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Tax Policy and Entrepreneurship: New Time Series Evidence

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ABSTRACT. Have tax policies affected entrepreneurial activity in the U.S.? We extend the time series literature on this topic by using more recent data and modern econometric techniques to examine the importance of federal income, payroll, capital gains, corporate income, and estate taxes on self-employment rates. Regression results show that most of these taxes have significant but small effects on self-employment activity. A battery of cointegration and causality tests confirms the general finding that taxes can have significant influences on entrepreneurship, but they are likely to be ineffective tools for generating meaningful changes in entrepreneurial activity.

KEY WORDS: self-employment, tax policy, time series analysis

JEL CLASSIFICATION: H2, J2

1. Introduction

Does tax policy affect the level of entrepreneurial activity in the economy? Can tax cuts or other pro-small-business policies increase the rates of small business formation and survival? If so, do existing tax policies enhance overall welfare, or could welfare be improved by changing the system? Tax policy can affect entrepreneurial activity in various ways. First, small business income is taxed differently from wage earnings on a paid job. If the business is incorporated, profits are taxed under the corporate income tax system. If the business is unincorporated, profits are often (but not necessarily) taxed as individual income under the personal income tax system. Consequently, tax policy influences not only the choice of whether or not to create a new business, but also how the new firm should be organized, and how profitable it can be.

Further, it is well known that various business expenses are tax-deductible, including the costs of certain things that might also provide non-business-related consumption benefits. Examples include vehicles and some costs associated with housing, if part of one's home is used in the business. Tax policy also influences the cost of capital, thereby affecting hiring and investment practices among small business owners. In many ways, small businesses (and self-employed individuals specifically) are relatively tax-favored vis-à-vis wage workers and even larger businesses in the US. In addition to the deductibility of many business expenses, no third party exists to withhold taxes on the behalf of self-employed workers. Numerous opportunities exist to re-categorize income or otherwise shield it from tax.

That tax policy *can* affect entrepreneurship is not at all surprising. The more normative question of whether tax policy *should* affect entrepreneurship is perhaps more puzzling. Those in favor of small business tax subsidies use the popular argument that entrepreneurial ventures fuel economic growth and create jobs. Further, they provide positive

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externalities, or economic benefits that accrue at no additional cost to others in the economy. Adding to these is the commonly perceived notion of imperfect capital markets. New ventures can be expensive to create, and lenders are often reluctant to finance risky new enterprises, so it is thought that governmental authorities should step in and provide these funds where possible. Indeed, the US Small Business Administration backs more than $12 billion annually in loans for small businesses. Those opposed to tax benefits for small businesses cite the distortion that results from productive resources being misallocated toward less efficient uses, in addition to the questionable evidence regarding the economic benefits of small businesses.

Regardless of where one stands in this broader debate, one critical question that remains unanswered is whether tax policy actually has an influence over the level of entrepreneurship in the economy. If taxes do not affect entrepreneurial activity, then using tax policy to engineer changes in entrepreneurship is not likely to be fruitful. Alternatively, if a non-zero effect can be determined, the actual parameter estimates can be used to more efficiently design tax policy to achieve desired changes in entrepreneurship.

This paper revisits the time series literature on the effects of tax policy on entrepreneurial activity, focusing primarily on self-employment rates.[1] Key contributions include the consideration of a broad set of tax policies (including income, payroll, capital gains, corporate income, and estate taxes), an updating of the data to include the major tax reform acts of the 1980s and 1990s, and the use of more advanced time series econometric tools. We examine the effects of various elements of US tax policy on self-employment, testing our baseline findings with various measures of self-employment. In addition to a broad set of standard time series regression models, we also present a number of bivariate and multivariate tests of causality and cointegration in order to gain more complete insight into the empirical effects of taxation on aggregate entrepreneurial activity.

2. Background and prior literature

The recent theoretical literature in this area has established that tax policy has fundamentally ambiguous effects on entrepreneurial activity. In particular, Cullen and Gordon (2002) expand upon the insights of Domar and Musgrave (1944) in showing that a higher tax rate, which reduces both the return and the risk inherent in entrepreneurial activity, can actually increase the level of entrepreneurial activity in the economy. This theoretical ambiguity has been supported by the equally ambiguous findings of the recent empirical literature on taxation and entrepreneurship, which has enjoyed a recent resurgence due to increased data availability. The empirical literature can be broken into three broad categories: "first generation" time series studies, "second generation" time series studies, and microdata studies.

First generation time series studies used econometric techniques that have since been found to be problematic. Specifically, they typically involve the use of ordinary least squares regression analysis, with simple corrections for the common problem of autocorrelation (i.e., where observations in the time series data are related in some way over time). These studies generally conclude that higher tax rates cause higher rates of self-employment (Long, 1982; Blau, 1987). The explanation for this result usually rests on the assumption that high tax rates drive workers out of paid employment, or wage jobs, into entrepreneurial ventures where they can more easily avoid or evade taxes.

More recent time series studies use more sophisticated econometric tools, typically involving some consideration of cointegration (i.e., the existence of a common stochastic trend among two or more variables). In time series data, one often observes that top income tax rates and entrepreneurship rates have trended generally downward in recent decades. Both were quite high in the mid-1900s but have gradually fallen over time. This fundamental relationship may or may not involve some form of causation, but only the more modern techniques can fully address this. Somewhat surprisingly, though, these more advanced studies

find similar positive relationships between tax rates and entrepreneurial activity even after dealing with cointegration (Parker, 1996; Cowling and Mitchell, 1997; Robson, 1998).

The third and final group of empirical studies relies on cross-sectional or panel data to examine the influence of tax policy on individual decisions about entrepreneurship. Results from these studies, which use sophisticated econometric techniques designed for panel data and examine more broadly defined entrepreneurial activities, have been less conclusive (Bruce, 2000, 2002; Gentry and Hubbard, 2000; Schuetze, 2000; Carroll et al., 2001; Cullen and Gordon, 2002). Indeed, some of them have indicated that higher tax rates on self-employment income might either increase or decrease self-employment rates.

To summarize, the more recent micro-data studies have called into question the long-standing consensus from the earlier time series studies. Our intent in this study is to revisit the time series analysis using more recent data and methods as well as a broader set of tax variables. The most recent time series study in this literature that uses US data relies on a time series that ends with 1982. Consequently, no time series study has yet been able to make use of the variation in tax policy brought about by broad US tax reform acts in 1986, 1991, 1993, and 1997. Further, only one of the prior time series studies has examined the importance of corporate income taxation (Robson, 1998), and none have examined capital gains or estate taxes as determinants of entrepreneurial activity.[2]

3. Self-employment and tax rates in the US

We begin with a discussion of our key measures of entrepreneurial activity. We examine four possibilities for this, drawing upon tax return data from the Internal Revenue Service (IRS) and Current Population Survey data from the Bureau of Labor Statistics (BLS). The first (*IRS Rate 1*) expresses the number of individual income tax returns with income from a small business/profession or farm as a share of all individual income tax returns.[3] The second (*IRS Rate 2*) adds to this all tax returns with income from a partnership or small business corporation.[4] The third (*BLS Rate 1*) counts the number of all non-agricultural workers aged 16 and older who are self-employed (SE) as a share of the total non-agricultural work force.[5] The fourth and final measure (*BLS Rate 2*) expands the third by including workers in the agricultural sector.

Our examination of these measures carries a number of useful advantages. First, given that tax returns are filed by households in the US while the BLS data are drawn from surveys of individuals, we will be able to differentiate between entrepreneurship at the household level (IRS Rates) and the individual level (BLS Rates).[6] Perhaps more importantly, we will be able to compare the effects of tax policies on measures of what individuals merely say they are doing (BLS) and measures of what households actually report doing on their income tax returns (IRS). We should not expect the IRS measures and BLS measures to track similarly over time given differences in intent and measurement. For example, the IRS measures will be sensitive to changes in the tax-filing population and the BLS measures will reflect changes in labor force participation and questionnaire design. These issues are discussed in more detail below.

Figures 1 and 2 show time series graphs of the IRS and BLS measures, respectively. It is interesting to note that while the two measures *within* each data source have moved similarly over time, there is a notable difference in the trends *across* the two data sources. The IRS measures have trended generally upward, with the exception of a protracted slump between the late 1960s and early 1980s. Conversely, the BLS measures exhibit a sharp downward trend through the late 1960s, and have remained relatively stable since. The downward trend during the earlier years for both IRS and BLS rates at least partially reflects the reduction in the number of farmers in the data. However, the subsequent divergence in trends is a bit more puzzling. One possible explanation is that labor force entry among new female entrepreneurs has only partially been offset by increased exit among male entrepreneurs. Another possibility is growth in entrepreneurial activity in the form of part-time businesses, which would likely show up in higher IRS entrepreneurship rates but not necessarily higher BLS rates. Interestingly, the

IRS measures display greater volatility over time, suggesting that the act of reporting entrepreneurial activities on a tax return might be more sensitive to tax policy than is the act of reporting self-employment activity on a survey. Figures 1 and 2 foreshadow the possibility that the estimated effects of tax policies on entrepreneurial activity could indeed be sensitive to the measure of entrepreneurial activity used in the analysis.

Federal tax policy can affect entrepreneurial activity in many ways.[7] First, personal income taxes reduce the return to labor of all forms, including self-employment. They also reduce the

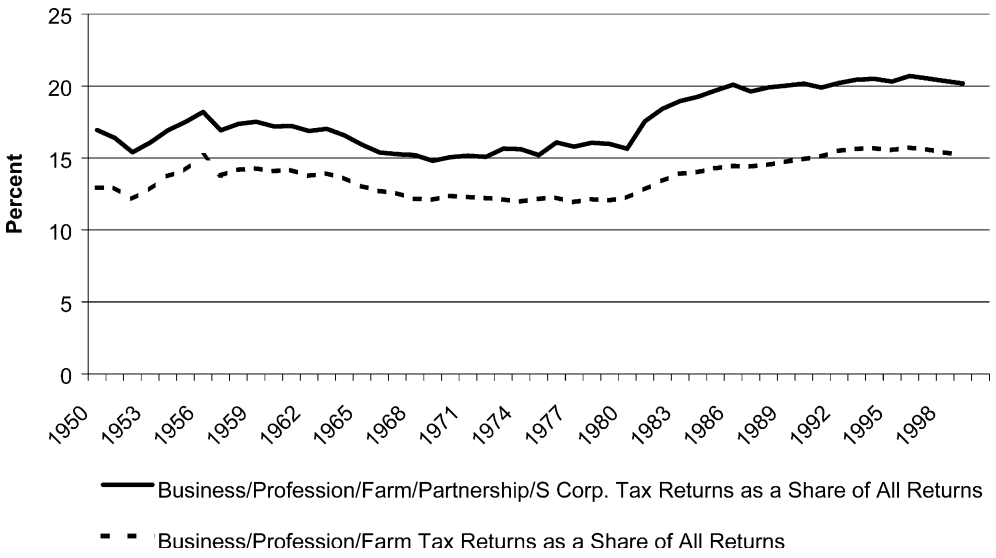

Figure 1. Entrepreneurship Rates from IRS Data 1950–2000.

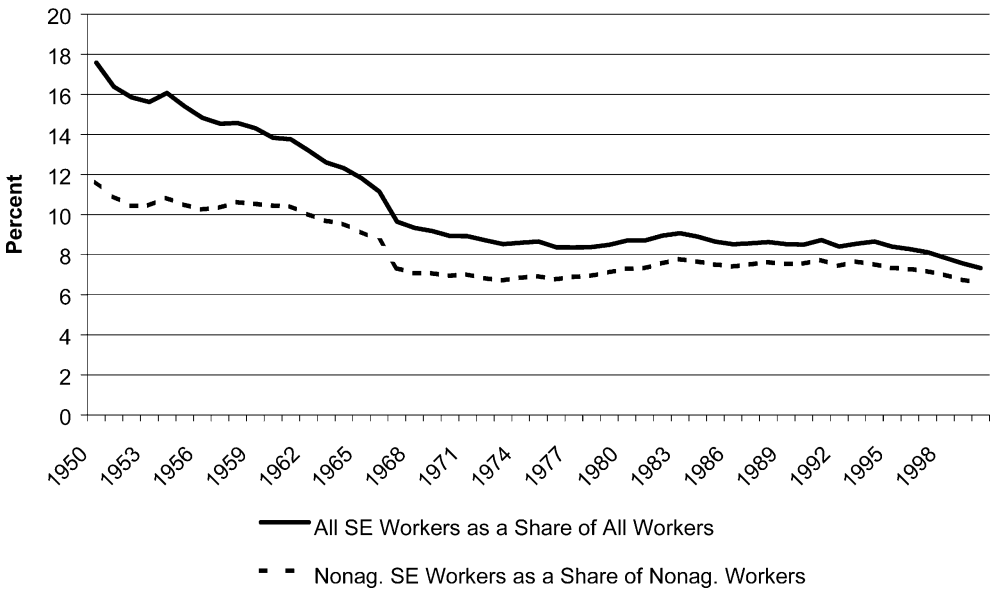

Figure 2. Entrepreneurship Rates from BLS Data 1950–2000.

inherent risk, however, as discussed above, and thus have ambiguous effects on self-employment rates.[8] Second, while the current payroll tax system taxes wage income and self-employment income at the same rate, this has not always been the case as shown below.[9] The eroding payroll tax preference toward self-employment income might have reduced the amount of entrepreneurial activity.

Third, capital gains taxes are also important, as they affect the net return from (and inevitably the supply of) capital that is provided to finance new ventures. While capital gains tax rates do not likely have a direct impact on many entrepreneurs, they might affect marginal investment decisions among venture capitalists, angel investors (family and friends), and entrepreneurs themselves.[10] Fourth, recent empirical evidence suggests that differences in tax rates on personal and corporate income can affect entrepreneurial activity, especially if the top personal income tax rate lies below the top corporate income tax rate. In such a scenario, corporate income might be restructured as individual income in order to reduce a firm's overall tax burden, potentially increasing observed self-employment rates in the process.[11] Finally, small businesses have figured prominently in the recent debate over the estate tax, with "death-tax" opponents suggesting that it causes many family firms to wither unnecessarily.[12]

We use the highest statutory tax rates from the personal income, payroll, capital gains, and corporate income in our empirical analysis. While many entrepreneurs do not actually face these top rates, a number of considerations make them appropriate as control variables. First, the top rates are very clear policy signals which might affect aggregate measures of entrepreneurial activity, even if individual-specific effective tax rates differ from them. Second, they represent easily measurable indicators of tax policies and proxy for maximum "next dollar" tax liabilities. Third, our use of top tax rates facilitates comparisons with earlier studies, many of which used similar tax rate variables. That said, we discuss results from using measures of effective income tax rates in the discussion that follows.

Figure 3 provides time series plots for three of our key federal tax rate measures: the top marginal income tax rate, the top capital gains tax rate, and the top corporate income tax rate. Despite increases in the late 1960s and early 1990s, the top personal income tax rate has trended downward since 1960. The top capital

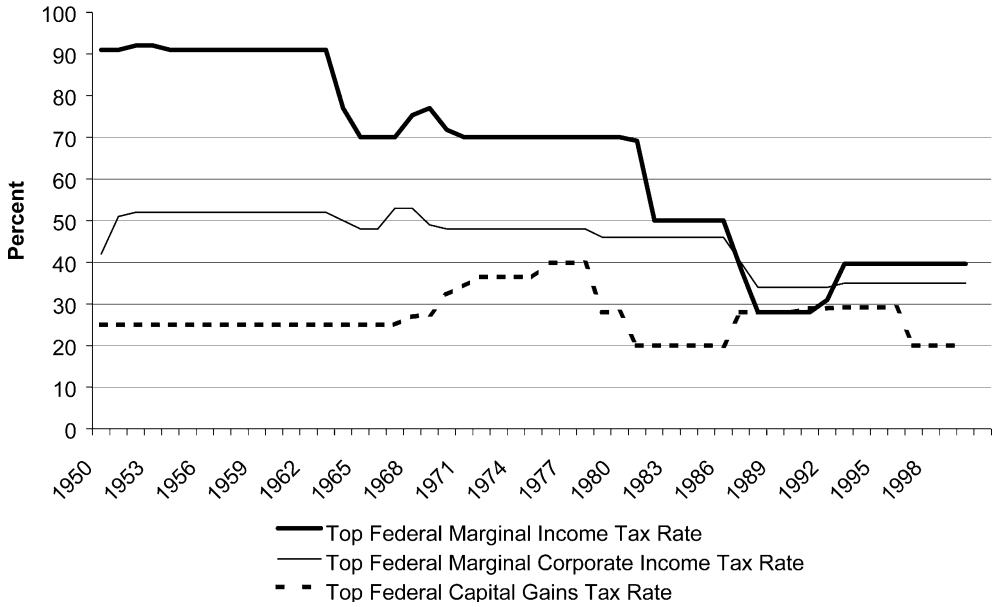

Figure 3. Statutory Tax Rates 1950–2000.

gains rate exhibits a more inconsistent trend. While it has not undergone as many changes over time, those changes have been substantial. An increase of 15 percentage points during the 1970s was more than reversed during the late 1970s and early 1980s. An increase in 1987 was later erased in 1997. The top corporate income tax rate displays the most stable trend, although it is interesting to note that it has always been less than the top personal income tax rate with the exception of a brief period in the late 1980s and early 1990s.

All three series in Figure 3 display a certain degree of volatility, which could have impacted the rates of entrepreneurial activity over time. However, one of the most important areas of differential taxation of entrepreneurs vis-à-vis wage workers has been the payroll tax.[13] While the US payroll tax has been in place since 1937, self-employment income was not covered by it until 1951. Figure 4 shows the net statutory payroll tax rates for wage-and-salary (WS) and self-employed (SE) individuals.[14] From 1951 through the early 1960s, the statutory payroll tax rate on self-employment income was three-fourths of the combined payroll tax rate on wage income. From the early 1960s through 1984, the rate on self-employment income was less than three-fourths of the rate on wage income. In an effort to equalize the treatment of wage and self-employment income in 1984, the gross statutory self-employment payroll tax rate was set equal to two times the wage-and-salary rate. Essentially, self-employed individuals were made liable for payroll taxes equal to the employer and employee shares for wage-and-salary individuals. This change in differential taxation could also have influenced self-employment rates over time.

A final element of tax policy involves the estate tax, which explicitly recognized the importance of small businesses beginning in 1983. From 1983 through 1998, a Special Use Valuation exclusion of $750,000 was permitted for small business owners and farmers, intended to increase the amount of business-related assets that could be shielded from estate tax liability. This preferential treatment was expanded beginning in 1998 via the Qualified Family-Owned Business deduction, such that the combined "small business exclusion" exceeded $1.4 million. Of course, the estate tax is currently being gradually repealed. Nonetheless, these changes in estate tax treatment could have influenced overall self-employment rates.

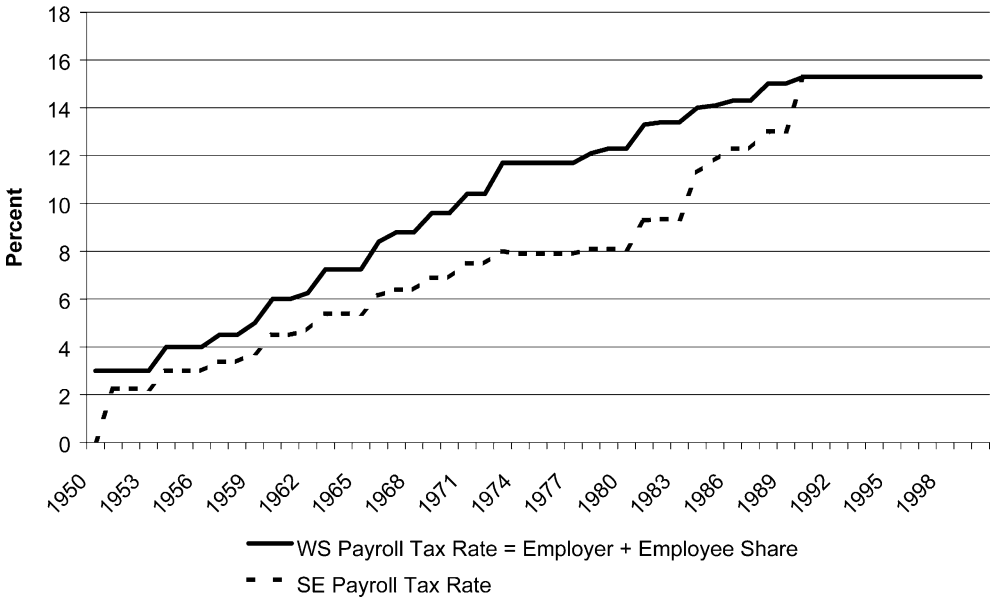

Figure 4. Payroll Tax Rates 1950–2000.

4. Preliminary regression analysis

We begin with a standard time series regression approach, using each of our four measures of self-employment separately as dependent variables. Our set of tax variables includes the top federal personal income, capital gains, and corporate income tax rates, wage and self-employment payroll tax rates, and a dummy for years in which the federal estate tax included a special use valuation or qualified family-owned business exclusion. To accurately gauge the impact of tax policies on entrepreneurial activity in such a framework, we must also control for changes in other factors such as other government policies, macroeconomic conditions, labor market conditions, and demographic characteristics over time in order to avoid potential bias from omitted variables.

We consider changes in the real value of the minimum wage, again following Blau (1987), in order to capture statutory variation in the hiring environment faced by new entrepreneurs as well as the explicit cost of leaving a wage job to become self-employed.[15] For macroeconomic effects, we follow much of the earlier literature by including the growth rate of real GDP, a measure of the stock of wealth, and a prominent interest rate (the prime rate). Our labor market characteristics also draw upon earlier work and include the unemployment rate, the share of the labor force that is female, and the share of the labor force that is employed in the services sector. Additionally, we include the number of work stoppages involving 1000 or more workers. Finally, we control for changing demographics by including the median age in the population, the share of the population with a high school diploma, and a dummy for years in which the President of the US was a Republican. More detailed data definitions and source notes, along with summary statistics, are provided in the Appendix tables.

A full set of multivariate Ordinary Least Squares (OLS) regression results appears in Table I where each of the four columns corresponds to a different measure of entrepreneurial activity as discussed above.[16] Beginning with the tax variables, we find that the top income tax rate has no economically significant effect on our four measures entrepreneurship. While its coefficient is statistically significant in the two BLS regressions, the magnitudes of the coefficients are quite small. It would take a 50-percentage-point cut in the top income tax rate to generate a one-percentage point change in entrepreneurial activity. The elasticities of the BLS entrepreneurship rates with respect to the top income tax rate range from 0.113 to 0.156.[17]

The top capital gains rate exerts a negative influence on all four of our entrepreneurship rates, but again the estimated effects are quite small. It would take a very large capital gains tax rate cut-on the order of 15 to 20 percentage points-to generate a one percentage point increase in entrepreneurship rates. Elasticities range from −0.109 to −0.148.

The top corporate income tax rate is found to have a similar but slightly larger effect, but only for our two BLS measures of entrepreneurial activity (elasticities are on the order of −0.52 to −0.640).[18] This result is striking, as it suggests that an increase the top corporate income tax rate reduces the extent to which workers *report* being self-employed, but it does not influence the extent to which they report ''entrepreneurial'' income on their tax returns. Further, the negative coefficients do not reveal the presence of income shifting between the corporate and personal income tax bases.[19]

The estimated coefficient on the wage-and-salary payroll tax rate is negative for all four specifications, and is statistically significant in all but one of the four regressions. The estimated elasticities of entrepreneurship rates with respect to the wage-and-salary payroll tax rate range from −0.278 to −0.393. A three-percentage-point cut in the wage-and-salary payroll tax rate would increase entrepreneurship rates by about one percentage point, all else (including the self-employment payroll tax rate) constant. A possible explanation for this is that an increase in the wage-and-salary payroll tax rate represents an increase in an entrepreneur's costs of hiring employees. Incidentally, the self-employment payroll tax rate has no discernible influence on any of our entrepreneurship rates. The estate tax exclusion dummy variable is also never statistically significant, suggesting that this

TABLE I
Time series regression results, 1950–1999

Variable	IRS Rate 1	IRS Rate 2	BLS Rate 1	BLS Rate 2
Top income tax rate	0.0044	0.0026	**0.0198**	**0.0182**
	(0.0094)	(0.0140)	**(0.0082)**	**(0.0085)**
Top capital gains tax rate	**−0.0548**	**−0.0909**	**−0.0424**	**−0.0575**
	(0.0135)	**(0.0201)**	**(0.0117)**	**(0.0121)**
Top corporate income tax rate	−0.0054	−0.0054	**−0.1165**	**−0.1208**
	(0.0223)	(0.0332)	**(0.0194)**	**(0.0200)**
WS payroll tax rate	**−0.3662**	−0.0535	**−0.3134**	**−0.2868**
	(0.1215)	(0.1812)	**(0.1055)**	**(0.1091)**
SE payroll rate	0.0003	−0.1026	0.1010	0.0030
	(0.0922)	(0.1375)	(0.0800)	(0.0828)
Estate tax exclusion	−0.2765	−0.2238	0.4452	0.1052
	(0.3297)	(0.4918)	(0.2863)	(0.2962)
Real minumum wage rate	**−0.8364**	**−1.2337**	**−0.2892**	**−0.4850**
	(0.1387)	**(0.2069)**	**(0.1205)**	**(0.1246)**
Real GDP growth rate	−0.0030	*0.0538*	0.0042	0.0066
	(0.0185)	*(0.0276)*	(0.0160)	(0.0166)
Stock of wealth	**−0.1717**	**−0.1384**	−0.0261	−0.0599
	(0.0435)	**(0.0649)**	(0.0378)	(0.0391)
Prime rate	**−0.1289**	**−0.1573**	0.0120	−0.0251
	(0.0400)	**(0.0596)**	(0.0347)	(0.0359)
Unemployment rate	**0.1695**	**0.3021**	**0.1076**	**0.1612**
	(0.0582)	**(0.0868)**	**(0.0505)**	**(0.0522)**
% Female	*0.2666*	**0.5550**	−0.1348	−0.2068
	(0.1549)	**(0.2311)**	(0.1345)	(0.1392)
% Services	0.0282	0.0901	**−0.5062**	0.0637
	(0.1692)	(0.2523)	**(0.1469)**	(0.1520)
Work stoppages	**−0.0027**	*−0.0023*	**−0.0023**	**−0.0020**
	(0.0008)	*(0.0012)*	**(0.0007)**	**(0.0007)**
Median age	**0.2043**	**0.4363**	**0.2656**	**0.3116**
	(0.0795)	**(0.1185)**	**(0.0690)**	**(0.0714)**
% High school	**−0.4190**	**−0.3928**	−0.0544	*0.1118*
	(0.0641)	**(0.0955)**	(0.0556)	*(0.0575)*
Republican president	**0.4589**	**0.5267**	**−0.2492**	**−0.2292**
	(0.0975)	**(0.1454)**	**(0.0847)**	**(0.0876)**
Time trend	**0.5622**	**0.3538**	**0.2182**	**−0.2026**
	(0.1006)	**(0.1501)**	**0.0874**	**(0.0904)**
Constant	**19.8852**	7.2186	**20.8497**	**18.2442**
	(4.5325)	(6.7608)	**(3.9362)**	**(4.0714)**
N	50	50	50	50
$\bar{R}^2$	0.9693	0.9728	0.9844	0.9955
D–W Stat.	1.7352	2.2360	1.9050	2.2098

Note: Bold and italicized type indicate statistical significance at the 5% and 10% levels, respectively.

pro-small-business policy had little to no effect on overall entrepreneurial activity.[20]

Turning to the non-tax variables, the real value of the minimum wage rate is found to have a consistently negative and statistically significant effect on entrepreneurship rates. A one-dollar increase in the real minimum wage rate results in roughly a one-percentage-point drop in our IRS entrepreneurship rates and a one-quarter to one-half percentage point drop in the two BLS rates. This echoes our finding regarding the wage-and-salary payroll tax rate, suggesting that the costs to a new entrepreneur of hiring workers (as measured by the minimum wage rate in this case) could be a substantial barrier to entry. Additionally, this result could be reflecting the increased cost of leaving a wage job to become self-employed if minimum wage

increases tend to be followed by increases at higher wage levels.

The results for our macroeconomic controls are equally mixed. The stock of wealth shows a small and surprisingly negative effect on both IRS rates, but no statistically significant effect on the BLS rates. The prime rate was also found to have a negative effect on both IRS rates, echoing earlier findings (Parker, 1996; Robson, 1998) that a higher cost of borrowed funds is a significant barrier to entrepreneurial activity. Real GDP growth, an essential control in these types of regressions, does not exert an independent influence on any of our entrepreneurship rates.

Labor market characteristics also appear to be important determinants of entrepreneurial activity, namely the unemployment rate and the number of work stoppages. Echoing the findings of Long (1982), Parker (1996), and Cowling and Mitchell (1997), we find that higher unemployment rates are associated with higher entrepreneurship rates. The effect of the number of sizeable work stoppages, while negative and statistically significant in three of our four specifications, is quite small in magnitude.

A few of the remaining factors in Table I are all found to be important predictors of entrepreneurial activity. Increases in the median age tend to increase entrepreneurship rates across the board, suggesting that self-employment is an important and growing labor market option for those nearing (or in) retirement. Entrepreneurship rates, at least those based on IRS data, generally tend to fall as the share of the population with a high school education has increased. Finally, and perhaps most interestingly, having a Republican President translates into higher IRS entrepreneurship rates and lower BLS entrepreneurship rates. This result alone is worthy of additional study, as the magnitudes of the coefficients are relatively large.

To summarize the results in Table I, two prominent themes emerge. First, the choice of definition for entrepreneurial activity is important. Only a few of our results pertain to all of our measures; most were specific to one definition or another. Consequently, empirical time series studies should test the robustness of their findings with alternative measures. Second, while their effects vary across definitions of entrepreneurial activity, taxes do seem to matter. While some of our tax-related findings were surprising, a number of interesting tax effects arose from the time series regressions. This suggests that tax policy *can* play a role in engineering changes in entrepreneurial activity in the economy, for better or worse.[21,22]

To be sure, the estimation of long-run statistical relationships in time series data via standard multivariate regression analysis has been found to be problematic in certain situations.[23] Fortunately, time series econometric techniques have been developed and refined in recent years, such that researchers are now able to more accurately determine underlying relationships between relevant economic factors. Indeed, Parker (1996) was the first to apply these tools to the analysis of taxes and entrepreneurship. The following section expands upon Parker's (1996) approach to test the findings of our preliminary regression analysis.

5. Cointegration and causality analysis

From our simple time series regression results, we are able to identify the possible policy and macroeconomic variables that potentially explain the level of self-employment activity in the economy. However, recent developments in the time series literature suggest that we examine the detailed time series properties of these variables before we can explore any possible relationships among them. We start with standard unit root tests. Following the earlier studies, we employ the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. These tests are almost standard in the literature and hence a detailed discussion of them is omitted.[24]

In spite of their popularity and effectiveness with large samples, these tests are sometimes criticized on the grounds that their failure to reject the null hypothesis (of non-stationarity) is responsible for their low power against 'weakly stationary' alternatives. Kwiatkowski et al. (1992) have highlighted this issue and proposed another test (known as the KPSS test) that takes care of the standard problem by way of using a "parameterization which provides a plausible representation of both stationary and non-stationary variables and which leads naturally to a test of the hypothesis of

TABLE II
Unit root tests

Variables	ADF (Lag)	PP	KPSS		KPSS(Trend)	
			$l = 1$	$l = 4$	$l = 1$	$l = 4$
A. Levels (Log values)						
IRS Rate 1	−1.296 (1)	−1.414	0.951	0.421	0.492	0.217
IRS Rate 2	−1.618 (0)	−1.726	1.501	0.651	0.486	0.215
BLS Rate 1	−1.447 (1)	−1.614	1.729	0.751	0.496	0.217
BLS Rate 2	−1.246 (1)	−1.473	2.144	0.925	0.574	0.248
Top income tax rate	−2.673 (1)	−2.231	2.184	0.941	0.215	0.113
Top capital gains tax rate	−2.668 (2)	−2.078	0.208	0.108	0.206	0.107
Top corporate income tax rate	−2.047 (3)	−3.884	1.989	0.871	0.402	0.211
WS payroll tax rate	−1.628 (11)	−0.253	2.322	1.004	0.614	0.277
Real minimum wage rate	−2.154 (1)	−1.868	0.444	0.215	0.435	0.209
Stock of wealth	−0.726 (0)	−1.174	2.533	1.105	0.197	0.124
Prime rate[a]	−2.979 (1)	−2.136	1.442	0.696	0.284	0.159
Unemployment rate	−2.621 (1)	−2.694	0.786	0.429	0.209	0.128
% Female	0.401 (4)	0.314	2.550	1.084	0.560	0.255
% Services	−1.966 (5)	−2.008	2.566	1.101	0.325	0.167
Work stoppages	−1.613 (0)	−1.485	2.156	0.935	0.485	0.218
Median age	−1.075 (1)	−0.789	1.580	0.684	0.618	0.272
% High school	0.818 (3)	−0.821	2.561	1.095	0.555	0.259
B. First differences (Log values)						
IRS Rate 1	−6.412 (0)	−6.446	0.168	0.146	0.114	0.101
IRS Rate 2	−6.476 (0)	−6.477	0.202	0.192	0.099	0.097
BLS Rate 1	−4.966 (0)	−5.028	0.283	0.204	0.122	0.092
BLS Rate 2	−4.931 (0)	−5.045	0.517	0.349	0.131	0.099
Top income tax rate	−4.948 (0)	−4.823	0.079	0.079	0.077	0.077
Top capital gains tax rate	−3.534 (1)	−6.655	0.131	0.101	0.066	0.052
Top corporate income tax rate	−5.378 (1)	−6.887	0.294	0.304	0.083	0.093
WS payroll tax rate	−5.467 (1)	−7.646	0.867	0.735	0.036	0.072
Real minimum wage rate	−2.220 (7)	−6.766	0.077	0.104	0.067	0.092
Stock of wealth	−5.555 (0)	−5.524	0.232	0.229	0.112	0.113
Prime rate[a]	−5.886 (1)	−5.004	0.069	0.105	0.035	0.055
Unemployment rate	−5.972 (1)	−7.474	0.068	0.099	0.050	0.075
% Female	−1.723 (3)	−5.749	0.865	0.735	0.081	0.112
% Services	−4.836 (2)	−5.217	0.245	0.257	0.052	0.061
Work stoppages	−8.465 (0)	−8.406	0.240	0.246	0.061	0.066
Median age	−8.107 (0)	−7.998	0.714	0.603	0.071	0.095
% High school	−4.673 (0)	−4.583	1.108	0.741	0.088	0.078

[a]Not in log values.

stationarity'' (Kwiatkowski et al., 1992, p. 161).[25] Since we are dealing with smaller sample size, it should be noted that this KPSS test helps to provide a proper conclusion on time series properties of the variables, in the event that the other two tests were biased towards the null.

All these unit root tests are conducted on the log values of the variables (except the prime rate) with time trend in the specifications. For the first two unit root tests, Akaike's Final Prediction Error (FPE) and Shwarz's (SBC) criterion determine the lag lengths. However, for the KPSS test, following the trend in the literature, lag truncation parameters of one and four are used. The test results are reported in Table II. The ADF and PP test results for all the variables do not reject the null hypothesis of non-stationarity in levels while rejecting the null in first differences at the 5 percent level. The only exception is the ADF test on the first log difference of the real minimum wage rate, where

the null could not be rejected even at the 10 percent level.

Overall, the evidence from these two tests indicates that all of our variables are non-stationary in levels but stationary in first differences. As discussed earlier, the KPSS test, unlike the other two, is based on the null of stationarity. Fortunately, this test confirms the findings of the ADF and PP test results. The overall evidence-non-rejection of the null by both ADF and PP and rejection by KPSS-is supportive of non-stationarity of order one. Therefore, the statistical characteristics of the variables fulfill the necessary requirements for searching for common stochastic trends among them.

The next task is to search for the presence of any stable long run relationships among the variables. Recent developments in the literature suggest the use of multiple cointegration tests based on the maximum likelihood estimation (MLE) method in a vector auto regressive (VAR) set-up.[26] Four sets of possibly cointegrated variables are considered, one set for each of our four measures of self-employment. The other member variables considered in each set are those that were found to be statistically significant in the initial time series regression analysis (Table I).[27]

The estimation procedures involve both the maximum eigenvalue and trace tests. The calculated test statistics are reported in Table III. Panels A and B report the estimated values of the λ_{max} and λ_{trace} test statistics, respectively, for different values of r (the number of cointegrating vectors). The test evidence is quite conclusive. For each of the four entrepreneurship rates, both of our test procedures reject the null of zero cointegrating vectors in favor of the respective alternatives. Hence in each of these cases there should be at least one and as many as two stable long run relationships among the variables. These results suggest that self-employment rates and tax variables do in fact have some stable relationships *in the presence of other significant variables*. Further, the relationships identified by our multiple cointegration analyses very closely mirror those from our regression analyses in Table I.[28]

TABLE III
Multiple cointegration test results

		IRS Rate 1	IRS Rate 2	BLS Rate 1	BLS Rate 2
A. Maximum eigenvalue tests:					
Null hypothesis	*alternative hypothesis*				
$r = 0$	$r = 1$	89.24*	86.79*	90.12*	90.27*
$r = 1$	$r = 2$	71.59*	48.60	79.26*	73.57*
$r = 2$	$r = 3$	49.14	36.83	46.76	48.65
$r = 3$	$r = 4$	48.35	31.12	44.22	35.47
$r = 4$	$r = 5$	34.57	22.77	34.46	27.96
$r = 5$	$r = 6$	19.46	17.54	27.04	12.89
$r = 6$	$r = 7$	17.75	16.49	15.47	10.17
$r = 7$	$r = 8$	14.39	5.69	12.23	9.43
$r = 8$	$r = 9$	8.64	4.04	11.00	3.79
B. Trace tests:					
Null hypothesis	*alternative hypothesis*				
$r = 0$	$r \geq 1$	358.74*	269.88*	365.12*	312.21*
$r = 1$	$r \geq 2$	269.50*	183.09*	275.00*	221.93*
$r = 2$	$r \geq 3$	197.91*	134.49	195.74*	148.36*
$r = 3$	$r \geq 4$	148.77	97.66	148.98	99.71
$r = 4$	$r \geq 5$	100.43	66.55	104.75	64.24
$r = 5$	$r \geq 6$	65.85	43.77	70.29	36.28
$r = 6$	$r \geq 7$	46.40	26.23	43.25	23.39
$r = 7$	$r \geq 8$	28.65	9.74	27.78	13.22
$r = 8$	$r \geq 9$	14.27	4.04	15.55	3.79

Note: *Indicates significance at the 5% level. See Osterwald-Lenum (1992).

To get more directly at the extent to which entrepreneurial activity is affected by tax policies, we turn to an examination of the bivariate relationships between the different definitions of self-employment and our various tax policy variables. At the empirical level we proceed in two ways. We first search for common stochastic trend(s) among the variables and their relationships by way of error-correction models in cases where the two variables are cointegrated, and then establish causal relationships among the variables that are not cointegrated by following in the spirit of Granger (1969) causality.

We find that the top corporate income tax rate is the only tax variable that is cointegrated with all four self-employment rates, as shown in Table IV. This reflects the possibility that businesses are more likely to be organized as unincorporated sole proprietorships when corporate income tax rates are high. Contrary to our preliminary regression results, this could also indicate the presence of income shifting between

TABLE IV
Bivariate cointegration test results

		Tax variables				
		TITR	TCGTR	TCITR	PTAXWS	PTAXSE
IRS Rate 1 and tax variables:						
A. Maximum eigenvalue tests						
Null hypothesis	*Alternative Hypothesis*					
$r = 0$	$r = 1$	4.62	5.81	22.55*	8.39	7.45
$r = 1$	$r = 2$	2.09	2.23	2.37	6.07	5.28
B. Trace tests:						
Null Hypothesis	*Alternative Hypothesis*					
$r = 0$	$r \geq 1$	6.71	8.08	24.92*	14.46	12.73
$r = 1$	$r \geq 2$	2.09	2.23	2.37	6.07	5.28
IRS Rate 2 and tax variables:						
A. Maximum eigenvalue tests						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r = 1$	5.53	5.56	22.81*	9.72	7.38
$r = 1$	$r = 2$	3.57	3.31	2.83	4.56	6.69
B. Trace tests:						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r \geq 1$	9.10	8.87	25.63*	14.28	14.07
$r = 1$	$r \geq 2$	3.57	3.31	2.83	4.56	6.69
BLS Rate 1 and tax variables:						
A. Maximum eigenvalue tests						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r = 1$	4.71	7.52	19.20*	10.79	9.01
$r = 1$	$r = 2$	3.03	3.28	1.65	3.73	6.69
B. Trace tests:						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r \geq 1$	7.74	10.80	20.85	14.52	15.69
$r = 1$	$r \geq 2$	3.03	3.28	1.65	3.73	6.69
BLS Rate 2 and tax variables:						
A. Maximum eigenvalue tests						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r = 1$	6.50	9.50	19.29*	13.49	11.26
$r = 1$	$r = 2$	3.54	4.41	3.58	5.26	6.75
B. Trace tests						
Null hypothesis	*Alternative hypothesis*					
$r = 0$	$r \geq 1$	10.04	13.91	22.87	18.75	18.01
$r = 1$	$r \geq 2$	3.54	4.41	3.58	5.26	6.75

Note: * indicates significance at the 5% levels.

corporate and personal tax systems. For all other tax variables the tests fail to reject the null hypothesis of no cointegration, suggesting that taxes and entrepreneurship share no other stable long run relationships.

Since the top income and capital gains tax rates and both payroll tax rates are not individually cointegrated with any of our self-employment rates, we can employ the standard Granger test (1969) to address the issue of possible causality running from these tax variables to self-employment rates. For this we need to use first-differenced data.[29] However, major limitations of this parametric test include its sensitivity to the specific functional forms of the variables used in the regression equation and its assumption of the homoskedasticity and normality of the residuals. As a result, it becomes important to employ the non-parametric version of the Granger test as proposed by Holmes and Hutton (1988, 1990), who argue that the causal ordering between X_t and Y_t is identical with the causal ordering between $g(X_t)$ and $h(Y_t)$ where g, $h \in H$ (H is a set of all monotonic transformations). Along these lines, they propose rank transformation, which forms under certain conditions a special case of monotonic transformation and requires the estimation of the following linear regression equation:

$$R(Y_t) = \alpha + \sum_{i=1}^{n1} \beta_i R(X_{t-i}) + \sum_{j=1}^{n2} \delta_j R(Y_{t-j}) + \xi_t$$

where $R(A)$ is rank transformation of A. If X_t (one of the tax variables) causes Y_t (one of the self-employment rates), the null hypothesis $\beta_i = 0$ for all i may be rejected in favor of the alternative hypothesis that $\beta_i = 0$ at least for some i.

To proceed, we first need to select the lag lengths of $n1$ and $n2$ in the above regression equation. We first fix the length of the autoregressive part $n2$ and then select $n1$ conditional upon $n2$, using Akaike's Final Prediction Error (FPE) and Schwartz's (SBC) criterion in both stages. Interestingly, the multiple rank test statistics reveal only one causal relationship, from payroll tax rates on wage and salary and self-employment income to *BLS Rate 2*. For the rest of the bivariate combinations, we cannot reject the null hypothesis of no causality at the 5 percent significance level.

6. Summary and conclusions

This study extends the time series literature on tax policy and entrepreneurship in several ways. First, we consider the effects of a broad set of tax policies (including income, payroll, capital gains, corporate income, and estate taxes). We also use more recent data, which allows us to exploit the variation brought about by the major tax reform acts of the 1980s and 1990s. Further, we use more advanced time series econometric tools and test our baseline findings with various measures of self-employment.

Our preliminary regression analysis shows that the top income and capital gains tax rates exert negative but quantitatively small influences on entrepreneurship rates. The top corporate income tax rate is found to have a larger negative effect, but only for the entrepreneurship rates that are derived from BLS labor market surveys. The payroll tax rate on wage employment is negative and statistically significant in three of our four specifications, while the self-employment payroll tax rate and our dummy for estate tax exclusions aimed at small businesses have no discernible influence on entrepreneurship rates.

Multiple cointegration analysis confirms the existence of stable long-run relationships between tax policy variables and self-employment rates in the presence of other statistically significant controls. However, pairwise cointegration analysis reveals that the top corporate income tax rate is the only tax variable that is cointegrated with all four self-employment rates. Furthermore, results from multiple rank causality analysis indicate only one causal relationship between any of our tax variables and self-employment rates. Specifically, we find that both payroll tax rates (on wage and self-employment income) exert a causal influence on our broadest BLS self-employment rate.

Where does this leave us? First, while we find some evidence that tax policies can affect self-employment rates, magnitudes are typically quite small and suggest that it would take a prohibitively large tax rate change to generate a noticeable change in self-employment activity. Nonetheless, our findings that (1) the top

corporate income tax rate is cointegrated with all of our measures of entrepreneurial activity, (2) payroll tax rates are causally related to one of our measures, and (3) both of these tax rates exert the largest effects on entrepreneurship in our time series regressions all reveal that the self-employed can indeed be affected by tax policies.

While these results do not provide specific policy prescriptions for engineering socially optimal levels of entrepreneurial activity, they suggest that corporate income tax and payroll tax rate changes (e.g., to deal with recent problems with the corporate income tax or social security funding) can have consequences for entrepreneurial activity. In the end, however, our results indicate that tax policies in isolation are not good instruments for generating changes in the level of entrepreneurial activity.

APPENDIX

TABLE A1
Summary statistics, 1950–1999

Variables	Mean	Std. deviation	Minimum	Maximum
Top income tax rate	65.298	21.816	28.000	92.000
Top capital gains tax rate	27.182	5.500	20.000	39.880
Top corporate income tax rate	45.460	6.743	34.000	53.000
WS payroll tax rate	10.380	4.336	3.000	15.300
SE payroll tax rate	8.450	4.533	0.000	15.300
Estate tax exclusion	0.340	0.478	0.000	1.000
Real minimum wage rate	4.722	0.541	3.658	5.797
Real GDP growth rate	3.572	2.450	−2.000	8.700
Stock of wealth	15883.2	8269.9	5966.8	39968.1
Prime rate	7.195	3.564	2.069	18.87
Unemployment rate	5.704	1.551	2.900	9.700
% Female	39.293	5.500	29.560	46.535
% Services	16.958	5.854	9.242	29.169
Work stoppages	208.26	141.17	17.00	470.00
Median age	30.622	2.177	27.800	35.500
% High school	60.818	15.559	34.300	83.400
Republican president	0.560	0.501	0.000	1.000

TABLE A2
Correlation table, 1950–1999

Variables	IRS rate 1	IRS rate 2	BLS rate 1	BLS rate 2
Top income tax rate	−0.548	−0.745	0.682	0.776
Top capital gains tax rate	−0.446	−0.416	−0.362	−0.268
Top corporate income tax rate	−0.648	−0.784	0.479	0.576
WS payroll tax rate	0.366	0.600	−0.856	−0.931
SE payroll tax rate	0.590	0.755	−0.721	−0.818
Estate tax exclusion	0.767	0.905	−0.397	−0.519
Real minimum wage rate	−0.542	−0.484	−0.486	−0.447
Real GDP growth rate	−0.054	−0.052	0.205	0.214
Stock of wealth	0.616	0.759	−0.646	−0.732
Prime rate	0.072	0.341	−0.646	−0.700
Unemployment rate	0.097	0.276	−0.324	−0.409
% Female	0.418	0.650	−0.823	−0.904
% Services	0.604	0.770	−0.693	−0.785
Work stoppages	−0.746	−0.867	0.418	0.581
Median age	0.842	0.908	−0.164	−0.276
% High school	0.467	0.690	−0.793	−0.878
Republican president	−0.022	0.040	−0.050	−0.035

TABLE A3
Data definitions and source notes

Variable	Definition
Top income tax rate	Highest US federal personal income tax rate (%).
Top capital gains tax rate	Highest US federal personal capital gains tax rate (%).
Top corporate income tax rate	Highest US federal corporate income tax rate (%).
WS payroll tax rate	Statutory US federal payroll tax rate on wage-and-salary income (%).
SE payroll tax rate	Statutory US federal payroll tax rate on self-employment income (%).
Estate tax exclusion	Dummy = 1 for years in which a special estate tax exclusion was permitted for small businesses (i.e., Special Use Valuation for 1983–2000 and Qualified Family-Owned Business for 1998–2000).[a]
Real minimum wage rate	Value of the US minimum wage (\$ 1996).[b]
Real GDP growth rate	Growth rate of inflation-adjusted Gross domestic product (\$ 1996).[c]
Stock of wealth	Flow of funds of the US (\$ billions).[d]
Prime rate	Prime interest rate.[c]
Unemployment rate	US Unemployment Rate.[c]
% Female	Percent of labor force age 14 and over that is female (%).[e]
% Services	Percent of labor force that is in the services sector (%).[f]
Work stoppages	Number of work stoppages involving 1,000 workers or more.[g]
Median age	Median age of the US population, in years.[h]
% High school	Share of the US population age 25 and over who have completed at least four years of high school (%).[h]
Republican president	Dummy = 1 for years in which the US President was a Republican.

Notes:
[a]*US Master Tax Guide*, CCH, Inc., various years.
[b]Available online at http://www.minimumwage.com.
[c]Federal Reserve Bank of St. Louis *FRED*® Database (http://research.stlouisfed.org/fred/).
[d]*Federal Reserve Statistical Release*, Federal Reserve Board of Governors, Table R100.
[e]*Current Population Survey*, US Bureau of Labor Statistics, various releases (http://www.bls.gov/cps/home.htm).
[f]*Handbook of Labor Statistics*, US Bureau of Labor Statistics, various years.
[g]*Compensation and Working Conditions: Summer 2000*, US Bureau of Labor Statistics.
[h]*Statistical Abstract of the United States*, US Department of Commerce, Bureau of the Census, various years.

Notes

[1] We recognize that not all entrepreneurs are self-employed, and that not all self-employed workers could be called entrepreneurs. However, we focus on self-employment because it is the most easily measured indicator of entrepreneurial activity, and has therefore been used most frequently in prior literature. Further, following earlier work, we do not focus solely on successful entrepreneurs. An examination of the effects of tax policy on entrepreneurial success, which would indeed be quite interesting, is left for future research.

[2] Robson's (1998) study, which relied on UK data, considered the effects of the corporate tax rate on small firms and tax rates under the Selective Employment Tax. Both were found to increase self-employment rates.

[3] Specifically, *IRS Rate 1* includes returns with either a Schedule C (small business/profession) or Schedule F (farm) attached.

[4] To be sure, such a calculation will be affected by changes over time in the tax filing population. In other words, if policy changes cause certain groups to be moved on or off the tax rolls, and if those groups are more or less likely than remaining filers to be entrepreneurs, our calculated rates could change as a result of nothing more than changes in the tax filing population. We return to this issue in the discussion of the empirical results below.

[5] Changes over time in the BLS measurement of the labor force are explored in greater detail below.

[6] While *IRS Rates 1 and 2* are defined using tax return, or household, data, it should be noted that all filing statuses (e.g., single, married filing jointly, married filing separately, etc.) are included.

[7] State and local tax policies can also have important effects, but an analysis of them is beyond the scope of our national time series study.

[8] See Bruce (2000, 2002), Cullen and Gordon (2002), Gentry and Hubbard (2000), and Schuetze (2000) for a more detailed discussion and for recent empirical evidence.

[9] See Bruce (2000, 2002) for additional discussion.

[10] Poterba (1989) discusses the relevant issues regarding entrepreneurship and capital gains taxes, and reveals that most venture capital is not subject to individual (i.e., personal) capital gains taxation. Nonetheless, we include the top capital gains rate in our analysis due to policy interest, as policy

makers continue to claim that capital gains tax rate cuts are good for small businesses.

[11] See Gordon and Slemrod (2000) for recent empirical evidence.

[12] Holtz-Eakin (1999) discusses many of the relevant issues regarding the effects of estate taxes on entrepreneurship. Despite questionable evidence on the effects of estate taxes on entrepreneurial activity, we include it in our analysis due to policy interest as with the capital gains tax discussed above.

[13] We do not fully consider the benefits provided from payroll tax revenues because the Social Security and Medicare systems do not have separate programs for self-employed workers. In other words, changes in the relative payroll tax treatment of self-employed workers have not been accompanied by changes in their relative treatment under the Social Security program.

[14] The ''net'' rates are inclusive of the credits and exclusion amounts used to phase in the changes enacted in 1984. It should be noted that as of 1990 the self-employment payroll tax applies to only 92.35 (or, 100-7.65) percent of self-employment earnings, and half of the self-employment taxes due may be deducted in computing adjusted gross income (AGI). The gross, pre-credit, statutory social security tax rates for wage-and-salary (employer plus employee contribution) and self-employment have been identical since 1984.

[15] Another reason for including the minimum wage rate is that it is a direct policy variable which might place a disproportionate burden on smaller businesses. This notion is reflected in the *de minimus* provision in the Fair Labor Standards Act which protects the smallest businesses from having to pay the minimum wage.

[16] An examination of the appropriate Durbin–Watson statistics and other tests for autocorrelation led us to choose OLS as our baseline methodology. Experimentation with a first-order autoregressive specification yielded virtually identical results to those in Table I.

[17] To test the sensitivity of these results, we replaced the top income tax rate with two different measures of an effective income tax rate. The first of these was calculated as the ratio of total federal individual income tax collections to total national personal income, while the second was the ratio of total federal individual income tax collections to total national adjusted gross income. These experiments yielded qualitatively similar results for the income tax rate and all other variables in the models.

[18] Robson (1998) was the only earlier study to examine the importance of corporate income tax rates. While we use the top corporate income tax rate, he used the (UK) corporate income tax rate for small firms and found a statistically significant positive effect on self-employment rates.

[19] For an income-shifting story to hold, we would expect to find that an increase in the top corporate income tax rate, holding the top personal income tax rate constant, would increase the self-employment rate.

[20] This is perhaps unsurprising given the small percentage of small businesses (or estates, generally) that eventually face a substantial estate tax liability.

[21] To address the issue regarding the calculation of self-employment rates from variable tax-filing populations (see note 4 above), we re-estimated the regressions in the first two columns of Table I with alternative tax-based self-employment rates. For these rates, we divided the number of tax returns with income from a small business or farm by the total work force, rather than the total number of tax returns, in each year. Results from this exercise were virtually identical to those in Table I, and thus are not reported here.

[22] We explore the importance of changes in the BLS labor force variables first by including dummy variables for major definition regimes and second by including a dummy for non-comparable years in the data series. Neither of these checks resulted in noticeable changes to our baseline findings in Table I.

[23] See Granger and Newbold (1974) for a discussion of these issues.

[24] Refer to Dickey and Fuller (1979, 1981) and Phillips and Perron (1988).

[25] According to KPSS, a time series X_t can be decomposed as: $X_t = \lambda t + \alpha_t + \varepsilon_t$ where $\alpha_t = \alpha_{t-1} + \mu_t$. Here t is a time trend, μ_t follows $iid(0, \sigma_\mu^2)$ and ε_t is a stationary error. The null hypothesis assumes that $\sigma_\mu^2 = 0$. Thus, α_t is viewed as a constant and the null hypothesis is the trend stationary hypothesis. The test statistic is given as: $\eta = T^{-2} \sum S_t^2 / s^2(L)$, where S_t^2 is the sum of the residuals from regressing the series on an intercept and possibly a time trend and $s^2(L)$ is a consistent non-parametric estimate of the disturbance variance. T is the sample size.

[26] Refer to Johansen and Jeselius (1990, 1992) for technical details.

[27] The dummy denoting Republican Presidents is excluded from the multiple cointegration analysis.

[28] More detailed results from the multiple cointegration analysis are available upon request from the authors.

[29] The standard Granger (1969) causality between two variables, X_t (say a tax variable) and Y_t (self employment rate) could be understood from the following regression:

$$\Delta Y_t = \alpha + \sum_{i=1}^{n1} \beta_i \Delta X_{t-i} + \sum_{j=1}^{n2} \delta_j \Delta Y_{t-j} + \varepsilon_t$$

where $\alpha, \beta_i, \delta_j$ are coefficients and ε_t is a white noise series. Under the hypothesis that X_t causes Y_t, the null that $\beta_i = 0$ for $\forall i$ may be rejected in favor of the alternative hypothesis that $\beta_i \neq 0$ at least for some i.

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