
| | (0.11) | | | |
| $\Delta$ log Poverty rate | −0.04 | | | |
| | (0.02) | | | |
| $\Delta$ log Fraction of population under 18 | 0.21 | | | |
| | (0.29) | | | |
| $\Delta$ log Fraction of population over 64 | 0.21 | | | |
| | (0.32) | | | |
| $\Delta$ log Fraction of population white | −0.30 | | | |
| | (0.20) | | | |
| $\Delta$ log Fraction of population $\geq$ 25 w/h.s. | −0.20 | | | |
| | (0.14) | | | |
| $\Delta$ log Social Security contrib | −0.01 | | | |
| | (0.01) | | | |
| $\Delta$ log Social Security benefits | −0.01 | | | |
| | (0.02) | | | |
| $R^2$ | 0.61 | | | |
| Observations | 336 | | | |

NOTES: Clustered standard errors by year in parentheses. Significance levels: *10%; **5%; ***1%. There are 336 total observations. All variables are differenced over 5 years and span the years 1970–2006. All nominal variables have been converted to real per capita terms using the CPI. Life insurance in force is the face value of all individual, group, and credit policies, as reported by the ACLI. State fixed effects, and linear and quadratic time trends are included in the specification. Federal spending is total federal spending net of expenditures on social security, other retirement and disability and other programs.
[a]The $t$-statistics in column (2) are calculated and reported in brackets for the test of whether the coefficient on the spending variable is equal to the negative of the coefficient on the tax variable. Coefficients and standard errors on taxes and spending variables are expressed in real dollars and are reported in column (3).
[b]The $t$-statistics in column (4) are calculated and reported in brackets for the test of whether the coefficients expressed in dollars are equal to 1.

date.[25] As can be seen, the estimated effects on the federal fiscal variables are, as expected, opposite in sign, with increased spending being associated with greater life insurance holdings, and greater taxes associated with lower life insurance in force. Further, the $t$-statistic shows that the federal tax coefficient is statistically

25. We experimented with alternative start dates such as 1971, 1972, 1973, and 1974. The results obtained from estimating the 5-year differencing regressions using the alternative start dates are qualitatively unchanged.

indistinguishable from the negative of the federal expenditure coefficient.[26] The only slight anomaly in the results is that the coefficients on both federal taxes and spending result in a point estimate marginally greater (10% level of significance) than a $1 response in life insurance for a $1 change in either federal taxes or federal spending. Speculatively, our only conclusion from this result is that people do not perceive, and/or they are not sensitive to aggregate changes in spending or taxes; rather, people respond in their planned bequest demand to the level of debt leading to the results that the net of the two coefficients are what motivate long-run response in life insurance purchases.

The results in Table 7 for state government fiscal variables are essentially equivalent to the federal variables. The difference in the state spending and state tax coefficients are about the same as for the federal fiscal variables, although unlike the federal coefficients the state government tax coefficient is smaller in magnitude than the expenditure coefficient. Nonetheless, the $t$-statistic shows that the two coefficients are essentially the negative of each other. Also similar to the federal fiscal variables, the dollar changes implied by the point estimates at the data means are much larger than $1, although nonetheless similar. While the federal government does not report capital separated from current expenditures, state governments do. In results that are available from the authors upon request, when state capital expenditures are separated from current state expenditures, we find smaller elasticities for capital spending, but very similar dollar values at the means of the variables. Thus, residents do not seem to view capital and current spending differently when determining how to adjust their life insurance holding in response to government fiscal behavior.[27]

## 4. SUMMARY AND CONCLUSION

Our paper offers the first explicit look at long-run behavior that is potentially motivated by intergenerational altruism, and thus allows an empirical test of whether household savings are likely to neutralize government debt (Barro 1974). Specifically, we use a panel of U.S. states from 1970 to 2006 to examine how the changes in the level of life insurance in force varies in response to changes in government debt at both the federal and state levels. Life insurance has the advantage that it benefits others besides the insured and that it represents an intention to bequeath assets. We find that households hold almost exactly $1 in additional life insurance for every

26. Note that in addition to deleting Social Security, we deleted other retirement and disability and other program spending from total federal spending, since these categories include life insurance for government workers and the VA. While we do not have state-specific values, including the national values had no effect at all on the results.

27. This brief description barely scratches the surface of issues with government debt. Other issues could include pension debt and the associated potential for incomplete information, the assumptions about state debt in other states if there is interstate mobility, the match between capital assets and associated debt service, as well as the potential correlation between capital assets and associated current expenditures, and whether those expenditures are well matched to residential demand.

$1 of new federal government debt over a 5-year period. Additionally, we find that households also act to similarly offset state government debt. This finding has two consequences. One, our focus, is that it provides cross-sectional evidence that households have intentions to save that are consistent with long-run altruism and debt neutrality. These results also suggest that households do not value the purported increase in government-owned capital stock on the margin.

The aggregate response in our data occurs despite the fact that not all households appear to hold life insurance. Further, we find that all of the additional life insurance comes from existing holders of life insurance increasing the amount per policy, compensating for a small decrease in the number of policyholders that is associated with rising debt. The response to state debt seems to be slightly different, in that there is a small addition to the number of holders of life insurance. We discuss that these results are consistent with a reduced-form view of general equilibrium causes of savings. In both cases, however, we find a full $1-for-$1 offset through life insurance for additions to government debt by either the federal, or state governments.

While the prior literature has attempted to test for Ricardian Equivalence through a focus on the short-term changes in consumption and spending associated with changes in fiscal policy, these findings do not provide any evidence that government debt is neutralized in the long run through additional bequests. We believe our results focus on the crux of Ricardian Equivalence, which is whether households are willing to express intergenerational concern based on levels of government debt. Our results provide direct evidence that neutrality is plausible by showing that planned intentional bequests, as indicated by household purchases of life insurance, rise in aggregate by an amount that is equal to changes in government debt.

## APPENDIX A: DATA SOURCES

The data used cover 48 states (Alaska and Hawaii are excluded) and span the years 1970–2006. The variables and their sources are the following:

(i) **Life insurance in force** consists of individual insurance, group insurance, and credit insurance. Data are available for the years 1970–2006. Data on the total number of life insurance policies are available for the years 1970–93. The number of individual and credit policies are available for the years 1970–2006 but the number of group policies is available for the years 1970–93. Data have been taken from the American Council of Life Insurers (ACLI).

(ii) **Federal government debt** is defined as debt held by the public. Data have been taken from Congressional Budget Office's "Revenue, Outlays, Deficits, Surpluses, and Debt Held by the Public."

(iii) **Federal government tax** is defined as federal government receipts. Data have been taken from the Congressional Budget Office's "Revenue, Outlays, Deficits, Surpluses, and Debt Held by the Public."

(iv) **Federal government spending** is defined as federal government outlays net of social security spending, other retirement and disability and other programs.

Data have been taken from the Congressional Budget Office's "Revenue, Outlays, Deficits, Surpluses, and Debt Held by the Public."

(v) **State government debt** is defined as state and local government long-term outstanding debt. Data have been taken from the Census Bureau State and Local Government Finance. Data on local government debt for the years 2001 and 2003 have been interpolated since the Census Bureau only reports state government data for those years.

(vi) **State government tax** is defined as state and local government total tax. Data have been taken from the Census Bureau State and Local Government Finance. Data on local government taxes for the years 2001 and 2003 have been interpolated since the Census Bureau only reports state government data for those years.

(vii) **State government spending** is defined as state and local government general expenditure. Data have been taken from the Census Bureau State and Local Government Finance. Data on local government general expenditure for the years 2001 and 2003 have been interpolated since the Census Bureau only reports state government data for those years.

(viii) **Gross Domestic Product (GDP)** data have been taken from the Bureau of Economic Analysis.

(ix) **Gross State Product (GSP)** data have been taken from the Bureau of Economic Analysis.

(x) **Poverty rate** is defined as the fraction of families or individuals with income below the poverty threshold as defined by the Census Bureau. Data have been taken from the Census Bureau and IPUMS–CPS (King et al. 2010). Data for the years 1971–73 and 1975–76 have been interpolated.

(xi) **Fraction of the population under the age of 18** data have been taken from the Census Bureau.

(xii) **Fraction of the population over the age of 64** data have been taken from the Census Bureau.

(xiii) **Fraction of the population that is white** data have been taken from the Census Bureau.

(xiv) **Fraction of the population that is at least 25 years old and has a high school degree** data have been taken from the Census Bureau and IPUMS–CPS (King et al. 2010). Data for the years 1971–73 and 1975–76 have been interpolated.

(xv) **Social Security Contributions** are defined as Old Age, Survivors, and Disability Insurance (OASDI) contributions from taxable earnings. Data have been taken from table 4.B10 in the Annual Statistical Supplement to the Social Security Bulletin. The authors only had access to the Annual Statistical Supplement to the Social Security Bulletin for the years 1970–74, 1977–79, and 1982–2006. Data for the years 1975–76 and 1980–81 have been interpolated.

(xvi) **Social Security Benefits** are defined as Old Age, Survivors, and Disability Insurance (OASDI) estimated benefits distributed. Data have been taken from table 5.J1 in the Annual Statistical Supplement to the Social Security Bulletin. The authors only had access to the Annual Statistical Supplement to the Social Security Bulletin for the years 1970–75 and 1979–2006. Data for the years 1976–78 have been interpolated.

## APPENDIX B: EXTRAPOLATION PROCEDURE FOR GROUP POLICIES

The total number of life insurance policies consists of individual, group, and credit policies and was obtained from the ACLI. This series covers the 48 states (Alaska and Hawaii are excluded) and spans the period from 1970 to 1993. ACLI reports the number of individual and credit policies for the 48 states and for the entire period from 1970 to 2006 but discontinues reporting the number of group policies after 1993.

The data used to estimate columns (8)–(9) in Table 6 are based on an extrapolated measure of the total number of life insurance policies for the 48 states and spanning the years 1970–2006. Data on the state level total number of life insurance policies were extrapolated using the following regression:

$$\begin{aligned} POL_{it} = {} & \beta_1 IND_{it}^S + \beta_2 CRD_{it}^S + \beta_3 IND_t^N + \beta_4 GRO_t^N + \beta_5 CRD_t^N \\ & + \beta_6 POL_t^N + \gamma_1 t + \gamma_2 t^2 + \delta_i + \epsilon_{it}. \end{aligned} \tag{B1}$$

$POL_{it}$ is state-level total life insurance policies, $IND_{it}^S$ is state-level individual policies, $CRD_{it}^S$ is state-level credit policies, $IND_t^N$ is national individual policies, $GRO_t^N$ is national group policies, $CRD_t^N$ is national credit policies, $POL_t^N$ is national total policies, $t$ and $t^2$ are the linear and quadratic time trends and $\delta_i$ is a state fixed effect.

Based on (1), the predicted values were obtained and then the year to year percentage change in the predicted values was computed. For each state, the percentage change in the predicted values of the total number of life insurance policies from 1993 to 1994 was used to compute the extrapolated total number of life insurance policies in 1994 using existing data in 1993. This process is reiterated for each of the following years until 2006 and the new created data series extends directly from 1993, the last year of the existing data.

An alternative measure used for the extrapolated measure of the total number of life insurance policies is to combine imputed data for the period 1970–92 with the estimated data for the period 1994–2006, which was obtained using the procedure outlined above. To estimate the total number of life insurance policies for the period 1970–92, we use the percentage change in the predicted values obtained from the estimation of (1). The percentage change from 1992 to 1993 is used to compute the total number of life insurance policies in 1992 using existing data for 1993. This process is reiterated for each of the preceding years until 1970 and the new created data series extends directly from 1993. Then we combine this new series with actual data for 1993 and the extrapolated series for 1994–2006.

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