

Tax Exclusion of Employer-based Insurance Premiums *

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Abstract

Americans who obtain health insurance coverage through employment do not currently pay income or payroll taxes on this benefit. Tax-deductible employer-based health insurance (EHI) is regressive, and we show that this tax policy can help correct misallocation between self-employment and firm employment. Agents face idiosyncratic health risk and have heterogeneous ability as workers or entrepreneurs, and choose their occupation. Linking employment and health insurance creates a wedge between the marginal cost and benefit of EHI and employment at a firm. In equilibrium, some highly skilled individuals with adverse health shocks leave entrepreneurship while individuals with intermediate skills but favorable health shocks opt to manage firms. In the presence of imperfect information on private agent's health risk and managerial ability, and in the absence of perfectly discriminating taxes, a regressive tax subsidy for entrepreneurs to purchase health insurance helps correct distortions associated with non-contractible heterogeneity in managerial talent and health shocks. The subsidy makes entrepreneurship a more (less) attractive option for the highly (medium) skilled unhealthy (healthy) agents as such a policy increases (reduces) net-tax entrepreneurial income. Consequently, this tax policy provides an additional incentive (disincentive) for the first (second) type to be an entrepreneur, hence improving talent allocation. For a dynamic equilibrium model calibrated to the US economy, we find that the welfare gain from improved talent allocation outweighs the loss due to reduced risk sharing associated with the regressive subsidy.

JEL Classification: E23, I10, O40.

Keywords: Employer-based health insurance, entrepreneurship, tax policy, imperfect information, mis-allocation

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1 Introduction

The U.S. has an employer-based health insurance (EHI) system under which employers offer health insurance to employees as part of a compensation package. Under the system employer and employee spending on these health insurance premiums are exempt from federal income and payroll taxes.¹ This exemption constitutes the single largest tax expenditure in the U.S., estimated to cost the federal government \$260 billion in income and payroll taxes in 2017. In addition, the policy is highly regressive (most of the benefits flow to those in the top half of the income distribution).² Missing from the debate about how to fund health insurance is the effect of this exclusion on an individual's choice to work as an employee at a firm or as an entrepreneur. Entrepreneurship is perhaps the most important source of jobs and economic growth in the United States and other economies. What are the effects of this regressive tax policy on output, firms, wages and welfare? This paper shows how a new channel associated with health insurance, which we call the talent allocation channel, affects entrepreneurship and the macroeconomy.³

The main rationale for tax exclusion of EHI premiums is that it may be the “glue” that holds the system together. A large pool of individuals creates a predictable distribution of risk that combines workers with a high risk of large health expenditures with many healthier workers. In smaller non-group markets, insurers fear adverse selection. The tax exclusion gives employers the incentive to offer insurance, thereby bringing some individuals with better risk characteristics to the pool. The two main arguments against tax exclusion of EHI premiums are the large loss of tax revenue and that the policy is regressive.⁴ Other arguments are that tax exclusion lowers the price of insurance, which provides an incentive to purchase “excessively generous policies,” and that the benefits associated with tax exclusion may distort job change and retirement decisions. We will show that tax exclusion can also distort occupational choice, but in a way that potentially can be “tuned” to offset other distortions in the economy.

Our model introduces heterogeneous ability in the form of differences in the talent to manage a firm. This links our results in spirit to the optimal taxation literature. It is well known that in an economy with heterogeneity and imperfect information, non-linear income taxes are optimal and involve a classical tradeoff (Mirrlees, 2001). On the one hand, a progressive tax

¹Employees typically pay part of the premium and this spending is also exempt from taxation if the firm has a Section 125 cafeteria plan. Gruber (2011) reports that 80 percent of employees with insurance have a Section 125 plan.

²<http://www.taxpolicycenter.org/briefing-book/how-does-tax-exclusion-employer-sponsored-health-insurance-work>. This is the third largest government expenditure on health care, after Medicare and Medicaid

³Entrepreneurs generate about half of output in the U.S. and productivity varies systematically with firm size. See <http://www.sba.gov/advo/stats/sbfaq.pdf>. The fact that health insurance affects whether an individual chooses to become an entrepreneur is well documented, both empirically (Fairlie, Kapur and Gates, 2001) and theoretically (Chivers, Feng and Villamil, 2016).

⁴Conditional on being covered by EHI, the policy is regressive because the progressive U.S. income tax code implies that individuals with higher income in a higher marginal tax bracket receive a larger tax break than those with lower income.

system counteracts inequality in initial conditions and can substitute for imperfect insurance against idiosyncratic risk. This insurance motive associated with taxation is well understood: progressive income taxes allow a government to redistribute from rich to poor individuals or from those who experience good versus bad expenditure shocks. On the other hand, progressive taxes reduce the incentive to work and/or run a business.

We add to this general problem the issue of occupational choice, and more specifically entrepreneurship. Chivers, Feng and Villamil (2016) showed that EHI can distort an individual's occupational choice between entrepreneurship and salaried work when EHI is mandated for workers, as is the case in the U.S. A health insurance mandate creates a wedge between the marginal cost and benefit of choosing to be a worker. The wedge can cause two types of talent misallocations. Some highly skilled individuals with adverse health shocks leave entrepreneurship while individuals with intermediate skills but favorable health shocks opt to manage firms. The potential misallocative effect of health insurance on occupational choice may affect the distribution of managerial ability and GDP.

When the government observes income, but not health expenditure shocks or managerial ability, direct corrective intervention to ameliorate the misallocation is difficult. The government would like to subsidize individuals with high managerial ability that are at greater risk for large health expenditure shocks or tax those with less managerial talent and more favorable shocks, but it cannot because it does not observe managerial ability and health risk directly. We show that using a regressive tax policy to pay for health insurance may improve the talent distribution, and hence output and welfare. The regressive tax on EHI can partially correct occupational misallocation because it is equivalent to a subsidy to those with high managerial talent but adverse health shocks, conditional on being an entrepreneur. In this paper, we analyze the optimal non-linear tax that corrects the misallocation arising from non-contractible heterogeneity in managerial talent and health shocks. We also compute the optimal tax that minimizes the welfare loss associated with the EHI friction.

In order to find the optimal regressivity of the subsidy to the U.S. EHI system, we use Feldstein's (1979) tax function to characterize U.S. tax and transfer policies that link a household's taxable income to a parameter that determines the degree of progressivity of the tax system. Using data from the 2000-2006 Panel Study of Income Dynamics, Heathcote, Storesletten and Violante (2015) find that this tax function precisely matches the actual tax/transfer scheme in the U.S. We incorporate this tax function into a model of the U.S. EHI system. This allows us to examine quantitatively how the progressivity of the tax system affects social welfare. On the margin, an individual making a choice between two occupations is choosing between two compensation packages. Let $T(\text{income} + \text{capital income} - \mathbf{1}_{\text{subsidy}}\text{premium})$ denote the non-linear income tax, where $\mathbf{1}_{\text{subsidy}}$ is an indicator function that denotes whether or not the individual receives an insurance subsidy. There are two occupations, with respective compensations:

- Workers: $\text{income} + \text{insurance} - T(\text{wage income} + \text{capital income} - \mathbf{1}_{\text{subsidy}}\text{premium})$.

- Entrepreneurs: $\text{income} - T(\text{profit income} + \text{capital income} - \mathbf{1}_{\text{subsidy}} \text{premium})$.

Workers' income is derived from wages and entrepreneurs' income derives from firm profit. In the absence of a subsidy, the indicator function is zero and a healthy individual may become an entrepreneur even without high managerial ability. This occurs if the profit from running a firm exceeds the monetary value of a worker's wage plus the mandated insurance inherent in an EHI system. Such an individual does not value EHI, but insurance is mandated for workers but not entrepreneurs.⁵ On the contrary, an individual with adverse health expenditure shocks but higher managerial ability may become a worker due to the high personal (but not publicly observable) value of insurance. US law prohibits contracts that discriminate among individuals based on personal characteristic such as health status.

When the EHI premium is income tax deductible, the indicator function is one and an unhealthy-high-skilled individual will benefit more from this favorable tax treatment of EHI and has a stronger incentive to become an entrepreneur than a healthy-medium-skill individual. First, compared with a medium skilled agent, the high skilled will earn a bigger profit as an entrepreneur, which means a larger tax subsidy from the EHI premium as his income will fall into a higher tax bracket. Second, due to the more favorable health risk, the healthy-medium-skilled individual may optimally choose to self-insure or to obtain health insurance in the private market when he chooses to be an entrepreneur. In either case, the EHI subsidy is not applicable, which reduces his incentive to become an entrepreneur. Consequently, the regressive tax associated with EHI counteracts the misallocation caused by EHI through linking health insurance with employment.

In order to understand the optimal level of subsidy to EHI that minimizes the talent misallocation from EHI, we consider a policy that extends income tax deductibility to private health insurance purchases, conditional on being an entrepreneur. Compared with the baseline economy, this policy encourages unhealthy-high-skilled individuals to run businesses, and it also incentivizes healthy-medium-skilled individuals to join entrepreneurship. Next, we adjust the progressiveness of the income tax function that governs the subsidy for health insurance purchases. We find that a more progressive tax function induces better talent allocation because it reduces the subsidy to less skilled individuals, while it increases the subsidy to the higher skilled. This allows us to address the following questions. Is this policy efficient? What are the policy's effects on the size distribution of firms, output, productivity and earnings? Can alternative policies perform better?

The intuition for our results is to begin by observing that current US policy treats entrepreneurs and workers differently. EHI provides risk pooling and is tax deductible. However, EHI can also distort the choice to become a worker or entrepreneur, leading to distortions in output and consumption. Current tax policy mitigates talent distortion through regressive sub-

⁵Zhigang: We need to explain the asymmetry: The worker gets a subsidy but ent does not. This was confusing to Matthias and will be very confusing to Gruber types (there is revenue loss from both ent and workers, which is different). Let's discuss this.

sidies to EHI and individual health insurance (i.e., the income tax code is progressive and EHI is tax deductible).

Other authors have argued that a regressive tax can improve welfare. Jeske and Kitao (2009) show that such a tax improves welfare because it improves risk sharing (holds EHI pool together).⁶ We introduce a new channel: Regressive tax policy improves the talent distribution (we need to explain this).

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The related existing literature largely focuses on distortions and inefficiency caused by credit market frictions on occupational choice (i.e., the decision to become an entrepreneur or worker, see Buera (2008), Jeong and Townsend (2009), Antunes, Cavalcanti and Villamil (2008), Gentry and Hubbard (2004), etc.), the effectiveness of different tax reforms (see Cagetti and De Nardi (2009), Kitao (2008), etc.), and optimal taxation to correct such distortions, see Scheuer (2013). We complement this literature by studying how optimal taxation can be used to correct a labor market distortion, more specifically the friction from EHI. The framework developed in this paper builds on Chivers, Feng and Villamil (2016), enriching it by introducing progressive income taxation and proportional consumption taxation.

The paper also contributes to a broad literature that studies macroeconomic aspects of health policies. This literature originates from Grossman (1972) and includes Brügemann and Manovskii (2010), Cole, Kim and Kruger (2014), Feng and Zhao (2014), French and Jones (2004), Hansen, Hsu and Lee (2014), Hall and Jones (2007), Jeske and Kitao (2009), Braun, Kopecky and Korshkova (2015), Pashchenko and Porapkkam (2012), and others. Our paper is most related to Jeske and Kitao (2009), who show that the regressive EHI subsidies are welfare improving since they hold the EHI risk pool together, and hence improve risk sharing. Our research complements Jeske and Kitao (2009) by studying another benefit of regressive EHI subsidies. Furthermore, we examine the optimal level of tax subsidy to EHI that minimize the welfare cost due to EHI frictions. Zhigang: We need to discuss Florian on taxation and entrepreneurship and better focus on Jeske and Kitao result on regressiveness (the focus on insurance).

Despite the active policy debate and the importance of small businesses to the U.S. macroeconomy, there is a surprising lack of analysis of the effect of health insurance tax policy on small businesses and entrepreneurship. This paper fills this gap in the literature by building a general equilibrium model with endogenous occupation choice and a health insurance decision. The paper is organized as follows. Section 2 summarizes the stylized facts and describes the policies. Section 3 builds a model consistent with the facts. Section 4 describes optimal behavior and the

⁶We focus on the U.S. EHI system. See Fossen and König (2015) for an analysis on the effect of German public health insurance system on entry into self-employment. A regressive tax subsidy reduces the after-tax health insurance cost differential between entrepreneurs and employed workers, which encourages entry into entrepreneurship. In Germany, the self-employed usually purchase health insurance in the private market as they don't have access to public health insurance. Fossen and König (2015) find that a 100 euro increase in the monthly health insurance cost difference between self-employed and workers will reduce the annual self-employment entry ratio by 0.38 percent.

equilibrium. Section 5 contains the model calibration and quantitative analysis is performed in section 6. Section 7 concludes.

2 Facts

A unique feature of the U.S. health care system is that over 90% of working-age Americans obtain health insurance through employers. U.S. law requires employers to offer health plans at common prices to all employees.⁷ The EHI premium is deductible from employees' taxable income, which is subject to a progressive income tax.⁸ Consequently, this tax policy is regressive because high-income individuals face a higher marginal tax rate and receive a larger tax break for insurance purchase than lower income individuals. There are intense debates about changing the EHI tax exclusion.

In 2010 the U.S. passed the Patient Protection and Affordable Care Act (ACA), which represents the most significant regulatory overhaul of its health care system since the creation of the Medicare and Medicaid programs in 1965.⁹ There is an ongoing debate about modifying the bill further or even repealing it altogether. Despite the continuing uncertainty about the U.S. health insurance system in the future, most working-age American continue to rely on EHI for health insurance coverage. This employer-based health insurance system has long been blamed for imposing a high "tax" on small businesses and their employees (Eibner 2008). We now summarize some stylized facts about U.S. healthcare system.

Fact 1: The U.S. healthcare system is largely employment based.

In the U.S. over 90% of private health insurance coverage is employment based. Buchmueller and Monheit (2009) discuss two government decisions that cemented the link between employment and health insurance: (i) During World War II the U.S. imposed wage and price controls, and in 1943 the War Labor Board ruled that the controls did not apply to fringe benefits such as health insurance. Many employers used insurance benefits to attract and retain workers. (ii) In 1954 the Internal Revenue Service ruled that health insurance premiums paid by employers were exempt from income taxation, providing a subsidy to EHI through the U.S. tax code.

Fact 2: Employment based health insurance has a premium based on a community rating.

The Employee Retirement Income Security Act of 1974 (ERISA), amended by the Health Insurance Portability and Accountability Act of 1996 (HIPAA), requires employers to offer health

⁷Employee Retirement Income Security Act of 1974 (ERISA), amended by the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

⁸This exclusion reduced federal tax revenues by \$268 billion in 2011, by far the largest federal tax exemption.

⁹Medicare and Medicaid were the first U.S. public health insurance programs. Medicare provides federal health insurance for individuals at least age 65 or disabled, that paid into the system. Medicaid covers low income groups designated by statute such as children or pregnant women.

plans at common prices to all employees. The common price is known as *community rating*, where insurers evaluate risk factors of a market population rather than an individual. In contrast, private health insurance is generally based on individual characteristics and is more expensive than employment based (group) insurance. Community ratings are one way to address a fundamental market incompleteness that arises, for example, because individuals cannot choose genetic risk. Adjusted community ratings permit lifestyle factors such as smoking status to be considered.

Fact 3: The EHI premium is tax deductible from employee taxable income.¹⁰

This exclusion reduced federal tax revenues by \$268 billion in 2011, by far the largest federal tax expenditure. Because it reduces taxable income, the exclusion benefits taxpayers in higher tax brackets more than those facing lower tax rates. There are intense debates on changing the tax exclusion of EHI. In November 2010, the Debt Reduction Task Force, chaired by Dr. Alice Rivlin and former senator Peter Domenici, proposed a plan to cap and phase out the tax exclusion. Sen. Marco Rubio, the Republican Presidential Candidate, wrote in the WSJ on Aug. 17, 2015: “First, I will ... create an advanceable, refundable tax credit that all Americans can use to purchase health insurance... and we should set the tax preference for employer-sponsored insurance on a glide path to ensure that it will equal the level of the credits within a decade.”

Fact 4: EHI affects occupational choice.

There is an extensive literature that studies the impact of health insurance policy and entrepreneurial decision. One of the well-documented empirical findings is that the availability of health insurance and the health status of the individual are significant fact for self-employment choice. Fairlie, Kapur and Gates (2011) find that business ownership rates increase at age 65 when individuals qualify for Medicare. Using a panel of tax returns from 1999 to 2004, Heim and Lurie (2010) find that an increase in the deductibility of health insurance premium for self-employed individuals (originated by the Tax Reform Act of 1986) increased the probability of being self-employed by 1.5 percent points. Wellington (2001) estimates that a guaranteed alternative source of health insurance would increase the probability of self-employment in the workforce by 2 to 3.5 percentage points, based on 1993 Current Population Survey (CPS) data.

Using the latest 9 panels of the Medical Expenditure Panel Survey (MEPS) over the period 2000–2008, Gai and Minniti (2015) find that a worse individual or family health status is associated with a lower likelihood of self-employment. The majority of the people who made the transition from employed worker to self-employed have better health status measured by total medical expenditure, the presence of disease, illness or disability. DeCicca (2012) finds that New Jersey’s Individual Health Coverage Plan, which was implemented in 1993 and included

¹⁰Zhigang: Let’s discuss. This is deductible for both the employee and the worker. Gruber has good numbers on this.

an extensive set of reforms that loosened the historical connection between traditional employment and health insurance, increased self-employment among New Jersey residents by roughly 14-20 percent. He also finds that individuals with lower health status presented larger behavioral responses to such policy change.

3 A simple endowment economy

In order to better illustrate the key features of our analysis, we first present a simple intuitive model of occupational choice with endowments.¹¹ Household have a common utility function given by $U(\cdot)$. If an agent chooses to operate a firm, the entrepreneur receives a random return of consumption good. If the agent chooses to be a worker he or she receives random compensation for employment. Heterogeneity is described by three shocks:

- x : managerial ability, with x^i for each agent i drawn from a uniform distribution $x \in [\underline{x}, \bar{x}]$. The agent i will receive x^i units consumption good if he/she chooses to be an entrepreneur.
- z : labor productivity that indicates the amount of consumption good if the agent chooses to be a worker.
- m : medical expenditure shocks that represent health spending (in terms of the consumption good) the agent faces. For simplicity assume that $m \in \{\underline{m}, \bar{m}\}$. Also assume that each household receives the mild health spending shock $\underline{m}$ with probability p , which is drawn from a uniform distribution $p \in [0, 1]$. Agent's health type p is unobservable to firm and health insurance company.

The household can obtain health insurance coverage either from their employer (EHI) as a worker, or purchase health insurance in a private market. EHI offers a pooling price π_E and is actuarially fair. Private health insurance sets a price $\pi(p)$ based on the agent's type p . Both type of health insurance are subject to perfect competition and charge an actuarially fair premium to cover the entire fraction of health spendings. We assume that the household's risk aversion is sufficiently strong so that every individual will enroll in either EHI or private health insurance. The health shock is independent of the managerial ability and labor productivity shocks. Hence we can derive the prices of health insurance as follows: $\pi_E = \int_{\hat{p}} (\hat{p}\underline{m} + (1 - \hat{p})\bar{m}) d\hat{p} = \frac{1}{2}(\underline{m} + \bar{m})$, $\pi(p) = p\underline{m} + (1 - p)\bar{m}$.

We now consider how occupational choice is determined in four cases in this simple model in order to build intuition.

¹¹We base this section on comments provided by Soojin Kim, a discussant at a conference.

Economy A, no EHI: In this economy, there is no EHI or private insurance. The agent's occupation choice hinges on the following equation.

$$p \cdot u(x - \underline{m}) + (1 - p) \cdot u(x - \bar{m}) \gtrless p \cdot u(z - \underline{m}) + (1 - p) \cdot u(z - \bar{m}),$$

where the left (right) hand side represents the expected payoff of being an entrepreneur (employed worker). Clearly there is a cutoff value of $x_A^*(p) = z$ so that agent with managerial ability higher than $x_A^*(p)$ will become entrepreneur. Note that the health insurance fully covers medical spending, we can simplify the equation as: $u(x - m) \gtrless u(z - m)$. This simplification will apply to the cases discussed below. In Figure 1, we plot the equilibrium frontier of occupation choice $x_A^*(p)$. As we can see that it is independent of the agent's health type p .

Economy B, with EHI: Now we introduce EHI into economy A. We assume that only workers have access to EHI, while the entrepreneurs can only get insurance in the private market.¹² Similarly, we find a cutoff value for occupational choice from the following equation.

$$u(x - \pi(p)) \gtrless u(z - \pi_E).$$

We have $x_B^*(p) = z - [\pi_E - \pi(p)]$, which implies that $x_B^*(p) > x_A^*(p)$ if $p < 1/2$, and $x_B^*(p) < x_A^*(p)$ if $p > 1/2$. Compared with economy A, the introduction of EHI creates two type of misallocations. More healthy (agent with $p > 1/2$) but less talent ($x_B^*(p) < x_A^*(p)$) enter entrepreneurship, while some unhealthy (agent with $p < 1/2$) but high ability ($x_B^*(p) > x_A^*(p)$) leaves entrepreneurship. The link between employment and health insurance distort the agent's occupation choice by rotating the equilibrium frontier.

Economy C, with EHI and EHI subsidy (only): Next we introduce subsidy to EHI purchase. To mimic the regressive subsidy, we assume that worker receives a subsidy of $\alpha z \pi_E$ from the government. Here a higher $\alpha > 0$ means a more regressive subsidy, while $\alpha < 0$ represents a progressive tax. Again we can find out the cutoff value by examining the following equation.

$$u(x - \pi(p)) \gtrless u(z - \pi_E + \alpha z \pi_E).$$

Hence we have $x_C^*(p) = z - \pi_E + \pi(p) + \alpha z \pi_E$. We can see that such subsidy correct the first type of misallocation since $x_C^*(p) > x_B^*(p)$ for healthy agent with $p > 1/2$. Unfortunately, this subsidy worsen the second type of misallocation. In the next economy, we will consider a policy that can potentially correct both misallocations.

¹²Entrepreneurs have access to EHI both in the data and the dynamic model considered below. Here we use a simplified assumption to capture the fact that small business owners have a higher cost to get EHI.

Economy D, with EHI and extended subsidy: Last, we consider a policy that extends the subsidy to entrepreneur purchasing private insurance. Similar to economy C, this is a regressive tax credit. We solve the cutoff value based on the equation below.

$$u(x - \pi(p) + \alpha x \pi(p)) \gtrless u(z - \pi_E + \alpha z \pi_E).$$

We find that $x_D^*(p) = \frac{z - \pi_E + \pi(p) + \alpha z \pi_E}{1 + \alpha \pi(p)}$. It is straightforward to show that $x_D^*(p) - x_B^*(p) > 0$ for larger p , and $x_D^*(p) - x_B^*(p) < 0$ for smaller p . This means that this extended subsidy corrects both type of misallocations. We also find that $\lim_{\alpha \rightarrow \infty} x_D^*(p) = z$, which implies that a sufficiently regressive subsidy restore the first best as we find in economy A.¹³ From Figure 1, we find that this regressive tax partially restore the efficient by rotating the equilibrium frontier of occupation choice counter-clock-wise toward the first best allocation as in economy A.

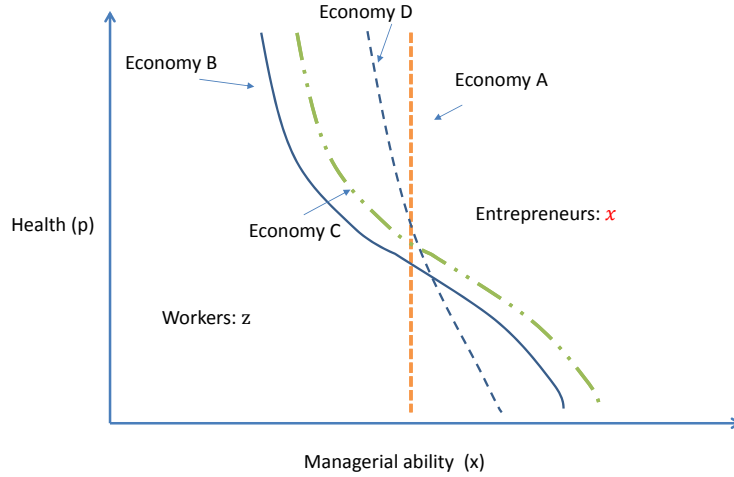


Figure 1: Talent misallocation and regressive tax

4 The Dynamic Model: Economic Environment

In this section, we extend the basic endowment economy discussed in section 3 to dynamic setting so that we can capture the general equilibrium effect. We consider production technology

¹³Apparently there is a tradeoff associated with the regressive subsidy. This is because to finance it needs additional tax revenue, which will introduce distortion into the economy. We take up this issue in the dynamic model.

to evaluate the impact on factor prices. We also consider a framework with incomplete market and distortionary tax.

Consider a Lucas (1978) span of control model, where individuals differ in the ability to manage capital and labor. Productivity x^i for each agent i is drawn from a common continuous cumulative probability distribution with $x \in [0, \infty)$. Productivity is not hereditary and is publicly observed. Households receive an idiosyncratic labor productivity shock z that indicates the efficiency units per unit of work hours. They also face an idiosyncratic health expenditure shock m_t^i , which follows a finite-state Markov process. For notational convenience, we drop agent superscript i and time subscript t whenever possible, and φ' denotes the future value of the variable φ .

As in Chivers, Feng and Villamil (2016) two types of individuals emerge in equilibrium, workers and managers. We begin with an overview. In section 4.3 we provide the intuition for equilibrium frontier of occupational choice, x^* , where individuals above this value choose to be managers and those below it are workers.¹⁴

4.1 Preferences, endowments and technology

Preferences: Consumption by an agent in period t is c_t , with utility given by $U(c_t)$.

Endowments: Each individual is endowed with managerial talent, x , and labor productivity z , which are random variables as specified in Section 6. Assume that the distribution and realizations are public information. Each agent receives a medical spending shock m . Agents are also endowed with an initial capital asset, a_0 , which can be used as an input in production. They have one unit of time that will supply inelastically to the firm as a worker.

Production: Firms use efficiency labor (n) and capital (k) to produce a single consumption good, y . Efficiency labor is $n = \int z\hat{n}$, the sum of hours worked, $\hat{n}$, weighted by the productivity of each worker, z . Note that $\hat{n} = 1$ in equilibrium. Capital depreciates at a constant rate of δ . Managers can operate only one project. The functional form of the production function is:

$$y = Xk^\alpha n^\gamma \quad \text{where } \alpha, \gamma > 0, \tag{1}$$

where firm productivity is given by $X = x^{1-(\alpha+\gamma)}$. We assume $\alpha + \gamma < 1$.

¹⁴See Acemoglu and Autor (2011) for a model with a continuum of occupations, which together produce a unique final good. A fixed inelastic supply of workers are endowed with low, medium or high skill, and capital is available at a constant price. Workers choose the allocation of skill to tasks (occupations). In contrast, we consider a model where individuals choose one of two occupations: entrepreneurs hire capital and labor to operate a firm with endogenous size determined by idiosyncratic managerial skill and other factors or workers with income determined by a market wage package and idiosyncratic productivity. Occupation, and hence the equilibrium number of workers, is determined endogenously and prices move to clear the respective factor markets. See the literature on the skill premium, which is defined as the ratio of the wages of skilled to unskilled workers, e.g., the relative wages of college graduates to high school graduates.

Factor remuneration: Firms rent capital at the common market rate $r(1 + \Delta)$, where r is the risk-free rate and $\Delta \geq 0$. We assume that the intermediary charges a proportional cost Δ per unit of funds loaned to the firm. As usual, this wedge above the risk-free rate accounts for intermediation costs and a risk premium.

We want our model to be consistent with the employment-based health insurance (**EHI**) system in the United States, which we take as given. The firm offers a worker a compensation package $\tilde{w}$ that includes a monetary wage w and a term that accounts for the expected cost of insurance. In order to simplify and match our model to observable data, we assume that each firm offers employment-based health insurance (**EHI**) with given probability p_E , determined by random shock i_E . Consistent with the data, $p_E(n)$ as a function of n increases with firm size.¹⁵ The firm's expected cost of providing EHI directly is $p_E [1 + g(n)] q_E$, where $g(n)$ is a decreasing function of n because it is more costly for a small firm to offer health insurance than bigger firms. We assume that when insurance is not offered, which happens with probability $1 - p_E$, firms compensate employees for the average cost of providing EHI, q_E . Thus, total labor compensation is given by¹⁶

$$\tilde{w} = w + p_E [1 + g(n)] q_E + (1 - p_E) q_E.$$

Health insurance market: There are two types of insurance, EHI and private insurance:

EHI: Households have access to EHI with probability $\hat{p}_E$ see section 5.1.1, which is determined by shock i_E . We differentiate between p_E and $\hat{p}_E$ because workers are randomly matched with firms of different sizes, but each worker has the same probability of receiving an EHI offer. Insurance covers a fraction $\phi(m)$ of total medical expenditures, where $\phi(\cdot)$ is a mapping $m \rightarrow [0, 1]$. The EHI premium is denoted by π_E and is not dependent on the individual's prior health history or any individual states. This accounts for the community rating practice in the U.S. where group health insurance cannot price-discriminate among the insured based on such individual characteristics. A fraction $\psi \in [0, 1]$ of the premium is paid by the employer as part of the compensation to employment.

Private: If the worker is not offered with EHI (or declines the EHI offer), she has the option to purchase health insurance in the private market at premium $\pi_P(m)$ with coinsurance rate $\phi(m)$. This can happen if a household becomes a manager and does not offer (or has no access to) EHI.

Once the firm makes an offer to the worker, which is denoted as $i_E = 1$, the worker chooses either to obtain coverage (through EHI or purchase health insurance in the private market) or

¹⁵This is equivalent to modeling the EHI offer decision as a preference shock, see Aizawa and Fang (2013); Nakajima and Tuzemen (2015).

¹⁶Chivers, Feng and Villamil (2015) show that the decision to offer health insurance can be endogenized and link the equation for compensation to observable data.

remain uninsured ($i'_{HI} = \{0, 1\}$).¹⁷ Health insurance companies are competitive. The premiums for EHI and private plans are determined by the expected expenditures for each contract plus a proportional markup denoted by η . EHI has two advantages compared with private insurance:

- (i) EHI receives a tax subsidy from the government as explained below, which is more cost-efficient for firms.
- (ii) EHI has a more inclusive risk pool, which helps to share risk among the insured.

Government: The government runs a balanced budget each period and provides the following programs.

- Public safety-net program, T_{SI} : This program guarantees each household a minimum consumption level of $\underline{c}$. This reflects the option available to U.S. households to rely on public transfer programs such as food stamps, Medicaid, disability and unemployment insurance if substantial income and health expenditure shocks occur.
- In the baseline model, the government subsidizes EHI by allowing the individuals to exclude the premium of EHI from payroll tax and income tax. Entrepreneurs can deduct health insurance premium paid in the private market from income tax base.¹⁸
- The government also needs to finance some exogenous spending G .

The government funds these programs by a linear consumption tax τ_c , payroll (Medicare and social security) tax τ_s , and progressive income tax $T(y)$. We model progressive taxation of total income as in Heathcote, Storesletten and Violante (2014). The total income taxes paid by each household are given by

$$T(y) = (y - \lambda_p y^{1-\tau_p})$$

where y is the household's total taxable income, τ_p measure the progressivity of the income tax.¹⁹ Note, when $\tau_p > 0$, the income tax is progressive. Conversely, when $\tau_p < 0$, the tax system is regressive.

4.2 Firm's problem

The firm's problem is:

$$\max_{n,k} Xk^\alpha n^\gamma - \tilde{w}n - \tilde{r}k \quad (2)$$

¹⁷In line with Jeske and Kitao (2009), we assume a segmented labor market where employers do not adjust wages if EHI coverage is declined.

¹⁸The Tax Reform Act of 1986 (TRA86) took the first step toward equalization by allowing self-employed workers to deduct 25 percent of their premiums from income prior to calculation of adjusted gross income (AGI). This percentage was increased to 30 percent by the start of my analysis in 1996, and then rose to 40 percent in 1997, 45 percent in 1998, 60 percent in 1999-2001, 70 percent in 2002, and finally 100 percent starting in 2003. Despite these changes, subsidies for the self-employed are lower than for employed workers, because premiums remain subject to the self-employment tax.

¹⁹Heathcote, Storesletten and Violante (2015) use data from the Panel Study of Income Dynamics (PSID) and estimate that $\tau_p = 0.151$ with a standard error of 0.003.

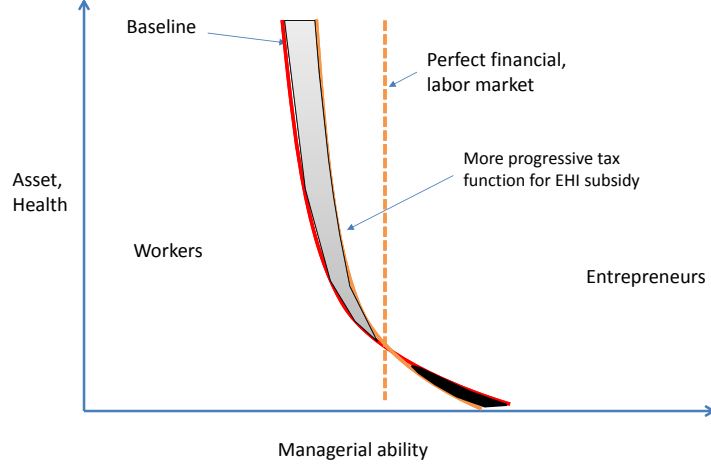


Figure 2: Talent misallocation and regressive tax

The average cost of hiring labor, $\tilde{w}$, includes monetary wage component w and the expected cost of EHI or a compensation payment by the firm when EHI is not offered. See Chivers, Feng and Villamil (2016) for the derivation of n^* and k^* , for constrained and unconstrained borrowing.

4.3 EHI and talent misallocation

Chivers, Feng and Villamil (2016) find that some individuals that are healthy but less skilled become entrepreneurs, while others that are less healthy but highly skilled leave entrepreneurship. These misallocations relative to a frictionless world are caused by the link between health insurance and employment. They call this “talent misallocation” as individuals that are healthy but less-skilled would be workers absent the EHI friction, while those with bad health shocks but high ability would run firms.

The government can potentially counteract these misallocations by subsidizing highly skilled unhealthy individuals, while taxing intermediate skilled but healthy agents, conditional on them becoming entrepreneurs. The unobservability of managerial ability and health risk make this direct redistribution, or “tagging”, impossible. However, a non-linear income taxation may partially correct misallocation through indirect general equilibrium. In our framework, the tax deductibility of the EHI premium is effectively a regressive tax. This is because high income individuals face a higher marginal tax rate and receive a larger tax break for insurance purchase than lower income individuals.

Compared with the economy without subsidy to EHI, such tax policy provides unhealthy-skilled individuals a larger tax benefit than healthy-medium-skilled agents, conditional on being entrepreneurs. The high skilled will earn a bigger profit as an entrepreneur, which means a larger tax subsidy from the EHI premium as his income will fall into a higher tax bracket. Hence the policy encourage their entrepreneurial activity (the dark area in Figure 2). At the meantime, due to the more favorable health risk, the healthy-medium-skilled individual may optimally choose to self-insure or to obtain health insurance in the private market when he chooses to be an entrepreneur. In either case, the EHI subsidy is not applicable, which reduces his incentive to become an entrepreneur (the grey area in Figure 2). Consequently, the regressive tax associated with EHI deductibility counteracts the misallocation caused by EHI through linking health insurance with employment.

There is also an indirect effect. As this regressive tax policy reduce talent misallocation, there are more high-skilled individuals run larger firm. The profits of these individual will increase, which translate into higher amount of taxable income. Higher productivity from the firm side also implies higher wage and capital return. All of these will benefit the worker through a “tickle down” effect, see Scheuer (2013).

5 Optimal behavior and equilibrium

The timing of the economy is given as follows.

1. Households enter each new period with assets a and health insurance status i_{HI} .
2. Idiosyncratic shocks x , z and m are drawn by nature.
3. Households make an occupation decision: entrepreneur ($\mathcal{I}_e = 1$) or worker ($\mathcal{I}_e = 0$).
4. Workers randomly match with firms. Idiosyncratic shock i_E is drawn, which determines the EHI offering status (EHI availability for workers).
5. Capital and labor markets clear and production takes place.
6. Households (as managers or workers) decide : health insurance ($i'_{HI} = \{0, 1\}$), consumption (c), borrowing/saving (a').

5.1 Firm manager

Firms are distinguished by their productivity realization x . Agents with sufficient ability to become managers choose the level of capital and the number of employees to maximize profit subject to a technological constraint and exogenously given health care policy. The benefits component of EHI exists for historical reasons and clearly it would be more efficient to use an

insurance pool. In order to simplify the exposition, first consider the problem of a manager with talent x^i for a given level of capital k (i.e., the labor input choice only):

$$\max_n Xk^\alpha n^\gamma - \tilde{w}n \quad (3)$$

where $\tilde{w} = [w + p_E(1 + g(n))q_E + (1 - p_E)q_E]$ is the firm's per capita labor cost and $g(n)$ is the administrative cost of organizing EHI at the firm level.

The first order conditions are:

$$n^*(k, x, \tilde{w}) = \left[\frac{\gamma Xk^\alpha}{\tilde{w}} \right]^{\frac{1}{1-\gamma}} \quad (4)$$

Substituting (4) into (3) yields the manager's profit function for a given level of capital:²⁰

$$y(k, x, \tilde{w}) = Xk^\alpha \left[\frac{\gamma Xk^\alpha}{\tilde{w}} \right]^{\frac{\gamma}{1-\gamma}} \quad (5)$$

5.1.1 Remark on random matching

Workers supply labor inelastically at the given wage package $\tilde{w}$. They enter the market and are randomly matched to firms. Workers receive EHI with probability $\hat{p}_E$, which is determined by shock i_E . We differentiate between p_E and $\hat{p}_E$ because each worker has the same probability of receiving an EHI offer. Consider two firms, one big and one small. The bigger firm offers insurance with 90% probability and the smaller with 50% probability. From the worker's point of view, probability $\hat{p}_E$ is a weighted average of the two firms. In general, $\hat{p}_E = \frac{\int \mathcal{I}_E n^* p_E(n^*) d\Psi(s)}{\int \mathcal{I}_E n^* d\Psi(s)}$. Equivalently, $\hat{p}_E = \int [\frac{n^*}{\int n^* d\Psi(s)}] p_E(n^*) d\Psi(s)$, where the weight is given by the term in brackets.²¹

5.1.2 Capital

Now consider the choice of capital. Let

- a denote the amount of self-finance; and
- l denote the amount rented from the capital market.

Both sources of funds are used to raise capital, with $k = (a - oop) + l$, where oop denotes out of pocket medical expenses. The entrepreneur can either use personal funds net of out-of-pocket medical spending ($a - oop$) or rent capital from the market (l). The two sources of funds have the following costs. The entrepreneur owns capital and therefore the opportunity cost of a is only the foregone interest the entrepreneur could have received from the capital market. This

²⁰This will adjust with EHI offering status, since EHI benefits from a tax subsidy.

²¹We model the way firms offer EHI as a preference shock i_E , an approach also used by Aizawa and Fang (2013). Chivers, Feng and Villamil (2016) also consider a cost shock, which is an alternative approach that endogenizes the insurance offer.

amount is given by ra . In addition, the entrepreneur may rent capital in the market, at cost $(1 + \Delta)rl$, $l \leq \bar{l}$. Here $\bar{l}$ is an upper limit on borrowing. We will first consider the case where this borrowing constraint does not bind.

Self-financed firm: When initial assets are sufficient to run a business without renting new capital from the market (i.e., $l = 0$), the manager of the firm solves the problem:

$$\nu(a, x, i_E; w, r) = \max_{k \geq 0} y(k, x, \tilde{w}) - rk - \tilde{w}n(k, x, \tilde{w}) \quad (6)$$

This gives the optimal physical capital level:

$$k^*(x, w, r) = \left[X \left(\frac{\gamma}{\tilde{w}} \right)^\gamma \left(\frac{\alpha}{r} \right)^{1-\gamma} \right]^{\frac{1}{1-\alpha-\gamma}} \quad (7)$$

From equation (5), the manager's profit at the optimal level of capital is:

$$\nu(k^*, x, w) = Xk^{*\alpha} \left[\frac{\gamma X k^{*\alpha}}{\tilde{w}} \right]^{\frac{\gamma}{1-\gamma}} - \tilde{w}n(k^*, x, \tilde{w}) - rk^* \quad (8)$$

Firm with assets borrowed from the market: When managers do not have enough personal assets to operate the firm, they can rent l from the capital market at rate $(1 + \Delta)r$. The firm's problem is given as follows.

$$\tilde{\nu}^*(\tilde{k}, x, w) = \max_{\tilde{k}} X\tilde{k}^\alpha \tilde{n}^\gamma - \tilde{w}\tilde{n} - \tilde{r}(\tilde{k} - (a - oop)) \quad (9)$$

where

$$\tilde{r} = \begin{cases} r - \delta & \text{if } \tilde{k} \leq a - oop \\ (1 + \Delta)r - \delta & \text{if } \tilde{k} > a - oop \end{cases} \quad (10)$$

$$\tilde{n}^*(\tilde{k}, x, w) = \left[\frac{\gamma X \tilde{k}^\alpha}{\tilde{w}} \right]^{\frac{1}{1-\gamma}}. \quad (11)$$

Similar to the self-financed firm, the optimal capital demand of the firm that borrows in the market will be a function of aggregate factor prices: $\tilde{r}$ and $\tilde{w}$.

5.2 Workers

Workers receive wage income from the firm and choose consumption, saving and health insurance to maximize expected discounted utility of consumption

$$\max_{\{c_t, a_{t+1}, i_{HI, t+1}\}} \mathbb{E} \sum_{t=0}^{\infty} \beta^t U(c_t).$$

5.3 The household's problem

Let $\mathcal{I}_e$ indicate occupational choice, where if $\mathcal{I}_e = 1$ the household is an entrepreneur and if $\mathcal{I}_e = 0$ the household is a worker. We can write the household's problem recursively as follows.

$$\mathbf{V}(a, x, z, m, i_{HI}) = \max_{\{a', c, i'_{HI}, \mathcal{I}_e\}} [\mathcal{I}_e V_e + (1 - \mathcal{I}_e) V_w + \beta \mathbb{E} \mathbf{V}(a', x', z', m', i'_{HI} | x, z, m)]$$

subject to

$$(1 + \tau_c)c + a' + oop + \tilde{\pi} \leq a + inc - Tax + T_{SI} \quad (12)$$

where

$$\tilde{\pi} = \begin{cases} \pi_E(1 - \psi) & i'_{HI} = 1, i_E = 1 \\ \pi_P(m) & i'_{HI} = 1, i_E = 0 \\ 0 & i'_{HI} = 0 \end{cases} \quad (13)$$

$$Tax = T(inc) + \tau_s [(1 - \mathcal{I}_e)\tilde{w}z + \mathcal{I}_e \nu(k, x; \tilde{r}, \tilde{w}) - i_E \tilde{\pi}] \quad (14)$$

$$T_{SI} = \max \left\{ 0, (1 + \tau_c)\underline{c} + T(\tilde{inc}) + oop - [a + inc] \right\} \quad (15)$$

$$inc = \begin{cases} (r - \delta)a + \tilde{w}z + (1 - i_E)q_E - i_E \tilde{\pi} & \text{if } \mathcal{I}_e = 0 \\ (r - \delta)a + \nu(k, x; \tilde{r}, \tilde{w}) - \tilde{\pi} & \text{if } \mathcal{I}_e = 1 \end{cases} \quad (16)$$

$$\tilde{inc} = \begin{cases} (r - \delta)a + \tilde{w}z + (1 - i_E)q_E & \text{if } \mathcal{I}_e = 0 \\ (r - \delta)a + \nu(k, x; \tilde{r}, \tilde{w}) & \text{if } \mathcal{I}_e = 1 \end{cases} \quad (17)$$

$$oop = (1 - i_{HI}\phi(m))m \quad (18)$$

The budget constraint (12) is standard: consumption, saving/borrowing, uncovered (out of pocket) medical expenses, and insurance premia cannot exceed asset market returns, labor income, net of taxes, and government transfers. Income tax, $T(inc)$, payroll tax and consumption tax $\tau_c c$ are collected to finance a consumption floor $\underline{c}$, EHI subsidy and other government spending. The premium that the manager pays for insurance as specified in equation (13), $\tilde{\pi}$, has two

components: i'_{HI} is the household's choice to buy health insurance for himself for next period and i_E is the shock that indicates that the employer must provide health insurance to the employee. The government defrays the cost of EHI by allowing the premium of EHI income tax and payroll tax deductible, see equation (14). Equation (15) presents a transfer T_{SI} from the government as specified in Hubbard et al. (1995). Equations (16) and (17) specify the taxable income of the worker or entrepreneur. The out of pocket medical expense oop is given by equation (18).

The value functions V_e and V_w are defined as follows:

$$\begin{aligned} V_e &= p_E(n^*)U(c|i_E = 1) + (1 - p_E(n^*))U(c|i_E = 0) \\ V_w &= \hat{p}_E U(c|i_E = 1) + (1 - \hat{p}_E)U(c|i_E = 0). \end{aligned}$$

$\hat{p}_E$ and p_E reflect the random matching between workers and firms, as explained in section 5.1.1.

5.4 Health insurance

There are two kinds of insurance, private and employer based group insurance. The latter benefits from pooling and tax advantages, while private insurance has higher administrative costs. The cost of providing insurance for the firm is given as:

$$q_E = \psi \pi_E \tag{19}$$

The EHI premium equals the expected cost of covering the health spending among the insured. It also charges a propotional markup η .

$$\pi_E = (1 + \eta) \int i_E i'_{HI} \phi(m) m d\Psi(s) \tag{20}$$

The premium for private insurance equals:

$$\pi_P(m) = (1 + \eta) \frac{\mathbb{E}[\phi(m') m' | m]}{1 + r - \delta}. \tag{21}$$

Markup η applies to both EHI and private insurance, consistent with MEPS data.

5.5 Steady state equilibrium

We characterize the steady state equilibrium. Denote the equilibrium aggregate variables by $\Phi = \{r, w, \pi_E, \hat{p}_E, \tau_y\}$. Individual state variables $s = \{a, x, z, m, i_{HI}\}$ denote asset holding $a \in \mathbb{A}$, managerial ability $x \in \mathbb{X}$, labor productivity $z \in \mathbb{Z}$, health spending shock $m \in \mathbb{M}$ and insurance status $i_{HI} \in \mathbb{I}$. Let $\mathbb{S} = \mathbb{A} \times \mathbb{X} \times \mathbb{Z} \times \mathbb{M} \times \mathbb{I}$ denote the entire state space.

Definition 1 *The steady state equilibrium for the economy is given by aggregate variables Φ , allocations $(c, a', i'_{HI}, \mathcal{I}_e)$ for households characterized by $s = (a, x, z, m, i_{HI})$ and the distribution*

of agents over the state space $\mathbb{S}$ given by $\Psi(s), s \in \mathbb{S}$, such that:

1. Given Φ , allocations $(c, a', i'_{HI}, \mathcal{I}_e)$ solve the household's optimization problem.
2. The health insurance market is competitive.
3. The asset market clears: $\int k d\Psi(s) = \int a d\Psi(s)$.
4. The labor market clears: $\int \mathcal{I}_e n d\Psi(s) = \int (1 - \mathcal{I}_e) \hat{n} z d\Psi(s)$.
5. The goods market clears.
6. The government balances its budget:

$$\int \{T(\text{inc}) + \tau_c c + \tau_s [(1 - \mathcal{I}_e) \tilde{w} z + \mathcal{I}_e \nu(k, x; \tilde{r}, \tilde{w}) - i_E \tilde{\pi}]\} d\Psi(s) = \int (T_{SI}) d\Psi(s) + G.$$
7. Distribution $\Psi(s)$ is time-invariant. The law of motion for the distribution of agents over the state space $\mathbb{S}$ satisfies $\Psi = \mathbf{F}_\Psi(\Psi)$, where $\mathbf{F}_\Psi$ is a one-period transition operator on the distribution, i.e. $\Psi_{t+1} = \mathbf{F}_\Psi(\Psi_t)$.

6 Calibration

Preferences: Household preferences are given by $\sum_{t=0}^{\infty} \beta^t U(c_t)$, where $U(c) = \frac{c^{1-\rho}-1}{1-\rho}$. The coefficient of relative risk aversion ρ is set to 1.5 in the baseline economy, which follows estimates in the literature. We also consider $\rho = 3$ as a robustness check. The subjective time discount factor β is set to 0.94 so that the aggregate capital-output ratio is 2.42 in the stationary equilibrium, consistent with U.S. data.

Labor Productivity: We assume that stochastic labor productivity z follows a first-order autoregressive process: $\ln z_t = \rho_z \ln z_{t-1} + \varepsilon_{z,t}$, where $\varepsilon_{z,t} \sim N(0, \sigma_z^2)$. In line with the literature, we choose the value for coefficient ρ_z and the residual variance σ_z^2 to be 0.94 and 0.02 respectively.²² To facilitate the computation, we approximate this process by a five state Markov process using the method of Tauchen and Hussey (1991). The calibrated Markov process is represented by finite states:

$$z \in \{0.646, 0.798, 0.966, 1.169, 1.444\}$$

and a transition matrix

$$\Pi_z = \begin{bmatrix} 0.731 & 0.253 & 0.016 & 0.000 & 0.000 \\ 0.192 & 0.555 & 0.236 & 0.017 & 0.000 \\ 0.011 & 0.222 & 0.533 & 0.222 & 0.011 \\ 0.000 & 0.017 & 0.236 & 0.555 & 0.192 \\ 0.000 & 0.000 & 0.016 & 0.253 & 0.731 \end{bmatrix}.$$

²²See Storesletten et al. (2004) and Hubbard et al. (1994).

Entrepreneurial ability and technology: The entrepreneur is endowed with managerial ability x and operates a firm with a neo-classical production function $Xk^\alpha n^\gamma$, where $X = x^{1-(\alpha+\gamma)}$. We assume that managerial ability x is distributed log-normal with mean μ_x and variance σ_x^2 , so that $\log(x) \sim N(\mu_x, \sigma_x^2)$. We choose α to match the capital share of 0.34 for the U.S economy for the period 1960-2000. We choose γ to match the fraction of entrepreneurs in the economy. We find μ_x and σ_x^2 to match the fraction of firms at different levels of employees and the mean size of establishments, which are listed in Table 3. See Chivers, Feng and Villamil (2016) for the details on calibration.

Health spending shocks and health insurance: We use Medical Expenditure Panel Survey (MEPS) data to estimate health expenditure shocks and health insurance. We focus on the working population and use seven states for health expenditures. In line with Jeske and Kitao (2009), we divide data into bins of size (20%, 20%, 20%, 20%, 15%, 4%, 1%). The first bin contains all agents whose health expenditures fall in the bottom twenty percentiles, while the last bin has agents inside the first percentile of the distribution. We represent each bin using the mean expenditure in that bin and normalize them in terms of the average earnings in 2003 (based on MEPS 2003, the average wage income of all heads of households is \$32,800). To this end, health spending follows a finite state Markov chain, with $m \in \{0.000, 0.006, 0.022, 0.061, 0.171, 0.500, 1.594\}$. The transition matrix for m is estimated by counting the fraction of agents who move into each bin in the following year.

$$\Pi_m = \begin{bmatrix} 0.542 & 0.243 & 0.113 & 0.061 & 0.032 & 0.007 & 0.002 \\ 0.243 & 0.330 & 0.242 & 0.117 & 0.056 & 0.011 & 0.001 \\ 0.119 & 0.224 & 0.296 & 0.232 & 0.098 & 0.025 & 0.006 \\ 0.058 & 0.130 & 0.225 & 0.347 & 0.201 & 0.035 & 0.005 \\ 0.043 & 0.079 & 0.140 & 0.263 & 0.371 & 0.090 & 0.014 \\ 0.030 & 0.063 & 0.080 & 0.203 & 0.359 & 0.200 & 0.065 \\ 0.008 & 0.024 & 0.073 & 0.106 & 0.269 & 0.286 & 0.233 \end{bmatrix}.$$

We calibrate the coinsurance rate for each of the seven shocks from the MEPS data, which is given as follows.

Health spending	$m > 0.000$	0.006	0.022	0.061	0.171	0.500	1.594
$\phi(m)$	0.341	0.532	0.594	0.645	0.702	0.765	0.845

Consistent with the data in section 2, the probability of providing EHI is increasing with firm size. In addition, administrative costs decrease with firm size.

Firm size	$n < 10$	10 – 24	25 – 99	100 – 999	$n > 1000$
$p_E(n)$	0.336	0.625	0.816	0.943	0.992
Administrative cost, $g(n)$	0.3	0.21	0.132	0.0849	0.06

Government: The government has an exogenous spending G to finance, which is set to 18% of GDP in the benchmark economy. The payroll tax is 12% and the consumption tax τ_c is set at 5.67% in the baseline, based on Mendoza et al. (1994). The minimum consumption floor $\underline{c}$ is calibrated so that the model has 20% of households with net worth of less than \$5,000 in the benchmark economy. In line with Heathcote, Storesletten and Violante (2015), we model the progressive income tax using a non-linear function: $T(y) = y - \lambda_p y^{(1-\tau_p)}$, where τ_p measure the degree of progressivity of the tax system. The parameter λ_p is determined in the equilibrium so that the government runs a balanced budget at each period. Using data from 2000-2006 Panel Study of Income Dynamics, Heathcote, Storesletten and Violante (2015) found that this tax function precisely matched the actual tax/transfer scheme in the U.S.²³ We assume that the government uses lump-sum tax to finance the policy changes considered in the next section.

Table 1: Parameter values, baseline economy

Parameters	Values	Description	Comments/observations
β	0.94	Discount factor	target K/Y ratio 2.42
α	0.3207	Capital share	target K share of 0.34
ρ	1.5, 3	Risk aversion	
γ	0.4693	Frac. of entrepreneurs	Antunes et al. (2008)
μ_x	-0.3667	Mean of distribution of x	mean size of firms
σ_x	2.302	Std. dev of distribution of x	size distribution of firms
m		Health spending shock	MEPS
$\phi(m)$		Coinsurance rate	MEPS
η	0.1	Markup of health insurance	MEPS
ψ	0.8	Employer contribution of EHI	MEPS
$g(n)$		Cost of providing EHI	MEPS
$p_E(n)$		Probability of providing EHI	MEPS
$\hat{p}_E$	0.558	% covered by EHI	MEPS
$\underline{c}$		Consumption floor	20% hhs with wealth < \$5000
τ_s	12%	Payroll tax	
δ	6%	Capital depreciation	

7 Quantitative Analysis

In this section, we first present the performance of our benchmark model. We then explain the design of policy experiments, followed by a detailed analysis of our counter-factual experiments. Finally, we provide some remarks on our numerical exercises.

²³This tax function was first discussed by Fdelstein (1979). An alternative way is to model the non-linear income tax function: $T(y) = \kappa_0 \left(y - (y^{-\kappa_1} + \kappa_2)^{-\frac{1}{\kappa_1}} \right)$ based on the estimation of Gouveia and Strauss (1994), see Conesa, Kitao and Kruger (2009) for application.

Table 2: Benchmark

Statistics	U.S. Data	Baseline Economy
Annual real interest rate	4.0	4.33
Aggregate capital share	0.33	0.36
Capital output ratio	2.5	2.42
% of entrepreneurs	7.0	7.81
Mean size of the firm	17.09	17.76
% firm at 0-9	70.7	74.85
% firm at 10-19	14.0	15.46
% firm at 20-49	9.4	6.677
% firm at 50-99	3.2	2.351
% firm at 100+	2.6	0.659
Health insurance take-up ratio		
all	75.7	70.33
EHI offered	99.0	97.9
EHI not offered	35.5	32.8

7.1 Baseline Economy

Our model succeeds in matching several aspects of the macroeconomy, including the distribution of firm size measured by the number of employees and observed patterns of health insurance coverage. Table 2 summarizes the performance of our model. In the benchmark, entrepreneurs account for 7.74% of the population, which is slightly below the target of 8%. This underestimate of entrepreneurship is attributed to the fact that our model of occupational choice does not account for other reasons that individuals choose to become entrepreneurs such as the utility value from “being your own boss.” Hence our analysis provides a lower bound. On average, firms hire 17.76 employees in our benchmark, very close to 17.09 in the data. The model is also successful in reproducing the fraction of firms with the selected levels of employment. Average ability in each firm group increases with size, and firms in the largest size group are more than twice as productive as those in the smallest group. In terms of health insurance coverage, our model has a take-up ratio of 70.3%, compared with 75.7% in the MEPS data.²⁴ The take-up ratio is the share of agents with health insurance coverage.

7.2 Policy experiments

We now conduct experiments to study the effect of tax deductibility of EHI premiums on allocations. Throughout the experiments, we keep the level of government expenditure G fixed. We may also vary the progressivity of the tax deductibility for EHI premiums, namely the value of τ_p , across experiments. We adjust λ_p to balance the government budget.

In each experiment, we compute the steady state implied by the new policy. We then compute

²⁴Employment-based insurance involves three factors: a worker must be employed by a firm that offers coverage, the worker must be eligible for coverage, and the worker must choose to take-up coverage.

the consumption equivalent variation (CEV) to assess the welfare effect of each policy. CEV measures the agent’s percentage change in consumption in every state of the world to determine if the agent is willing to move to another economy given a specific tax policy.

Policy A: Abolish the tax deductibility of EHI premium In this experiment, the government abolishes the deductibility of the EHI premium entirely, for both income and payroll taxes. Taxes are now levied on the entire portion of the insurance premium, including the employer contribution to EHI. Hence, taxable income is given by $[(r - \delta)a + \tilde{w}z + (1 - i_E)q_E]$ for workers, and $[(r - \delta)a + \nu(k, x; \tilde{r}, \tilde{w})]$ for entrepreneurs. We design this policy to understand the impact of the current health insurance policy on occupational talent allocation and welfare.

Column “no subsidy” in Tables 3 and 4 summarize the impacts of the policy experiment. The middle section of Table 3 presents statistics on health insurance. The lower section presents statistics on the firm size distribution and other aggregate measure of productivity. Removing the tax subsidy to EHI raises the effective cost of EHI. Healthier agents who face a lower premium in the private insurance market will drop out of the EHI pool. Their departure deteriorates the overall “health quality” of the EHI pool, which leads to an even higher EHI premium. This process continues and eventually the EHI market partially collapses and only 26.9% are insured. The insurance premium increases by 67%. This is consistent with the findings in Jeske and Kitao (2009).

In the production side, the higher EHI premium drags down the wage, which encourage more lower-skilled and healthy agents to join entrepreneurship. It also reduces entrepreneurs profit, particularly those who have higher-skills but are less healthy since they run a bigger firm and are more likely to provide EHI to employees. This is because the removal of tax deductibility of EHI premiums raises the cost of providing health insurance for the firm. Hence they may opt out of entrepreneurship. Consequently, this policy rotates the equilibrium frontier of occupational choice counter-clockwise. As we can see from the lower section of Table 3, there are more entrepreneurs, 9.5% versus 7.8% in the baseline. However, aggregate productivity falls by more than 10% as there are more lower-skilled agents who run smaller firms.

In Table 4 column “no subsidy” reports the welfare effect of this policy change. The wage slightly increases for workers, but not enough to compensate for the welfare loss due to the lower health insurance coverage and increased exposure to health spending shocks. The average net tax earning of entrepreneurs drops significantly as both firm size and productivity fall. Overall, the policy leads to a welfare loss of 1.9% measured by consumption equivalence.

Policy B: Extend tax deductibility to non-group insurance This policy extends tax deductibility to non-group insurance, and adjusts the non-linear tax base function for the tax deductibility of EHI premium. The total income tax of the household is adjusted from $T(inc; \tau_p^{baseline})$ to $T(inc; \tau_p^{baseline}) + \frac{T(inc; \tau_p^{exp}) - T(inc; \tau_p^{baseline})}{inc} i_E \tilde{\pi}$ conditional on the agent choosing to be an en-

trepreneur, where $\frac{T(inc;\tau_p^{exp})-T(inc;\tau_p^{baseline})}{inc}$ represents the marginal tax rate change from the baseline to this policy.

This policy has exactly the opposite effect compared with Policy A. In terms of the health insurance market, the extended tax subsidy encourages health insurance takeup in the private market. Overall health insurance coverage increases to 97.2%. The fiscal cost of extending the deductibility is reflected in the higher effective income tax, but the tax falls largely on entrepreneurs as they have higher earnings.

The extended tax subsidy increases the opportunity cost of leaving the wage sector for less-skilled and healthy agents as private insurance gets cheaper. Due to the same reason, it raises the potential gain for higher-skilled and unhealthy agents to become entrepreneurs. Consequently, this policy helps to restore the equilibrium frontier of occupational choice as explained in Economy D discussed in Section 3. We observe an 0.8% increases in aggregate productivity. Compared to the benchmark, this policy benefits most agents and leads to a welfare gain of 0.33% measured by consumption equivalence.

Policy C: Optimal level of regressive tax subsidy to EHI Notice that there is an interesting tradeoff when the tax subsidy is extended. Effectively this is a regressive tax as the income tax is progressive. A higher income earner gets a larger subsidy as they face a higher marginal income tax rate. A more regressive tax subsidy helps to restore the equilibrium frontier of occupational choice, but it also reduces welfare because it reduces risk sharing associated with the income shock. In this experiment, we vary the value of τ_p^{exp} as defined in Policy B. We want to find the optimal level of regressiveness of tax subsidy to EHI, measured by τ_p^{exp} , that balances the efficiency gain from an improvement in talent allocation and the loss from reduced risk sharing.

As the subsidy gets more regressive, entrepreneurship becomes less attractive to lower-skilled and healthy agents. This is because they will receive a smaller subsidy as they run a smaller firm and earn a lower profit. The opposite is true for higher-skilled and unhealthy agents. Hence, a more regressive subsidy to health insurance is beneficial to talent allocation. As we can see from the lower section of Table 3, a higher value of τ_p leads to fewer entrepreneurs but bigger fraction of larger firm. Aggregate productivity can vary by over 1% when τ_p increases from 0.0 to 0.45. The left panel of Figure 3 presents the change in output per firm as τ_p increases.

While a higher value of τ_p improves talent allocation, it also affects the income distribution. As we increase τ_p , workers' after-tax income drops, while it increases for entrepreneurs. The right panel of Figure 3 documents how the after-tax earnings of workers and entrepreneur change with the value of τ_p . Overall, we find an inverted U-shape welfare effect with respect to the value of τ_p .

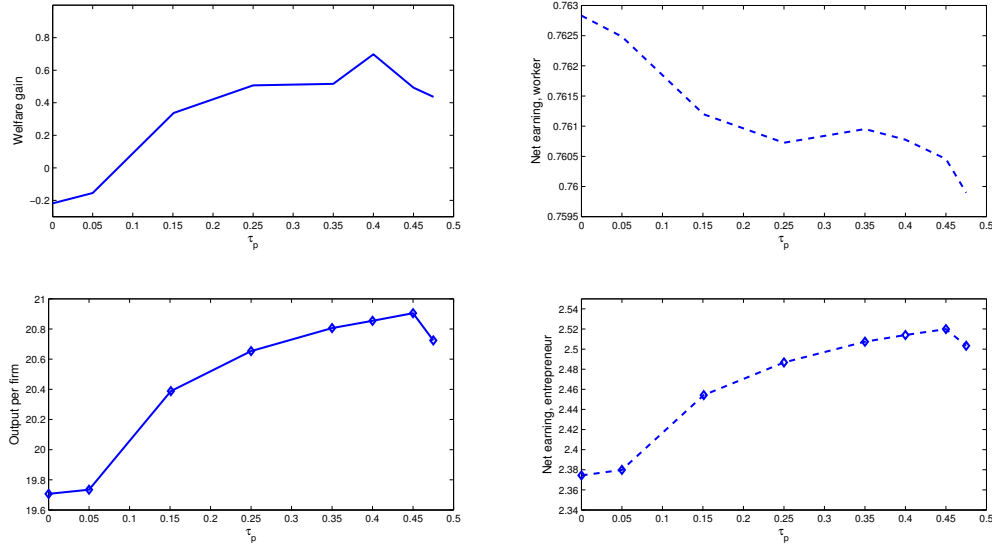
Table 3: Aggregate variables

<i>Statistics</i>	<i>Base</i>	<i>no subsidy</i>	<i>extend subsidy</i>	<i>extend subsidy</i>				
				$\tau_p = 0.0$	$\tau_p = 0.151$	$\tau_p = 0.25$	$\tau_p = 0.35$	$\tau_p = 0.45$
K/Y	2.704	2.72	2.711	2.712	2.711	2.712	2.718	2.713
Ag output	100	99.01	99.489	100.03	99.489	99.347	99.15	99.22
HI take-up (%)	69.5	26.941	97.213	97.197	97.213	97.216	97.226	96.685
EH coverage (%)	65.814	26.184	66.294	65.91	66.294	66.387	66.457	66.433
EH premium	100	167.035	100.13	100.06	100.13	100.14	100.17	100.2
Entrepren %	7.81	9.454	7.434	7.733	7.434	7.328	7.26	7.227
Ave x	100	89.01	100.85	100.17	100.85	101.1	101.27	101.35
Output per firm	100	81.79	104.52	101.03	104.52	105.88	106.67	107.17
Output per worker	100	100.8	99.09	99.95	99.09	98.83	98.57	98.55
% firm at 0-9	75.0704	79.4055	73.8095	74.8222	73.8095	73.4307	73.1818	73.0594
% firm at 10-19	15.3265	12.6613	16.1017	15.4791	16.1017	16.3346	16.4876	16.5629
% firm at 20-49	6.6197	5.46858	6.95453	6.68563	6.95453	7.05513	7.1212	7.15373
% firm at 50-99	2.3304	1.92511	2.44821	2.35355	2.44821	2.48362	2.5069	2.51833
% firm at 100+	0.653	0.539454	0.68604	0.659511	0.68604	0.696	0.7025	0.70569

Table 4: Welfare comparasion

<i>Statistics</i>	<i>Base</i>	<i>no subsidy</i>	<i>extend subsidy</i>	<i>extend subsidy</i>				
				$\tau_p = 0.0$	$\tau_p = 0.151$	$\tau_p = 0.25$	$\tau_p = 0.35$	$\tau_p = 0.45$
Welfare	0	-1.911	0.33726	-0.218	0.33726	0.5068	0.5159	0.4926
% w/ +CEV	0	0	99.88	3.78	99.88	99.9	99.89	99.87
HI take-up (%)	69.5	26.941	97.213	97.197	97.213	97.216	97.226	96.685
EHI coverage (%)	65.814	26.184	66.294	65.91	66.294	66.387	66.457	66.433
EHI premium	100	167.035	100.13	100.06	100.13	100.14	100.17	100.2
Entrepren %	7.81	9.454	7.434	7.733	7.434	7.328	7.26	7.227
Ave x	100	89.01	100.85	100.17	100.85	101.1	101.27	101.35
Net-tax earning								
workers	100	101.677	100.44	100.663	100.44	100.385	100.415	100.35
entrepreneurs	100	81.24	103.237	99.878	103.237	104.602	105.47	105.997
Ave. tax (%)								
workers	18.223	19.519	17.594	17.699	17.594	17.572	17.54	17.56
entrepreneurs	40.351	40.70	41.065	41.026	41.065	41.048	41.0	40.98

Figure 3: Regressive subsidy and talent allocation



8 Conclusion

In this paper, we study the impact of a regressive tax subsidy on talent allocation. We extend the framework in Chivers, Feng and Villamil (2016) by introducing a nonlinear tax on income. Current US tax policy allows individuals to deduct the EHI premiums from their income tax base. This is equivalent to a regressive tax because higher income individuals face a higher marginal tax rate, which gives them a higher EHI subsidy. Jeske and Kitao (2009) find that this regressive tax has merit in terms of maintaining the “health quality” of the insurance pool and alleviating adverse selection problems that could plague the EHI market. Our work identifies an additional benefit of such a regressive tax policy: it can mitigate the talent misallocation studied in Chivers, Feng and Villamil (2016).

EHI creates a link between health insurance and employment which leads to a wedge between the marginal cost and marginal benefit of being employed as a worker. This wedge distorts the individual’s occupation decision. Chivers, Feng and Villamil (2016) find that healthy but less skilled individuals become entrepreneurs, while others that are less healthy but highly skilled leave entrepreneurship. The government can potentially counteract these misallocations by subsidizing highly skilled unhealthy individuals, while taxing intermediate skilled but healthy agents, conditional on them becoming entrepreneurs. The unobservability of managerial ability and health risk make this direct redistribution, or “tagging”, impossible. Our policy experiment indicates that the regressive nature of EHI tax deductibility can improve the allocation through both direct and indirect effects. This policy provides unhealthy-skilled individuals with a larger tax benefit than healthy-medium-skilled agents, conditional on being entrepreneurs. Hence it

directly alters the individual's incentive to engage in entrepreneurial activity. It also improve the allocation indirectly by enlarging the tax base, which reduces the effective tax rate, and increases wage and capital income.

A regressive tax policy negatively effects risk sharing of income shocks. This paper also studies how policy should balance the tradeoff between improved allocation and worse risk sharing. Adapting the analysis of optimally progressive income taxation in Heathcote, Storesletten and Violante (2015), we find that a more regressive tax subsidy for EHI to entrepreneurs is welfare improving.

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