Taking Care Off Business: Firm Size, Entrepreneurship and Employer-Based Health Insurance*

David Chivers, Zhigang Feng and Anne Villamil
Centre for Growth and Business Cycles Research
Department of Economics, University of Manchester

Abstract

We present an occupational choice model where agents are heterogeneously endowed with managerial talent and experience health cost shocks. Each worker is paid a wage package, which includes both a monetary wage and health insurance. Larger firms are able to offer better wage packages due to economies-of-scale in the purchasing of health insurance. The results suggest that employer-based health insurance may have a negative impact on entrepreneurship and persistent inequality. We also provide policy experiments as well as look at the potential impact of "Obamacare".

JEL Classification:

Keywords: Entrepreneurship, Uncertainty, Health

*The authors are grateful to to
Address for correspondence: David Chivers, Department of Economics, University of Manchester, Manchester M13 9PL, England. **Tel:** 0161-275-3908. **Fax:** 0161-275-4928. **E-mail:** david.chivers@manchester.ac.uk.

1 Introduction

Income uncertainty and bankruptcy are to two of the most feared prospects when starting a business.[1] As a result, the surrounding literature suggests that an individual facing the choice of whether or not to start a firm will be concerned with the possible spread of returns from entrepreneurship (See Blackburn and Chivers 2013; Moskowitz and Vissing-Jørgensen 2002). However, by choosing to become an entrepreneur, rather than working for a firm, exposes the individual to other idiosyncratic risks - such as healthcare costs - that would otherwise be covered by an employer. The question for the individual does not simply become what is the risk of entrepreneurship? Rather, what is the associated risks of not being employed by a firm?[2]

These negative health shocks have so far been overlooked in the occupational choice literature which tend to focus on uncertainty of the project itself when considering the effect of risk on entrepreneurship. It follows that within economies where Employer-based Health Insurance (EHI) makes up a significant proportion of the economy's healthcare system - such as the U.S. economy - the cost and quality of health insurance will be an important factor in the entrepreneurial decision.[3]

Livshits, MacGee and Tertilt (2007) and Chatterjee et al. (2005) found health shocks to be one of the most important factors in cases of consumer bankruptcy.[4] The percentage of bankruptcies relating to medical costs are estimated to be within the range of 19.3 percent and 46 percent (Sullivan, Warren, and Westbrook 2000; Jacoby, Sullivan and Warren 2001; and Domowitz and Sartain 1999).[5] Given that a significant proportion of entrepreneurs will be credit constrained and must therefore borrow to fund their entrepreneurial pursuits, a sufficiently large healthcost could potentially force the entrepreneur to file for bankruptcy. This event becomes event even more likely when considering that the majority of entrepreners' assets are tied-up in their firm (ref).

It is arguable, therefore, that health insurance is of greater importance to the employer rather than their employees. This, however, is not reflected in the data. Within the U.S., 96 percent of individuals who work for private firms are offered insurance compared to only 55 percent of self-employed individuals (SBA 2011). This could be

[1] In a survey of over 26,000 individuals accross 30 countries, 40 percent of US individuals said bankruptcy would be their greatest fear when starting up a business and 46 percent said income uncertainty would be their greatest fear (See Eurobarometer 2010).

[2] Our results can be generalised to any non-monetary benfit of being employed such as life-insurance, union membership etc.

[3] The reason that health insurance is provided by firms within the US can be traced back to a cap on wage earnings after the second world war (See Buchmuell and Monheit 2009)

[4] Altough this concerns consumer bankruptcy it is important to note that small businesses have an incentive to file under Chapter 7 personal bankruptcy law (See Fan and White 2003)

[5] Livshits, MacGee and Tertilt (2007) also identify divorce and the death of a spouse as the other main expense shocks.

due to the relatively high cost of obtaining individual health insurance compared to the cost of group health insurance.[6] However, even within the group health insurance market we observe that the number of firms that offer group health insurance increases with the firm size of the firm. Brugemann and Manovskii (2011) show that this relationship is robust even when accounting for wage. Table 1 shows the significant gap in the percentage of firms that offer insurance by firm size in 2011.

Table 1

Firm Size	<10	10-24	25-99	100-999	1000>
Insurance Rate (offered?)	28.3%	58.4%	78.1%	93.3%	99.5%

A natural starting point in explaining this observation would be to consider the fact that the average cost of insurance is lower per worker when firm size increases.[7] For example, smaller firms may suffer from higher premiums due to the presence of an individual with a costly medical condition, whereas larger firms, are able to absorb these large medical costs (Brugemann and Manovskii 2011). Another possibility is that large firms can gain economies-of-scale by distributing the administration cost of providing insurance over a larger number of employees (SBA 2011).[8] A further possibility is that larger firms can obtain better premium rates due to their substantive bargaining power than compared to smaller firms (See Sorenson 2001). Our intention, however, is not to determine the exact reason as to why costs are decreasing with firm size, but to investigate the impact that this phenomenon has on the entrepreneurial decision.[9] Specifically, we suggest two main effects of how Employer-based Health Insurance (EHI) can influence an individuals occupational choice:[10]

1) A *direct* effect: The incentive to start a firm decreases as an individual can obtain better healthcare benefits through an employer than if starting a firm.

2) An *indirect* effect: It will be comparably more expensive to employ workers for smaller firms than larger firms.[11]

The direct effect is intuitive. If an individual were to start a firm, the cost (quality) of their health insurance would be more expensive (lower) than if obtained by a firm as part of their wage package. We define the wage package as the compensation for worker's labour which consists of a monetary wage and other benefits such as health insurance. The indirect effect, however, it a little more involved. As the average cost of

[6] It could be that entrepreneurs have different attitudes towards risk and thus forgo insurance. If this is the case, entrepreneurs are still more likely to go bankrupt as they are uninsured.

[7] Is there any evidence for this cost?

[8] Adiministrative costs for small firms make up around 25 percent of premiums compared to around 5 percent for large firms.

[9] It may be possible to do this but the data for this is private MEPS data.

We can look at this at cost

[10] is it occupational choice or just firm size that is affected?

[11] 3) As small firms are the least insured, they are more likely to become bankrupt from health shocks. We could show this?

insuring an individual decreases with firm size, it is comparatively more expensive for small firms to offer EHI than for larger firms. Hence, the cost of employing workers is higher for a small firm than for a large firm. As a result, some small firms could choose not to offer health insurance (as we see in table 1). However, these firms must offer a higher monetary wage to compensate the employee for not being offered insurance (As show by Olson 2002 and Dey and Flinn 2005) If firms choose to offer no health insurance or compensation payment better quality workers will prefer to work for firms that offer a higher wage package. Whatever the small firms decision, it will result in a lower level of output for the firm. Hence, the incentive to become an entrepreneur is impeded by an inability to compete with wage packages offered by larger firms. [12]

These effects offer an explanation as to why Employer-based Health Insurance (EHI) is shown to have a negative affect on starting a firm in the data. For example, Fairlie, Kapur and Gates (2011) suggest that a substantive and significant increase in business ownership rates for males over the age of 65 - the age at which individuals are eligible for government sponsored healthcare (e.g. Medicare). Furthermore, there is a large negative effect on business creation for those without coverage compared to those who are covered under their spouse's insurance. Their results suggest a potential 33 percent reduction in business creation due to Employer-based Health Insurance.[13]

To get a feel for the size of these health shocks we re-estimate the shocks given in Jeske and Kitao (2009) using data from the 2011 MEPS survey. The original estimates by Jeske and Kitao used data from the 2003 MEPS survey and it is apparent that health costs have increased within this period.[14] It is also clear to see that even if individuals have insurance, there is potential for significantly large health costs. It is important to note that this shock does not take into account income lost from the illness by affecting the individuals ability to work. We abstract from this loss in productivity in our model as it is something that is difficult to insure against, for obvious moral hazard reasons and due to lack of data.

How important these health costs are to the individual will naturally depend on their ability to absorb the shock.[15] As mentioned earlier, firm managers may be much more susceptible to health shocks as their assets are tied-up in the firm. This gives the potential for an increase in the rates of bankruptcy amongst entrepreneurs. Alternatively, rather than investing in the firm, managers may create a "buffer stock" of liquid savings to pay off any unforeseen medical expenses (See Deaton 1991). Entrepreneurs would prefer to invest in the firm as the expected return from investing gives a higher

[12] I could mention firm size premium here of later?

[13] There are other studies we could put here

[14] The employee must pay a yearly premium for health insurance. The deductible is the amount that must be paid of the health care expenses before the insurance company contributes. The coinsurance rate is the amount the individual is expected to contribute after the deductible up to the maximum pay out.

[15] What makes matters more complex is that individuals below a certain level of income will be offered medicare. This means that individuals on higher wealth levels value insurance more than individuals on lower income levels.

return than the return from lending. Not only does this decrease the incentive to invest in the firm to begin with, but it also reduces the overall size of the firm and prevents firms from escaping their borrowing constraint.

It is unquestionable that providing high quality healthcare is important to an economy. However, if the way the health insurance system is provided impacts the level of entrepreneurship it can have adverse consequences for the development of that economy. For example, if EHI raises the level of wealth required to become an entrepreneur, then some of the most talented individuals may be deterred from starting a firm. This may lead to a decrease in economic growth and an increase in inequality (as in Banerjee and Newman 1993; Galor and Zeira 1993).

If this is the case, the question becomes, do the benefits of employer-based health insurance outweigh the potential negative cost of lower entrepreneurship levels? This essentially comes down to the relative efficiency of employer-provided health insurance compared to other health insurance systems: which system can provide the highest quality healthcare at the lowest cost.

Comparing healthcare systems with a multitude of providers to systems with a monopolistic insurer would involve comparing the benefits of a competitive market to the benefits of economies-of-scale. One of the main innovations of this paper is that it provides a framework to analyze the effects of different health insurance systems on the level of entrepreneurship. Rather than trying to establish which system is more efficient at providing healthcare, we examine each health insurance system at varying degrees of efficiency. [16]

Specifically, we first examine the effects of making it compulsory for EHI to be offered by all firms. We then examine the effects of removing EHI and replacing it with a number of private insurance companies that offer group insurance. Finally, we examine a government heath insurance system funded under a variety of different taxes.[17]

A further benefit of this paper is that we can discuss the recent implications of the Affordable Care Act (ACA) passed in 2010 (referred to commonly as "Obamacare") which has been a subject of much contemporary debate. In this way, our paper is related to Aizawa and Fang (2013) who cover a labour search model where individuals are matched with firms offering health insurance coverage to assess the impact of ACA on health insurance coverage.

The aim of the ACA was to increase the number of low-income individuals to obtain health insurance. One of the main features of ACA was the introduction of insurance exchanges for individuals who do not have EHI to obtain insurance at group-based premium rates. Those individuals with income 133-400 percent abvove the poverty line will also have these premiums subsidised.[18] Crucially, we are able to examine whether

[16] This is related to Summers (1989) mandated benefits argument.

[17] Within this paper, we concentrate on the U.S. due to data availabilty but could easiliy adapt this model to other countries.

[18] Another feature of ACA is that employers with more than 50 full-time employees must provide EHI to their employees or pay a fine. As a large percentage of firms with 50 employees already provide

the ACA will have an effect on the number of entrepreneurs within the economy In this respect, the ACA deals with the *direct effect* but not the *indirect effect* of EHI as discussed earlier.

Our results suggest that if we *take care off business*, the levels of entrepreneurship increase along with firm size. More results to follow...

The outline of the rest of the paper is as follows. In section 2 we present a model. In section 3 we show the benchmark calibration results. In section 4 we discuss policy experiments. In section 5 we look at the impact of ACA. Finally, we offer a conclusion in Section 6.

2 The Model

Consider a Lucas (1978) span of control model, where individuals differ only in their ability, x,to manage a firm. The ability x^i for each agent i is drawn from a common continuous cumulative probability distribution function $\Gamma(x)$ with $x \in [0,1]$. Productivity is not hereditary and is publicly observed (i.e., there is full information ad all agents know $\Gamma(x)$ ex ante and they know all realizations ex post). Households face an idiosyncratic health expenditure shock m_t which follows a finite-state Markov process. We determine a critical value of ability, x^*, where individuals above this value choose to be managers and those below it are workers.

Firm managers compensate their employees with wage package. This consists of a monetary wage w and group health insurance (EHI) which covers a fraction of the health expenditure shock $\phi(m)$. If insurance is not offerered, a monetary compensastion b is given to an employee in addtion to their wage. Whether a firm offerers insurance to their employees will be determined by a shock i_E. The proability of a firm experiencing this shock and therefore offering insurance is increasing with firm size. If a firm does not offer insurance, health insurance can be purchased from the private market. For notational convenience, we drop agent superscript i and time subscript t whenever possible. Let z and z' represent the current and future value of variable z.

2.1 Preferences, endowments and technology

Preferences: Consumption by agent i in period t is c_t^i, with utility given by $U^i(c_t^i)$ with constant relative risk aversion.

Endowments: Each individual is endowed with productivity, x^i, drawn from a continuous cumulative probability distribution $\Gamma(x)$, where $x \in [0,1]$. We assume that the distribution and realisations are public information. Each agent receives a medical spending shock m^i. Agents are also endowed with initial assets, a^i, which can be used as an input in production.

health insurance to their employees this will not have that much effect on our analysis.

Production: Firms use labour (n), and capital (k) to produce a single consumption good (y). Capital fully depreciates between periods. Managers can operate only one project. The functional form of the production function is:

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

Government We assume a public safety-net program, T_{SI}. This program guarantees each household a minimum consumption level equal to $\underline{c}$. This reflects the option available to U.S. households to rely on public transfer programs such as food stamp, Medicaid, disability and unemployment insurance, etc, in case of substantial income and health spending shocks.

The government uses a lumpsum tax, to finance the public safety-net program together with subsidy to EHI. The government runs a balanced budget period by period.

Factor remuneration: Firms rent capital at the common market rate r. Workers offer labour and in return recieve a wage package. Part of this wage package is given in and are are offered a wage package is given in monetary terms w. We assume that each firm will offer employment-based health insurance (**EHI**) with a certain probability p_E, given by random shock i_E. We assume that p_E increases with the size of the firm.[19][20]

If $i_E = 1$ then firms offfer health insurance the total cost of hiring labor is $w+q_E(n)$, where $q_E(n)$, is an increasing function of n.[21] Note, $q_E(n)$ reflects the fact that it is more costly for a small firm to offer health insurance than larger ones, due to economies of scale.

If $i_E = 0$ then a firm must compensate a worker.with a monetary benefit b so the total cost of hireing a worker becomes $w + b$. The value of the compensation payment b will be monetary value of insurance - i.e. what the insurance is worth to the individual. As a result, there will be one market clearing wage package that yields the same expected utility, where $EU[w + q_E(n)] = EU[w + b]$. [22]

[19] See Appendix

[20] This is equivalent to modeling the EHI offer decision as a preference shock, see Aizawa and Fang (2013).

[21] The central question is how health care policy, for example Affordable Care Act (ACA), affects household's self-employment decision. One of the key issues is that a self-employed may only get health insurance coverage from the private market, which costs substantially more than EHI. Hence, health insurance may hinder some talent manager to open a startup. ACA also imposed an employer mandate, which requires that firms over 50 employees providing EHI. Such mandate will distort firm's labor demand decision. Aizawa and Fang (2013) look at this issue and their results suggest that the effect is quite small.

[22] See Appendix for why firms offer a wage package

2.2 Health insurance

Households have access to EHI with probability $\hat{p}_E$, which is determined by shock i_E.[23] We differentiate between p_E and $\hat{p}_E$. This is because workers are randomly matched with firms of different sizes, but each worker has the same probability to get an EHI offer.[24]

Once the firm makes an offer to the worker, which is denoted as $i_E = 1$, the worker decides either to obtain coverage or remain uninsured ($i_{HI} = \{0, 1\}$). The EHI premium costs q_E and the insurance covers a fraction $\phi(m)$ of total medical expenditures, where $\phi(\cdot) \in [0, 1]$. The premium is not dependent on the indivudual's prior health history. This accounts for the practice that group health insurance cannot price-discriminate among the insured based on such individual characteristics. If the worker is not offered EHI, he/she has the option to purchase health insurance in the private market at premium $q(m)$ with a coinsurance rate $\phi(m)$. Note that this can happen when the household becomes a manager and does not offer (or has no access to) EHI.

Health insurance: -based Group Health Insurance (EHI) Under fair insurance insurance, the cost of insurance is equal to the the expected health shock. This is the cost of insurance that would be offered in a perfectly competitive market.

$$q_E = \sum_{s=0}^{s} E\left[\pi_s \phi_s m_s\right]. \tag{2}$$

where q_E is the cost of insurance, π is the probability of the shock given states of the world s, ϕ is the insruance rate where and m_s the value of the health shock.. However, we introduce an adminstation costs for small firms, q_A.

$$q_E(n) = \lambda^j q_A + \sum_{s=0}^{s} E\left[\pi_s \phi_s m_s\right] \tag{3}$$

where λ is a decreasing function of firm size n. The number of intervals that λ deceases over is given by j. As presented in the introduction, the adminstration costs repreresents the notion that the cost of group health insurance is decreasing in firm size.

Health insurance: Private Health Insurance (PI) Individuals who are not offered EHI can purchase health insurance via the private market. Unlike EHI, these insurance companies.*can* discriminate by a persons past health shock. Furthermore, as

[23] See appendix I

[24] Consider two firms, one large and one small. The largest firm offers insurance with 90% probability and the smaller with probaility 50%. From the worker's point of view, probability $\hat{p}_E$ is a weighted average of the two firms. In general, the weights are the equilbrium fraction firms of different sizes where the distribution generates the average.

the individual is purchasing alone, it cannot benefit from economies-of-scale savings in the administation cost q_A. Hence, the cost of private insurance q_p' becomes.

$$q_P(m') = q_A + \frac{1}{1+r}\sum_{s=0}^{s} E\left\{\pi_s \phi_s m_s' | m\right\} \tag{4}$$

2.3 Occupational choices

The firm's problem is given as:

$$\max_{n,k} x^i k^\alpha n^\gamma - \left[i_E\left\{w + (1-\psi+\lambda(n)q_A)\,q_E\right\} + (1-i_E)(w+b_E)\right]n - (1+r)k \tag{5}$$

Note, ψ of EHI is the premium is paid by the firm and the administation q_A cost is given as a percentage increase on the fair premium q_E.[25]

3 Optimal behavior and equilibrium

The timing of the economy is given as follows.

1. The household enters new period with asset a^i, health insurance status i_{HI}.
2. Idiosyncratic shocks x^i, are m^i are drawn.
3. Household makes decision on: entrepreneurship.
4. Workers randomly mathch with firms. Idiosyncratic shock i_E is drawn, which determines the EHI offering status.
5. Capital and labor markets clear and production takes place.
6. Households make decision on: health insurance, consumption, borrowing/saving and labor supply. Note both manager and workers decide on health insurance purchase.

3.1 Firm manager

Firms are distinguished solely 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 the health care friction, where the benefits component of compensation exists for historical reasons. Clearly it would be more efficient to use an insurance pool.

[25] Further explanation here. Note, individuals pay a fix cost ψ rather than a fraction of the insurance cost. Although it is possible to implement, it would have distoritonary effects on the wage package.

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):

$$\max_n x^i k^\alpha n^\gamma - \left[i_E \left(w + \left(1 + \lambda(n) q_A - \psi\right) q_E\right) + \left(1 - i_E\right)\left(w + b_E\right)\right] n \tag{6}$$

The FOC is given as

$$n'(k, x, w) = \gamma x^i k^\alpha n^{\gamma-1} - \left[i_E \left(w + \left(1 + \lambda'(n) q_A - \psi\right) q_E\right) + \left(1 - i_E\right)\left(w + b_E\right)\right] = 0 \tag{7}$$

There will exist different n^*depending on the size of the firm. Crucially, this will depend on how λ is distributed. We will assume that λ decreases over a number of intervals j, Consider the simple case where j equals two, there is only economies-of-scale for suffciently large firms and not for small firms. Hence, for small firms, λ is equal to 1. Optimal n^* for small firms therefore would be expressed as

$$n^{j*}_{SMALL}(k, x, w) = \left[\frac{\gamma x^i k^\alpha}{i_E \left(w + \left(1 + q_A - \psi\right) q_E\right) + \left(1 - i_E\right)\left(w + b_E\right)}\right].^{\frac{1}{1-\gamma}}$$

For a large firm which can benefit from economies of scale n^* is expressed as

$$n^{j*}_{LARGE}(k, x, w) = \left[\frac{\gamma x^i k^\alpha}{i_E \left(w + \left(1 + \lambda q_A - \psi\right) q_E\right) + \left(1 - i_E\right)\left(w + b_E\right)}\right],^{\frac{1}{1-\gamma}}$$

where $\lambda \in (0, 1)$ Naturally, in this simple case this creates an incentive for firms sufficiently close to the point where it becomes a "large" firm to employ more workers in order to obtain the savings from economies-of-scale.[26] From now on, we will use the supscipt j to indicate that there are multiple steady-states variables depending on the distribution of the savings due to economies of scale λ.

Substituting (**??**) into (6) yields the manager's profit function for a given level of capital:[27]

$$y^j_i(k, x, w) = x k^\alpha \left[\frac{\gamma x^i k^\alpha}{i_E \left(w + \left(1 + \lambda^j q_A - \psi\right) c_E\right) + \left(1 - i_E\right)\left(w + b_E\right)}\right]^{\frac{\gamma}{1-\gamma}} \tag{8}$$

Now consider the choice of capital. Let

- a denote the amount of self-financed capital; and
- l denote the amount of funds borrowed from a bank.

Both sources of funds are used to raise capital, with $k(\cdot) = a(\cdot) + l(\cdot)$. There is no commitment problem regarding bank loan repayment, so the two sources of funds have the same cost.

[26] One way round this is to consider the economies-of-scale effect λ being a convex function such as $\frac{n^\theta}{n}$. It can be shown that the marginal savings for a firm employing one more worker would not be greater than the marginal cost of employing one more worker.

[27] This will adjust with EHI offering status, since EHI benefits from tax subsidy.

Unconstrained firm When initial assets are sufficient to run a business without resorting to credit finance (i.e., $l = 0$), the manager of the firm solves the problem:

$$\nu_i^j(a, x, i_E; w, r) = \max_{k \geq 0} y_i(k_i, x, w) - rk - \varphi \tag{9}$$

where $\varphi = \left[i_E\left(w + \left(1 + \theta\frac{n^\theta}{n}q_A - \psi\right)c_E\right) + (1 - i_E)(w + b_E)\right]\left[\frac{(1-\alpha)x^i k^\alpha}{i_E\left(w+\left(1+\theta\frac{n^\theta}{n}q_A-\psi\right)c_E\right)+(1-i_E)(w+b_E)}\right]^{\frac{1}{1-\gamma}}$ denotes the labor cost. :

Subbing n_i^j into profits ν_i^j gives

$$\nu_i^{j^*}(a, x, i_E; w, r) = (1-\gamma)(xk)^{\frac{\alpha}{1-\gamma}}\left[\frac{\gamma}{i_E\left(w + (1 + \lambda^j q_A - \psi)c_E\right) + (1 - i_E)(w + b_E)}\right]^{\frac{\gamma}{1-\gamma}} \tag{10}$$

$$k_i^{j^*}(x, w, r) = \left[x\left(\frac{\gamma}{i_E\left(w + (1 + \lambda^j q_A - \psi)c_E\right) + (1 - i_E)(w + b_E)}\right)^\gamma\left(\frac{\alpha}{r}\right)^{1-\gamma}\right]^{\frac{1}{1-\alpha-\gamma}} \tag{11}$$

From equation (8), the manager's profit at the optimal level of capital is:

$$\nu_i^j(k_i^{j^*}, x, w) = xk^\alpha\left[\frac{\gamma x^i k_i^{*\alpha}}{i_E\left(w + (1 + \lambda^j q_A - \psi)c_E\right) + (1 - i_E)(w + b_E)}\right]^{\frac{\gamma}{1-\gamma}} - \left[i_E\left(w + \left(1 + \lambda^j q_A - \psi\right)c_E\right) + \right. \tag{12}$$

The manager's consumption is determined as follows.

$$c + a' + (1 - i_{HI}\phi)m + \tilde{\pi} \leq (1 + r)a + \nu_i(k^*, x, w) - Tax + T_{SI} + \tau_s i_E \pi_E \tag{13}$$

where

$$\tilde{\pi} = \begin{cases} \pi_E & i'_{HI} = 1, i_E = 1 \\ \pi_P(m) & i'_{HI} = 1, i_E = 0 \\ 0 & i'_{HI} = 0 \end{cases} \tag{14}$$

$$T_{SI} = \max\{0, \underline{c} + Tax + \tilde{\pi} - \tau_s i_E \pi_E + (1 - i_{HI}\phi)m + (1 + r)(k - a) - \upsilon_i(k^*, x, w)\} \tag{15}$$

$$a' \geq -\bar{a}. \tag{16}$$

$$l \leq (1 - \Delta)\frac{\nu_i(a, x, w) + rk^*}{1 + r} - oop \tag{17}$$

Note $\tilde{\pi}$ is what the manager pays for insurance, i'_{HI} is choice for the entrepreneur to buy health insurance for himself for next period, and i_E is the shock (employer has to provide insurance to employee). The government subsidizes EHI purchasing with

$\tau_s i_E \pi_E$. Equation (17) is a credit constraint for the firm, where *oop* is the out-of-pocket health shock of the entrepreneur and is defined asw

$$oop = (1 - i_{HI}\phi(m))\, m. \tag{18}$$

Notice $\frac{\nu_i(a,x,w)+(1+r)k^*}{1+r}$ works as a collateral, which yields the present value of the firm's earning net of labor cost. We assume that there is a proportional cost of borrowing, which is represented by $(1 - \Delta)$. This constraint introduces interesting dynamics as the entrepreneur's health insurance decision will affect its future available credit.

Constrained firm When managers do not have enough fund to operate the firm, they can borrow from the capital market at the risk free rate r. However, they can borrow up to a limit of $\bar{l}$. If the optimal level of capital k^* can be financed by borrowing, then the firm's problme will be similar to the unconstraned one.[28]

When managers are credit constraint, namely $a + \bar{l} < k^*$, the firm will operate at the capital level of $a + \bar{l}$. Notice the borrowing limit $\bar{l}$ is endogenous, see equation (17). According, the credit constrained firms have borrowing that is determined by the equation as follows.

$$\tilde{\nu}^{j^*}(\tilde{k}, x, w) = x\tilde{k}^{\alpha}\tilde{n}^{\gamma} - i_E \left(w + \left(1 + \lambda^j q_A - \psi\right) q_E\right) + (1 - i_E)\,(w + b_E)\tilde{n} - ra - (1+r)\bar{l} \tag{19}$$

where

$$\tilde{k}^j = a + \bar{l} = a + \frac{\tilde{\nu}^*(\tilde{k}, x, w) + ra + (1+r)\bar{l}}{(1+r)}(1 - \Delta) - oop \tag{20}$$

$$\tilde{n}^{j^*}(\tilde{k}, x, w) = \left[\frac{(1-\alpha)x^i\tilde{k}^{\alpha}}{i_E\,(w + (1 + \lambda^j q_A - \psi)\, q_E) + (1 - i_E)\,(w + b_E)}\right]^{\frac{1}{1-\gamma}}. \tag{21}$$

Hence the credit constrained firms are different in their own capital holding.

$$\tilde{k}^j = \begin{cases} k^{j^*} & \text{if } a \geq k^* - \frac{\tilde{\nu}^*(\tilde{k},x,w)+ra+(1+r)\bar{l}}{(1+r)}(1-\Delta) + oop \\ a + \frac{\tilde{\nu}^*(\tilde{k}^*,x,w)+(1+r)\tilde{k}^*}{(1+r)}(1-\Delta) - oop & \text{if } a < k^* - \frac{\tilde{\nu}^*(\tilde{k},x,w)+ra+(1+r)\bar{l}}{(1+r)}(1-\Delta) + oop \end{cases}$$

where $\tilde{k}^{j^*}$ is the solution to equation (19).

3.2 Workers

Workers maximize expected discounted utility of consumption subject to the following budget constraint:

$$c + a' + (1 - i_{HI}\phi)\, m + \tilde{\pi} \leq (1+r)a + \tilde{w} - Tax + T_{SI} + \tau_s i_E q_E$$

[28] We should start with the case that $\bar{l}$ is sufficiently large.

where

$$\tilde{\pi} = \begin{cases} q_E(1-\psi) & i'_{HI}=1, i_E=1 \\ q_P(m) & i'_{HI}=1, i_E=0 \\ 0 & i'_{HI}=0 \end{cases} \tag{22}$$

$$\tilde{w} = \begin{cases} w + \left(1+\lambda^j q_A - \psi\right) q_E & i_E = 1 \\ w & i_E = 0 \end{cases} \tag{23}$$

$$T_{SI} = \max\left\{0, \underline{c} + Tax + \widetilde{q} - \tau_s i_E q_E + \left(1 - i_{HI}\phi\right) m - \left[(1+r)a + \tilde{w}\right]\right\} \tag{24}$$

$$a' \geq -\bar{a} \tag{25}$$

Tax is the lumpsum tax, which is collected to finance consumption floor and to subsidize EHI purchasing.

3.3 Government

The government runs a balance budget.

$$Tax = T_{SI} + \int \tau_s i_E \pi_E. \tag{26}$$

3.4 Value functions

$$V(a, x, m, i_E, i_{HI}) = \max_{\mathcal{I}_w, \mathcal{I}_e}\{V_w, V_f\} \tag{27}$$

Note that $\mathcal{I}_w, \mathcal{I}_e$ represent household's occupational choice, and

$$V_f = \max_{a', i'_{HI}} E_{i_E}\left[U(c)\right] + \beta E[V(a', x', m', i'_{HI})] \tag{28}$$

denotes the value function for the entrepreneur, and the worker's value functionV_w is given by the appropriate wage. We start with the case that $\bar{l}$ is sufficiently large, hence firms are never credit constrained. Given aggregate prices, firm's optimal demand for capital and labor will determined from the FOCs. Note E_{i_E} indicates that different occupations yield different probability of getting EHI.

$$E_{i_E}\left[U(c)\right] = \begin{cases} p_E(n^*)U(c|i_E=1) + (1-p_E(n^*))U(c|i_E=0) & \text{entrepreneur} \\ \hat{p}_E U(c|i_E=1) + (1-\hat{p}_E)U(c|i_E=0) & \text{worker} \end{cases} \tag{29}$$

3.5 Steady state equilibrium

We characterize the steady state equilibrium. Denote the equilibrium aggregate variables with $\Phi = \{r, w, \pi_E, \hat{p}_E, \tau_y\}$, state variables $\theta = \{a, x, m, i_{HI}\}$.

Definition 1 *The steady state equilibrium for the economy is given by aggregate variables* Φ*, allocations* $(c, a', i'_{HI}, \mathcal{I}_w, \mathcal{I}_e)$ *for households characterized by* $\theta = (a, x, m, i_E, i_{HI})$*, such that:*

1. *Given* Φ*, allocations* $(c, a', i'_{HI}, \mathcal{I}_w, \mathcal{I}_e)$ *solves household's optimization problem.*
2. *Health insurance market is competitive.*
3. *Asset market clears* $\int k = \int a$*.*
4. *Labor market clears* $\int \mathcal{I}_e n = \int \mathcal{I}_w$*.*
5. *Good market clears.*
6. *Government balances its budget.*

4 Calibration

Health spending shocks and health insurace Health spending follows a finite state Markov chain, with $\{0.000, 0.006, 0.022, 0.061, 0.171, 0.500, 1.594\}$, which has been normalized in terms of the average earning (wage income of all heads of households, the average earning is \$32800 in 2003). The transition matrix for m is given by:

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

The coinsurance rate for each of the seven binds 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

	Value	Descriptive	Taken From
β	0.96	Discount Factor	Antunes et al (2008)
α	0.35	Capital Share	Antunes et al (2008)
σ	1.5	Risk Aversion	
γ	0.55	Labour Share	Antunes et al (2008)
ε	4.422	Distribution of $x^{\frac{1}{\varepsilon}}$	Antunes et al (2008)
m		Health Shock	Jeske and Kitao (2009)
ϕ		Insurance Rate	Jeske and Kitao (2009)
ψ		Employee Premium	Jeske and Kitao (2009)
$q(n)$		Total Premium EHI	
$p_E(n)$		Probability of EHI	Agency for Healthcare
$\widehat{p}_E$		% Covered by EHI	AHRQ
$\underline{c}$		Consumption Floor	20% hhds wealth <$5000
τ_s		Payroll Tax	
δ		Capital Depreciation	

5 Policy Experiment: Funding Health Care

Policy Expriment 1: EHI Expansion We expand EHI from the 62 percent level in the data to 100 percent coverage. There is a tradeoff: People are insured, which makes agents more willing to bear the risk of entrepreneurship. All workers and entrepreneurs now have insurance. However, firms that orginally did not want to offer insurance have are paying an additional χ.

$$n^{j*}_{SMALL}(k,x,w) = \left[\frac{\gamma x^i k^\alpha}{i_E\left(w+\left(1+\lambda^j q_A-\psi\right)q_E\right)+\left(1-i_E\right)\left(w+\left(1+\lambda^j q_A-\psi\right)q_E+\chi\right)}\right]^{\frac{1}{1-\gamma}}.$$

This shock i_E essentially reflects the outcome of the firms decision to offer insurance or not. A firm will look at the cost of either buying insurance or just paying the individual a monetary compensation.

$$w+\left(1+\lambda^j q_A-\psi\right)q_E < w+b$$

As λ^j is decreasing in firm size, this is why larger firms will be more likely to offer healthcare. However, different firms will essentially have their own idiosyncratic cost in setting up insurance. What we see in the data is a reflection of this process.

Firm Size	<10	10-24	25-99	100-999	1000>
Insurance Rate	28.3%	58.4%	78.1%	93.3%	99.5%

Rather than explicitly model this idiosyncratic shock to individual firms in supplying insurance. That is why, when expanding EHI to 100% we can essentially add an extra cost χ to those individuals that would have preferred to offer a the financial compensation b.

Policy Expriment 2: Private Firm Oligopoly In the next 2 expermients we now take care off business. In this type of insurance, individuals

$$n^{j^*}(k,x,w) = \left[\frac{\gamma x^i k^\alpha}{w}\right]^{\frac{1}{1-\gamma}}$$

All individuals have acccess to health insurance from an oligopoly of private insurers at rate $(1+\lambda q_A)\, q_E$. The variable λ is the same for everyone as everyone benefits from group insurance. λ also reflects the effciency that these oligopolistic insurers can provide insurance.

Policy Expriment 3: Government Funded In this sitution it is essentially the same as the previous case except now the government can fund taxation in a variety of ways.

The government provides EHI, as in Canada. The subsidies are the same as in EHI. See equation (20). The last term is that the insurance is tax deductable. Also see (21) ψ is the employer contribution. Both terms are now paid by the governmentt directly through the tax system.

$$n^*(k,x,w) = \left[\frac{\gamma x^i k^\alpha}{w + (1+\lambda q_A - \psi)\, q_E}\right]^{\frac{1}{1-\gamma}}$$

We can vary ψ, which is the amount that the individual has to pay for insurance.

The other method of funding could be a tax on firm profits

$$\nu_i^j(a,x,i_E;w,r) = \max_{k\geq 0} y_i(k_i,x,w) - rk - \varphi - (1+\lambda q_A - \psi)\, q_E \tag{30}$$

5.1 Policy Experiment: Funding Health Care: ACA Obamacare

By 2014 state or federally run health insurance exchanges will be established in which all individuals who are either unemployed, self-employed and not currently covered by employer-sponsored health insurance can purchase insurance at subsidized premium rates. Individuals who purchase their insurance from the insurance exchanges will be charged a premium that is independent of their health expenditure risk. Individuals who are not offered insurance from their employers and whose income is between 133 and 400 percent of the FPL are eligible to buy health insurance through insurance exchanges at subsidized rates according to Table 3 below.

Individuals who are not offered insurance from their employers and whose income is between 133 and 400 percent of the FPL are eligible to buy health insurance through insurance exchanges at subsidized rates according to Table 3 below.

Income in % of FPL	Premium Subsidy Rate
100-150%	94%
150-200%	77%
200-250%	62%
250-300%	42%
300-350%	25%
350-400%	13%

The implementation of health insurance exchange will change the premium equation into the following one.

$$\pi_E = \begin{cases} \pi_E & i'_{HI} = 1, i_E = 1 \\ \pi_{HIX}(1 - \tau_{HIX}) & i'_{HI} = 1, i_E = 0 \\ 0 & i'_{HI} = 0 \end{cases}$$

where $\blacksquare_{HIX}$ is the premium of health insurance exchange and τ_{HIX} is the subsidy rate corresponding to table X. HIX will also have a loading cost. ACA requires that the medical loss ratio must be at least 80%, which translates into a upper bound on loading cost of 0.25

	Output per capita % baseline	Wage % baseline	% of entreprenerus
Baseline	8842.8	0.4481	7,71
EHI Expansion			
Private Health Insurance			
Universal HI			
HI Exchange "Obamacare"			

5.2 Welfare analysis

In order to measure the welfare cost/gain of a specific policy, we ask how much would an agent with state $(a, x, m, i_H I)\, gain/lose, inpercentagetermsoflifetimeconsumptionifhelivedthroug$ $state? Putdifferently, howmuchwouldanagentwithwealth-productivitypair\, (a, x, m, i_H I)\, intheinitial$ $statebewillingtogiveupasapercentageofitslifetimeconsumptiontoavoidthetaxreform? So, welfarechar$ $equivalentvariation. Theanswertothisquestionisafunctionthatsolvethefollowingequations. E_0 \Sigma_{t=0}^{\infty} \beta^t u$ $E_0 \Sigma_{t=0}^{\infty} \beta^t u\, (\hat{c}_t)$where c_t^*denotes the consumptions in the initial state, while $\hat{c}_t$ is the consumption under the new policy. For the case of CRRA preference $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$, we can exploit the homogeneity of the utility function and the the solution to the above equation is given by

$$\varpi(a,x,m,i_{HI}) = \left[\frac{V^*(a,x,m,i_{HI}) + \frac{1}{(1-\sigma)(1-\beta)}}{\hat{V}(a,x,m,i_{HI}) + \frac{1}{(1-\sigma)(1-\beta)}}\right]^{\frac{1}{1-\sigma}} - 1.$$

This welfare change is called conditional welfare change , as it is computed for an individual that is in a particular state. We have plots for $\varpi(a,x,m,i_{HI})$ as follows.

6 Conclusion

To be completed.

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7 Appendix

Appendix I: Computation Given the values for parameters, the distribution $\Gamma(x)$ for x, Ω_a for a, and Ω_m for m.The numerical algorithm works as follows.

1. Set a tolerance $\in > 0$

2. Guess $\Phi^0 = \left(r^0, w^0, \pi_E^0, \hat{p}_E^0, \tau_y^0\right) .Solve for optimal household behavior$

$$f : (\theta; \Phi) \to (c, a\prime, i\prime_{HI}, \mathcal{I}_w, \mathcal{I}_e, n, k) ,$$

where $\theta = \{a, x, m, i_E, i_H\} .We will use the method of value function iteration as follows.$

(a) Guess value function $V^0(\theta; \Phi^0) and policy functions \mathrm{f}^0(\theta; \Phi^0)$.

(b) Update value and policy functions:

$$V^1\left(\theta; \Phi^0\right) = \max_{I_w, I_e} \left\{ \left[\max_{a\prime, i\prime_{HI}} E_{i_E}\left[U(c|_w = 1)\right] + \beta E[V^0(\theta\prime)] \right] \left[\max_{a\prime, i\prime_{HI}} E_{i_E}\left[U(c|_e = 1)\right] + \beta E[V^0(\theta\prime)] \right] \right\}$$

$$f^1\left(\theta; \Phi^0\right) = \arg\max V^1\left(\theta; \Phi^0\right)$$

(c) Stop if $\max\{|V^1 - V^0|, |f^1 - f^0|\} \leq \epsilon$. Otherwise, set V$^0 = V^1, f^0 = f^1 andrepeatstep(b)$.

(d) Set $V^* = V^1$, and $f^* = f^1$.

3. Generate a large number of individuals, $N = 10000$. For each agent j assign a vector of initial condition $\left(a_0^j, x_0^j, m_0^j, i_E, 0^j, i_H I, 0^j\right), where \mathrm{x}_0^j \sim \Gamma(x),\ m_0^j \in \Omega_m, i_{HI}^j =$ 0.

4. Simulate the economy for T periods, where T is sufficiently large.

5. Calculate the following statistics from the simulated path $\left\{a_t^j, x_t^j, m_t^j, i_E, t^j, i_H I, t^j, I_w^j, I_e^j, n^j, k^j\right\}_t =$ 0^T

and τ_y^1 that balances the government's budget.

6. Stop and set $(r^*, w^*, \pi_E^*, \hat{p}_E^*) = (r^0, w^0, \pi_E^0, \hat{p}_E^0)$, if $\max\left\{LS^0, KS^0, |\pi_E^1 - \pi_E^0|, |\hat{p}_E^1 - \hat{p}_E^0|\right\} \leq$ ϵ. Otherwise, update aggregate variables (restart from step 2):

$$
\begin{aligned}
r^0 &= \chi r^0 + (1-\chi)\rho KS^0 \\
w^0 &= \chi w^0 + (1-\chi)\rho LS^0 \\
\pi_E^0 &= \chi \pi_E^0 + (1-\chi)\pi_E^1 \\
\hat{p}_E^0 &= \chi \hat{p}_E^0 + (1-\chi)\hat{p}_E^1 \\
\tau_y^0 &= \chi \tau_y^0 + (1-\chi)\tau_y^1.
\end{aligned}
$$

Appendix II This raises the question why firms would want to offer health insurance to begin with? Workers will always prefer health insurance over not being insured as they are risk averse. As it is cheaper for a firm to spend a portion of the the workers compensation by purchasing insurance for them q_E then to give them the same value in monetary terms as a monetary wage. However, as non of these firms are large enough to influence the wage, competition within the market to force firms to give firms all of the benefit to workers. Although each individual supplies labour inelastically, we still are operating in a perfectly competitive labour market - each firm could offer a better package to capture the whole market. Therefore, the wage package is given at the perfectly competitive market rate and no one firm can influence the market. This argument is analgous to the the more frequently cited world interest rate in small open economy models.

Appendix III: Higher costs for premiums or just worse insurance? Rather than assuming that there is only one level of covereage of insurance. at different prices depending on firm size. We can reformulate the cos of insurance equation X as

$$
q_E(n) = \sum_{s=0}^{s} E\left[\pi_s \phi(n)_s m_s\right] \tag{31}
$$

Now insurance costs the same regardless of firm size. However, the quality, the coverage of insurance ϕ, increases with frim size. Altough firms will be able to offer insurance at a lower cost, firms that do not offer the market clearing rate of wage will not be able to employ workers. Hence the wage package becomes $EU[w+q_E^i+b^i] = EU[w+q_E^{i*}]$ where q_E^{i*} is the highest quality insurance package offered a firm. Although q_E are equivilant in monetary terms, q_E^{i*} gives a higher level of insurance. Hence, smaller firms must compensate their workers for this. In this instance, firms who do not offer insurance must give workers a monetary component which is identical to as before $EU\ [w+b^{i^*}]$.

The result of this is that not only are smaller firms more likely to go bankrupt due to worse insurance, individuals who work for smaller firms also have worse insurance coverage.