Funding Employer-based Insurance: Regressive Taxation and Premium Exclusions *

Zhigang Feng† Anne Villamil‡

University of Nebraska University of Iowa

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Abstract

U.S. employer-based health insurance (EHI) premiums are not subject to income or payroll taxes. This is regressive taxation because higher income individuals face higher marginal tax rates, which gives a higher EHI subsidy. We show this regressive policy mitigates misallocation between firm and self-employment from non-contractible heterogeneity in talent and health shocks. In our general equilibrium model, removing tax exclusion raises insurance premiums by 67%, coverage falls to 26.9%, and welfare decreases 1.9% due to reduced risk sharing and misallocation. If tax exclusion is extended to private insurance, coverage increases to 97.2%, workers' taxes fall, and welfare increases 0.3%.

JEL Classification: E23, I10, O40.

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

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†Department of Economics, University of Nebraska, Omaha, NE 68106, z.feng2@gmail.com

‡Department of Economics, University of Iowa, Iowa City, IA 52242, annevillamil@gmail.com

1 Introduction

In an economy with heterogeneity and imperfect information, non-linear income taxes involve a classical tradeoff. On one hand, a progressive tax 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 of more able individuals to participate (e.g., work). Given these two effects, it is generally optimal for the most able agents to pay a relatively lower marginal tax rate to keep them in the market. This regressive optimal tax structure expands the tax base and allows marginal taxes to be lowered for the remaining individuals.

This paper focuses on taxes associated with the U.S. health insurance market, where health expenditures account for nearly 18% of GDP. The U.S. has a mix of employment based health insurance (EHI) and private health insurance for the working age population. EHI is required by law not to discriminate among employees based on health status, which reduces adverse selection in this market. In the private insurance market, where no such requirement exists, insurance companies have an incentive to price-discriminate and offer favorable terms to individuals at lower risk for high health expenditure shocks. Private insurance, therefore, leads to less pooling, less risk sharing, and higher premiums.

U.S. entrepreneurs, particularly small business owners, are more likely to rely on the private health insurance market. They have three options. (i) An individual may operate a firm, offer EHI to workers, and cover herself. (ii) The entrepreneur may purchase insurance for herself on the private market and not offer EHI to workers. (iii) The entrepreneur may choose to remain uninsured (e.g., if private insurance is too costly). Moreover, empirically health expenditure shocks are large and persistent in the U.S. relative to other countries (OECD Health Statistics 2017). Consequently, misallocation may arise in occupational choice. Some individuals with high health risk who have high managerial talent may choose to work as employees with EHI coverage. They may forgo becoming entrepreneurs if health insurance on the private market does not exist or is sufficiently expensive.

Current U.S. tax policy permits a tax deduction for employment-based health insurance premiums, which is effectively a regressive tax on health insurance. This regressive tax can partially correct this type of 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 this misallocation, which arises 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.

We evaluate corrective tax policy in an occupational choice model where individuals have heterogeneous ability as workers and entrepreneurs. They choose either to operate a firm or become a worker, and crucially EHI is linked with employment. Section 2 explains that EHI emerged in response to wage and price controls imposed after World War II rather than by explicit policy design. We take this system as given. This link between health insurance and employment creates a wedge between the marginal cost and benefit of choosing to be a worker. Two types of occupation misallocation can occur: some individuals with high managerial ability and adverse health shocks leave entrepreneurship to work at firms with EHI, while individuals with intermediate managerial skill but favorable health shocks opt to manage firms. We show that exempting EHI premiums, which is a regressive tax policy, mitigates this misallocation problem.

Our paper builds on several important contributions. Scheuer (2013) shows that taxes on business income that are less progressive than taxes on labor income can mitigate frictions that entrepreneurs face in credit markets. He constructs a model in which individuals have different skills as a manager and worker. Individuals choose their occupation, face adverse selection in the credit market, and investment size is fixed. He abstracts from insurance. Scheuer shows that occupational misallocation can occur, and that differential taxation of entrepreneurial profits and labor income can correct it. Endogenous cross-subsidization occurs and leads to the wrong "mix" of agents - excessive (insufficient) entry of low-skilled (high-skilled) into entrepreneurship. A profit tax that is regressive relative to the tax on labor income can, in theory, restore efficient occupational choice.

In our model adverse selection is also important, but we focus on health insurance rather than the credit market. Regressive taxes alter the mix of occupational choices and affect risk pooling in the insurance market. In our model the policy instruments are differential subsidies for health insurance rather than differential taxes on income and profit. In addition, our quantitative macro model allows us to estimate the occupational misallocation effect. Because we extend the fixed investment size in Scheuer (2013), entrepreneurs with idiosyncratic shocks can vary investment. Therefore, they optimally vary firm size and our model endogenously determines the distribution of firm sizes.[1]

Our paper is also related to Jeske and Kitao (2009). They study adverse selection in the health insurance market in a quantitative macro model and find that a regressive tax can improve risk sharing. They show that regressive EHI subsidies hold the EHI risk pool together, by inducing better risks to remain in the market. We extend their approach by introducing occupational choice. As in their analysis we find that a regressive tax can improve risk sharing. We also show that the regressive tax can reduce occupational misallocation. In order to do this we extend the general equilibrium model of occupational choice in Chivers, Feng and Villamil (2017) with lump sum taxes to the regressive U.S. EHI system.

In the Chivers et al. model individuals choose to earn income either as a worker or an en-

[1] Cole, Kim and Krueger (2017) also study investment and health, but they focus on dynamic incentives to invest in health. See Restuccia and Rogerson (2013) and the references therein for recent work on misallocation in quantitative macro models.

trepreneur. Each individual has an idiosyncratic talent for entrepreneurship, which is the ability to manage labor and capital, idiosyncratic labor productivity as a worker, and idiosyncratic health risk. We extend their lump sum setting in order to investigate how nonlinear health insurance taxes and subsidies can be used to correct the misallocation. Our key mechanism is that nonlinear taxes alter the distribution of entrepreneurial talent in the economy (i.e., the mix of occupations). Appropriate taxes and subsidies induce some highly skilled individuals with adverse health shocks to become entrepreneurs. Analogously, individuals with intermediate managerial skill but favorable health shocks, who would otherwise opt to manage firms, optimally choose to become workers.

Finally, our paper builds on quantitative models of the tax system. In seminal work, Feldstein (1969) provided a tax function to characterize U.S. tax and transfer policies that linked 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 (2017) found 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.

As explained previously, the fact that the EHI premium can be deducted from income makes U.S. health insurance tax policy regressive. An individual with a propensity for high health risk and high managerial skill will benefit more from this favorable tax treatment of EHI, and has a stronger incentive to become an entrepreneur than an individual with a propensity for better health shocks and lower managerial skill. Compared with an agent with intermediate skill, one with higher skill will earn a larger profit as an entrepreneur, which means a larger tax subsidy from the EHI premium (higher income falls into a higher tax bracket). Furthermore, due to the more favorable health risk, the better health shock profile -medium skill individual may optimally choose to forgo insurance or obtain health insurance in the private market when she chooses to be an entrepreneur. In either case, the EHI subsidy is not applicable, which reduces the incentive to become an entrepreneur. Consequently, the regressive tax counteracts the misallocation associated with EHI.

We use the model to conduct counterfactual policy experiments. In the first case the government abolishes deductibility of EHI premiums for both income and payroll taxes. All insurance premiums are fully taxable, including the employer contribution to EHI. We find that the EHI market partially collapses and only 26.9% remain insured. Insurance premiums increase by 67% due to adverse selection and welfare decreases by -1.9% due to reduced risk sharing and misallocation. We next extend tax deductibility to non-group insurance, while adjusting the non-linear tax base function to offset the tax deductibility of EHI premiums. Health insurance coverage increases to 97.2%. Extending premium deductibility leads to a slightly higher income tax on entrepreneurs, a slightly lower tax on workers, and welfare overall increases by 0.3%. Compared with the baseline economy, this policy encourages higher-skilled individuals with poor health expenditure shocks to run businesses. Finally, we adjust the progressivity of the income tax function that governs the effective 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.

Overall, our results show that the misallocation of relatively few but highly productive individuals affects the broader macroeconomy. This occurs for two reasons. First, entrepreneurs create jobs so they directly affect the distribution of firm sizes, output and earnings. Second, firm size is positively correlated with productivity, both empirically and in the model. Ensuring that the most productive entrepreneurs choose this occupation can raise the earnings and welfare of workers, in addition to the entrepreneur.

Our paper takes as given limited information, the absence of perfectly discriminating taxes, and the historical structure of the U.S. EHI system. Governments observe income, but not health expenditure shocks or managerial ability. As a consequence, direct corrective intervention to ameliorate misallocation is difficult. A 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 ability and health risk directly. We show that a regressive tax policy on health insurance can improve the talent distribution, and hence output and welfare. Of course these results would not hold if perfect information, perfectly discriminating taxes, and perfect insurance were possible.

Despite the active policy debate and the importance of entrepreneurs to the 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 by building a general equilibrium model with occupational choice, Markov health expenditure shocks, a health insurance decision, and an endogenously determined managerial ability distribution that is affected by tax policy associated with health insurance. The paper is organized as follows. Section 2 summarizes stylized facts and describes the policies. Section 3 builds a model to illustrate the intuition. Section 4 develops a general equilibiurm model that is consistent with the facts. Section 5 describes optimal behavior and the equilibrium. Section 6 contains the model calibration and quantitative analysis is performed in section 7. Section 8 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. The EHI premium is deductible from employees' taxable income, which is subject to a progressive income tax. 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.

In 2010 the U.S. passed the Patient Protection and Affordable Care Act (PPACA), which represents the most significant regulatory overhaul of its health care system since the creation of the Medicare and Medicaid programs in 1965.[2] Despite the continuing uncertainty about the U.S. health insurance system in the future, most working-age American continue to rely on EHI for coverage. We 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 firms 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 plans at common prices to all employees. The common price is based on *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 address market incompleteness, e.g., individuals do not choose genetic risk. Adjusted community ratings permit lifestyle factors such as smoking status to be considered.

Fact 3: The EHI premium is deductible from taxable income and treats workers and entrepreneurs asymmetrically.

The EHI exclusion reduces federal tax revenues by about \$260 billion, and is by far the largest federal tax expenditure; see Gruber (2011, Table 2). Total tax revenue from the EHI exclusion, denoted "Tax," has two parts, a non-linear income tax, $T(inc)$, and a payroll tax, $\tau_s\,[payroll]$:

$$Tax = T(inc) + \tau_s\,[payroll]$$

First, $T(inc)$ is a non-linear income tax, where inc denotes labor income + capital income − $\mathbf{1_{subsidy}}$premium, and $\mathbf{1_{subsidy}}$ is an indicator function. The specific compensation for each occupation is:

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

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

When the EHI premium is income tax deductible, the indicator function is one. A high health risk-high skill individual will benefit more from this favorable tax treatment of EHI and has a stronger incentive to become an entrepreneur than a low health risk-medium skill individual. 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 this income will fall into a higher (progressive) tax bracket. In addition, due to the more favorable health risk, the low health risk-medium skill individual may optimally choose to self-insure (i.e., forego insurance) 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 the incentive to become an entrepreneur.[3] Second, in most cases workers can deduct payroll taxes, $\tau_s\,[payroll]$, but entrepreneurs cannot. The payroll tax is for Social Security and Medicare (publicly provided retirement benefits and healthcare benefits for those at least age 65 or disabled and who paid into the system).

On the margin, an individual making a choice between two occupations is choosing between two compensation packages. Tax policy treats workers and entrepreneurs asymmetrically because workers can deduct $T(inc) + \tau_s\,[payroll]$ but entrepreneurs can deduct only $T(inc)$. Because it reduces taxable income, the exclusion is more beneficial to taxpayers in higher tax brackets than those facing lower tax rates. Importantly, workers and entrepreneurs are treated differently as a class in the tax code, but U.S. law prohibits contracts that discriminate among individuals based on personal characteristic such as health status for EHI.[4]

Fact 4: EHI affects occupational choice.

Empirically, health insurance and individual health status affect self-employment. 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 premiums for self-employed individuals (originating from the Tax Reform Act of 1986) increased the probability of being self-employed

[3] As a consequence, the regressive tax associated with EHI counteracts the misallocation inherent in linking health insurance with employment. In the absence of a subsidy, the indicator function is zero and a low health risk 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 EHI. Such an individual does not value EHI, but firms are required to provide insurance for workers above a certain firm size. In contrast, 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.

[4] The 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 in 1996, and rose to 40 percent in 1997, 45 percent in 1998, 60 percent in 1999-2001, 70 percent in 2002, and finally 100 percent in 2003. Despite these changes, subsidies for the self-employed are lower than for workers because premiums remain subject to a self-employment tax.

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

Jackson, Looney and Ramnath (2017) find that small business owners and self-employed individuals are about three times as likely to purchase PPACA Marketplace coverage as workers. Twenty percent of PPACA Marketplace consumers were small business owners or self-employed in 2014. Middle and lower-income Americans who buy coverage through the Marketplace are eligible for tax credits to make coverage affordable. They report that about 65 percent of small business owners and 69 percent of all self-employed or independent workers have incomes below $65,000, the group most likely to rely on the PPACA Marketplace for health insurance. Overall coverage purchased in the Marketplace increased by about 50 percent between 2014 and 2015, and increased further in 2016. Jackson, Looney and Ramnath (2017) figure 3 shows that the percentage of self-employed increased over the period 2000 to 2014 and table 4 shows a similar pattern for self-employed, sole proprietors, and small business owners.

3 Simple endowment economy to build intuition

We first present a simple model of occupational choice with endowments.[5] Households have a common utility function given by $U(\cdot)$. If an agent chooses to operate a firm she receives a random return of consumption good, and if she chooses to be a worker she receives a possibly different random return. Heterogeneity is described by three shocks:

- managerial ability x: units of consumption good if the agent chooses to be an entrepreneur, with x^i for each agent i drawn from a uniform distribution $x \in [\underline{x}, \bar{x}]$.
- labor productivity z: units of consumption good if the agent chooses to be a worker.
- medical expenditure shock m: agent health spending (in consumption good), with $m \in \{\underline{m}, \bar{m}\}$. Each household receives the low health spending shock $\underline{m}$ with probability p,

[5]We base this section on comments provided by Soojin Kim.

which is drawn from a uniform distribution $p \in [\underline{p}, \bar{p}]$. Agent health type p is unobservable to the firm and insurance company.

Consider an extreme example, where workers can buy health insurance coverage either from their employer (EHI) or in a private market. Entrepreneurs can purchase health insurance only in the private market.[6] 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 types of health insurance are subject to perfect competition and charge an actuarially fair premium to cover health expenditures. Assume that risk aversion is sufficiently strong that every individual will enroll in either EHI or private health insurance. To simplify the exposition, we assume that all workers purchase EHI (e.g., due to the subsidy). The health shock is independent of the managerial ability and labor productivity shocks. Hence we can derive the price of each type of health insurance as follows:

- EHI Insurance premium: $\pi_E = \frac{\int_p x^*(p)(p\underline{m}+(1-p)\bar{m})dp}{\int_p x^*(p)dp}$, where agent with $x < x^*(p)$ becomes worker and choose EHI.
- Private insurance premium: $\pi(p) = p\underline{m} + (1-p)\bar{m}$.

The simple model has four cases and occupational choice is determined as follows.

Economy A, autarky (no EHI or private insurance): The agent's occupation choice hinges on the following equation:

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

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 agents with managerial ability higher than $x_A^*(p)$ will become entrepreneurs. In Figure 1, we plot the equilibrium frontier of occupation choice $x_A^*(p)$. Note that the vertical line is independent of the agent's health type p.

Economy B, with EHI: Now introduce EHI into economy A. By assumption workers have access to EHI or private market insurance, while entrepreneurs have access only to the private market. Similarly, we find a cutoff value for occupational choice from the following equation:

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

Clearly, $x_B^*(p) = z - [\pi_E - \pi(p)]$. Note that $\frac{\int_p x^*(p)(p\underline{m}+(1-p)\bar{m})dp}{\int_p x^*(p)dp} > \bar{p}\underline{m} + (1-\bar{p})\bar{m} = \pi(\bar{p})$ and $\frac{\int_p x^*(p)(p\underline{m}+(1-p)\bar{m})dp}{\int_p x^*(p)dp} < \underline{p}\underline{m} + (1-\underline{p})\bar{m} = \pi(\underline{p})$, since $(p\underline{m} + (1-p)\bar{m})$ decreases in p. This implies

[6] We use this extreme assumption in this section solely to capture the fact that small business owners face higher insurance costs. We make this simplifcation in this example to build intuition. In the full model we match U.S. data on entrepreneur and worker access to EHI. The two expenditure shocks will also be extended to match health insurance data from the U.S. economy.

that $x_B^*(\underline{p}) > x_A^*(\underline{p})$ and $x_B^*(\bar{p}) < x_A^*(\bar{p})$. Compared with economy A, introducing EHI creates two types of misallocations:

- High health agents (with $p \to \bar{p}$) with less ability ($x_B^*(p) < x_A^*(p)$) enter entrepreneurship.
- Low health agents (with $p \to \underline{p}$) with high ability ($x_B^*(p) > x_A^*(p)$) exit entrepreneurship.

Figure 1 shows that linking employment with health insurance distorts occupation choice by rotating the equilibrium frontier.

Economy C, with EHI and EHI subsidy (only): Next we introduce a subsidy to the purchase of EHI. To mimic the regressive subsidy, assume that workers receive 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. The cutoff value follows from the equation:

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

Clearly, $x_C^*(p) = z - \pi_E + \pi(p) + \alpha z \pi_E$. The subsidy corrects the first type of misallocation since $x_C^*(p) > x_B^*(p)$ for healthy agents with $p \to \bar{p}$. Unfortunately, this subsidy worsens the second type of misallocation. See figure 1. In the next economy, we consider a policy that can potentially correct both misallocations.

Economy D, with EHI and extended subsidy: Last, consider a policy that extends the subsidy for purchasing private insurance to entrepreneurs. Similar to economy C, this is a regressive tax credit. The cutoff value follows from:

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

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 types of misallocations.[7]

Summary This simple example shows how talent misallocation occurs when entrepreneurs face a higher cost to obtain EHI than workers. Figure 1 shows that a regressive tax can partially restore efficiency by rotating the equilibrium frontier of occupation choice toward the first best allocation in economy A. In the next section we extend the simple endowment economy to a dynamic general equilibrium model. We replace the extreme EHI insurance cost asymmetry used in this example by a setting that mimics key features of the U.S. economy. Specifically, health insurance is linked to employment and EHI premia are tax advantaged relative to private insurance.

[7] There is a tradeoff associated with the regressive subsidy because financing it requires additional tax revenue. This introduces further distortions into the economy. We take up this issue in the dynamic model.

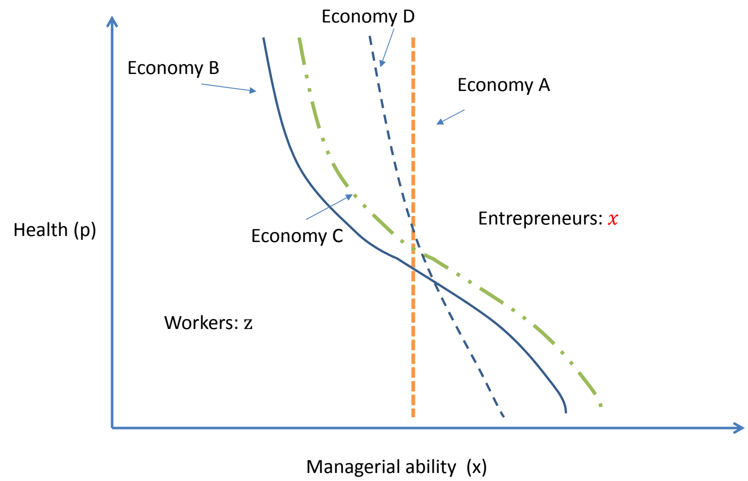

Figure 1: Talent misallocation and regressive tax

4 Dynamic General Equilibrium Model: Economic Environment

In this section, we extend the basic endowment economy in section 3 to a general equilibrium model in order to evaluate how counterfactual policies affect output, productivity, factor prices, and the distribution of managerial ability in the economy. The economy has incomplete markets, distortionary taxes, and ability is unobservable. We use a Lucas (1978) span of control production technology. Individuals differ in the ability to manage capital and labor, with productivity x^i for each agent i drawn from a common continuous cumulative probability distribution with $x \in [0, \infty)$. Productivity is not hereditary. Households also receive an idiosyncratic labor productivity shock z that indicates the efficiency units per unit of work hours. All agents 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 (2017) two types of individuals emerge in equilibrium, workers and managers. Section 4.1 specifies the economy and section 4.2 provides intuition for the equilibrium frontier of occupational choice, x^*, where individuals above this value choose to be managers and those below it are workers.

4.1 Preferences, endowments, technology, insurance and government

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 specified in section 6. The distributions are known, but realizations are not publicly observable. 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 they 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:

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

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

Factor remuneration, capital: Firms rent capital at the common market rate $r - \delta$, where r is the risk-free rate and δ is depreciation.

Factor remuneration, labor: Firms offer workers a compensation package $\widetilde{w}$ that includes a monetary wage w and a term that accounts for the expected cost of insurance q_E.[8] Workers supply labor inelastically at the given wage package $\tilde{w}$. We build our model to be consistent with the EHI system in the U.S., which we take as given (see section 2).

In order to simplify and match our model to observable data, we assume that each firm offers EHI with given probability p_E, determined by random shock i_E. Consistent with the data, $p_E(n)$ is a function of n such that the probability of having EHI increases with firm size n.[9]

- The firm's expected cost of providing EHI is $p_E\,[1 + g(n)]\,q_E$. Function $g(n)$ is decreasing in firm size n and accounts for the fact that it is more costly for small firms to offer health insurance than large 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 by[10]

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

[8]This is equivalent to a model where the firm offers a monetary wage w and subtracts the cost of EHI from the wage rate. See Jeske and Kitao (2009).

[9]This is equivalent to modeling the EHI offer decision as a preference shock. See Aizawa and Fang (2015) or Nakajima and Tuzemen (2016).

[10]Chivers, Feng and Villamil (2017) show that the decision to offer health insurance can be endogenized and link the equation for compensation to observable data.

Health insurance market: Consistent with the facts in section 2, there are two types of insurance, EHI and private:

EHI: Employment-based insurance has the following features.

- π_E: The EHI premium does not depend on an individual's prior health history or individual states. This is community rating in the U.S.; group health insurance cannot price-discriminate by law among the insured based on individual characteristics (facts 1 and 2).

- $\phi(m)$: The co-insurance rate specifies the fraction of total medical expenditures covered, where $\phi(\cdot)$ is a mapping $m \to [0, 1]$.

- $\psi \in [0, 1]$: The fraction of the premium the employer pays (part of employee compensation).

- $\hat{p}_E$: The probability that a worker has access to EHI, 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. We use random matching because it makes employment history irrelevant (i.e., it is not necessary to keep track of which worker worked for which firm). [11]

Private: If the worker is not offered EHI (or declines the EHI offer), she has the option to purchase health insurance in the private market. This can happen if a household becomes a manager and does not offer (or has no access to) EHI.

- $\pi_P(m)$: The private insurance premium depends on private medical expenditure shocks.

- $\phi(m)$: The coinsurance rate is the fraction of total medical expenditures covered.

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 the private market) or remain uninsured ($i'_{HI} = \{0, 1\}$).[12] 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. There are two advantages to EHI compared with private insurance:

(i) The government gives EHI a tax subsidy, which is more cost-efficient for firms (see below).

(ii) EHI has a more inclusive risk pool, which helps to share risk among the insured.

[11] Chivers, Feng and Villamil (2017) consider two type 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, $\hat{p}_E = \frac{\int \mathcal{I}_e n^* p_E(n^*) \mathrm{d}\Psi(s)}{\int \mathcal{I}_e n^* \mathrm{d}\Psi(s)}$. Equivalently, $\hat{p}_E = \int [\frac{n^*}{\int n^* d\Psi(\mathrm{s})}] p_E(n^*) d\Psi(\mathrm{s})$, where the weight is given by the term in brackets. They also consider a cost shock, an alternative approach that endogenizes the insurance offer.

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

Government: The government runs a balanced budget each period and funds three programs.

- Public safety-net program, T_{SI}, to guarantee households minimum consumption level $\underline{c}$: U.S. households can use public transfer programs such as food stamps, Medicaid, disability and unemployment insurance if substantial income and health expenditure shocks occur.
- EHI premium exclusion: In the baseline model, the government subsidizes EHI by excluding premiums from payroll tax and income tax. Entrepreneurs can deduct private market health insurance premiums from income tax.
- Spending G: The government finances exogenous spending.

The government funds these programs with three taxes (fact 3, section 2):

- τ_c : linear consumption tax
- τ_s: payroll tax (Medicare and social security)
- $T(y)$: progressive income tax

We model progressive taxation of total income as in Heathcote, Storesletten and Violante (2017). The total income taxes paid by each household are given by

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

y is the household's total taxable income and τ_p measures the progressivity of the income tax.[13] When $\tau_p > 0$ the income tax is progressive, and when $\tau_p < 0$ the tax system is regressive.

Firm's problem: The firm's problem is:

$$\max_{n,k} X k^{\alpha} n^{\gamma} - \widetilde{w} n - (r - \delta) k \tag{2}$$

The average cost of hiring labor, $\widetilde{w}$, 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 (2017) for the derivation of n^* and k^*, for constrained and unconstrained borrowing.

4.2 EHI and talent misallocation

In a model with EHI and lump sum taxes, Chivers, Feng and Villamil (2017) find that some individuals that have lower health risk and lower skill become entrepreneurs, while others with higher health risk and skill leave entrepreneurship. These misallocations relative to a frictionless world are caused by the link between health insurance and employment. "Talent misallocation"

[13] Heathcote, Storesletten and Violante (2017) use data from the Panel Study of Income Dynamics (PSID) and estimate that $\tau_p = 0.151$ with a standard error of 0.003.

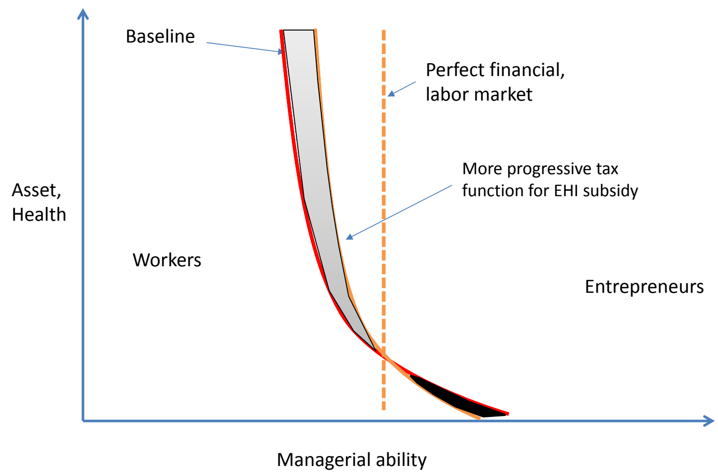

Figure 2: Talent misallocation and regressive tax

occurs as individuals with bad health shocks but high ability would run firms absent the EHI friction, and the lower health risk and skill would be workers. The government can potentially counteract these misallocations by subsidizing high health risk and skill individuals, while taxing agents with intermediate skill and good health risk, conditional on them becoming entrepreneurs. The unobservability of managerial ability and health risk make this direct redistribution, or "tagging", impossible. A non-linear income tax may partially correct misallocation through indirect general equilibrium effects. In our framework, the tax deductibility of EHI premiums is effectively such 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 to the economy without a subsidy to EHI, this tax policy provides high health risk and skill individuals a larger tax benefit than lower health risk and skill agents, conditional on being entrepreneurs. The high skilled will earn a bigger profit as entrepreneurs, and a larger EHI premium tax subsidy, because their income will fall into a higher tax bracket. Hence the policy encourages these individuals to become entrepreneurs (the black area in Figure 2). In contrast, lower health risk and skill individuals may optimally choose to self-insure (or obtain health insurance in the private market if an entrepreneur). In either case, the EHI subsidy is not applicable, which reduces the incentive to become an entrepreneur (the grey area in Figure 2). Consequently, the regressive tax associated with EHI deductibility directly counteracts the misallocation caused by linking health insurance with employment in an EHI system. There are also indirect effects. As the regressive tax policy reduces talent misallocation, more high skilled individuals run larger firm. The profits of these individuals increase, which translates into higher taxable income and a larger tax base. Higher firm productivity implies a higher wage and capital return. This benefits workers through what Scheuer (2014) calls a "trickle down" effect.

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 whether or not the firm offers EHI to 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), and 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 insurance policy. The U.S. EHI system 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):

$$\max_{n} X k^{\alpha} n^{\gamma} - \widetilde{w} n \tag{3}$$

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

The first order conditions are:

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

Substituting (4) into (3) yields the manager's profit function for a given level of capital:[14]

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

5.1.1 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). Each source of funds has the following costs. First, the entrepreneur owns capital and the opportunity cost of a is the foregone interest the entrepreneur could have received from the capital market. This amount is given by ra. Second, the entrepreneur may rent capital in the market, at cost rl, $l \leq \bar{l}$. Here $\bar{l}$ is an upper limit on borrowing. For simplicity, we first consider the case where this borrowing constraint does not bind. Whether or not the constraint binds is an equilibrium outcome, e.g., the constraint may bind if a bad medical expenditure shock occurs.

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:

$$\nu(a, x, i_E; w, r) = \max_{k \geq 0} y(k, x, \widetilde{w}) - (r - \delta)k - \widetilde{w}n(k, x, \widetilde{w}) \tag{6}$$

This gives the optimal physical capital level:

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

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

$$\nu(k^*, x, w) = Xk^{*\alpha} \left[\frac{\gamma X k^{*\alpha}}{\widetilde{w}} \right]^{\frac{\gamma}{1-\gamma}} - \widetilde{w}n(k^*, x, \widetilde{w}) - (r - \delta)k^* \tag{8}$$

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 r. Denote the optimal factor demands when the credit constraint binds by $\tilde{n}$ and $\tilde{k}$. The firm's problem is:

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

[14] This will adjust with EHI offering status, since EHI has a tax subsidy.

where

$$\tilde{n}^*(\tilde{k}, x, w) = \left[\frac{\gamma X \tilde{k}^\alpha}{\widetilde{w}}\right]^{\frac{1}{1-\gamma}} \tag{10}$$

Similar to the self-financed firm, the optimal capital demand when the firm 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 the 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. The household's problem written recursively is:

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

subject to

$$(1 + \tau_c)c + a' + oop + \tilde{\pi} \leq (1 + r)a + inc - Tax + T_{SI} \tag{11}$$

where

$$\tilde{\pi} = \begin{cases} \pi_E(1-\psi) & i'_{HI}=1, i_E=1 \\ \pi_P(m) & i'_{HI}=1, i_E=0 \\ 0 & i'_{HI}=0 \end{cases} \tag{12}$$

$$Tax = T(inc) + \tau_s \left[(1-\mathcal{I}_e)\tilde{w}z + \mathcal{I}_e \nu(k,x;r-\delta,\widetilde{w}) - (1-\mathcal{I}_e)i_E\tilde{\pi}\right] \tag{13}$$

$$T_{SI} = \max\left\{0, (1+\tau_c)\underline{c} + T(\widetilde{inc}) + oop - [a + inc]\right\} \tag{14}$$

$$inc = \begin{cases} (r-\delta)a + \tilde{w}z + (1-i_E)\,q_E - i_E\tilde{\pi} & \text{if } \mathcal{I}_e = 0 \\ (r-\delta)a + \nu(k,x;r-\delta,\widetilde{w}) - i_E\tilde{\pi} & \text{if } \mathcal{I}_e = 1 \end{cases} \tag{15}$$

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

$$oop = (1 - i_{HI}\phi(m))\,m \tag{17}$$

Budget constraint (11) 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 τ_s, and consumption tax $\tau_c c$ are collected to finance a consumption floor $\underline{c}$, the EHI subsidy and other government spending. The premium for insurance in equation (12), $\tilde{\pi}$, has two components: i'_{HI} is the household's choice to buy health insurance 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 excluding the EHI premium from income tax and payroll tax, see equation (13). In (13) note that the entrepreneur does not deduct the premium from the payroll tax, but can deduct it from the income tax. This is the indicator function term: $\mathcal{I}_e$. Equation (14) is a public safety net payment T_{SI} from the government (possibly zero) as specified in Hubbard et al. (1995). Equation (15) specifies the taxable income of the worker and the next equation is for the entrepreneur. Out of pocket medical expense oop is given by equation (17).

The value functions V_e and V_w are defined as follows:

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

$\hat{p}_E$ and p_E reflect the random matching between workers and firms, as explained in section 4.1.

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:

$$q_E = \psi \pi_E \tag{18}$$

The EHI premium equals the expected cost of covering health spending among the insured, including a proportional markup η.

$$\pi_E = (1+\eta) \int i_E i'_{HI} \phi(m) m \mathrm{d}\Psi(s) \tag{19}$$

The premium for private insurance is:

$$\pi_P(m) = (1+\eta) \frac{\mathbb{E}\left[\phi(m')m'|m\right]}{1+r-\delta}. \tag{20}$$

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 $\Phi = \{\tilde{r}, \tilde{w}, \tilde{\pi}, \hat{p}_E, \phi(\cdot), T(\cdot), \tau_s, \tau_y\}$. 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: $\int k \mathrm{d}\Psi(s) = \int a \mathrm{d}\Psi(s)$.*

4. *The labor market clears: $\int \mathcal{I}_e n \mathrm{d}\Psi(s) = \int (1-\mathcal{I}_e)\hat{n} z \mathrm{d}\Psi(s)$.*

5. *The goods market clears.*

6. *The government balances its budget:*
   $\int \{T(inc) + \tau_c c + \tau_s [(1-\mathcal{I}_e)\tilde{w}z + \mathcal{I}_e \nu(k, x; \tilde{r}, \widetilde{w}) - i_E \tilde{\pi}]\} \mathrm{d}\Psi(s) = \int (T_{SI}) \mathrm{d}\Psi(s) + G.$

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 Model Parameters

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.[15] To facilitate the computation, we approximate this process by a five state Markov process using the method of Tauchen and Hussey (1991). See Appendix 1.

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 (2017) 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) and Pashchenko and Porapakkarm (2013), 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 percentile, while the last bin has agents inside the first percentile of the distribution. The other bins are defined analogously. 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 $\$32,800$). See Appendix 1.

Government: The government finances exogenous spending G, which is set to 18% of GDP in the benchmark economy. See the CBO Economic Outlook (2016), excluding social security. The payroll tax for Social Security and Medicare 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

[15]See Storesletten et al. (2004) and Hubbard et al. (1994).

calibrated so that the model has 20% of households with net worth of less than $\$5,000$ in the benchmark economy.[16] In line with Heathcote, Storesletten and Violante (2017), we model the progressive income tax using a non-linear function: $T(y) = y - \lambda_p y^{(1-\tau_p)}$, where τ_p measures the degree of progressivity of the tax system. Parameter λ_p is determined in equilibrium so that the government runs a balanced budget in each period. Using data from the 2000-2006 Panel Study of Income Dynamics, Heathcote, Storesletten and Violante (2017) found that this tax function precisely matches the actual tax/transfer scheme in the U.S.[17] We summarize the parameters in Table 1.

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 (Soc Sec & Medicare)	CBO Outlook 2016
τ_p	0.151	Progressivity of the tax system	Heathcote et al. (2014)
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.

7.1 Baseline Economy

Our model succeeds in matching several aspects of the macroeconomy, including the distribution of firm size and observed patterns of health insurance coverage. Table 2 summarizes the perfor-

[16] See Chivers et al. (2017) and Nakajima and Tuzemen (2016).

[17] This tax function was first discussed by Feldstein (1969). An alternative way is to model the non-linear income tax function: $T(y) = \kappa_0 \left(y - \left(y^{-\kappa_1} + \kappa_2 \right)^{-\frac{1}{\kappa_1}} \right)$ based on the estimation of Gouveia and Strauss (1994). See Conesa, Kitao and Kruger (2009) for an application.

Table 2: Benchmark

Statistics	U.S. Data	Baseline Economy
Annual real interest rate $(r - \delta)$	4.0	4.33
Aggregate capital share	0.33	0.36
Capital output ratio	2.5	2.42
% of entrepreneurs	8.3	7.81
Mean size of the firm	17.09	17.76
% firm at 0-9	70.7	74.85 ($\bar{x}_1 = 1.36$)
% firm at 10-19	14.0	15.46 ($\bar{x}_2 = 1.79$)
% firm at 20-49	9.4	6.68 ($\bar{x}_3 = 2.13$)
% firm at 50-99	3.2	2.35 ($\bar{x}_4 = 2.54$)
% firm at 100+	2.6	0.66 ($\bar{x}_5 = 3.14$)
Health insurance take-up ratio		
all	75.7	70.33
EHI offered	99.0	97.9
EHI not offered	35.5	32.8

mance. In the benchmark, entrepreneurs account for 7.74% of the population, slightly below the target of 8.3%. This underestimate of entrepreneurship may occur because our model does not account for other reasons that individuals become entrepreneurs such as the utility value from "being your own boss." Hence our analysis provides a lower bound. Firm size is measured by number of employees. On average, firms hire 17.76 employees in our benchmark, 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, with firms in the largest size group 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.[18] 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 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.

[18] Employment-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.

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 $[(r-\delta)a + \nu(k, x; r-\delta, \widetilde{w})]$ 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 summarizes 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 measures of productivity. Removing the tax subsidy to EHI raises the effective cost of EHI. Agents with lower health risk face a lower premium in the private insurance market and 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 with only 26.9% insured, relative to 70.33% in the baseline model. The insurance premium increases by 67%. This is consistent with the findings in Jeske and Kitao (2009).

On the production side, the higher EHI premium drags down the wage, which encourages more lower-skilled and lower health risk agents to become entrepreneurs. It also reduces entrepreneur profit, particularly those who have higher skills but higher health risk since they run bigger firms 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.

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 premiums. The household's total income tax 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 entrepreneur, 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 take up in the private market. Overall health insurance coverage increases to 97.2%, from the baseline of 69.5%. The fiscal cost of extending deductibility is reflected in the higher effective income tax, and 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. For the same reason, it raises the potential gain for higher-skilled and higher health risk agents to become entrepreneurs. Consequently, this policy helps restore the equilibrium frontier of occupational choice as explained in Economy D discussed in Section 3. We observe an 0.8% increase in aggregate productivity. Compared to the benchmark, this policy benefits most agents (99.88% have a positive CEV) and leads to a welfare gain of 0.34% 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 in Policy B. 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 as defined in Policy B. We want to find the optimal level of the regressive tax subsidy to EHI, measured by τ_p^{opt}, which 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 low health risk agents. This is because they will receive a smaller subsidy as they run smaller firms and earn lower profit. The opposite is true for higher-skilled and higher health risk agents. Hence, a more regressive subsidy to health insurance has a beneficial effect on talent allocation. As we can see from the lower section of Table 3, a higher value of τ_p leads to fewer entrepreneurs but a bigger fraction of larger firms. That is, entrepreneurs fall from 7.81% to 7.43%, and the percentage of firms with 0-9 employees falls while the percentage of firms in all four larger employee size groups grows. The key insight in the model, as in the data, is that larger firms are more productive. Observe that average productivity increases from 1.2 for firms with 0-9 employees to 3.14 for firms with more than 100 employees in Table 3.

In addition, 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 and it increases for entrepreneurs. The right panel of Figure 3 documents how the after-tax earnings of workers and entrepreneurs change with the value of τ_p. Overall, we find an inverted U-shape welfare effect with respect to the value of τ_p.

Figure 3: Regressive subsidy and talent allocation

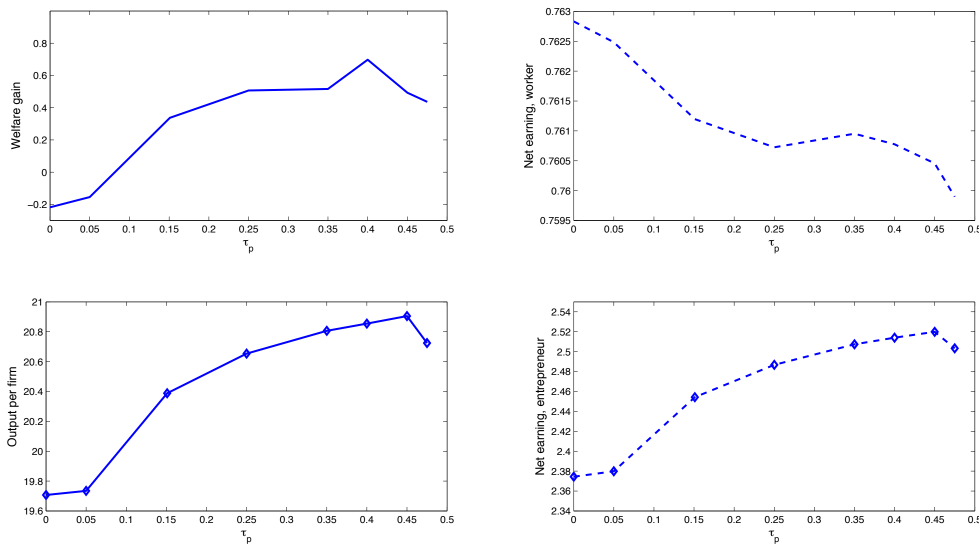

Table 3: Aggregate variables

Statistics	*Base*	*no subsidy*	*extend subsidy*	*extend subsidy*				
				$\tau_p = 0.0$	$\tau_p = 0.151$	$\tau_p = 0.25$	$\tau_p = 0.35$	$\tau_p = 0.45$
K/Y	2.704	2.72	2.71	2.71	2.71	2.71	2.72	2.71
Ag output	100	99.01	99.49	100.03	99.49	99.35	99.15	99.22
HI take-up (%)	69.5	26.94	97.21	97.20	97.21	97.22	97.23	96.69
EHI coverage (%)	65.814	26.18	66.29	65.91	66.29	66.39	66.46	66.43
EHI premium	100	167.04	100.13	100.06	100.13	100.14	100.17	100.2
Entrepreneur %	7.81	9.45	7.43	7.73	7.43	7.33	7.26	7.23
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	75.07	79.41 ($\bar{x}_1 = 1.36$)	73.81 ($\bar{x}_1 = 1.20$)	74.82 ($\bar{x}_1 = 1.36$)	73.81 ($\bar{x}_1 = 1.36$)	73.43 ($\bar{x}_1 = 1.36$)	73.18 ($\bar{x}_1 = 1.36$)	73.06 ($\bar{x}_1 = 1.36$)
% firm at 10-19	15.33	12.66 ($\bar{x}_2 = 1.79$)	16.10 ($\bar{x}_2 = 1.79$)	15.48 ($\bar{x}_2 = 1.79$)	16.10 ($\bar{x}_2 = 1.79$)	16.34 ($\bar{x}_2 = 1.79$)	16.49 ($\bar{x}_2 = 1.79$)	16.56 ($\bar{x}_2 = 1.79$)
% firm at 20-49	6.62	5.47 ($\bar{x}_3 = 2.13$)	6.95 ($\bar{x}_3 = 2.13$)	6.69 ($\bar{x}_3 = 2.13$)	6.95 ($\bar{x}_3 = 2.13$)	7.06 ($\bar{x}_3 = 2.13$)	7.12 ($\bar{x}_3 = 2.13$)	7.15 ($\bar{x}_3 = 2.13$)
% firm at 50-99	2.33	1.93 ($\bar{x}_4 = 2.54$)	2.45 ($\bar{x}_4 = 2.54$)	2.35 ($\bar{x}_4 = 2.54$)	2.45 ($\bar{x}_4 = 2.54$)	2.48 ($\bar{x}_4 = 2.54$)	2.51 ($\bar{x}_4 = 2.54$)	2.52 ($\bar{x}_4 = 2.54$)
% firm at 100+	0.65	0.54 ($\bar{x}_5 = 3.14$)	0.69 ($\bar{x}_5 = 3.14$)	0.66 ($\bar{x}_5 = 3.14$)	0.69 ($\bar{x}_5 = 3.14$)	0.70 ($\bar{x}_5 = 3.14$)	0.70 ($\bar{x}_5 = 3.14$)	0.71 ($\bar{x}_5 = 3.14$)

Table 4: Welfare comparison

Statistics	*Base*	*no subsidy*	*extend subsidy*	*extend subsidy*				
				$\tau_p = 0.0$	$\tau_p = 0.151$	$\tau_p = 0.25$	$\tau_p = 0.35$	$\tau_p = 0.45$
Welfare	0	-1.91	0.34	-0.22	0.34	0.51	0.52	0.49
% with CEV>0	0	0	99.88	3.78	99.88	99.9	99.89	99.87
HI take-up (%)	69.5	26.94	97.21	97.20	97.21	97.22	97.23	96.69
EHI coverage (%)	65.81	26.18	66.29	65.91	66.29	66.39	66.46	66.43
EHI premium	100	167.04	100.13	100.06	100.13	100.14	100.17	100.2
Entrepreneur %	7.81	9.45	7.43	7.73	7.43	7.33	7.26	7.23
Ave x	100	89.01	100.85	100.17	100.85	101.1	101.27	101.35
Net-tax earning								
workers	100	101.68	100.44	100.66	100.44	100.39	100.42	100.35
entrepreneurs	100	81.24	103.24	99.88	103.24	104.60	105.47	106.0
Ave. tax (%)								
workers	18.22	19.52	17.59	17.70	17.59	17.57	17.54	17.56
entrepreneurs	40.35	40.70	41.07	41.03	41.07	41.05	41.0	40.98

7.3 Productivity and superstars

A key finding of our paper is that tax policy changes the distribution of managerial talent. The table below compares our baseline model with Chivers et al. (2017) and Guner et al. (2008). All three model do a reasonably good job of matching the distribution of managerial ability. In the models, as in the data, productivity rises with firm size. For example, in our baseline model average productivity $\bar{x}$ within quintiles rises from 1.36 for the smallest firms (0-9 employees) to 3.14 for the largest firms (more than 100 employees). The highest productivity, x_{max}, is very high relative to $\bar{x}_1$ through $\bar{x}_5$, but the mass of such "superstar" managers is very small (f_{max}). In other words, ability distribution $f(x)$ has a long but thin upper tail.

Statistics	*US Data*	*Baseline*		*CFV (2017)*	*GVY (2008)*
Mean Firm Size	17.09	17.76		17.76	17.11
% firm at 0-9	70.7	74.85 ($\bar{x}_1 = 1.36$)		74.98 ($\bar{x}_1 = 1.55$)	73.3 (NA)
% firm at 10-19	14.0	15.46 ($\bar{x}_2 = 1.79$)		10.24 ($\bar{x}_2 = 2.05$)	13.4 (NA)
% firm at 20-49	9.4	6.68 ($\bar{x}_3 = 2.13$)		9.38 ($\bar{x}_3 = 2.38$)	7.5 (NA)
% firm at 50-99	3.2	2.34 ($\bar{x}_4 = 2.54$)		2.53 ($\bar{x}_4 = 2.82$)	3.2 (NA)
% firm at 100+	2.6	0.66 ($\bar{x}_5 = 3.14$)		2.87 ($\bar{x}_5 = 3.63$)	2.6 (NA)
x_{max}	NA	4019		3841	3360.2
f_{max}	NA	0.0001		0.0010	0.0014

The existence of a small number of superstar firms in the three models is consistent with recent empirical work by Autor, Dorn, Katz, Patterson and Van Reenen (2017). Using U.S. Economic Census data from about 700 industries in six sectors (manufacturing, finance, retail trade, wholesale trade, services, and utilities and transportation), they find that the share of revenue controlled by the top four companies in an industry rose from an average of about 38 percent in 1982 to about 43 percent in 2012 in the manufacturing sector, from about 24 percent to 35 percent over the same period in finance, and doubled from 15 percent to 30 percent in retail trade. In other words, the U.S. economy is moving toward an outcome with a few large, superstar firms where winners "take more." Our paper shows the effect that such superstars can have on macroeconomic variables (output, productivity, wages and welfare). Most importantly we show that health insurance tax policy has a quantitatively important effect on whether or not individuals with superstar managerial ability choose to run firms or become workers.

8 Conclusion

In this paper, we study the impact of a regressive tax subsidy on talent allocation. Current U.S. tax policy allows individuals to deduct EHI premiums from their income. 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 a regressive tax has merit because it helps to maintain the "health quality" of the insurance pool and it reduces adverse selection problems that are inherent in the EHI market. Our policy experiments show that the regressive nature of EHI tax deductibility can improve the allocation through both direct and indirect effects. The policy provides a larger tax benefit to individuals with higher health risk and managerial talent, relative to those with less risk and skill, conditional on being entrepreneurs. Hence it directly alters the individual's incentive to engage in entrepreneurial activity, changing the "mix" of entrepreneurs and workers in the economy and firm size. It also improves the allocation indirectly by enlarging the tax base, which reduces the effective tax rate, and increases wage and capital income.

There are a number of extensions that would be interesting. As in Scheuer (2013), in order to focus on equilibrium occupational choice and the role of an elastic occupational choice margin, our paper abstracts from endogenous labor supply. In this case the regressivity of optimal taxes is not driven by a desire to stimulate the intensive effort margin or to manipulate wages. Instead, this allows us to focus on the inefficiency of occupational choice from endogenous cross subsidization. Recently, in models that abstract from occupational choice, Feng and Zhao (2017) study the effect of health insurance on aggregate labor supply and Rong (2017) examines inequality in health insurance and wages. While we would lose the focus on occupational choice, these are interesting extensions.

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Appendix 1

This Appendix contains details from the model calibration for:

- Calibrated Markov process for stochastic labor productivity z. The five states are:

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

  and a transition matrix

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

- Calbrated Markov process for medical expenditure shocks m. The seven expenditure states are: $m \in \{0.000, 0.006, 0.022, 0.061, 0.171, 0.500, 1.594\}$. Jeske and Kitao (2009) estimate

  the transition matrix for m 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

Appendix 2

In the baseline model the coefficient of risk aversion is 1.5. Table 5 reports the results when risk aversion is 3. Observe that the welfare loss is smaller in the "no subsidy" experiment (only -1.52 when ρ is 3 versus -1.91 when ρ is 1.5). This occurs because when risk aversion is higher EHI participation was and remains relatively high (63.1% when ρ is 3 versus 26.9% when ρ is 1.5). This lowers the loss from less risk sharing. The welfare gain from extending the subsidy is higher when risk aversion increases from 1.5 to 3 (0.62 versus 0.33). The EHI premium is lower.

Table 5: Talent Allocation under Policies with $\rho = 3.0$

Statistics	*Base*	*no subsidy*	*extend subsidy*
Welfare	0	-1.52	0.62
% with CEV>0	0	0.3	98.8
HI take-up (%)	89.7	63.1	97.6
EHI coverage (%)	53.1	38.9	65.9
EHI premium	100	117.7	84.0
Entrepren %	7.38	8.82	7.71
Ave x	100	91.5	99.8
Output per firm	100	84.8	97.5
% firm at 0-9	73.6	77.93	74.76
% firm at 10-19	16.23	13.57	15.52
% firm at 20-49	7.01	5.86	6.7
% firm at 50-99	2.47	2.06	2.36
% firm at 100+	0.69	0.58	0.66
Net-tax earning			
workers	100	98.71	102.41
entrepreneurs	100	84.54	98.01
Ave. tax (%)	24.0	24.4	24.8