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ABSTRACT

In this paper, we first provide evidence that existing measures of business incomes and valuations based on widely used surveys such as the Survey of Consumer Finances are mismeasured. We then develop a theory disciplined by U.S. national accounts and business census data to measure net incomes and private business *sweat equity*—which is the value of time to build customer bases, client lists, and other intangible assets. We estimate an aggregate sweat equity value of 0.65 times GDP, with little cross-sectional dispersion in valuations when compared to business net incomes and large cross-sectional dispersion in rates of return. Our estimate of sweat equity is close to the estimate of marketable fixed assets used in production by private businesses, implying a high ratio of intangible to total assets. We use the model to evaluate the impact of greater tax compliance of private businesses and lower tax rates on the net income of both privately held and publicly traded businesses. We find larger sectoral and aggregate effects from the tax policy experiments relative to studies that abstract from private business and, in particular, the accumulation of sweat capital. Finally, we show that our results are robust to including nonpecuniary benefits of business ownership.

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1. Introduction

Tax advantages for business income introduced in the Tax Reform Act of 1986 have led to rapid growth in the private U.S. business sector. Much of this growth is attributed to pass-through (or flow-through) entities, which now account for over half of yearly business net income reported to the Internal Revenue Service (IRS).[1] Despite this growth, little is known about these businesses because survey data are unreliable and business valuations depend importantly on unmeasured time—sweat—that owners devote to building *sweat equity*, namely, the value of client lists, customer bases, and other intangible assets.[2] In this paper, we first provide evidence that existing measures of business incomes and valuations are mismeasured and then develop a theory disciplined by U.S. national accounts and business census data to measure net incomes and sweat equity in U.S. private, pass-through business.[3] Once measured, we consider the impact of tax policy changes on private, pass-through businesses and C corporations.

We develop a theory of sweat equity with the key feature that business owners put time into two activities: production of goods and services and accumulation of sweat capital—building client lists, customer bases, goodwill, and so on. Sweat capital is an input of production, along with plant, equipment, and hours. The income generated from sweat capital can be thought of as dividends, whose present value is the sweat equity we are interested in measuring. Each period, individuals choose to run their own business or work for another business, and the choice is driven primarily by their productivity levels in each activity, their accumulated sweat capital, and tax policy, which may be advantageous to time allocated to business. We assume plant and equipment can be rented, and therefore the main start-up cost is the labor input required for the accumulation of sweat capital, which is not pledgeable. As in Aiyagari (1994), productivities are stochastic and individuals are heterogeneous, but in our model, there are two productivity shocks, one affecting business production and another affecting wages of employees. If the shocks are not perfectly

[1] Pass-through entities such as Subchapter S corporations and partnerships distribute all earnings to owners, who, like sole proprietors, report business net incomes on their individual tax returns. See Cooper et al. (2016) and Smith et al. (2017) for details about these businesses based on administrative tax data.

[2] Furthermore, unlike publicly traded C corporations, there are no market prices for ongoing concerns that can be used to infer the total U.S. private business valuation. See Hall (2001), who imputes values for intangible assets using the U.S. flow of funds accounts.

[3] Because of data limitations discussed later, we do not include the sweat equity of private Subchapter C corporations, which earn only a small fraction of total C-corporate net income.

correlated, individuals will switch between the two sectors. When business owners switch, their sweat capital deteriorates with time.

Key parameters of our baseline model are chosen to ensure that model income and product shares are consistent with U.S. national account data, model taxable income distributions are consistent with IRS data, and model business age profiles and hours are consistent with U.S. Census data. For this baseline, we estimate an aggregate sweat equity value of 0.65 times GDP, which is close to the estimate of fixed assets used by private businesses. We find little cross-sectional dispersion in sweat equity valuations when compared to business net incomes. This result follows from the fact that there is a lot of switching in and out of business ownership in the United States. Since the model matches this feature of the data, individuals in the model have similar expectations of the present value of future dividend incomes arising from the accumulation of sweat capital, even if their current business incomes are very different. Little dispersion in valuations and large dispersion in incomes means that we find large differences in the implied rates of return on sweat equity. The 5th to 95th percentile range for business owners is -50 to 100 percent returns. The range for all individuals is slightly smaller at -40 to 60 percent since there are many with no private business dividends.[4]

Once we have measured the sweat equity for the baseline, we use the model to estimate the impact of tax policy changes on the sweat equity valuations and other key economic aggregates. We first consider policies ensuring greater tax compliance of private businesses, who understate their adjusted gross incomes by roughly 50 percent according to calculations of the Bureau of Economic Analysis (BEA). We find that enforcing tax compliance would have a significant, negative impact on labor inputs and sweat capital in private business production. We also consider policy changes that lower business tax rates, on both pass-through businesses and Subchapter C corporation profits. If we lower both business tax rates by 10 percentage points, we find wages and GDP higher by 5 percent, C-corporate output higher by 6.5 percent, private business output higher by 9 percent, and sweat equity higher by 6 percent.

[4] Hall and Woodward (2010) use data on start-ups backed by venture capitalists to recover an estimate of entrepreneurial returns and find that the risk-adjusted returns are very low. These entrepreneurs are primarily organized as C corporations because of restrictions on pass-through entities for issuing preferred shares and therefore would not be included in our analysis.

The impact of tax changes depends on the degree to which individuals are able to substitute between running a private, pass-through business and working for a C corporation. Comparing our baseline results to a one-sector version of the model analyzed by Aiyagari and McGrattan (1998), we find larger effects of lowering rates on corporate profits because individuals have the opportunity and willingness to switch out of private businesses and into public businesses. For example, Aiyagari and McGrattan (1998) would predict almost no change in corporate hours in response to a 10 percentage point decline in the tax rate on profits, whereas we find a 2.8 percent rise, which is due primarily to individuals switching between sectors.

Our paper is related to studies of small businesses and entrepreneurship. There are now many quantitative theories of entrepreneurship. Most of them model entrepreneurs as agents employing physical capital subject to uninsurable idiosyncratic risk and financing constraints. See, for example, Angeletos and Calvet (2006) for a model with uninsurable capital income risk and Buera (2009), Cagetti and De Nardi (2006), Dyrda and Pugsley (2017), Li (2002), Meh (2005), and Quadrini (1999, 2000) for analyses of models with both uninsurable capital income risks and financing frictions that restrict external equity and assume collateral constraints on debt. These studies mainly focus on the role of financial frictions in accounting for dispersion in survey-based measures of wealth and income.[5] Also related to our study are Hurst and Pugsley (2011, 2017), who model entrepreneurial choices as driven by nonpecuniary benefits of owning a business and use their theory to account for survey-based differences in business incomes and wages.[6] None of these studies explicitly model the accumulation of the business owners' sweat in building the business and therefore cannot be used to estimate aggregate or cross-sectional valuations of this key business asset or the impact of changes in taxation of pass-through entities.[7]

Empirically, we differ from the literature in our choice of facts to use for disciplining the theory. Much of the literature has used survey data on business net incomes and valuations

[5] The literature on factor misallocation uses similar theories of entrepreneurs to quantify cross-country differences in aggregate productivity. See, for example, Buera and Shin (2013), Midrigan and Xu (2014), and Restuccia and Rogerson (2008), and Hopenhayn's (2014) survey for a complete list of references.

[6] We analyze an extension of our model with nonpecuniary benefits and find that our quantitative results are robust to adding this feature.

[7] In other literatures, researchers model investments in intangible capital—including brand and customer capital—to study trade patterns, asset pricing, firm dynamics, and business cycles, but they do not model the entry and time-use decisions of small business owners. See, for example, Arkolakis (2010), Belo, Lin, and Vitorino (2014), Drozd and Nosal (2012), Gourio and Rudanko (2014), and McGrattan and Prescott (2010a,2010b).

from the Federal Reserve's Survey of Consumer Finances (SCF), the Kauffman Foundation's Firm Survey (KFS), or the Census Bureau's Survey of Income and Program Participation (SIPP).[8] We document large differences between survey responses about taxable business incomes and the actual business incomes reported on tax forms. Furthermore, the errors are not systematically biased. In the SCF, most respondents overstate business incomes. In the SIPP, most respondents understate business incomes. In the KFS, respondents overstate both revenues and expenses and understate net incomes. The percentage errors vary widely over time and in the cross section. These reporting errors cast serious doubt on the accuracy of self-reported assessments of business valuations, especially for businesses with significant sweat equity.

2. Data

In this section, we motivate our interest in accounting for the sweat equity of private, pass-through businesses and describe data that can be used to guide our theory and measurement. We start with statistics from Pratt's Stats on business transactions and show that intangible assets—both identifiable assets such as customer and client lists and nonidentifiable assets such as goodwill—are a significant fraction of the transacted values.[9] While Pratt's Stats can be used to highlight the importance of intangible assets, this transaction dataset is not a representative sample of all business sales and does not include information for ongoing businesses. The Federal Reserve Board's widely used SCF does have information on taxable incomes and self-reported wealth for actively managed businesses, but we document here that the survey responses by proprietors, partners, and S-corporation owners to questions about their business incomes are not reliable. We also compare survey responses of the KFS and the SIPP to IRS data and find large differences.[10] For information on business incomes, we instead use data from the IRS, and for information on business owners, we use data from the U.S. Census Bureau's Survey of Business Owners (SBO). The SBO provides information on turnover rates of business, time allocation to business operations,

[8] See, for example, Benhabib, Bisin, and Luo (2015), Cagetti and De Nardi (2006), Hamilton (2000), Hurst and Pugsley (2011, 2017), Kartashova (2014), McGrattan and Prescott (2010a), Meh (2005), Moskowitz and Vissing-Jorgensen (2002), and Quadrini (1999, 2000).

[9] Pratt's Stats is a database with complete financial data on over 27,000 acquired private companies.

[10] See Bhandari, Birinci, McGrattan, and See (2018), who do a comprehensive study of all surveys that ask questions about businesses, compare outcomes with aggregated administrative data, and document large inconsistencies in business incomes, receipts, and number of returns.

and financing requirements for business start-ups. Finally, we report relevant statistics from the U.S. national accounts that will be matched to our model aggregates.

2.1. Business Acquisition Data

A key finding from business transactions data is that roughly 50 percent of the value is allocated to assets categorized by the IRS as intangible, regardless of the business industry, age, legal structure, or size.[11] These intangible assets include customer- and information-based intangibles, trademarks, trade names, franchises, contracts, patents, copyrights, formulae, processes, designs, patterns, noncompete agreements, licenses, permits, and goodwill. In Table 1, we report ratios of intangible asset values to the total assets for a sample of 6,855 sales of businesses over the period 1994–2017.

We restrict attention to U.S. private businesses in three legal organization categories, namely, S corporations, sole proprietorships, and partnerships, and we report the ratios by industry, age, and different measures of business size.[12] The ratio of intangible asset value to total asset value for all transactions has a mean of 58 percent and a median of 64 percent, with the remaining value attributed to cash, trade receivables, inventories, fixed assets, and real estate. We think of these estimates as lower bounds for ongoing concerns, in part because there could be reputational loss with a new owner.

The estimates are almost the same across legal structure, although most of the transactions are for S corporations. By industry, we find some variation in the intangible intensity, with agriculture, mining, and utilities (NAICS 11–22) at the low end, averaging 44 percent, and information and financial (NAICS 51–53) at the high end, averaging 80 percent. By age, we find an increase in the intangible intensity, starting at an average of 44 percent for new enterprises and plateauing at an average of 58 percent after 15 years. Conditioning on size, we find the intangible intensity rises with sales and assets, but falls with the number of employees. Overall, the ranges of the reported statistics are not wide.

[11] Both buyers and sellers file an asset acquisition statement (Form 8594) with the IRS that specifies the allocation of the purchase price to specific assets. These forms are used to determine the purchaser's depreciable assets and the seller's capital gain or loss.

[12] We exclude C corporations because most are public, and we exclude limited liability companies because Pratt's Stats does not provide details on the owner's legal status. In Bhandari and McGrattan (2017), we report the statistics for the entire database.

2.2. Household Survey Data

One disadvantage of the Pratt's Stats sample is that it is not representative and does not include data for continuing businesses. A widely used representative sample for all businesses is the SCF household survey, which is specifically designed to provide information about household wealth, including business wealth. One possible issue with the SCF is that the business valuations are not based on transactions but rather are self-reported and therefore unlikely to be accurate estimates for intangible-intensive businesses. A second and more serious issue is that the business income data—which could potentially be capitalized to provide an alternative estimate of business wealth—are not consistent with IRS data even though the households are asked to report specific lines from their tax forms.

In Table 2, we show data for the 2007 survey (with all other years shown in Bhandari and McGrattan (2017)) from the SCF, which is directly comparable to the 2006 tax year data from the IRS.[13] For the individual taxes, we compare incomes for sole proprietors who file Schedule C with their individual tax form (1040) and partners and S-corporation shareholders who file Schedule E with their individual tax form. Since the SCF asks about all Schedule E income, we include income to estates, trusts, rents, and royalties along with income to partners and S-corporation shareholders.

The first three columns of Table 2 show results for sole proprietors and the second three for partners and S-corporation shareholders. The first row reports total income in billions for all returns, and the rows below have data for subgroups of tax filers who are ranked by their adjusted gross income (AGI). The total Schedule C income earned by sole proprietors reported to the IRS in 2006 was $282 billion. The total Schedule E income earned by partners, S-corporation shareholders, and others who reported supplemental income to the IRS in 2006 was $466 billion. Aggregated responses in the SCF were too high by more than 70 percent. If we consider subgroups of the population, the errors are also large, in some cases negative and in other cases positive. The first subgroup is the bottom half of returns filed, those with the lowest AGI. According to the SCF, sole proprietors in this group earned $31 billion in business income (listed on their Schedule C).

[13] See also Johnson and Moore (2011), who compare the 2001 SCF and 2000 IRS tax year data and find large differences.

The actual tax forms show $50 billion, and therefore we list a −39 percent error. According to the SCF, this same group reported $19 billion in Schedule E income when the actual income on the tax forms was a loss of $41 billion. For the next three groups of filers, incomes reported on the SCF are overstated relative to the actual IRS incomes, and the errors are greater than 50 percent in all cases.

The last three columns of Table 2 compare net incomes of S corporations that file Form 1120S in addition to reporting pass-through distributions on their individual tax forms. In this case, we sort shareholders (as opposed to returns) according to their business receipts and group the bottom half into the first group (0 to 50) and so on. We then report their net incomes on ordinary business. For 2006, S corporations reported $296 billion in net income to the IRS. According to the SCF, the total was $577 billion, 95 percent too high. For the subgroups of shareholders, the incomes are overstated for the first three subgroups—with errors greater than 100 percent—and understated for the businesses with the highest receipts.

When we analyze the data over time, we find many incidents of errors greater than 100 percent. In Figure 1, we report errors for all returns for tax years 1988 to 2012. There are three estimates per year corresponding to the three incomes reported in Table 2. For example, in tax year 2006, the errors for Schedule C filers, Schedule E filers, and S corporations are 78, 73, and 95 percent, respectively. In some years, the errors exceed 200 percent and show no sign of trending downward. Even in 2012, the year with the best results, the errors are 30, 55, and 11 percent, respectively. One reason for the discrepancies between SCF and IRS data is the fact that few respondents refer to tax documents when answering the questionnaire. When the SCF reviewer is asked if the respondents referred to tax documents, an average of 4 percent of households answered that they frequently did in years prior to 2003 and 7 percent did in years after 2003. In most years, an additional 7 or 8 percent answered that they sometimes referred to tax documents. A second reason for large discrepancies in the case of private businesses is the SCF sample size, which is too small to generate a representative sample. For example, in the case of statistics reported in Table 2 for S corporations, the IRS reports data for 3.9 million businesses, while the SCF coverage is only 2.8 million.

In Table 3, we report comparable results for sole proprietors in the SCF and SIPP datasets for tax year 2006. For convenience, we report the same information on sole proprietors from the SCF and IRS as reported in Table 2, alongside new information from the SIPP dataset. In contrast to SCF households, SIPP households significantly understate net incomes. The error for all returns is −57 percent in SIPP and 78 percent in SCF. The error for high-income returns is −86 percent in SIPP and 182 percent in SCF. The only consistent findings are for low-income households who understate their income in both surveys, but the implied errors are still large.[14]

In Table 4, we summarize findings of Gurley-Calvez et al. (2016), who compared responses about receipts, expenses, and profits for businesses in the KFS with matched tax forms. They find that the firms in the survey overstate receipts and overstate expenses by more, leading to understated profits across the distribution. These findings are for the most part in contrast to the SCF versus IRS comparison, which shows that most firms overstate net income.

2.3. Business Census Data

Another representative survey that we analyze is the U.S. Census survey of business owners. The Census data do not include business valuations but do include information about businesses and owners that, along with theory, can be used to infer sweat equity valuations. More specifically, to discipline our model, we use information from the 2007 SBO public use microdata sample (PUMS) on the year of the business acquisition, the hours spent working in the business, and capital sources and requirements for business start-ups.[15]

In Figure 2, we show the percentage of owners by years since acquiring their business. Two profiles are plotted: one for all owners reporting and another for owners for which the business is their primary source of income.[16] Roughly 11 percent of business owners had just acquired the business at the time of the survey. Conditioning on the business being the primary source of

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[14] Business incomes are also reported in two panel surveys conducted by the Institute of Social Research at the University of Michigan, namely, the Panel Study of Income Dynamics (PSID) and the Panel of Entrepreneurial Dynamics (PSED). The questionnaire for the PSID does not ask about the legal entity of the business and therefore cannot be linked to tax forms. The questionnaire for the PSED does ask about the legal entity of the business and taxable incomes, but the response rate for the question asking about profits and losses is only 9 percent for tax year 2006.

[15] A widely used alternative business census dataset is the Longitudinal Business Database (LBD). One disadvantage of the LBD is its exclusion of firms without paid employees. Of the 27 million firms in the SBO, 21 million are nonemployer firms.

[16] The microdata sample includes information for up to four owners of the business. Only 3 percent of the 26.4 million firms have more than four owners.

income, 9 percent of owners had just acquired. The rate of ownership falls to about 5 percent for businesses acquired 5 years ago and 1 percent for businesses acquired 30 years ago.[17]

Using the Census SBO survey, we estimate average weekly hours for all owners and for owners who report that the business income is their primary source of income. There are 37 million owners in businesses with up to four owners working on average 33 hours per week. Of these, 18.3 million report that their primary income comes from the business, and these owners report 44 hours per week on average.[18] Assuming the available stock of workers aged 16 to 64 in 2007 is 197 million and weekly discretionary time is 100 hours, the aggregate time that private business owners devote to their business is roughly 6.2 percent of total available time (that is, $33/100\times 37/197$), with owners that receive primary income from the business contributing 4.1 percent of total available time (that is, $44/100\times18.3/197$).[19] The remaining labor input is allocated to work in C corporations and the government, which is equal to roughly 18 and 4 percent of total time, respectively.

The SBO also provides information on financing needs of private business owners, most of whom are sole proprietors or S corporations and partnerships with one or two owners. Of those businesses reporting a source of start-up capital in the 2007 PUMS sample, only 12 percent had a bank or government loan or guaranty, and most of these owners borrowed a relatively small amount (less than $100,000) when compared to average assets in private businesses. Twenty-three percent reported that they needed no start-up capital. For the remaining owners, the main source of capital was personal savings or loans from family members, with roughly 65 percent reporting this as a source of capital. Eleven percent used credit cards and 6 percent used home equity lines.

2.4. National Account Data

Finally, we summarize the national account data that should be consistent with aggregate data from our theory. (See Bhandari and McGrattan (2017) for full details.) In Table 5, we report categories of income and product in such a way as to be directly comparable to theoretical

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[17] We also constructed acquisition profiles for different industries to determine if there were large differences based on the business activity, say, restaurants versus dental offices. We did not find large differences.

[18] The number of owners reporting that the business is their primary income in the SBO is similar to the estimate of 17.2 million that comes from summing 10.4 million proprietors and partners working primarily in business reported by the BEA and the 6.8 million S-corporation shareholders reported by the IRS.

[19] For the 2 percent of businesses with more than four owners, we have only included hours of the first four owners.

values in the next section. The values in the right column are shares relative to total adjusted income or product. Three adjustments are made to both totals: we subtract sales taxes, add consumer durable depreciation and imputed services, and add additional intellectual property products (IPP) investment categories not currently included in the national income and product accounts (NIPA).[20]

Starting with incomes, roughly three-fourths of total adjusted income is categorized as business income and one-fourth as nonbusiness income to household or government. We split business income into three categories: income to pass-through entities (sole proprietorships, partnerships, and Schedule S corporations), labor income of workers in C corporations, and capital income. The first category includes NIPA proprietors' income (excluding inventory and capital consumption adjustments, which are included with capital income). This income category includes income to sole proprietorships and partnerships, net income to S corporations, and S-corporation compensation that is deducted from net income on Form 1120S.[21] The next category of income in Table 5 is C-corporation compensation, which is total compensation less S-corporation and nonbusiness compensation. Capital income is the third category of business income and includes C-corporation profits, rental incomes, net interest, indirect business taxes less sales taxes, an imputation for IPP investment, and depreciation. Currently, the NIPA IPP investment category is 4 percent of NIPA GDP, which is roughly one-third of current estimates of total intangible investments. (See Corrado et al. (2005).) The final income category includes all nonbusiness incomes. Nonbusiness incomes include compensation to household, nonprofit, and government employees, net interest and rental incomes paid to households, nonprofits, and government, indirect business taxes paid by households and nonprofits, profits of government enterprises, imputed capital services to consumer durables and government investment, and depreciation of residential and government fixed assets.

The remainder of Table 5 categories are NIPA products. Private consumption includes consumption of nondurables and services less sales taxes and imputations for capital services and durable depreciation. Government consumption is the same as in NIPA. Investment is divided into business and nonbusiness, as in the case of incomes. We split business investments into that of C

[20] For example, advertising and marketing costs would be included here.

[21] The BEA includes a large imputation for underreported income of proprietors based on estimates from tax compliance studies. Later, we treat the NIPA data as total income and assume that businesses effectively face a lower tax rate on their income.

corporations and that of pass-through entities using data from the BEA fixed asset tables and IRS corporate filings. Nonbusiness investments include consumer durables less sales tax, residential and government investment, and net exports.

Next, we develop a theory consistent with the facts laid out above.

3. A Theory of Sweat Equity

In the model economy that we analyze, households can choose to work for large public firms (C corporations) or small private firms (S corporations, sole proprietorships, and partnerships).[22] Two key features in our model distinguish public and private firms. The first is taxation: C corporations pay corporate income tax, while most private firms are small, pass-through entities that avoid taxation of profits. A second distinction is the underlying assets of the business. In the case of small private businesses, a large component of their value is accumulated sweat (time) to build the business customer base, client list, and other business intangibles. This time is not compensated with wage payments but rather as capital gains.[23]

At a point in time, the state vector for households includes financial assets a, sweat capital κ, productivity in C-corporate work ϵ, and productivity in running one's own business z. Households choose to allocate their time to C-corporate work or running a business to maximize the overall value:

$$V\left(a,\kappa,\epsilon,z\right)=\max\{V_c\left(a,\kappa,\epsilon,z\right),V_s\left(a,\kappa,\epsilon,z\right)\},$$

where $V_c(\cdot)$ is the value to working in the C corporation and $V_s(\cdot)$ is the value to running one's own business (whether it be an S corporation, a sole proprietorship, or a partnership).[24]

The problem of working in a C corporation is relatively standard. In this case, the households choose consumption of goods produced by the large firms, c_c, consumption of goods produced by the small private firms, c_s, leisure ℓ, and financial assets next period a' to maximize the value

[22] In reality, some C corporations are small and some are privately held. However, most C corporations are large, publicly traded companies.

[23] Much of C-corporation intangible investment does show up in the national accounts as intermediate purchases or employee compensation. A good example of the latter is wage compensation to R&D scientists.

[24] In reality, some individuals run a business and work for someone else, but data on time use show that their average hours in the primary job are much higher than in their secondary job.

function:

$$V_c\left(a,\kappa,\epsilon,z\right)=\max_{c_c,c_s,\ell,a'}\{U\left(c\left(c_c,c_s\right),\ell\right)+\beta\sum_{\epsilon',z'}\pi\left(\epsilon',z'|\epsilon,z\right)V\left(a',\kappa',\epsilon',z'\right)\} \tag{3.1}$$

subject to

$$\begin{aligned} a' &= [(1+r)\,a + w\epsilon n - (1+\tau_c)\,(c_c + pc_s) \\ &\qquad - T^w\,(w\epsilon n) + \bar{y}_{nb} - \bar{x}_{nb}]/\,(1+\gamma) \\ \kappa' &= \lambda\kappa \\ \ell &= 1-n \\ a &\geq 0, \end{aligned}$$

where r is the after-tax interest rate on financial assets, w is the wage rate, p is the relative price of goods produced by small private firms, τ_c is the tax levied on consumption, $T^w(\cdot)$ is the tax function on labor earnings, $\bar{y}_{nb}$ is (exogenous) nonbusiness income, and $\bar{x}_{nb}$ is (exogenous) nonbusiness investment. Technology grows at rate γ, and all variables are assumed to be divided by $(1+\gamma)^t$. We also assume that any sweat capital accumulated in past businesses deteriorates at rate λ.[25]

If households instead choose to run a business, then in addition to consumption, leisure, and financial assets, they choose how to allocate working time between growing the business and production. They also need to decide how much plant and equipment to rent.[26] The maximization problem in this case is

$$V_s\left(a,\kappa,\epsilon,z\right)=\max_{c_c,c_s,a',h_y,h_\kappa,k_s}\{U\left(c\left(c_c,c_s\right),\ell\right)+\beta\sum_{\epsilon',z'}\pi\left(\epsilon',z'|\epsilon,z\right)V\left(a',\kappa',\epsilon',z'\right)\} \tag{3.2}$$

subject to

$$\begin{aligned} a' &= [(1+r)\,a + py_s - (r+\delta_k)\,k_s - e - (1+\tau_c)\,(c_c+pc_s) \\ &\qquad - T^b\,(py_s - (r+\delta_k)\,k_s - e) + \bar{y}_{nb} - \bar{x}_{nb}]/\,(1+\gamma) \end{aligned}$$

[25] Extensions could allow for accumulation of sweat capital while working at a C corporation or wages conditional on sweat capital. Such extensions would require additional data.

[26] Here, we assume that they rent marketable fixed assets such as physical plant and equipment. We would get the same results if they owned the capital, since their financial assets are claims to earnings from marketable fixed assets.

$$\kappa' = \left[(1 - \delta_\kappa) \kappa + f_\kappa (x, h_\kappa) \right] / (1 + \gamma)$$

$$y_s = z f_y (\kappa, k_s, h_y)$$

$$\ell = 1 - h_\kappa - h_y$$

$$a' \geq \max (0, \chi p y_s),$$

where the hours allocation is h_κ to growing the business and h_y to production, and the marketable fixed assets is k_s, which is rented at rate r. The business income is sales py_s less rental payments $(r + \delta_k)k_s$ and any expenses used in producing new sweat capital e. The constraint on assets for the business owners now depends on the term $\chi p y_s$, which can be interpreted as a working capital constraint for business owners.

We have written the problem for the owners without paid employees. An alternative and isomorphic formulation allows for paid employees, with their compensation included in both receipts and expenses. For example, we could include hours of employees in private businesses, say h_e, as follows:

$$y_s = z f_y (\kappa, k_s, h_y, h_e).$$

If f_y is a Cobb-Douglas function, then total income could be written as the sum of income shares times the factor inputs. Value added in our baseline model above is equivalent to the total income net of any outside labor services. In other words, adding employees in the private sector is the same as adding their compensation to both value added and to factor payments in the baseline model. Without loss of generality, we have instead assumed that all employees are hired by C corporations.

C corporations choose hours n_c and fixed assets k_c to solve

$$\max_{k_c, n_c} y_c - w n_c - (r_k + \delta_k) k_c$$

subject to $y_c = AF(k_c, n_c)$. Here, r_k is the before-tax rental rate on capital.

The government spends g, borrows b, and collects taxes on consumption, labor earnings, private business income, C-corporation dividends, and C-corporation profits. The government budget constraint is given by

$$g + (r - \gamma) b = \tau_c \left(\int c_{ci} di + \int p c_{si} di \right) + \int T^w (w \epsilon_i n_i) di$$

$$+\int T^b\left(py_{si}-\left(r+\delta_k\right)k_{si}-e_i\right)di+\tau_p\left(y_c-wn_c-\delta_k k_c\right)$$

$$+\tau_d\left(y_c-wn_c-\left(\gamma+\delta_k\right)k_c-\tau_p\left(y_c-wn_c-\delta_k k_c\right)\right). \tag{3.3}$$

Here again, we assume that all variables are divided by the technological trend growth.

In equilibrium, rental and wage rates are equated to marginal products

$$r_k = AF_k\left(k_c, n_c\right)-\delta_k$$
$$w = AF_n\left(k_c, n_c\right),$$

and since private firms are for the most part pass-through entities that do not pay corporate profits, it must be the case that

$$r = \left(1-\tau_p\right)r_k.$$

Market clearing implies that

$$\begin{aligned}
y_c &= \int c_{ci}\,di+\int e_i\,di+\left(\gamma+\delta_k\right)\left(k_c+\int k_{si}\,di\right)+g\\
n_c &= \int n_i\epsilon_i\,di\\
\int a_i\,di &= b+\left(1-\tau_d\right)k_c+\int k_{si}\,di\\
\int y_{si}\,di &= \int c_{si}\,di,
\end{aligned}$$

where $1-\tau_d$ is the price of C-corporate fixed assets and $(1-\tau_d)k_c$ is the value of this capital.

Once we compute an equilibrium for the model economy, we can compute the variable of interest, namely, the *value of sweat equity* V_b:

$$V_b\left(a,\kappa,\epsilon,z\right)=d+\beta\sum_{\epsilon',z'}\pi\left(\epsilon',z'|\epsilon,z\right)U_c\left(c',\ell'\right)V_b\left(a',\kappa',\epsilon',z'\right)/U_c\left(c,\ell\right),$$

where d is the sweat dividend, the payment to the business owner for putting time into accumulating intangible investments such as client lists. This dividend is equal to ϕpy_s-e. Note that a value can be computed for all individuals, including those working in C corporations.

Given a value for sweat equity, we can compute the *intangible intensity* of business i by computing the ratio

$$\mathcal{I}_i=\frac{V_{bi}\left(a_i,\kappa_i,\epsilon_i,z_i\right)}{V_{bi}\left(a_i,\kappa_i,\epsilon_i,z_i\right)+k_{si}},$$

which is comparable to the Pratt's Stats estimates discussed earlier.[27]

4. Model Parameters

In this section, we choose parameters to ensure that key statistics of the model are consistent with data from the U.S. Census of businesses, the IRS, and the U.S. national accounts. Specifically, we choose parameters of preferences, technologies, and stochastic processes to match data on business acquisitions, time devoted to business, financing requirements, dispersion in taxable incomes, and the national accounts.

We start with our functional form choices for the utility function $U(\cdot)$, the production technology $F(\cdot)$ of C corporations, and the production technologies $f_y(\cdot)$ and $f_\kappa(\cdot)$ available to private businesses, namely,

$$\begin{aligned}
U\left(c\left(c_c, c_s\right), \ell\right) &= \left(c\left(c_c, c_s\right)^{\eta} \ell^{1-\eta}\right)^{1-\mu} / \left(1-\mu\right) \\
c\left(c_c, c_s\right) &= \left(\omega c_c^{\rho} + \left(1-\omega\right) c_s^{\rho}\right)^{1/\rho} \\
F\left(k_c, n_c\right) &= k_c^{\theta} n_c^{1-\theta} \\
f_y\left(\kappa, k_s, h_y\right) &= \kappa^{\phi} k_s^{\alpha} h_y^{\nu} \\
f_\kappa\left(e, h_\kappa\right) &= e^{\vartheta} h_\kappa^{\varepsilon},
\end{aligned}$$

where $\phi + \alpha + \nu = 1$ and $\vartheta + \varepsilon < 1$. In addition to the parameters of these functions, we need to set depreciation rates δ_k, δ_κ, the discount rate β, the growth rate γ, the rate of deterioration of sweat capital λ, nonbusiness shares $\bar{x}_{nb}/y$ and $\bar{y}_{nb}/y$, and all fiscal variables in (3.3). The level of TFP in C-corporate production, which is given by A, is set so that y_c is normalized to 1 in equilibrium.

The first step is to choose parameters that ensure the model's national accounts are consistent with Table 5 and the data on time allocation in business and nonbusiness. The model accounts, which can be matched directly to the table, are as follows:

Incomes:

Pass-through entities (sweat)	$(p \int y_{si}\, di - (r+\delta_k) \int k_{si}\, di - \int e_i\, di)/y$
C-corporation labor income	wn_c/y

[27] Later, we discuss adjustments that must be made for taxes paid on the dividends.

Capital income	$((r_k + \delta_k)k_c + (r + \delta_k)\int k_{si}\, di)/y$
Nonbusiness income	$\bar{y}_{nb}/y$
Products:	
Private consumption	$(\int c_{ci} + pc_{si})\, di)/y$
Government consumption	g/y
C-corporation investment	x_c/y
Pass-through investment	$\int x_{si}\, di/y$
Nonbusiness investment	$\bar{x}_{nb}/y$,

where x_c and $\{x_{si}\}$ are investments in fixed assets used in the C corporations and private businesses, respectively.

To achieve a close match to the NIPA C-corporation labor income shares, we set $\theta = 0.41$. To match an overall allocation of time to work in business of 24 percent, we set $\eta = 0.42$. Since output in C corporations is normalized and $\bar{y}_{nb}$ is set exogenously, we can vary ω to match the relative size of pass-through output to total output. With an estimate for total output y, we use estimates from Table 5 and set $\bar{x}_{nb} = 0.185$, $\bar{y}_{nb} = 0.451$, and $g = 0.234$. To pin down the depreciation on non-sweat capital (that is, k_c and $\int k_{si}\, di$), we used NIPA fixed asset tables and set $\delta_k = 0.05$. For growth of technology, we use $\gamma = 0.02$, and to match a 4 percent annual interest rate, we set $\beta = 0.98$. For curvature in preferences, we use a standard estimate of $\mu = 1.5$.

When choosing parameters to match the NIPA flows, we attributed NIPA pass-through income to compensation for the owner's time. To address the concern that some of the NIPA pass-through is rents to physical capital directly owned by the businesses, we examine expenses attributed to cost of capital on the IRS income statements. We find them to be large, on the order of 848 billion dollars for 2007. Using BEA data for the current-cost net stock of fixed assets and a range of estimates for U.S. real estate—which was high relative to its historical trend in 2007—we derive an estimate of these rents by multiplying the capital stocks by estimates of their user costs of capital. This calculation yields a range of estimates for ownership of physical capital used in the private, pass-through business sector between 0 and 15 percent, with the highest estimate based on above-trend values for real estate taken from the U.S. flow of funds accounts.

For tax rates, we use effective rates based on NIPA government revenues and IRS data. The tax rate on consumption is $\tau_c = 0.06$, which is based on NIPA sales tax data. The effective tax on dividends is $\tau_d = 0.14$ and is found by multiplying the marginal rate from taxable distributions and the fraction of distributions that are taxable. The tax rate on C-corporation profits is $\tau_p = 0.33$, which is total tax revenues divided by profits. In our baseline computations, we assume that the tax functions $T^w(\cdot)$ and $T^b(\cdot)$ are proportional with rates τ_w and τ_b. The tax rate on labor income from C corporations is $\tau_w = 0.4$ and includes federal, state, local, and payroll taxes. The effective tax rate on the sweat income of pass-through entities τ_b is assumed to be 0.2 or one-half of τ_w. This choice is motivated by findings from tax compliance studies. Using the IRS's National Research Program for tax year 2001, Johns and Slemrod (2010) find significant underreporting of business income in all but the bottom 10 percent of returns when sorted by the estimated true AGI. Their estimates of pre- and post-audit AGI distributions are nearly the same, and therefore we assume a constant proportion of misreported income for all income groups. Then, to determine the level of misreporting, we use the fact that the BEA imputes roughly 50 percent of proprietors' income in their measure of AGI on the basis of data obtained from tax compliance studies.[28] Finally, net borrowing in the baseline is 1.2 percent of output, which pins down the stock of debt and then transfers residually.

Stochastic processes for productivity are chosen to match dispersion in C-corporation wages and pass-through incomes (with means of ϵ and z both normalized to 1). We consider two baseline cases. The first is uncorrelated autoregressive processes for the logarithm of z and e—both with a serial correlation of 0.7 and standard deviation of 0.1—mapped to a 25-state Markov chain. The second uses the same transition matrix, but we replace the values of z with values of z^2 in order to generate more skewness in sweat incomes.[29]

Given the stochastic process for productivities, we calibrate the parameters governing the technology to produce sweat goods (ϕ, ν, α) and the rate at which sweat capital depreciates after exit (λ) using information on sweat income from NIPA, time allocated to private business, and the information about business dynamics, namely, the entry and exit rates along with the induced age profile of businesses from the SBO. Since sweat income is the sum of compensation for hours

[28] See Ledbetter (2007). Note that S corporations also have an incentive to report wage income as a distribution to avoid payroll taxes. See Smith et al. (2017).

[29] Our quantitative results do not change when we increase the serial correlation parameter from 0.7 to 0.9 and decrease the standard deviation from 0.1 to 0.075 on z.

spent in accumulating sweat capital and hours in production, the share of sweat income in total income is informative about the combination $\phi + \nu$ and residually $\alpha = 1 - \nu - \phi$.[30] A higher ϕ (and lower ν) means that agents with better ideas can reap benefits from their available time for longer duration, which in turn induces more C-corporate workers to switch and start businesses. Thus, with a ϕ that is too large, the model overpredicts hours in business and underpredicts hours in C corporations as compared to data. The parameter λ has a more direct implication on average duration conditional on entry. A higher λ implies that it is less costly to exit and reenter the business sector. This naturally shortens the age of business but at the same time has little effect on hours or the fraction of population that is engaged in running a business. We compute the business age profile from the SBO and match the level and slope, as shown in Figure 2. We can also compare our estimates of the fraction of owners' time devoted to accumulating sweat equity to estimates of labor for marketing and sales in the aggregate data; both are on the order of 10 percent of labor input.

Motivated by the work of Hurst and Lusardi (2004) and evidence about financing needs from the SBO, we set $\chi = 0$ in our baseline model and check the sensitivity of our results by increasing this to $\chi = 0.25$, which says that the businesses require next-period assets that exceed one-quarter of annual sales for working capital. We find that the constraint is binding for roughly 2 percent of the businesses and, therefore, find no quantitative impact on our main results.[31]

We do not have independent information on the remaining parameters, namely, the elasticity of substitution between public and private firms, ρ, the depreciation rate on sweat capital, δ_κ, and the production parameters for new sweat capital, ε and ϑ. For the elasticity, we use $\rho = 0.5$. For the depreciation rate, we use the same rate as other capital, namely, $\delta_\kappa = 0.05$, in our baseline computations. For production of sweat, we assume some diminishing returns and set $\varepsilon = \vartheta = 0.4$. In all cases, we run sensitivity tests.

In Table 6, we report our model's national accounts for the case that $\ln z$ is normally distributed

[30] Smith et al. (2017) use IRS tax filings to show that business income falls substantially after premature owner deaths, suggesting that a large part of the income is not returns to physical capital.

[31] Evans and Jovanovic (1989) impose a collateral constraint of the form $\varphi a' \geq k$ and estimate $\varphi = 1.44$. Typical calibrations in the literature following them assume a capital-output ratio of around 3 and φ in the range of 1 to 2, which in our model translates to businesses requiring 1.5 to 3 years of liquid assets for their working capital. Also prevalent in the literature are enforcement constraints that are consistent with high estimates for working capital requirements. For example, firms that are constrained in Cagetti and De Nardi (2006) need to hold about 2 years of sales in liquid assets.

and the case with the z process more skewed (and all other parameters the same). In the first case, the equilibrium wage rate w is 3.093, the price of c_s goods is 1.140, and the pre-tax return r_k is 0.06384. In the second case, with z more skewed, the equilibrium wage rate is 3.133, the price of c_s goods is 0.9985, and the pre-tax return is 0.06376. We see that the model does well in matching the aggregate data for both productivity processes.

In Figure 3, we plot our model's prediction for the acquisition profile, for both the normal productivity and the skewed productivity cases, along with the profile for business owners in the SBO. The model profiles bracket the data, with greater skewness in productivity leading to more switching between work and running a business and hence a steeper profile.

In Figure 4, we plot Lorenz curves for IRS taxable incomes along with our model's predictions in the baseline case with skewed productivity shocks. Figure 4A shows IRS wages, which we match up to our model's C-corporate wages. Figure 4B shows IRS business incomes on Form 1040 Schedules C and E (for sole proprietorships, partnerships, and S corporations), along with our model's business income. Although we have only 25 states in the Markov chain governing productivity shocks (ϵ, z), we do well in matching the overall dispersion in taxable incomes, with the exception of business incomes in the highest percentiles of the population that are more skewed in the data than in the model.[32]

5. Results

In this section, we use the model for two purposes. First, we use it to measure the aggregate value of sweat equity, its distribution, and the dispersion in the associated rates of return. Second, we use the model to quantify the impact of changing business taxation.

5.1. Valuations and Returns

We start with our main aggregate estimates of the total value of sweat equity $\int V_{bi}\, di$, aggregating across all individuals, and the intangible intensity $\int \mathcal{I}_i\, di$, aggregating across all private businesses, and then discuss the distributions.

[32] We have made an extreme assumption in the model that individuals work in one sector or another. Relaxing this assumption would imply a better fit of the model but would make the model less tractable.

In the model with normally distributed business productivity shocks, we find that the aggregate value of sweat equity is equal to 0.63 times GDP. In the case of skewed productivity shocks, we find that the aggregate value of sweat equity is 0.65 times GDP. The intangible intensities for private businesses in the two baseline cases are given by 0.44 in the case that $\ln z$ is normally distributed and 0.51 in the case that it is skewed. In other words, sweat equity is large and roughly as valuable for businesses as fixed assets.[33]

In Table 7, we report our findings for the cross-sectional distributions in the baseline case with skewed productivity shocks.[34] The first column reports cross-sectional statistics for the intangible intensity of private businesses. Recall that this is the ratio of the sweat equity V_b to the value of sweat equity and fixed assets k_s used in production. The average intensity is 51 percent, with a standard deviation of 29 percent, and the median is slightly higher at 53 percent. Looking across the distribution, we find intensities of 20 percent at the 10th percentile and 97 percent at the 90th percentile.

In the next column of Table 7, we report the sweat equity values, all relative to the median, and find little dispersion in these values. The sweat equity value at the 10th percentile is 0.71 times the median and the sweat equity value at the 90th percentile is 1.50 times the median. Little dispersion in sweat equity values follows from the fact that there is significant switching in and out of business ownership. The value of a business is the present value of future dividend incomes, which is not very different for owners facing the same stochastic process for productivity, even if their current incomes are significantly different. This reasoning is also consistent with the fact that there is substantial dispersion in intangible intensities and little dispersion in sweat equity values. The greater dispersion in intangible intensities reflects the fact that current incomes and therefore production inputs vary significantly, and thus there is wide dispersion in the use of fixed assets.

Dispersion in current incomes relative to values translates into significant dispersion in rates of return to sweat equity. In Table 7, we report both the gross return and the dividend yield in order to compare the results to cross-sectional data for which we only have dividend yields. For

[33] The intangible intensities are lower by roughly 10 percent if we value the sweat dividends after tax. In this case, we can compare the estimate to McGrattan and Prescott (2010b), who find a comparable estimate of 44 percent for the intangible-intensity of all U.S. businesses.

[34] See Bhandari and McGrattan (2017) for all results shown here and below in the case with normally distributed productivity shocks.

business owners, the mean gross return is 11.4 percent with a standard deviation of 23 percent. The dividend yield is 3.5 percent and therefore the mean capital gain is 7.9 percent. The median gross return is 9.2 with a dividend yield of 2.1. The 10th to 90th percentile range in gross returns is -16.7 to 44.5, with most of the difference due to capital gains.

The full histogram for sweat equity returns is displayed in Figure 5A, along with the fitted kernel. This shows that the full range of returns is about -50 percent to over 100 percent. Because of this dispersion, the commonly used procedure of estimating wealth as the ratio of income divided by a common rate of return—sometimes called capitalizing income—would lead to wrong answers. Following such a procedure would lead to the conclusion that there is significant dispersion in valuations.

The next set of statistics shown in Table 7 are sweat equity valuations and returns for all individuals. Even those working for C corporations have an expected future income from running a business and may well have accumulated some sweat capital (κ) from past investments in a business. Considering all individuals instead of just business owners increases the dispersion in the value of sweat equity V_b, but not by much. We find that the mean-to-median ratio is slightly higher, at 1.17, and the sweat equity value at the 90th percentile is a little more than double that of the 10th percentile. The mean gross return to sweat equity is 4.6 percent, with a dividend yield of 1.4 percent and capital gain of 3.2 percent. Figure 5B shows the full histogram of the gross returns of all individuals. The figure shows wide dispersion, although less than for current business owners.

In Figure 6, we display the model's Lorenz curves for sweat equity, sweat capital, and dividends to clearly illustrate the differences in dispersion across these measures. As the figure shows, there is far more dispersion in the income measure d than the valuation V_b, with the capital stock κ falling somewhere between.

In Table 7, we also compare our estimates of dividend yields to the empirical analogues in the 2007 SCF. We focus on SCF dividend yields—net incomes of actively managed businesses divided by the business net worth—since capital gains are not available. Earlier, we showed that SCF net incomes, when aggregated, are grossly in error. Here, we show that these errors translate into implausibly high estimated returns. The mean SCF dividend yield, which is a lower bound for the gross return, is 307 percent with a standard deviation of 2,813. This estimate is significantly higher than our 3.5 percent prediction and *any* estimate of mean U.S. corporate dividend yields (say, for example, based on NIPA data or Standard & Poor's company data). Even the median firm has high yields estimated at 20 percent, again significantly higher than our 2.1 percent prediction. At the 90th and 99th percentiles, businesses report 500 and 5,000 percent yields.[35]

In Table 8, we sort businesses in our skewed productivity baseline case by their gross returns and then examine their cross-sectional characteristics. The first column shows the age in years of the business. The average age for firms in the 4.5 to 11.9 percent range, which includes the median, is 15.4 years. Many of the youngest firms are in the 14.7 to 19.4 percent range, which is why the average age in this group is the lowest at 5.1 years. The difference between businesses with the very highest and lowest returns is only 4 years.

The next column of Table 8 shows how the intangible intensities covary with returns. The businesses with the lowest intensities are building up sweat equity and are relatively younger, with above-average returns. The range in intensities across brackets is 29 percent to 71 percent, well within the range shown in Table 7.

The final columns of Table 8 show how factors of production and outputs of private businesses covary with returns. We find much less variation in sweat capital after sorting by returns than in fixed assets, hours, and output. The latter depend importantly on a firm's level of productivity, although we can see that it is not strictly monotonic, since shocks occur and drive returns higher or lower. Sweat capital shows no pattern and ranges from 0.27 to 0.40. Fixed assets, hours, and output are lowest for businesses with near-zero returns and highest for businesses with above-average returns.

We turn next to using the model for analyzing tax changes that affect businesses, both private and public.

5.2. Counterfactuals

We analyze three changes in business taxation and report the impact on key statistics for the

[35] We find implausibly high SCF dividend yields even when restricting the sample to high net worth businesses. For example, considering only businesses with net worth above the median, we find average yields of 33 percent.

economy. In the first case, we experiment with greater tax enforcement for private businesses, raising the effective tax rate from 20 percent to 35 percent. In the second case, we consider a lower tax rate on private businesses with similar tax compliance, implying a rate decrease from 20 percent to 10 percent. Finally, we consider lowering tax rates on all businesses, both private and public: private businesses are assessed an effective 10 percent rate, and C corporations are assessed a 20 percent rate, down from 30 percent in the baseline. In all cases, we report results for the skewed productivity baseline. (See Bhandari and McGrattan (2017) for results with normally distributed productivity shocks.)

The main results are shown in Table 9 and are displayed as percentage changes relative to the baseline case. The first column shows the impact of having greater compliance. Recall that private firms in the baseline report roughly half of their actual income and thus face an effective tax rate of 20 percent rather than the statutory 40 percent. In this counterfactual experiment, we assume that there is greater compliance, leading to an effective 35 percent tax rate and 7.67 percent higher tax revenues. As expected, this change affects private businesses more than C corporations. The C-corporate wage falls only 0.22 percent, but the relative price p of private small business goods rises 10 percent. Consumption, and therefore production, of such goods falls 14 percent. Investment shifts from private business, falling by roughly 6 percent, to C corporations, rising by roughly 2 percent. Because C corporations contribute most to value added in the aggregate economy, GDP rises by only 0.6 percent. Hours in the production of new sweat capital and private business output are most affected, both falling about 23 percent. The sweat capital stock falls 18 percent, while the stock of fixed assets used in production falls 6 percent. The C-corporate stock of fixed assets rises 2 percent, and with the interest rate higher, financial assets rise 23 percent. Despite a large drop in the sweat capital stock, the decline in sweat equity values is modest, at roughly 3 percent, since V_b is a measure of the value of future business income.

In the second experiment, we lower the tax rate on private businesses to an effective rate of 10 percent, down from 20 percent in the baseline. This experiment, which is reported in the second column of Table 9, serves as a useful benchmark when we lower all business taxes, since factors of production can be shifted relatively easily across sectors. With only a lowering of the tax rate on private business, tax revenues fall by 5.28 percent. As in the greater compliance case, we find more significant changes in activity in private business than in C corporations. Consumption of private business goods is higher by almost 9 percent, and consumption of C-corporate goods is lower by roughly 2 percent. These changes are accomplished with a shift of hours and capital out of C corporations and into private business. The shift out of C corporations implies a slight drop in GDP of roughly 0.3 percent. Increased hours in the building of new sweat capital leads to a rise of the stock by 11 percent and a rise in sweat equity of nearly 4 percent.

The final experiment involves a lowering of the tax rate on private business net income to 10 percent and, additionally, the corporate income tax rate to 20 percent, down from 30 percent in the baseline. The results are reported in the third column of Table 9. For this case, we find that tax revenues are lower, but by less than in the case with only a lower tax rate on private business. Lowering the tax rate on corporate income implies a significant rise in C-corporate wages, which are taxed at 40 percent. Consumptions and outputs are now higher in both sectors, and GDP is higher by 4.7 percent. Factors of production are all higher, most notably hours building up sweat capital and producing private output, which both rise roughly 13 percent, and fixed assets used by C corporations, which rises almost 15 percent. Despite the increases in capital stocks in both sectors, financial assets are lower by 4.9 percent because the level of government debt needed to balance the budget is lower.

But with taxes lower in both sectors, future sweat dividends are even more valuable, implying a significant rise in sweat equity, more than 6 percent. The higher sweat equity values imply less switching between sectors and flatter profiles of business acquisitions. (See Figure 3.) This implies fewer start-ups and longer durations for private businesses.

5.3. Exploring the Mechanism

In this section, we explore how including private businesses that accumulate sweat equity can affect predictions about the impact of tax policy changes. We do this in two ways. First, we explore the nature of the mechanism by quantifying changes in occupational choice and changes in economic decisions conditional on one's occupational choice. Second, we compare the outcomes of an economy with both public and private business and significant switching between sectors to an economy with only one business sector.

5.3.1. *Intensive versus Extensive Margin*

Changes in aggregate outcomes can be decomposed into adjustments on the extensive margin—that is, the choice to become an entrepreneur or a worker—and the intensive margin—that is, the choice of hours, savings, and production conditional on the occupation choice. Here, we quantify the relative importance of these two margins in the case with the tax rate on private business net income lowered by 10 percentage points (column 2 of Table 9).

To motivate our decomposition, it helps to introduce some notation. Let $H(\tau)$ be some steady state aggregate quantity for given policies, say total hours in the private business sector, which can be summarized by a vector τ. Let $h(x,\tau)$ be the average hours conditioned on some characteristic x, say the business age, and let $\mu(x,\tau)$ be the density of businesses with characteristic x in the steady state given τ. In this case, the following relation must hold:

$$H(\tau) = \int h(x,\tau)\,\mu(x,\tau)\;dx.$$

We are interested in decomposing the total change in H across steady states associated with policy τ and τ'.

Let $\Delta H = H(\tau) - H(\tau')$, and we will use the Δ operator to denote the difference across policy τ and τ'. Simple algebra yields

$$\Delta H = \int \Delta h(x)\left(\frac{\mu(x,\tau)+\mu(x,\tau')}{2}\right)dx + \int\left(\frac{h(x,\tau)+h(x,\tau')}{2}\right)\Delta\mu(x)\;dx.$$

We refer to the first integral as the "intensive margin" and the second as the "extensive margin." The decomposition also provides a cross-sectional decomposition of the two components by characteristic x.

In Table 10, we report the decomposition for output and hours for private businesses of all ages and again for subgroups in different age categories. Take, for example, the case of private business output shown in the first column. According to our results in column 2 of Table 9, output rose 8.84 percent when the tax rate was lowered from 20 to 10 percent. Seventy percent of this change in output can be attributed to the extensive margin and 30 percent to the intensive margin. Looking further at the age subgroups, we find that changes along the extensive margin are primarily due to a higher fraction of older businesses (or, equivalently, to a longer duration for businesses because of the better tax environment), while changes along the intensive margin are primarily due to younger businesses increasing production. We see a similar pattern for hours in production, with older businesses accounting for more of the changes along the extensive margin and younger businesses accounting for more of the changes along the intensive margin. For hours in building sweat capital, the main changes come from the intensive margin for young businesses, accounting for roughly 55 percent of the total change (of 15.5 percent).

Models that abstract from either the extensive or intensive margins of adjustment will incorrectly measure the relevant elasticities that are an input to studying the effect of tax policies.[36] As a check on our estimates, we also compute an extensive margin elasticity for hours, which can be compared to the literature that estimates an extensive margin Hicks elasticity for labor force participation in response to tax changes. (See a review in Chetty et al. (2013).[37]) To do this, we compute the change in the log of the fraction of people running a business and divide it by the change in the log of the price (or one minus the tax rate on business net income). We find an estimate of 0.51 for entrepreneurial participation, which is slightly higher than estimates for labor force participation, ranging from 0.13 to 0.43.[38]

5.3.2. *One-Sector versus Two-Sector Model*

Next, we compare our results for a lowering of the corporate tax rate in our two-sector baseline model and a one-sector version studied by Aiyagari and McGrattan (1998).[39] We consider two calibrations of the one-sector model: one based on our parameterization of preferences and technologies and one based on Aiyagari and McGrattan (1998). The results are reported in Table 11. The first three rows are C-corporate output, capital, and hours. The last row is private hours, which are shown only for our two-sector model. In the baseline model and our parameterization of Aiyagari and McGrattan's (1998) model, we lower the tax rate τ_p from 30 percent to 20 percent. For the Aiyagari and McGrattan (1998) calibration, we lower the tax on capital from the baseline

[36] For example, Cagetti and De Nardi (2006) abstract from the intensive margin, and Aiyagari (1994) and Aiyagari and McGrattan (1998) abstract from the extensive margin.

[37] We do not have the ideal statistic, which would be the extensive margin elasticity for entrepreneurs.

[38] As a point of reference, we find an estimate of 1.76 percent for the same experiment using the model of Cagetti and De Nardi (2006).

[39] The exercise is analogous to comparing business cycle statistics for a model with and without home production. Even if the variables of interest are market hours and output, fluctuations in market variables depend on the willingness and opportunity to substitute between home and market activity.

rate of 37.5 percent to 27.5 percent. The point of showing two one-sector calibrations is to disentangle the effect of including a private business sector—and switching between private and public activity—and the effect of different calibrations that are necessary when constructing consistent national accounts between model and data.

In both parameterizations of the one-sector model, we find little change in hours of work with a lowering of the tax rate on corporate profits; the hours change by less than 1 percent. In our baseline model, the impact of tax changes depends on the degree to which individuals are able to substitute between running a private business and working for a C corporation. For our parameterization, we find a 2.8 percent rise in C-corporate hours and a 2.3 percent decline in private hours. We also find larger increases in output and capital in the two-sector model, even if we use the same parameters. If we compare directly to Aiyagari and McGrattan (1998), we find an increase in output that is more than double, 8 percent versus 3.4 percent, and an increase in capital that is significantly higher, 16.1 percent versus 9.7 percent.

5.4. Nonpecuniary Benefits

In this section, we extend the baseline model to allow for nonpecuniary benefits along the lines of Hurst and Pugsley (2017). We show that our earlier results are robust to this extension.

Hurst and Pugsley (2017) include an additive term in preferences that stands in for nonpecuniary benefits of running a business, call it b for benefit, which is added to $U(c_c, c_s, \ell)$ if the household is running a business. In our extension, we allow for this benefit to be high $b = \bar{b}$ or low $b = 0$ and include it with the exogenous state vector: (ϵ, z, b).

As in Hurst and Pugsley (2017), we want this extended model to be consistent with the findings of Hamilton (2000) and Hurst and Pugsley (2011). Based on data from SIPP, Hamilton finds that entrepreneurs remain in business even though their earnings are lower than they would be in paid employment. His estimate is a differential of 35 percent for individuals that have been in business for 10 years. Our model delivers this result even in our baseline case with $\bar{b} = 0$. This result follows from the fact that wages are taxed at a higher rate of 0.4, twice that of the effective tax rate on business net income. This implies a pre-tax differential of roughly 33 percent, which is close to Hamilton's (2000) estimate.

The main finding of Hurst and Pugsley (2011) is that 50 percent of business owners say that they are in business for nonpecuniary benefits. To generate an answer of 50 percent, we consider the following experiment.[40] We assume that 30 percent of all individuals in the economy are high $\bar{b}$ types, that the probability of transiting from high $\bar{b}$ to high $\bar{b}$ is 90 percent, and that the process for b is independent of the process for (ϵ, z). These choices completely characterize the transition matrix for (ϵ, z, b). Finally, we set the value of $\bar{b}$ so that 50 percent of business owners are high $\bar{b}$ types.

For this extension, we rerun the experiment of lowering the tax on private businesses by 10 percentage points. We find little change from the results shown in Table 9. The largest impact that we find is a dampening of the increase in hours in sweat capital building and private business production. In the baseline case, we find a 15.5 percent increase in hours to sweat capital building and 15.3 to production, whereas in the extension, these estimates are 14.8 and 14.6, respectively. The fact that they respond less should not be surprising, given that operating a business provides a nonpecuniary benefit, but the impact is not very large. Given the results of this sensitivity analysis, we argue that our main quantitative results are robust in including nonpecuniary benefits to business ownership.

Finally, we can quantify the nonpecuniary benefit over and above that of the tax differential. Comparing individuals in the same position for 10 years, we find that wage owners earn a 5.5 percent premium on their after-tax earnings.

5.5. Life-Cycle Dynamics

Thus far, we have abstracted from life-cycle considerations when estimating sweat equity and running our tax experiments. In this section, we show how to modify the model to allow for finite lives of both businesses and individuals, and we use additional statistics from the national accounts and the SBO to discipline the introduction of additional parameters. We show that our estimates of sweat equity and our results from tax experiments are hardly changed.

Following Blanchard (1985), we introduce two types of agents, young and old. The young face the probability of aging—transiting from a young type to an old type and the probability of

[40] Without more data, we have no way to further discipline the choices of $\bar{b}$ and the transition matrix.

death—replacing an old type with a young offspring. For both young and old, there is a choice of running a business or working for others, so the value functions must satisfy

$$V_y(a,\kappa,\epsilon,z) = \max\{V_{y,c}(a,\kappa,\epsilon,z), V_{y,s}(a,\kappa,\epsilon,z)\}$$

$$V_o(a,\kappa,\epsilon,z) = \max\{V_{o,c}(a,\kappa,\epsilon,z), V_{o,s}(a,\kappa,\epsilon,z)\}.$$

Young households that are running their own business solve the following maximization problem:

$$\begin{aligned} V_{y,s}(a,\kappa,\epsilon,z) = \max_{c_c,c_s,k_s,h_y,h_\kappa,a',\kappa'} &\{U(c,\ell) \\ &+ \beta\pi_y \sum_{\epsilon',z'} \pi(\epsilon',z'|\epsilon,z) V_y(a',\kappa',\epsilon',z') \\ &+ \beta(1-\pi_y) \sum_{\epsilon',z'} \pi(\epsilon',z'|\epsilon,z) V_o(a',\kappa',\epsilon',z')\} \end{aligned}$$

subject to the same constraints as business owners in the dynastic model. The stochastic aging is governed by the probability that a young agent becomes old $(1-\pi_y)$.

Old households that are running their own business solve

$$\begin{aligned} V_{o,s}(a,\kappa,\epsilon,z) = \max_{c_c,c_s,k_s,h_y,h_\kappa,a',\kappa'} &\{U(c,\ell) \\ &+ \beta\pi_o \sum_{\epsilon',z'} \pi(\epsilon',z'|\epsilon,z) V_o(a',\kappa',\epsilon',z') \\ &+ \beta\iota(1-\pi_o) \sum_{\epsilon',z'} \pi(\epsilon',z') V_y(a',\kappa',\epsilon',z')\} \end{aligned}$$

subject to the same constraints as in the baseline, except

$$\kappa'_0 = [(1-\delta_\kappa)\kappa + f(h_\kappa, e)]/(1+\gamma)$$

$$\kappa' = \begin{cases} \kappa'_0 & \text{if old to old} \\ \tilde{\lambda}\kappa'_0 & \text{if old to young} \end{cases}$$

$$y_s = \tau_o^b z k_s^\alpha \kappa^\phi h_y^\nu, \quad \alpha+\phi+\nu=1,$$

where π_o is the probability of remaining an old type, $\iota \in [0,1]$ is a measure of altruism, τ_o^b is a measure of lowered productivity in old age, and $\tilde{\lambda}$ is a measure of lost business capital when the owner dies.

The young C-corporation employees solve

$$V_{y,c}(a,\kappa,\epsilon,z) = \max_{c_c,c_s,\ell,a'} \{U(c,\ell)$$

$$
\begin{aligned}
&+ \beta \pi_y \sum_{\epsilon', z'} \pi \left(\epsilon', z' | \epsilon, z\right) V_y \left(a', \kappa', \epsilon', z'\right) \\
&+ \beta \left(1 - \pi_y\right) \sum_{\epsilon', z'} \pi \left(\epsilon', z' | \epsilon, z\right) V_o \left(a', \kappa', \epsilon', z'\right) \}
\end{aligned}
$$

subject to the same constraints as in the dynastic model.

The old C-corporation employees solve:

$$
\begin{aligned}
V_{o,c} \left(a, \kappa, \epsilon, z\right) = \max_{c_c, c_s, \ell, a'} \{ & U \left(c, \ell\right) \\
& + \beta \pi_o \sum_{\epsilon', z'} \pi \left(\epsilon', z' | \epsilon, z\right) V_o \left(a', \kappa', \epsilon', z'\right) \\
& + \beta \iota \left(1 - \pi_o\right) \sum_{\epsilon', z'} \pi \left(\epsilon', z'\right) V_y \left(a', \kappa', \epsilon', z'\right) \}
\end{aligned}
$$

subject to the same constraints as in the baseline, except productivity is now $\epsilon_o = \tau_o^w \epsilon$, where τ_o^w is a measure of lowered productivity in old age.

The market clearing conditions are the same as before, but the government budget constraint is slightly different and is given by

$$
\begin{aligned}
g + \left(r - \gamma\right) b = \tau_c \left(\int c_{ci} di + \int p c_{si} di \right) &+ \int T^n \left(w \epsilon_i n_i\right) di \\
&+ \int T^b \left(p y_{si} - \left(r_s + \delta\right) k_{si} - e_i\right) di + \tau_p \left(y_c - w n_c - \delta k_c\right) \\
&+ \tau_d \left(y_c - w n_c - \left(\gamma + \delta\right) k_c - \tau_p \left(y_c - w n_c - \delta k_c\right)\right) \\
&- T^r \int \chi_{i,old} di,
\end{aligned}
$$

where ϵ_i includes the τ_o^w factor.

For the life-cycle version of the problem, we need to parameterize the probabilities of switching between young and old, π_y, π_o, the fraction of business capital passed to the young, $\tilde{\lambda}$, the productivities of the old, τ_o^w, τ_o^b, retirement transfers, T^r, and altruism ι. We interpret "young" as ages 25 to 65 and "old" as over 65. The probabilities (π_y, π_o) are pinned down using population shares by age. In particular, one-quarter of the population is old, and youth lasts about 40 years. The productivity of the old worker, τ_o^w, is set to zero to capture retirement and low hours in C corporations by people over 65. To set the productivity of old business owners, τ_o^b, and lost sweat capital after death, $\tilde{\lambda}$, we use data on average business age for young and old from the SBO. Specifically, we target two moments, namely, the average business age for owners that are over 65 (17.5 years) and the average business age for owners that are 25 to 65 (7.7 years). We end up with an estimate of $\tilde{\lambda} = 10$ percent and $\tau_o^b = 90$ percent. In the baseline, we have no altruism and set ι to 1. Finally, the T^r estimate is set to be consistent with total spending for Social Security plus Medicare in the national accounts.

Using this parameterized model, we recompute the value of sweat equity and rerun the tax experiments. We find that the aggregate value of sweat equity is 0.63 times GDP, almost the same as in the baseline model.[41] For the experiment with a lowering of the pass-through business tax rate by 10 percentage points, we find nearly the same effects, as shown in Tables 9 and 10. Although old agents have a lower extensive margin elasticity, they work less and are less productive. Therefore, they contribute less to the aggregate effect of the tax change.

6. Conclusions

In this paper, we used theory and U.S. data to measure sweat equity in private business. We find it is large—about as large as fixed assets—and varies little in the cross section. We then showed that tax policy changes of the magnitude being discussed by U.S. policymakers would have a significant effect on key economic aggregates and the allocation of hours and capital to production in privately held versus publicly traded businesses.

[41] With a life-cycle model, one can compute the value of a business until the end of an owner's life, which is necessarily smaller than the total value since it ignores dividends paid to future generations. If we calculate the value to end of life, we find an estimate of 0.4 times GDP.

A. Data Sources

The main sources of data reported in the main text are as follows:

- Pratt's Stats of Business Valuation Resources
- Survey of Consumer Finances of the Board of Governors of the Federal Reserve System
- Kauffman Firm Survey of the Kauffman Foundation
- Survey of Income and Program Participation of the U.S. Census Bureau in the Department of Commerce.
- Statistics of Income of the Internal Revenue Service
- Characteristics of Business Owners of the U.S. Census Bureau in the Department of Commerce
- National income and product accounts and fixed assets of the Bureau of Economic Analysis in the Department of Commerce

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Figure 1. Percent Differences between Aggregate SCF and SOI Estimates

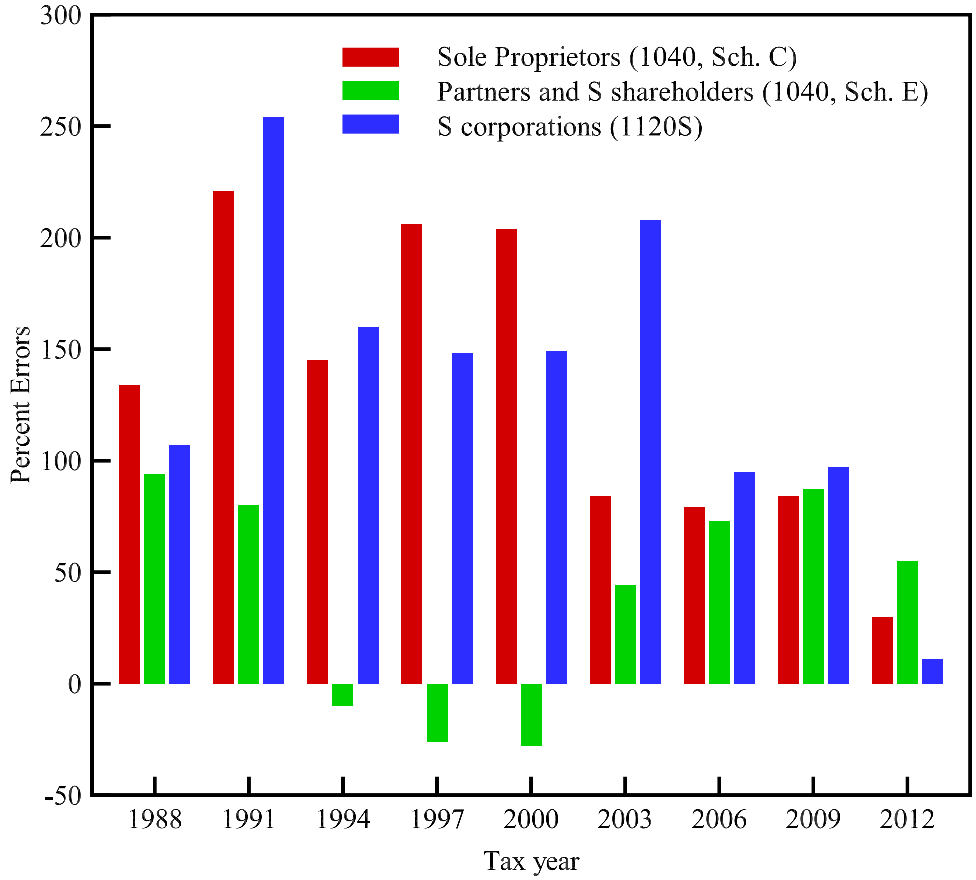


Figure 2. Business Acquisition Profile, U.S. Census Data

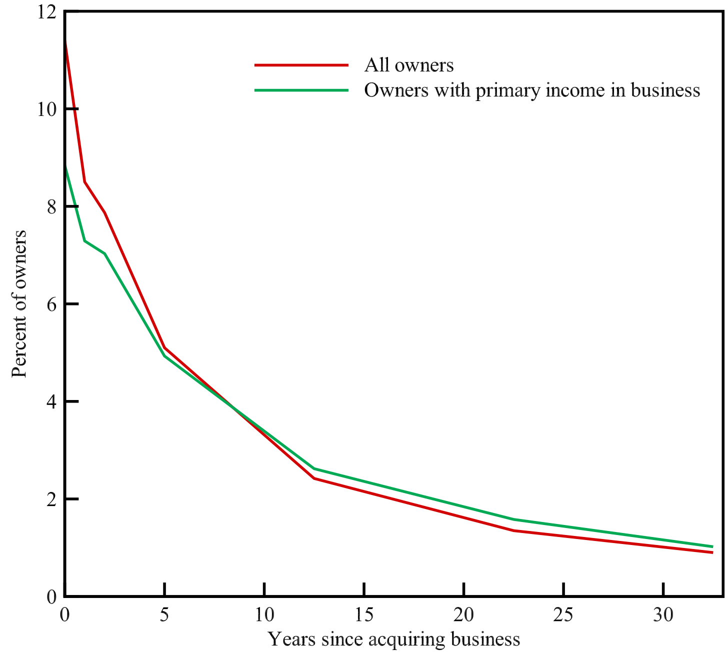


Figure 3. Business Acquisition Profile, Data and Model Baselines

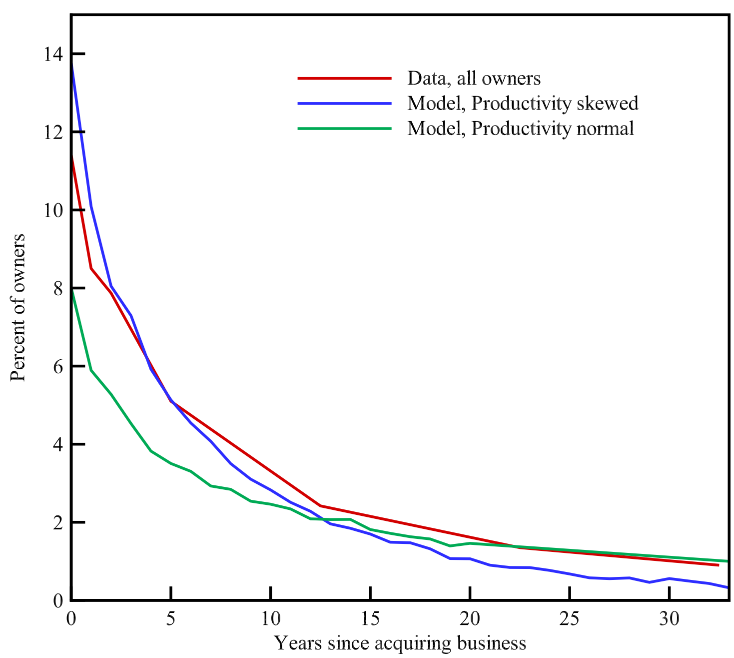
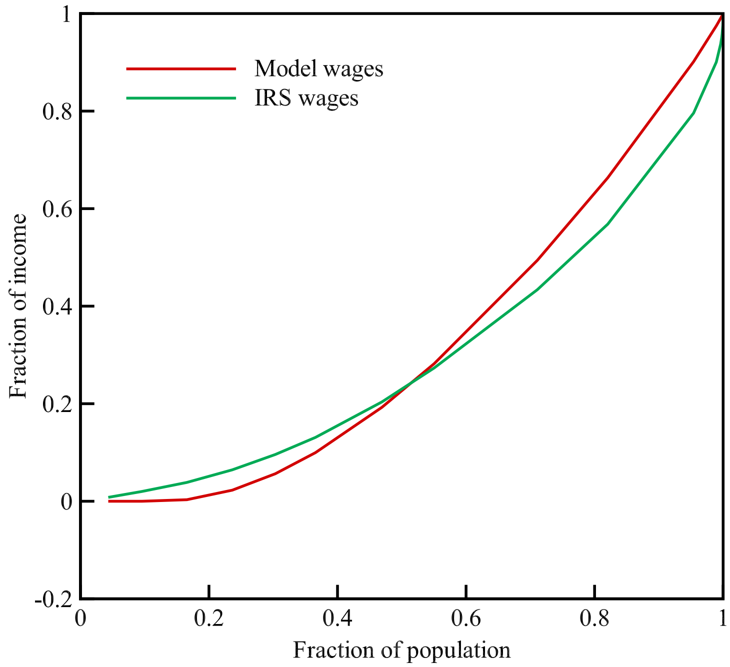


Figure 4. Taxable Incomes, Data and Model

A. Wages



B. Business Incomes

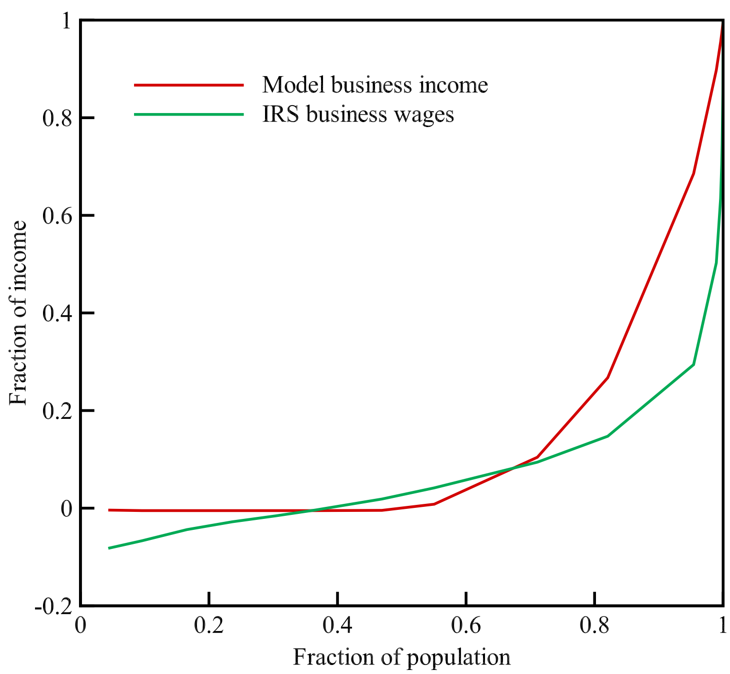
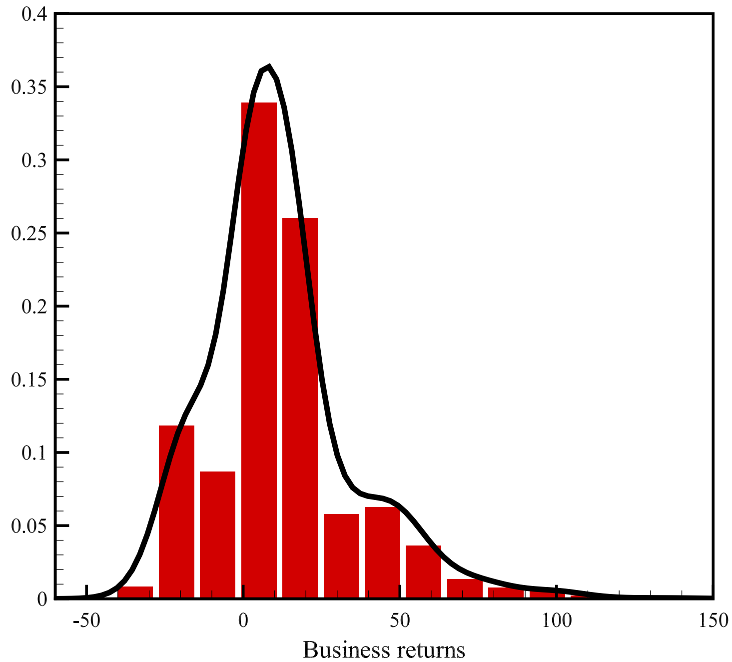


Figure 5. Model Returns to Sweat Equity

A. Business Owners



B. All individuals

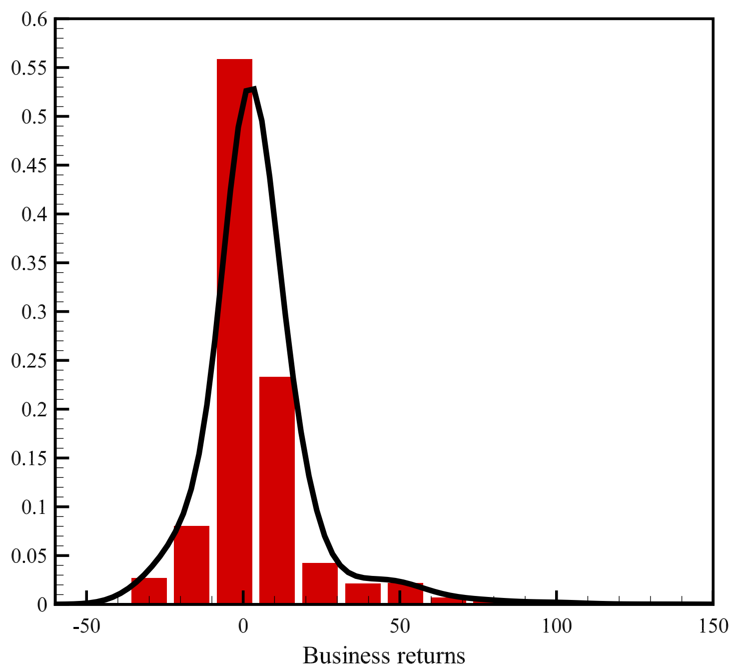


Figure 6. Model Lorenz Curves, All individuals

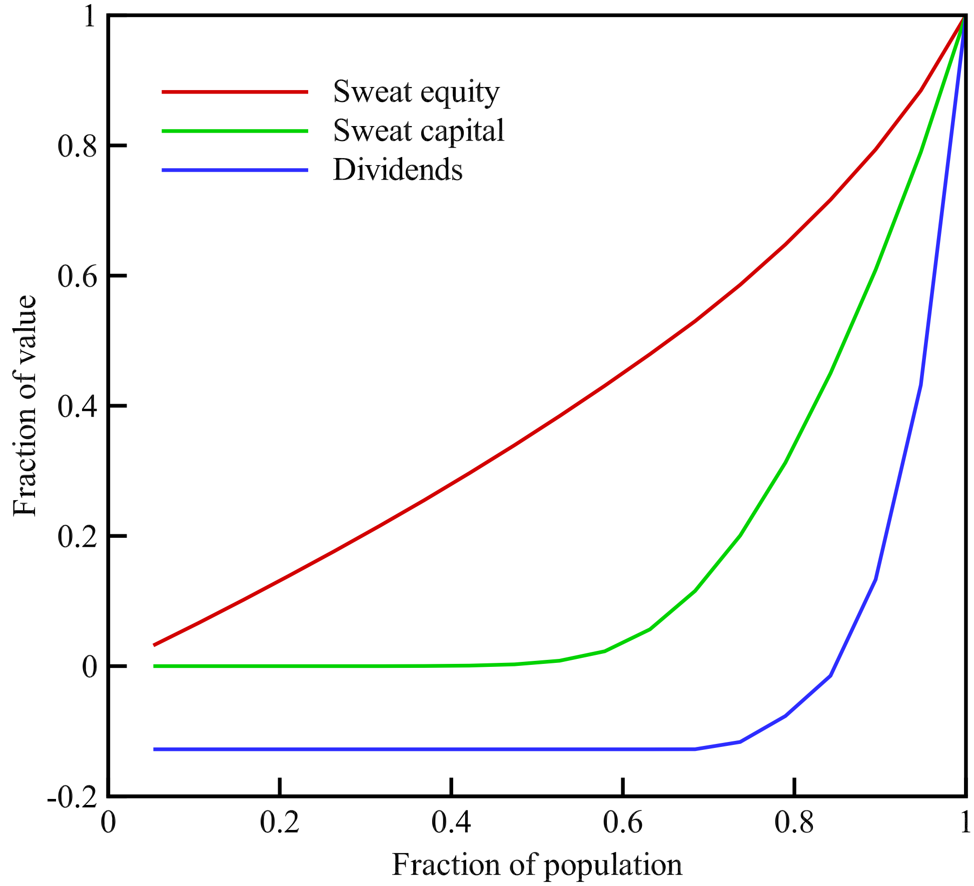


Table 1. Ratios of Intangible Asset Value to the Business Total Assets By Legal Structure, Industry, Age, and Measures of Size

Characteristic	Count	Mean	Median	Std. Dev.
Legal Structure				
S Corporations	5,519	0.58	0.64	0.32
Sole Proprietors	1,140	0.57	0.64	0.31
Partnerships	196	0.57	0.67	0.32
Industry (NAICS)				
11–22	26	0.44	0.47	0.31
23–33	975	0.60	0.65	0.34
42–49	1,618	0.56	0.62	0.29
51–53	420	0.80	0.93	0.27
54–56	1,156	0.75	0.83	0.24
61–81	2,658	0.48	0.49	0.31
Age				
0–1	104	0.44	0.45	0.34
1–2	217	0.54	0.53	0.32
2–4	509	0.55	0.57	0.33
4–15	2,772	0.59	0.65	0.28
15+	2,633	0.58	0.64	0.28
Employment				
0–2	1,432	0.60	0.67	0.32
2–3	653	0.59	0.63	0.31
3–5	1,043	0.55	0.62	0.31
5–10	1,147	0.55	0.60	0.30
10+	985	0.57	0.62	0.35
Net Sales ($ thousands)				
0–178	1,334	0.56	0.63	0.34
178–323	1,355	0.54	0.58	0.32
323–560	1,385	0.57	0.62	0.31
560–1,167	1,392	0.59	0.66	0.29
1,167+	1,383	0.63	0.70	0.32
Total Assets ($ thousands)				
1–75	1,325	0.48	0.48	0.34
75–143	1.358	0.54	0.56	0.32
143–254	1,377	0.59	0.65	0.33
254–550	1,405	0.64	0.71	0.28
550+	1,389	0.65	0.72	0.28
All Transactions	6,855	0.58	0.64	0.32

Note: Transactions include only sales of S corporations, sole proprietorships, and partnerships in the *Pratt's Stats* database over the period 1994–2017.

Table 2. Comparison of the 2007 SCF and IRS Business Incomes, Amounts in Billions of U.S. dollars

Income Percentiles	Individual Tax Form						Business Tax Form		
	Sole Proprietors			Partners/S-Corps			S Corporations		
	SCF	IRS	%Error	SCF	IRS	%Error	SCF	IRS	%Error
0−100	503	282	78	806	466	73	577	296	95
0−50	31	50	−39	19	−41	−146	39	6	500
50−90	176	94	87	70	33	111	248	93	167
90−99	173	92	87	196	128	53	257	125	105
99+	124	44	179	520	346	50	34	72	−53

Note: The 2007 SCF asks respondents to report line items on their 2006 tax forms. Data from individual tax returns are first sorted by AGI and then by Schedule C income (for sole proprietors), and Schedule E income (for partners, S-corporation shareholders, estates, trusts, renters, and royalty earners) is attributed to the bottom 50 percent, 50 to 90 percent, 90 to 99 percent, and 99 to 100 percent of returns. The row with range 0 to 100 is the total income in billions of dollars. Data from businesses filing Form 1120S are first sorted by business receipts, and then the net income of S corporations is attributed to the bottom 50 percent, 50 to 90 percent, 90 to 99 percent, and 99 to 100 percent of shareholders. The row with range 0 to 100 is the total net income of S corporations in billions of dollars.

Table 3. Comparison of the 2007 SCF, SIPP, and IRS Sole Proprietor Incomes, Amounts in Billions of U.S. dollars

Income Percentiles	IRS Data	Survey Data			
		SIPP	%Error	SCF	%Error
0-100	282	121	−57	503	78
0-50	50	11	−78	31	−38
50-90	94	50	−47	176	87
90-99	92	53	−42	173	88
99+	44	6	−86	124	182

Note: For details on SCF and IRS sole proprietorship data, see note for Table 2. Households in the SIPP dataset are sorted by total income, which includes the following categories: total earned income, means-tested cash transfers, property (asset) income, and other incomes.

Table 4. Comparison of KFS and IRS Business Tax Data, 2004-2011, Amounts in Thousands of US dollars

Statistic	Receipts			Expenses			Profit		
	KFS	IRS	%Error	KFS	IRS	%Error	KFS	IRS	%Error
Mean	552	417	32	369	188	96	30	169	−82
Median	92	66	39	57	36	57	5	24	−79
25th[a]	21	11	74	1	12	−1,400	−3	1	−700
75th[a]	350	281	25	236	152	55	31	142	−78
99th[a]	11,500	7,434	55	7,450	2,680	178	810	2,478	−67

Note: The source of statistics for the distributions of receipts, expenses, and profits is Gurley-Calvez et al. (2016). These authors matched IRS administrative data with the KFS, which is an eight-year panel of new firms beginning in 2004. Responses from the survey are matched to tax data from Form 1040, Schedule C for sole proprietorships, Form 1065 for partnerships, and Form 1120S or 1120 for corporations. Eighty percent of firms are matched to tax files, and the matched data file includes 3,940 firms. Profits do not necessarily equal receipts less expenses because data in all categories are not available for all firms in all years.

[a] The data are reported for percentiles in the distributions.

Table 5. National Income and Product Account Shares, 2007

Total Adjusted Income[a]	1.000
Business incomes	0.742
Pass-through entities	0.087
Proprietors' income without IVA, CCadj	0.055
S-corporation business net income[b]	0.017
S-corporation compensation[b]	0.015
C-corporation labor income	0.335
Total compensation	0.479
Less: S-corporation and nonbusiness	0.144
Capital income	0.320
C-corporate profits	0.054
Rental income	0.005
Net interest	0.025
Indirect business taxes less sales tax	0.018
Imputed IPP net investment[c]	0.025
Depreciation[d]	0.189
Nonbusiness incomes of household and government	0.258
Total Adjusted Product[a]	1.000
Private nondurable consumption less sales tax[e]	0.574
Government consumption	0.134
Investment	0.292
Business	0.186
C corporations	0.146
S corporations, proprietors	0.040
Nonbusiness[f]	0.106

[a] Three adjustments are made to NIPA income and product: sales taxes are subtracted, consumer durables are classified as investment, and additional IPP categories are included with investment that are not currently included in NIPA investment.

[b] This category is 1120S net income from a trade or business and excludes portfolio and real estate rental income.

[c] NIPA IPP investment net of depreciation is 0.5 percent of adjusted GDP.

[d] Includes imputed depreciation of consumer durables and additional IPP capital and excludes depreciation of residential and government capital.

[e] Includes services to consumer durables.

[f] Includes residential and government investment and net exports.

Table 6. National Account Shares, Data and Baseline Models

	Data[a]	Models: Normal $\ln z$	Models: Skewed $\ln z$
Total Adjusted Income			
Business incomes	0.742	0.748	0.743
Pass-through entities	0.087	0.094	0.103
C-corporation labor income	0.335	0.343	0.337
Capital income	0.320	0.301	0.303
Nonbusiness incomes	0.258	0.262	0.257
Total Adjusted Product			
Private nondurable consumption	0.574	0.556	0.558
Government consumption	0.134	0.136	0.134
Investment	0.292	0.300	0.300
Business	0.186	0.193	0.195
C corporations	0.146	0.147	0.144
S corporations, proprietors	0.040	0.046	0.056
Nonbusiness	0.106	0.108	0.106

[a] See Table 5 for more details.

Table 7. Cross-Sectional Characteristics of Businesses

	Model Predictions[a]							
	Business Owners				All Individuals			SCF
Statistics	Intangible Intensity	Sweat Equity	Gross Return	Dividend Yield	Sweat Equity	Gross Return	Dividend Yield	Dividend Yield
Mean	0.51	1.07	11.4	3.5	1.17	4.6	1.4	307
Std. deviation	0.29	0.34	23.0	6.1	0.49	16.4	4.2	2,813
Percentiles:								
10th	0.20	0.71	-16.7	0.0	0.78	-10.8	0.0	0
50th	0.53	1.00	9.2	2.1	1.00	2.0	0.0	20
90th	0.97	1.50	44.5	10.2	1.89	17.7	7.9	240
95th	0.99	1.60	54.9	11.6	2.20	36.6	9.9	500
99th	1.00	2.27	87.4	21.4	3.66	66.8	19.1	5,000

Note: The model statistics are based on the case with skewed $\ln z$ productivity shocks.

[a] The intangible intensity is the ratio of the business valuation V_b relative to the V_b plus the value of fixed assets used in the business k_s. The business valuation statistics for all individuals and business owners are reported relative to the median. The gross return on the business is the sum of the capital gain to sweat equity (V_b) plus the dividend yield, and both are in percentage terms. The dividend in this case is the share of revenues to sweat equity (that is, $\phi p y_s - e$). The final column is the dividend yield (in percent) based on SCF data and is found by dividing net income by self-reported net worth for actively managed businesses.

Table 8. Characteristics of Businesses, Sorted by Returns

Return Bounds	Age of Business	Intangible Intensity	Private Business Production			
			Sweat capital	Fixed assets	Hours	Output
−27.0, −15.3	11.2	0.67	0.37	1.14	0.06	0.27
−15.3, −0.6	15.5	0.65	0.35	2.01	0.09	0.48
−0.6, 2.3	17.8	0.71	0.27	0.67	0.04	0.16
2.3, 4.5	15.3	0.66	0.30	0.84	0.05	0.20
4.5, 11.9	15.4	0.47	0.33	3.50	0.15	0.83
11.9, 14.7	9.8	0.29	0.40	5.75	0.25	1.36
14.7, 19.4	5.1	0.35	0.31	4.62	0.23	1.09
19.4, 42.2	8.3	0.46	0.29	5.61	0.21	1.33
42.2, 208.8	6.3	0.34	0.32	4.34	0.27	1.64

Note: The model statistics are based on the case with skewed $\ln z$ productivity shocks.

Table 9. Tax Policy Counterfactuals, Percent Changes

	Greater Compliance	Lower Rate, Private Business	Lower Rates, All Businesses
Tax revenues	7.67	-5.28	-4.80
Prices			
Wage (w)	-.22	0.31	5.36
Relative price (p)	10.09	-5.26	-2.77
Interest rate (r)	0.68	-0.79	-0.53
Consumptions			
Private business ($\int c_{si}\, di$)	-14.19	8.84	8.97
C corporation ($\int c_{ci}\, di$	4.01	-2.30	3.02
Investments			
Sweat capital expenses ($\int e_i\, di$)	-6.00	2.82	5.74
Private business capital ($\int x_{si}\, di$)	-5.81	3.50	6.20
C-corporate capital (x_c)	2.36	-0.97	14.74
Outputs			
Private business ($\int y_{si}\, di$)	-14.19	8.84	8.97
C corporation (y_c)	2.68	-1.42	6.45
GDP ($y_c + \bar{y}_{nb} + p \int y_{si}\, di$)	0.58	-0.27	4.70
Hours			
Sweat capital building ($\int h_{\kappa i}\, di$)	-23.56	15.48	13.31
Private business production ($\int h_{yi}\, di$)	-22.51	15.30	12.87
C-corporate production ($\int n_i \epsilon_i\, di$)	2.90	-1.72	1.03
Capital stocks			
Sweat capital ($\int \kappa_i\, di$)	-17.97	11.06	9.78
Fixed assets ($\int k_{si}\, di$)	-5.81	3.50	6.20
C corporation (k_c)	2.36	-0.97	14.74
Financial assets ($\int a_i\, di$)[a]	23.21	-16.07	-4.94
Sweat equity (V_b)	-2.92	3.87	6.14

Note: The model statistics are based on the case with skewed $\ln z$ productivity shocks.

[a] Nonbusiness capital related to investment $\bar{x}_{nb}$ is not included.

Table 10. Lower Tax Rate on Private Business Net Income,
Extensive versus Intensive Margin Decomposition

		Hours	
	Output ($\int y_{si}\, di$)	Sweat building ($\int h_{\kappa i}\, di$)	Production ($\int h_{yi}\, di$)
Extensive Margin (%)	70	25	41
Ages 0-2	4	7	3
2-5	12	4	7
5-10	11	3	6
10-15	10	2	6
15+	32	8	19
Intensive Margin (%)	30	75	59
Ages 0-2	16	55	21
2-5	4	5	11
5-10	4	5	11
10-15	2	3	5
15+	5	7	11

Note: The model statistics are based on the case with skewed $\ln z$ productivity shocks.

Table 11. Lower Tax Rate on Corporate Profits, Percent Changes,
One-Sector versus Two-Sector Models

		One-Sector Model	
	Two-Sector Model	Baseline parameters	Aiyagari-McGrattan (1998) parameters
C-corporate:			
Output (y_c)	8.0	6.3	3.4
Capital (k_c)	16.1	13.9	9.7
Hours (n_c)	2.8	0.8	0.9
Private hours ($\int h_{yi}\, di$)	−2.3	–	–

Note: Statistics for the two-sector (baseline) model are based on the case with skewed $\ln z$ productivity shocks.