Entrepreneurship and the Policy Environment

ENTREPRENEURSHIP AND THE POLICY ENVIRONMENT

YANNIS GEORGELLIS and HOWARD J. WALL*

December 2002, revised March 2004

This paper uses a spatial panel approach to examine the effect of the government-policy environment on the level of entrepreneurship. Specifically, we investigate whether marginal income tax rates and bankruptcy exemptions influence rates of entrepreneurship. Whereas previous work in the literature finds that both policies are positively related to entrepreneurship, we find non-monotonic relationships: a U-shaped relationship between marginal tax rates and entrepreneurship and an S-shaped relationship between bankruptcy exemptions and entrepreneurship. (*JEL* J23, R12)

I. INTRODUCTION

Entrepreneurship is thought to be an important factor in spawning innovation, employment, and economic growth. Because the benefits flowing from entrepreneurship are not necessarily captured by the entrepreneurs themselves, but can be realized more generally, the case is often made that the level of entrepreneurship is below its social optimum and deserves some attention from policymakers. Despite the recognized importance of entrepreneurship, however, there has been relatively little empirical analysis of the role played by the government-policy environment.

Previous research on self-employment and entrepreneurship has examined the roles of various demographic, human capital, and financial considerations in the decision to become an entrepreneur. Typically, studies have indicated the importance of (i) the earnings differential

* We would like to acknowledge the comments and suggestions of two anonymous referees, Kate Antonovics, Mark Partridge, Mike Dueker, and seminar participants at Southern Illinois University at Carbondale and the Annual Conference of the Western Economic Association International, Seattle, June 29-July 3, 2002. We would also like to acknowledge the research assistance of Paige Skiba. The views expressed are those of the authors and do not necessarily represent official positions of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

Y. Georgellis: Senior Lecturer, Department of Economics and Finance, Brunel University, Uxbridge, UB8 3PH, UK. Phone 01895 203174, Fax 01895 203384, E-mail yannis.georgellis@brunel.ac.uk

H. Wall: Research Officer, Federal Reserve Bank of St. Louis, 411 Locust Street, St. Louis, MO 63166. Phone 314-444-8533, Fax 314-444-8731, E-mail wall@stls.frb.org

between entrepreneurship and paid employment (Rees and Shah, 1986; Gill, 1988; Hamilton, 2000); (ii) liquidity constraints (Evans and Jovanovic, 1989; Evans and Leighton, 1989, Holtz-Eakin et al., 1994 and 1994b; Black and Strahan, 2002); (iii) satisfaction differentials (Taylor, 1996; Blanchflower and Oswald 1998; Blanchflower, 2000); (iv) macroeconomic conditions (Taylor, 1996; Parker, 1996; Cowling and Mitchell, 1997); and (v) intergenerational human capital transfers (Dunn and Holtz-Eakin, 2000; Hout and Rosen, 2000).[1]

Empirical studies that have considered the effects of the policy environment on entrepreneurship have focused on personal income tax rates, with the expectation that higher tax rates should suppress entrepreneurship. Nearly all studies, however, have found a positive relationship, whether it is between tax rates and aggregate rates of entrepreneurship (Long, 1982a; Evans and Leighton, 1989; Blau, 1987; Parker, 1996; Robson, 1998; and Bruce and Mohsin, 2003) or between tax rates and the individual-level probability of entrepreneurship (Long, 1982b; Scheutze, 2000; Fan and White, 2003). This divergence between expectations and results is usually attributed to the perception that, because of the nature of a tax system that relies on self-reporting, being an entrepreneur allows for relatively greater opportunities for tax avoidance.[2] Cullen and Gordon (2002), however, argue that, because entrepreneurs have the option of whether or not to incorporate their business, and because personal income tax rates are higher than corporate ones, the tax system provides a net subsidy to risk-taking. This is because an entrepreneur facing losses would prefer to face personal income tax rates so that the deduction of the losses against other income would have greater tax-reducing value. All else equal, an

1. Le (1999) provides a fairly comprehensive survey of the empirical literature.

2. Robson and Wren (1999) is an exception that finds a negative relationship between tax rates and entrepreneurship. They also have a theoretical model of tax avoidance and the entrepreneurial decision.

increase in personal income tax rates make this option more valuable, thereby increasing the likelihood that someone would choose to become an entrepreneur.

Other studies have begun to look at the question of taxes and entrepreneurship using more-complicated indicators of the tax system. Robson and Wren (1999) separate the effects of average and marginal tax rates, suggesting that the former represents the incentive for tax avoidance while the latter represents the disincentive effect.[3] Bruce (2000) looks at the differential tax treatment of self-employment and wage-and-salary earnings, finding that marginal and average tax rates on self-employment earnings are negatively related to the probability of becoming self-employed. Gentry and Hubbard (2000) find that the more progressive a tax system is, the less likely it is that an individual will enter self-employment. Bruce, Deskins, and Mohsin (2003) look at state-level differences in a variety of tax policies, including rates of sales taxes and personal and corporate income taxes, along with whether states allow combined reporting and limited liability corporations.

A recently opened line of inquiry into the effects of the policy environment on entrepreneurship has raised the question of whether or not bankruptcy laws affect the number of entrepreneurs (Berkowitz and White, 2004; Fan and White, 2003; White, 2001). Briefly, U.S. bankruptcy laws allow individuals filing for personal bankruptcy to exempt some of their assets and income from distribution to their creditors. The exemptions, which differ a great deal across states, can include some or all of the value of a person's home (the homestead exemption), pension holdings, and an assortment of other assets.[4]

---

3. Their theoretical model separates the tax effects into pure marginal and pure average tax changes, roughly analogous to substitution and income effects. Unfortunately, the tax rates they use in their empirical analysis are simply the average and marginal tax rates, each of which has income and substitution effects.

4. For detailed discussions of U.S. personal bankruptcy laws and the incentives they create, see White (1998), Fay, Hurst, and White (2002), Gropp, Scholz, and White (1997), and Dye (1986).

The direct effect of these exemptions is to provide a sort of wealth insurance in the event that an entrepreneurial venture fails. Thus, by this wealth-insurance effect, higher exemption levels should lead to more entrepreneurs. Less direct than the wealth-insurance effect is a credit-access effect, which works in the opposite direction. It arises because banks and other credit providers adjust their actions in response to changes in bankruptcy exemptions. As a result, the higher the exemption level, the less credit will be available at a given interest rate.[5] These two opposing effects of bankruptcy exemptions on entrepreneurship mean that the sign of the total effect is ambiguous in general. However, Fan and White (2003) find that the wealth-insurance effect dominates the credit-access effect for all levels of the exemption. In fact, they find that homeowners in states with an unlimited homestead exemption are 35 percent more likely to be self-employed than equivalent homeowners in states with low exemption levels.

In an attempt to resolve the results on the effects of taxes and to enhance the modeling of bankruptcy exemptions, this paper takes a different approach to estimating the effects of government policies on entrepreneurship. Specifically, following Georgellis and Wall (2000a), we create a state-level panel dataset that pools observations over space and time.[6] This allows us to look at the effects of changes in policies over time while exploiting the large differences across states in levels of entrepreneurship, bankruptcy exemptions, and tax rates. The advantages of this approach over aggregate time-series studies — which have only one observation per time period — are that we can include a large number of control variables, use more-general specifications of policy variables, and control for trends more effectively. Another advantage, which we outline in greater detail below, is that it allows us to create a continuous

5. Berkowitz and White (2002) show how small, unincorporated businesses face lower credit access and higher interest rates in states with higher exemption levels.

6. See also Wall (2004); Bruce, Deskins, and Mohsin (2003); and Black and Strahan (2002).

variable for the homestead exemption, rather than having to group different exemption levels together into dummy variables, as is necessary when using individual-level panels.

Using the spatial-panel approach, we find a U-shaped relationship between marginal tax rates and entrepreneurship. At low tax rates the relationship is negative, and at high rates it is positive. Also, we find an S-shaped relationship between the homestead exemption and entrepreneurship. Specifically, an increase in the homestead exemption from very low or very high levels acts to reduce the number of entrepreneurs, while an increase in the middle range acts to increase the number of entrepreneurs.

II. SPATIAL AND TEMPORAL TRENDS IN U.S. ENTREPRENEURSHIP

We define the rate of entrepreneurship as the proportion of the working-age population that is classified as nonfarm proprietors. In common with most of the literature, we exclude farm proprietors on the grounds that the decision to become a farm proprietor depends on different factors than the decision to become a nonfarm proprietor, and because farmers operate under different bankruptcy laws than do other proprietors.

Proprietors' employment is the number of people who are employed in their own business, regardless of whether that business is incorporated. Various other measures of entrepreneurship have been used in the literature, such as the non-farm self-employed, which excludes farmers and the incorporated.[7] The rate of entrepreneurship is usually calculated with the labor force or total employment in the denominator. We prefer to use the working-age population because, unlike the size of the labor force or the number employed, it is not likely to move with the number of entrepreneurs as people move between employment states. This

7. Bruce and Holtz-Eakin (2001) examine a variety of measures and conclude that it makes little difference which one is used.

distinction also recognizes the fact that entrepreneurs are drawn from the entire working-age population, not just those currently employed or in the labor force.

Figures 1a and 1b illustrate the cross-state differences in the levels and growth of entrepreneurship during our sample period, 1991-98. In general, states in the western half of the country had the highest levels of entrepreneurship. The eastern part of the country contained all of the regions with the lowest rates of entrepreneurship: the Great Lakes, the Upper South, and the Deep South. In the East, only New England states were in the top two quartiles of entrepreneurship. As Figure 1b shows, all states saw increases in their rates of entrepreneurship between 1991 and 1998, and there was some convergence. Southern states, New York, and the lagging western states had the highest growth in entrepreneurship, while much of the West saw relatively little growth.

III. EMPIRICAL MODEL

Assume that each person has the option of being an employee of someone else, becoming an entrepreneur, or not working. The utility outcomes of these options are uncertain and depend on prevailing market conditions and the person's abilities and preferences in each of the activities. Define the *mean person* as that member of a state or national population who possesses the mix of characteristics and skills expected of a randomly selected person. Denote the utility that the country's mean person would attain as: an entrepreneur in state *i* as U_i^e, an employee as U_i^m, and not working as U_i^n. For the country's mean person, the utility levels in these activities differ across states because of differences in industrial mix, business conditions, government policies, and amenities.

For state *i*'s mean person, the difference in utility between entrepreneurship and employment is $U_i^e - U_i^m + \delta_i$, where δ_i differentiates the mean person in the state from the mean person in the country as a whole. δ_i differs across states because of spatial differences in education levels, age, entrepreneurial human capital, and other individual characteristics, some of which are unobservable or unmeasurable. Similarly, for state *i*'s mean person, the difference in utility between entrepreneurship and not working is $U_i^e - U_i^n + \lambda_i$, where λ_i differentiates the mean person in the state from the mean person in the country as a whole.

Define a random variable e_{ij} such that $e_{ij} = 1$ if person *j* in state *i* is an entrepreneur and $e_{ij} = 0$ otherwise. If person *j* were selected randomly from state *i,* the probability that he would be an entrepreneur is the probability that entrepreneurship provides a higher level of utility to state *i*'s mean person than do the alternatives:

$$\Pr[e_{ij} = 1] = \Pr[U_i^e - U_i^m + \delta_i > 0,\ U_i^e - U_i^n + \lambda_i > 0]. \tag{1}$$

Summing (1) across the N_i people in *i* and dividing by the population, N_i,

$$E_i \equiv \frac{1}{N_i}\sum_{j=1}^{N_i} \Pr[e_{ij} = 1] = F(U_i^e - U_i^m + \delta_i, U_i^e - U_i^n + \lambda_i), \tag{2}$$

where F_1 and $F_2 > 0$. Assuming a large enough population, E_i is the rate of entrepreneurship in state *i*.

According to equation (2), a state's rate of entrepreneurship increases along with the relative utility that entrepreneurship provides for the state's mean person. This differs across states because (i) state labor forces differ in their relative skills and preferences for entrepreneurship (i.e., δ_i and λ_i differ across states) and (ii), controlling for individual

characteristics, the relative suitability for entrepreneurship differs across states (i.e., $U_i^e - U_i^m$ and $U_i^e - U_i^n$ differ by state).

Using *t* to denote the time period, assume that (2) can be estimated with the following regression equation:

$$E_{it} = \alpha_i + \tau_t + \boldsymbol{\beta}'\mathbf{X_{it}} + \boldsymbol{\theta}'\mathbf{Z_{it}} + \boldsymbol{\gamma}'\mathbf{G_{it}} + \varepsilon_{it}. \tag{3}$$

In equation (3), α_i is a state-specific component that is constant over time and τ_t is a year-specific component that is common to all states. The vectors $\mathbf{Z_{it}}$ and $\mathbf{X_{it}}$ measure, respectively, business conditions and average demographic characteristics in state *i* in year *t*. Government policy variables are included in the vector $\mathbf{G_{it}}$, and ε_{it} is the error term.

IV. DATA

The demographic variables included in $\mathbf{X_{it}}$ capture the spatial and temporal differences in age, gender, and racial compositions of state populations. As outlined in Georgellis and Wall (2000b), rates of self-employment differ a great deal across these categories. We therefore include age variables that measure differences in population shares of broad age categories. Also, because men are nearly twice as likely as women to be self-employed, we include the female share of a state's population. Finally, $\mathbf{X_{it}}$ includes the black, Native American, Asian and Pacific Islander, and Hispanic population shares. Large variations in self-employment across these groups might explain state-level differences in entrepreneurship. For example, the self-employment rate for blacks is only about one-third of that for whites and Asians.

Here and in the previous section we discuss these variables in terms of the supply of potential entrepreneurs. However, one should be careful about the interpretation of the estimated

coefficients because these demographic groups might also differ in their demand for the products that are more likely to be produced by entrepreneurs. For example, as Georgellis and Wall (2000b) report, over 10 percent of self-employed women in 1997 were in the child-care business, while virtually no men were. This indicates that a state with a higher-than-average female population share might have a higher-than-average supply of child-care providers. On the other hand, such a state also has a higher-than-average number of women demanding child-care services.

The vector of business conditions, $\mathbf{Z}_{it}$, includes measures of a state's economy that affect the profitability of entrepreneurship. These include the state's unemployment rate, per capita real income, per capita real wealth (as proxied by dividends, interest, and rent), relative proprietor's wage, and industry employment shares. As with our demographic variables, the interpretation of the roles of these variables is not entirely clear because each can simultaneously indicate the demand for entrepreneurs' services and the supply of entrepreneurs. For example, while we include the unemployment rate as a measure of the health of a state's economy, Parker (1996), among others, includes it as an indicator of the number of people with limited opportunities for wage-and-salary employment who might be pushed into self-employment.

As Georgellis and Wall (2000a) demonstrate, the specification of our control variables — the elements of $\mathbf{X}_{it}$ and $\mathbf{Z}_{it}$ — is potentially important. They show, for example, that the relationship between the rates of self-employment and unemployment in Britain is hill-shaped. Indeed, the best fit in the present context would allow for nonlinear relationships. Nonetheless, our present purpose is to estimate the effects of taxes and the homestead exemption, and a simple linear specification for the control variables makes little difference in this regard. Therefore, for parsimony, we use a linear specification for these control variables.

Presently, the variables of most interest are those measuring marginal tax rates and the homestead exemption. For the former, we use the maximum marginal tax rates (state plus federal) as generated by the NBER's TAXSIM model (see Table 1 for the state maximum marginal tax rates in 1990 and 1997, the first and last years of data used in our study). Of the tax rate measures used in the literature, this one best fits our needs. For one, it is the measure used in the paper most comparable to ours, Fan and White (2003). But, more importantly, it is exogenous, unlike the average marginal tax rate also generated by TAXSIM. While very few people will actually face the maximum marginal tax rate, there should be a very strong correlation between the marginal tax rates that the average person faces and the maximum rate.

We constructed our homestead exemption variable to take into account several state-level differences in bankruptcy law. First, as noted above and as summarized by Table 1, there are large differences in the exemption level across states: In 1997, five states did not allow any homestead exemption, while seven had an unlimited exemption. Also, some states allow for the federal exemption to be substituted at the filer's discretion, and some states allow married filers to double the exemption level. Because our variable is meant to capture the exemption that the average person in a state might face, we also take into account differences in the average house prices and the likelihood that a filer owns rather than rents.

Our homestead exemption variable starts by taking the state exemption level or, if the state allows the federal option, the maximum of the state and federal exemption levels. If this is greater than the average house price in the state, we use the average house price instead, which is a more accurate representation of the exemption that the average person would get. We then multiplied this by the state's homeownership rate and, if the state allows married householders to double the exemption, we also multiply it by one plus the state's share of households in which

both spouses reside together. The result of this divided by the average house price yields our homestead exemption rate.

Note that the sources for all of the data used to construct our variables are given in the data appendix, as are the summary statistics for all of the independent variables described above. We should also note that our two most important dependent variables — the homestead exemption rate and the maximum marginal tax rate — are statistically independent, as indicated by their correlation coefficient of -0.01.

As we mention above, one of the main benefits of our spatial panel approach is that the relative abundance of observations means that we can easily allow for non-linearities. This is important because, for each of our government policy variables, there are opposing effects, meaning that the relationships might be non-monotonic. This is easiest to see with tax rates, for which the standard negative labor-effort effect is countered by the positive tax-avoidance effect. Assuming a non-trivial cost to being caught avoiding taxes, at low tax rates the incentive to avoid taxes will not be terribly strong because the net expected benefits are not very high. Conversely, under very high tax rates, the benefit of avoiding taxes is much higher.

Our choice of functional form for the tax and homestead exemption variables is crucial to our results. Theory gives us no guidance on the appropriate specification; so, to be as general as reasonably possible, we began with a cubic form for both variables. This specification fits the homestead exemption rate well, yielding statistically significant coefficients for all three terms. However, because the coefficients on all three terms for the tax variable were not statistically different from zero, we re-estimated using a quadratic specification, which yielded two statistically significant coefficients. Thus, our baseline model, which we report and discuss in

detail below, uses a quadratic tax variable and a cubic homestead exemption variable. In the section following our discussion of the baseline results, we discuss alternative specifications.

V. EMPIRICAL RESULTS

Our dependent variable is the rate of entrepreneurship, as defined above, for 1991-1998, and our independent variables are all lagged by one year. To allow for the most general error structure given our data constraints, we estimate (3) using feasible generalized least squares (FGLS). This allows for state-specific heteroskedastic errors, although, because of a relatively short panel, we still need to assume that errors are uncorrelated across states.[8] We also allow for each state's errors to follow their own AR(1) process.

Table 2 summarizes our results. As discussed above, we attach little importance to the coefficients on our demographic and business conditions variables, but simply note that omitting them would have a statistically significant effect on the results. More importantly, our estimation indicated that the marginal tax rate and the homestead exemption rate are both related non-monotonically to the rate of entrepreneurship.

Our estimates of the effects of marginal tax rates on entrepreneurship indicate that at tax rates at the low end of our observed rates — 28 to 35 percent — an increase in the tax rate will reduce the number of entrepreneurs (see Figure 2). Beyond this range, higher marginal taxes will increase the number of entrepreneurs indirectly as, presumably, the tax-avoidance incentives become large enough to begin outweighing the possible penalties.

The cubic relationship between the homestead exemption rate and entrepreneurship is illustrated by Figure 3. At very low and very high exemption rates — between 0 and 20 percent

8. A useful rule of thumb is that there are twice as many time periods as cross-sectional units (Beck and Katz, 1995).

and above 60 percent — an increase in the homestead exemption leads to a decrease in the rate of entrepreneurship, suggesting that the credit-access effect dominates. At the mid-range of exemption rates — between 20 and 60 percent — an increase in the homestead exemption rate leads to an increase in the rate of entrepreneurship, suggesting that the wealth-insurance effect dominates. Note, though, that only rates between 50 and 72 percent lead to a higher rate of entrepreneurship than there would be with no homestead exemption at all.

The year dummies are also interesting and suggest an underlying trend in entrepreneurship not captured by demographics, business conditions, or government policies. The estimated coefficient on the 1998 dummy indicates that state rates of entrepreneurship would have risen, on average, by 1.2 percentage points from 1991 to 1998 if all of the variables we include in our estimation remained at their initial levels.

Figure 4 plots the estimated fixed effects across the states, illustrating the extent to which differences in entrepreneurship are determined by differences in the variables included in our regression. Most noticeably, comparing Figures 1a and 4, we see that not all states with low levels of entrepreneurship also have low estimated fixed effects. In particular, states in the Great Lakes, Upper South, and Deep South regions have low levels of entrepreneurship, typically falling in the lowest quartile. However, the fixed effects for the Deep South states are not in the lowest quartile, while those for the Great Lakes and Upper South states are. This indicates that the relatively low levels of entrepreneurship in the Deep South are due to relatively inhospitable business conditions, demographic factors, or government policies. On the other hand, the low levels of entrepreneurship in the Great Lakes and Upper South are attributable to fixed factors, which Georgellis and Wall (2000a) suggest might include cultural, historical, or sociological factors that suppress entrepreneurship. At the other extreme are states in New England and the

West, which have high levels of entrepreneurship and high estimated fixed effects. This suggests that one of the reasons for the high levels of entrepreneurship are that these states contain the cultural, historical, and sociological makeup to pursue and succeed in entrepreneurship.

VI. ALTERNATIVE ESTIMATES

Our baseline model uses specific functional forms for the policy variables and generalized least-squares estimation to allow for state-specific autocorrelation and cross-sectionally uncorrelated heteroskedasticity. To check the consequence of these choices on our estimation of the effects of our policy variables, we present the results of six alternatives.[9] These alternative results, which either use a different specification of the policy variables or place stronger restrictions on the error terms, are reported in Table 3 and illustrated by Figures 5 and 6.

Alternative I restricts the coefficients on the squared and cubed terms of the policy variables to zero. Estimation under these restrictions yields a positive and statistically significant effect for the marginal tax rate on entrepreneurship and a negative but statistically insignificant effect for the homestead exemption rate. Alternative II restricts the coefficient on the cubed term of the homestead exemption rate to zero while using the same quadratic functional form for the marginal tax rate as in the baseline model. The estimated relationship between the maximum marginal tax rate and entrepreneurship under this restriction differs very little from the baseline results. On the other hand, as previously stated, the estimated coefficients on the homestead exemption rate are both statistically no different from zero. The results from these two alternative specifications indicate that the choices we have made about the specification of the policy variables are important for our conclusions. Likelihood ratio tests reject the null

9. Wall (2004) demonstrates how not allowing for autocorrelation and heteroskedasticity, in particular, has severe consequences for the state-level panel of entrepreneurship in Black and Strahan (2002).

hypotheses that the restrictions that these alternatives place on the higher-order terms do not have a statistically significant effect on the estimation. Therefore, the least-restrictive baseline model is preferred statistically to the two alternatives.

Three other alternatives place stronger restrictions on the error terms than does the baseline model: In alternative III they are assumed to be homoskedastic, in alternative IV they are not autocorrelated, and in alternative V their autocorrelation is common across states. As Figure 5 illustrates, none of these restrictions has an effect on the estimated U shape for the relationship between marginal tax rates and the rate of entrepreneurship, although the coefficients in alternative III are not statistically significant. The important differences are that the estimated relationship is flatter with alternative III and steeper with alternatives IV and V.

For the relationship between the homestead exemption rate and the rate of entrepreneurship, only the estimates from alternative III differ in any non-trivial way. All three alternatives yield an S-shaped relationship, although the estimated relationship is everywhere steeper with alternative III than with the baseline model. Another important difference is that alternative III suggests that all homestead exemption rates above 42 percent will yield more entrepreneurship than would a zero exemption, whereas the baseline model suggests that this is true only for homestead exemption rates between 50 and 72 percent.

Alternative VI replaces the continuous homestead exemption variables with dummy variables for discrete ranges of the homestead exemption rate. Because this removes any general assumption regarding functional form, it allows us to verify the general shape of the cubic relationship of our baseline model. We split the observed homestead exemption rates into octiles, each with 50 observations, and estimate the model with the first octile omitted to avoid perfect collinearity. As summarized by Table 3, for all but one of the octiles of the homestead

exemption rate, the rate of entrepreneurship is statistically different from what it would be under the first octile. Further, as illustrated by Figure 6, these results confirm the general S-shape to the relationship between the homestead exemption rate and the rate of entrepreneurship. Note also that this specification has little effect on the estimated relationship between the rate of entrepreneurship and the maximum marginal tax rate.

VII. CONCLUDING REMARKS

This paper uses the spatial panel approach of Georgellis and Wall (2000a) to estimate the effects of personal income tax rates and bankruptcy exemptions on entrepreneurship. Using data for all 50 states of the United States for 1991-1998, we find non-homothetic relationships. Specifically, at low initial tax levels, an increase in marginal tax rates reduces the number of entrepreneurs, although at higher initial tax levels it will do the opposite. We also find that at very low and very high initial levels an increase in the homestead exemption will reduce the number of entrepreneurs. In the mid-range of homestead exemption rates there is a positive relationship between the exemption level and entrepreneurship. Further, only for relatively high homestead exemption rates will the level of entrepreneurship be higher than if there were no homestead exemption at all.

TABLE 1

State Homestead Exemptions and Maximum Marginal Tax Rates

	Maximum Marginal Tax Rates		Homestead Exemptions	
State	**1990**	**1997**	**1990**	**1997**
Alabama	3.65	3.12	$5,000	$5,000
Alaska	0	0	54,000	54,000
Arizona	6.51	4.8	100,000	100,000
Arkansas	7	7	no limit	no limit
California	9.3	9.78	7,500	15,000
Colorado	4.76	5.36	20,000	30,000
Connecticut	0	4.5	0	75,000
Delaware	7.7	6.9	0	0
Florida	0	0	no limit	no limit
Georgia	5.66	5.83	5,000	5,000
Hawaii	9	9	30,000	30,000
Idaho	8.2	8.2	30,000	50,000
Illinois	3	3	7,500	7,500
Indiana	3.4	3.4	7,500	7,500
Iowa	7.39	6.36	no limit	no limit
Kansas	5.15	6.45	no limit	no limit
Kentucky	4.39	6	5,000	5,000
Louisiana	4.14	3.75	15,000	15,000
Maine	8.5	8.5	7,500	12,500
Maryland	5	6	0	0
Massachusetts	5.95	5.95	100,000	100,000
Michigan	4.6	4.4	3,500	3,500
Minnesota	8	8.86	no limit	200,000
Mississippi	4.75	4.85	30,000	75,000
Missouri	4.39	6	8,000	8,000
Montana	8.59	6.83	40,000	40,000
Nebraska	6.4	7	10,000	10,000
Nevada	0	0	90,000	125,000
New Hampshire	0	0	5,000	30,000
New Jersey	3.5	6.37	0	0
New Mexico	7.83	8.4	20,000	30,000
New York	7.88	6.85	10,000	10,000
North Carolina	7	8.08	7,500	10,000
North Dakota	3.77	5.25	80,000	80,000
Ohio	6.9	7.2	5,000	5,000
Oklahoma	6.72	6.05	no limit	no limit
Oregon	8.12	9	15,000	25,000
Pennsylvania	2.1	2.8	0	0
Rhode Island	6.04	9.66	0	0
South Carolina	7	7.3	5,000	5,000
South Dakota	0	0	no limit	no limit
Tennessee	0	0	5,000	5,000
Texas	0	0	no limit	no limit
Utah	6.26	5.72	8,000	8,000
Vermont	6.54	8.85	30,000	30,000
Virginia	5.75	5.75	5,000	5,000
Washington	0	0	30,000	30,000
West Virginia	6.5	6.5	7,500	15,000
Wisconsin	6.93	6.93	40,000	40,000
Wyoming	0	0	10,000	10,000
Federal			7,500	15,000

TABLE 2

Baseline FGLS Results. Dependent variable: state rate of entrepreneurship = (non-farm proprietors' employment)/(working-age population)

	Coefficient	Standard Error	t-statistic
Policies			
Maximum marginal tax rate	-0.092	0.056	-1.66
Maximum marginal tax rate squared	1.3 e^{-3}	0.7 e^{-3}	1.75
Homestead exemption rate	-0.118	0.024	-4.93
Homestead exemption rate squared	0.004	0.001	4.77
Homestead exemption rate cubed	-3.3 e^{-5}	0.7 e^{-5}	-4.69
Demographics			
Adult share aged 45-65	0.173	0.054	3.22
Adult share aged 65+	0.034	0.078	0.44
Female share of population	0.080	0.020	4.06
Black share of population	-0.146	0.086	-1.70
Native American share of population	0.175	0.407	0.43
Asian/Pac. Isl. share of population	-0.111	0.180	-0.62
Hispanic share of population	-0.067	0.066	-1.01
Business conditions			
Unemployment rate	0.106	0.025	4.26
Real per capita income	-1.1 e^{-4}	0.9 e^{-4}	-1.23
Real per capita wealth	0.310	0.229	1.35
Relative proprietor's wage	0.342	0.399	0.86
Industry shares	Yes	—	—
Year dummies			
1992	-0.221	0.055	-4.01
1993	-0.106	0.090	-1.18
1994	0.207	0.119	1.73
1995	0.606	0.152	3.98
1996	1.038	0.183	5.67
1997	1.153	0.219	5.25
1998	1.224	0.255	4.81
State fixed effects	Yes	—	—
Constant	-22.442	119.659	-0.19
Log-likelihood		-6.291	
Number of observations		400	
Estimated covariances		50	
Estimated autocorrelations		50	

Note: The estimation corrects for state-specific heteroskedasticity and autocorrelation. Omitted reference variables are: adult share aged 18-44, white share of population, government share of employment, and 1991.

TABLE 3

Alternative FGLS Results. Dependent variable: state rate of entrepreneurship = (non-farm proprietors' employment)/(working-age population)

	I	II	III	IV	V	VI
Maximum marginal tax rate	0.008* (0.004)	-0.096* (0.055)	0.066 (0.084)	-0.134* (0.065)	-0.129* (0.065)	-0.119* (0.053)
Maximum marginal tax rate squared	–	1.4 e^{-3}* (0.7 e^{-3})	0.001 (0.001)	0.002* (0.001)	0.002* (0.001)	0.002* (0.001)
Homestead exemption rate	-0.003 (0.004)	-0.010 (0.009)	-0.158* (0.029)	-0.116* (0.023)	-0.115* (0.023)	–
Homestead exemption rate squared	–	9.8 e^{-5} (9.9 e^{-5})	0.006* (0.001)	0.004* (0.001)	0.004* (0.001)	–
Homestead exemption rate cubed	–	–	-4.9 e^{-5}* (0.9 e^{-5})	-3.2 e^{-5}* (0.7 e^{-5})	-3.2 e^{-5}* (0.7 e^{-5})	–
Second octile of homestead exemption rate	–	–	–	–	–	-0.285* (0.087)
Third octile of homestead exemption rate	–	–	–	–	–	-0.391* (0.095)
Fourth octile of homestead exemption rate	–	–	–	–	–	-0.477* (0.199)
Fifth octile of homestead exemption rate	–	–	–	–	–	-0.445* (0.126)
Sixth octile of homestead exemption rate	–	–	–	–	–	0.146 (0.165)
Seventh octile of homestead exemption rate	–	–	–	–	–	0.382* (0.233)
Eighth octile of homestead exemption rate	–	–	–	–	–	0.259* (0.232)
Demographics, bus. cond's, year and state effects	Yes	Yes	Yes	Yes	Yes	Yes
Heteroskedasticity	Yes	Yes	No	Yes	Yes	Yes
Autocorrelation	State	State	State	None	Common	State
Log-likelihood	-7.56	-4.49	-114.92	-26.55	-26.46	0.514

Note: Standard errors are in parentheses. "*" indicates statistical significance at the 10 percent level.
Model I: baseline model with restriction that higher-order effects of policy variables are zero.
Model II: baseline model with restriction that third-order effect of homestead exemption is zero.
Model III: baseline model with assumption that errors are homoskedastic.
Model IV: baseline model with assumption that errors are not autocorrelated.
Model V: baseline model with assumption that autocorrelation is common across states.
Model VI: baseline model with home exemption rate octiles and state-specific heteroskedasticity and autocorrelation.

FIGURE 1a
Average Rates of Entrepreneurship, 1991-98

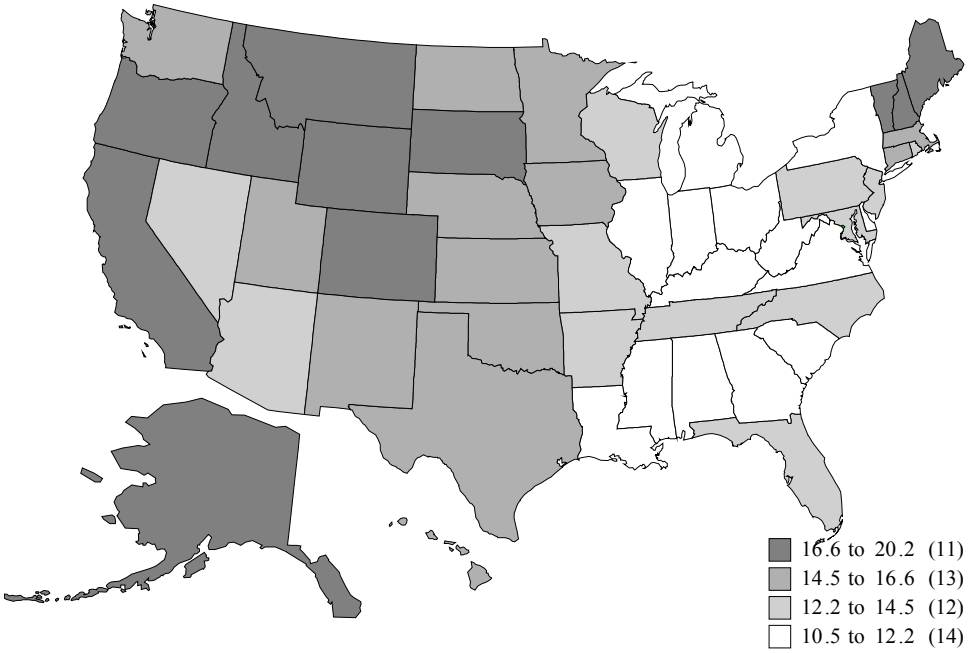


FIGURE 1b
Percentage Change in Rates of Entrepreneurship, 1991-98

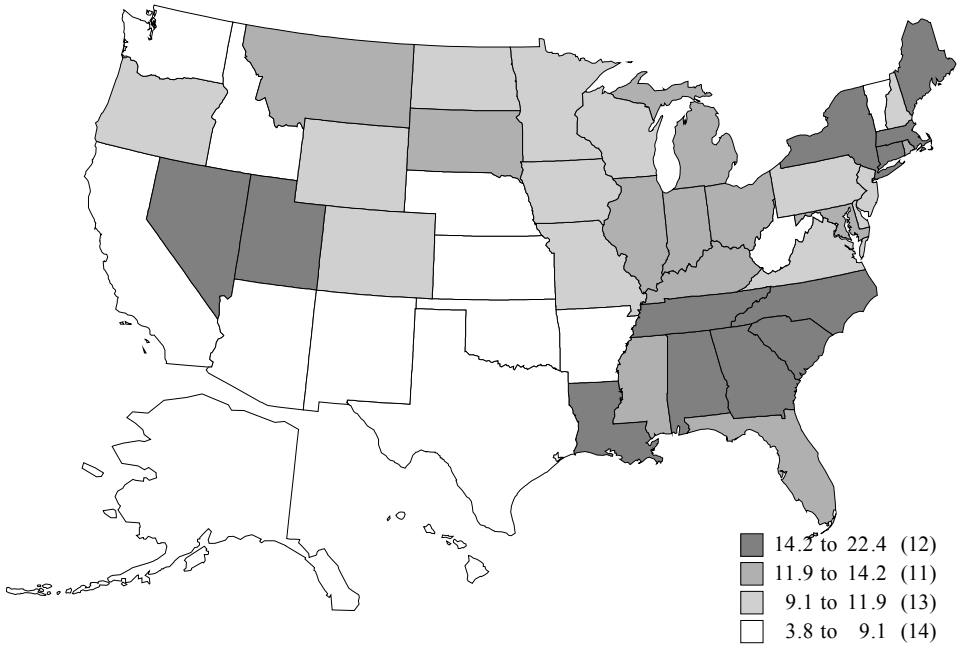


FIGURE 2

Entrepreneurship and Marginal Taxes

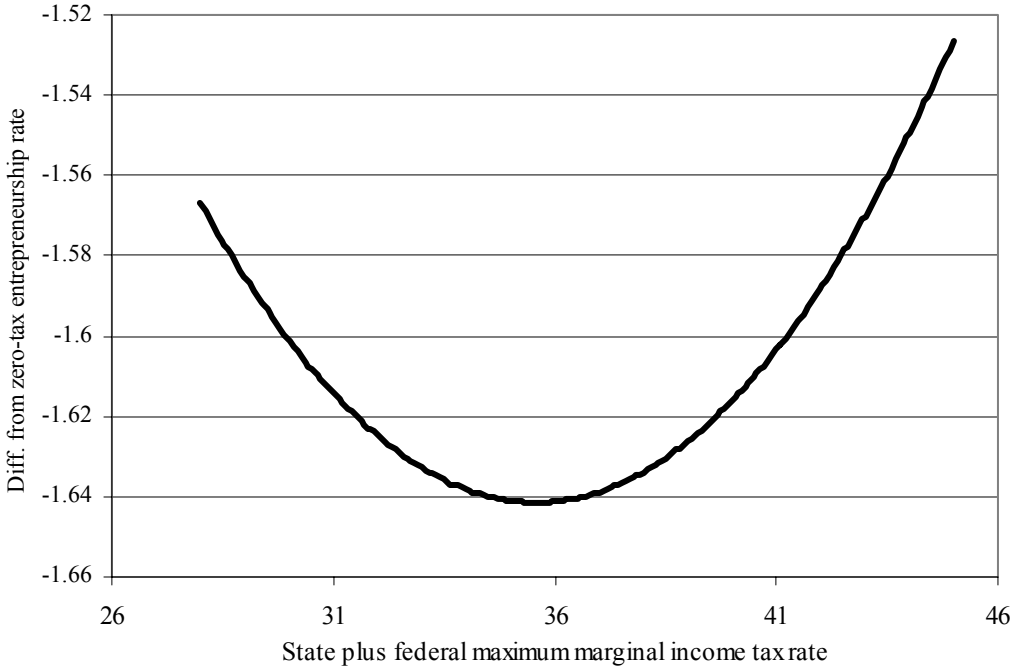


FIGURE 3

Entrepreneurship and the Homestead Exemption

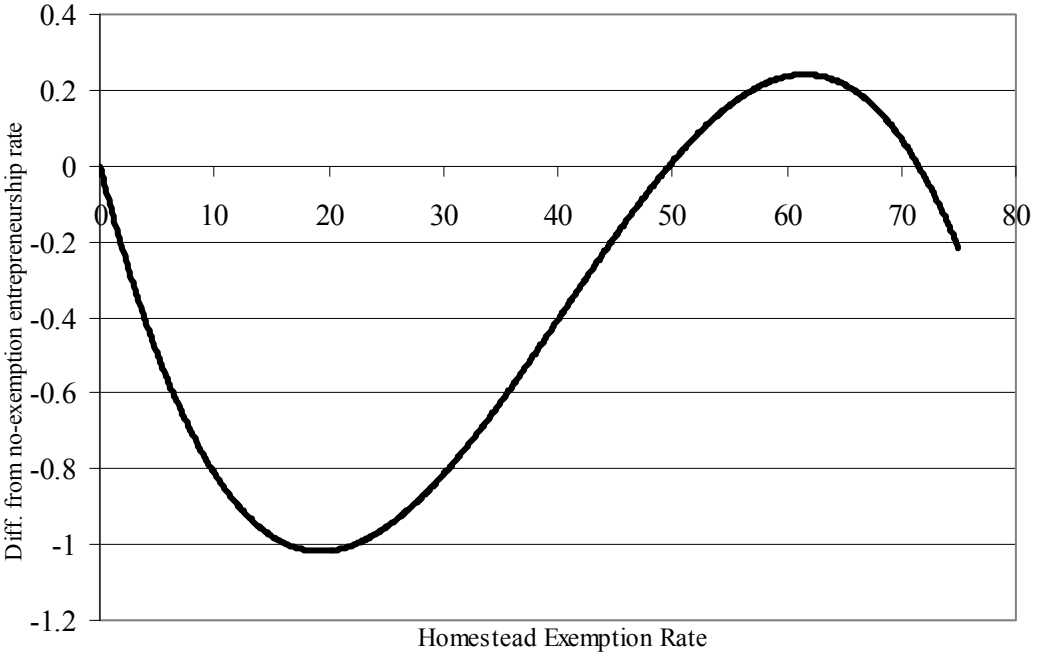


FIGURE 4
Estimated State Fixed Effects

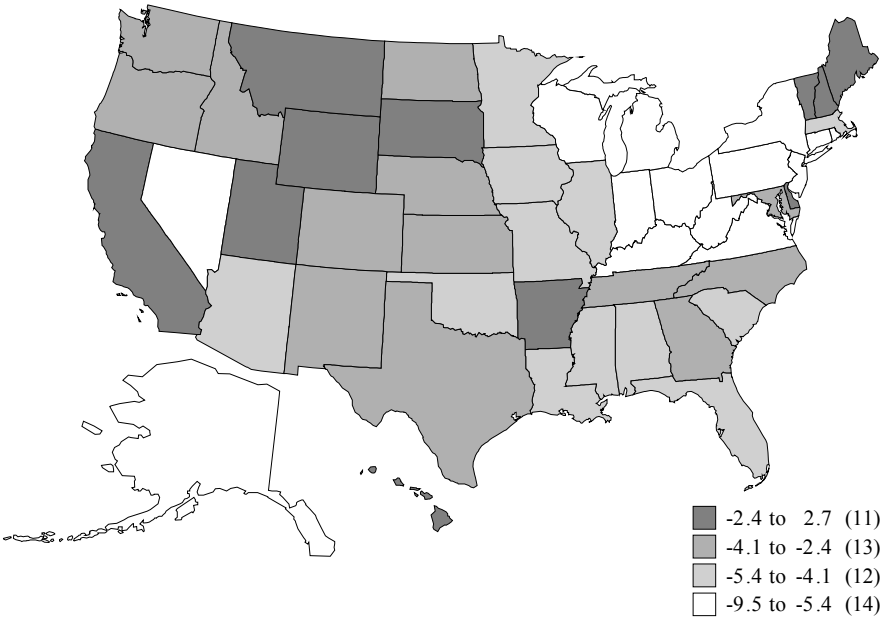


FIGURE 5
Alternative Estimates: Maximum Marginal Tax Rate

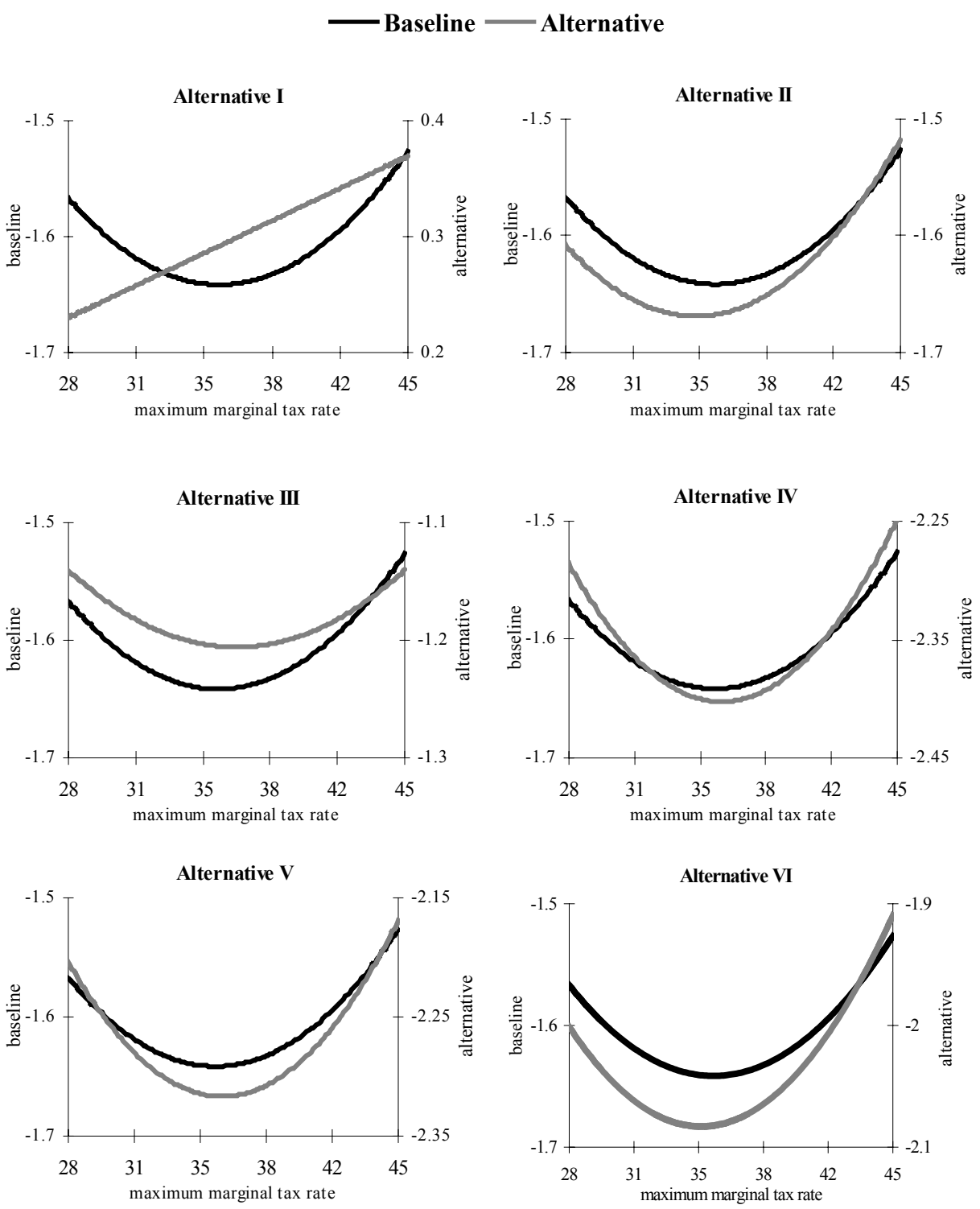
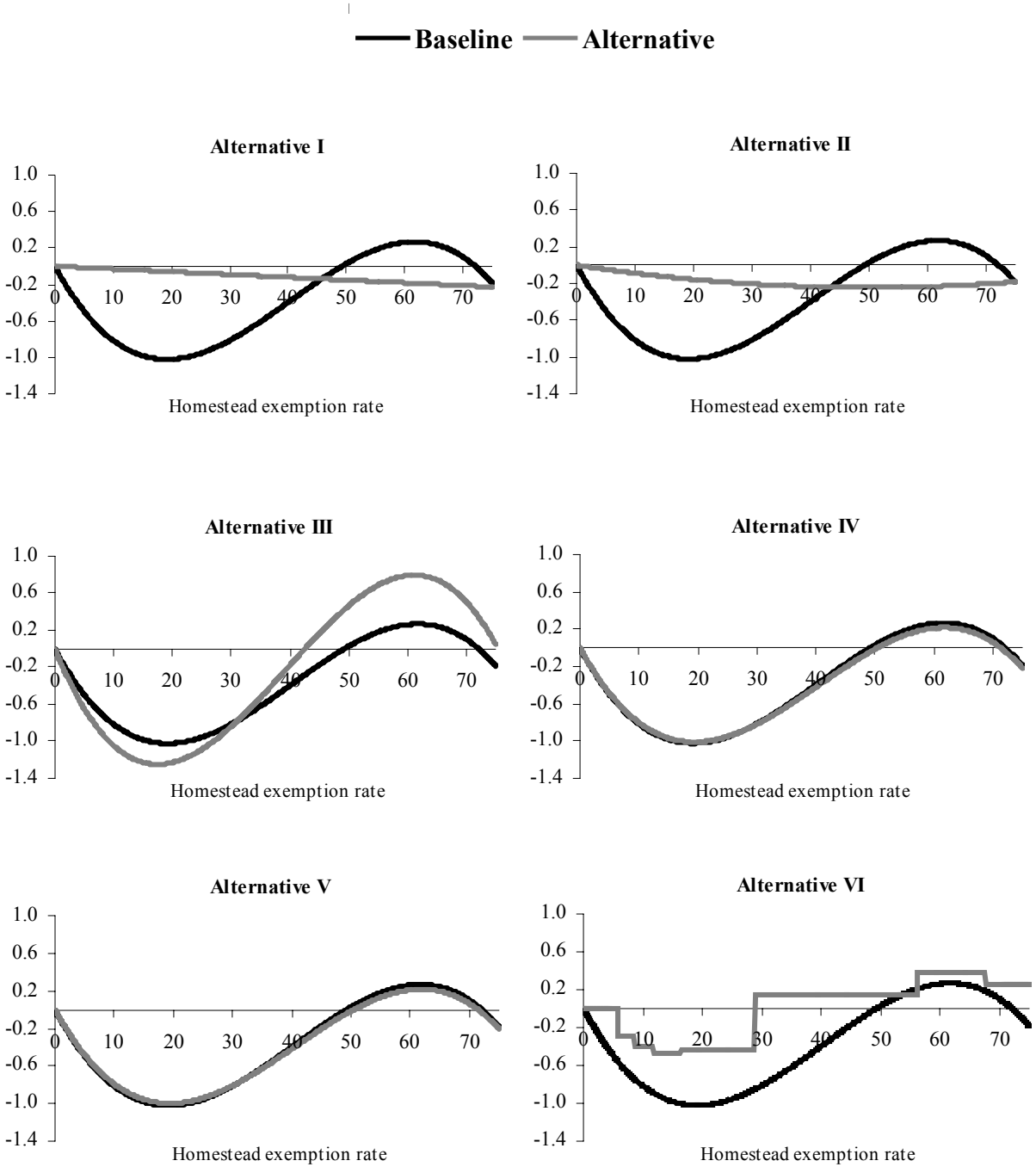


FIGURE 6
Alternative Estimates: Homestead Exemption Rate



DATA APPENDIX

Data series	**Source**
Non-farm proprietors' employment	Regional Economic Information System, Bureau of Economic Analysis, Table CA25
Unemployment rate	Bureau of Labor Statistics
Dividends, interest, and rent	Regional Economic Information System, Bureau of Economic Analysis, Table CA05
Per capita gross state product	Bureau of Economic Analysis
Average non-farm proprietors' income; average wage and salary disbursements	Regional Economic Information System, Bureau of Economic Analysis, Table CA30
Industry employment shares	Establishment Survey, Bureau of Labor Statistics
Age, race, and sex population shares	Bureau of the Census
Maximum marginal tax rates	TAXSIM, National Bureau of Economic Research
Homestead bankruptcy exemptions	Elias, Renaur, and Leonard, *How to File for Chapter 11 Bankruptcy*, various editions
Median house price	Derived using median house price from 1990 Census and the Home Price Index from the Office of Federal Housing Enterprise Oversight
Home ownership rate	Bureau of the Census
Share of households with householder and spouse	Bureau of the Census, derived from 1990 and 2000 Census assuming constant state-level rates of change

TABLE 1A
Summary Statistics for Independent Variables

	Coefficient	**Standard Error**
Maximum marginal tax rate	-0.092	0.056
Homestead exemption rate	-0.118	0.024
Adult share aged 45-65	0.173	0.054
Adult share aged 65+	0.034	0.078
Female share of population	0.080	0.020
Black share of population	-0.146	0.086
Native American share of population	0.175	0.407
Asian/Pac. Isl. share of population	-0.111	0.180
Hispanic share of population	-0.067	0.066
Unemployment rate	0.106	0.025
Real per capita income	$-1.1\ e^{-4}$	$0.9\ e^{-4}$
Real per capita wealth	0.310	0.229
Relative proprietor's wage	0.342	0.399

REFERENCES

Beck, N., and J. N. Katz. "What to Do (and Not To Do) with Time-Series Cross-Section Data." *American Political Science Review,* 89(3), 1995, 634-647.

Berkowitz, J., and M. J. White. "The Effect of Personal Bankruptcy Law on Small Firms' Access to Credit." *RAND Journal of Economics*, 35(1), 2004, 69-84.

Black, S. E., and P. E. Strahan. "Entrepreneurship and the Availability of Bank Credit." *Journal of Finance,* 57(6), 2002, 2807-2833.

Blanchflower, D. G. "Self-Employment in OECD Countries." *Labour Economics,* 7(5), 2000, 471-505.

Blanchflower, D. G., and A. J. Oswald. "What Makes an Entrepreneur?" *Journal of Labor Economics,* 16(1), 1998, 26-60.

Blau, D. M. "A Time Series Analysis of Self-Employment in the United States." *Journal of Political Economy,* 95(3), 1987, 445-467.

Bruce, D. "Effects of the United States Tax System on Transitions into Self-Employment." *Labour Economics,* 7(5), 2000, 545-574.

Bruce, D., J. Deskins, and M. Mohsin. "State Tax Policies and Entrepreneurial Activity: A Panel Data Analysis." *Proceedings of the 96th Annual Conference on Taxation,* National Tax Association, 2004, forthcoming.

Bruce, D., and D. Holtz-Eakin. "Who Are the Entrepreneurs? Evidence from Taxpayer Data." *Journal of Entrepreneurial Finance and Business Ventures,* 1(1), 2001, 1-10.

Bruce, D., and M. Mohsin. "Tax Policy and Entrepreneurship: New Time Series Evidence." Working Paper, University of Tennessee-Knoxville, 2003.

Cowling, M., and P. Mitchell. "The Evolution of U.K. Self-Employment: A Study of Government Policy and the Role of the Macroeconomy." *The Manchester School,* 65(4), 1997, 427-442.

Cullen, J. B., and R. H. Gordon. "Taxes and Entrepreneurial Activity: Theory and Evidence for the U.S." NBER Working Paper 9015, June 2002.

Dunn, T., and D. Holtz-Eakin. "Financial Capital, Human Capital, and the Transition to Self-Employment: Evidence from Intergenerational Links." *Journal of Labor Economics,* 18(2), 2000, 282-305.

Dye, R. A. "An Economic Analysis of Bankruptcy Statutes." *Economic Inquiry,* 24(3), 1986, 417-428.

Evans, D. S., and B. Jovanovic. "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints." *Journal of Political Economy,* 97(4), 1989, 808-27.

Evans, D. S., and L. S. Leighton. "Some Empirical Aspects of Entrepreneurship." *American Economic Review,* 79(3), 1989, 519-35.

Fan, W., and M. J. White. "Personal Bankruptcy and the Level of Entrepreneurial Activity." *Journal of Law and Economics,* 46(2), 2003, 543-567.

Fay, S., E. Hurst, and M. J. White. "The Household Bankruptcy Decision." *American Economic Review,* 92(3), 2002, 706-718.

Gentry, W. M., and R. G. Hubbard. "Tax Policy and Entrepreneurial Entry." *American Economic Review,* 90(2), 2000, 283-287.

Georgellis, Y., and H. J. Wall. "What Makes a Region Entrepreneurial? Evidence from Britain." *Annals of Regional Science,* 34(3), 2000a, 385-403.

Georgellis, Y., and H. J. Wall. "Who Are the Self-Employed?" Federal Reserve Bank of St. Louis *Review,* 82(6), 2000b, 15-24.

Gill, A. M. "Choice of Employment Status and the Wages of Employees and the Self-Employed: Some Further Evidence." *Journal of Applied Econometrics,* 3(3), 1988, 229-34.

Gropp, R., J. K. Scholz, and M. J. White. "Personal Bankruptcy and Credit Supply and Demand." *Quarterly Journal of Economics*, 112(1), 1997, 217-252.

Hamilton, B. H. "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment." *Journal of Political Economy,* 108(3), 2000, 604-31.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen. "Entrepreneurial Decisions and Liquidity Constraints." *RAND Journal of Economics,* 25(2), 1994a, 334-47.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen. "Sticking it Out: Entrepreneurial Survival and Liquidity Constraints." *Journal of Political Economy,* 102(1), 1994b, 53-75.

Hout, M., and H. S. Rosen. "Self-Employment, Family Background, and Race." *Journal of Human Resources,* 35(4), 2000, 670-92.

Le, A. T. "Empirical Studies of Self-Employment." *Journal of Economic Surveys,* 13(4), 1999, 381-416.

Long, J. E. "Income Taxation and the Allocation of Market Labor." *Journal of Labor Research*, 3(3), 1982a, 259-276.

Long, J. E. "The Income Tax and Self-Employment." *National Tax Journal*, 35(1), 1982b, 31-42.

Parker, S. C. "A Time Series Model of Self-Employment Under Uncertainty." *Economica,* 63(251), 1996, 459-475.

Rees, H., and A. Shah. "An Empirical Analysis of Self-Employment in the U.K." *Journal of Applied Econometrics,* 1(1), 1986, 95-108.

Robson, M. T. "The Rise in Self-Employment Amongst U.K. Males." *Small Business Economics*, 10(3), 1998, 199-212.

Robson, M. T., and C. Wren. "Marginal and Average Tax Rates and the Incentive for Self-Employment." *Southern Economic Journal,* 65(4), 1999, 757-773.

Scheutze, H. J. "Taxes, Economic Conditions and Recent Trends in Male Self-Employment: A Canada-U.S. Comparison." *Labour Economics,* 7(5), 2000, 507-544.

Taylor, M. P. "Earnings, Independence or Unemployment: Why Become Self-Employed?" *Oxford Bulletin of Economics and Statistics,* 58(2), 1996, 253-66.

Wall, H. J. "Entrepreneurship and the Deregulation of Banking." *Economics Letters,* 82(3), 2004, 333-339.

White, M. J. "Why it Pays to File for Bankruptcy: A Critical Look at Incentives under U.S. Bankruptcy Laws and a Proposal for Change." *University of Chicago Law Review*, 65(3), 1998, 685-723.

White, M. J. "Bankruptcy and Small Business." *Regulation,* 24(2), 2001, 18-20.