S E D A P

A PROGRAM FOR RESEARCH ON

SOCIAL AND ECONOMIC DIMENSIONS OF AN AGING POPULATION

Entrepreneurship, Liquidity Constraints and Start-up Costs

Raquel Fonseca
Pierre-Carl Michaud
Thepthida Sopraseuth

SEDAP Research Paper No. 173

For further information about SEDAP and other papers in this series, see our web site:
http://socserv.mcmaster.ca/sedap

Requests for further information may be addressed to:
Secretary, SEDAP Research Program
Kenneth Taylor Hall, Room 426
McMaster University
Hamilton, Ontario, Canada
L8S 4M4
FAX: 905 521 8232
e-mail: sedap@mcmaster.ca

Entrepreneurship, Liquidity Constraints and Start-up Costs

Raquel Fonseca
Pierre-Carl Michaud
Thepthida Sopraseuth

SEDAP Research Paper No. 173

February 2007

The Program for Research on Social and Economic Dimensions of an Aging Population (SEDAP) is an interdisciplinary research program centred at McMaster University with co-investigators at seventeen other universities in Canada and abroad. The SEDAP Research Paper series provides a vehicle for distributing the results of studies undertaken by those associated with the program. Authors take full responsibility for all expressions of opinion. SEDAP has been supported by the Social Sciences and Humanities Research Council since 1999, under the terms of its Major Collaborative Research Initiatives Program. Additional financial or other support is provided by the Canadian Institute for Health Information, the Canadian Institute of Actuaries, Citizenship and Immigration Canada, Indian and Northern Affairs Canada, ICES: Institute for Clinical Evaluative Sciences, IZA: Forschungsinstitut zur Zukunft der Arbeit GmbH (Institute for the Study of Labour), SFI: The Danish National Institute of Social Research, Social Development Canada, Statistics Canada, and participating universities in Canada (McMaster, Calgary, Carleton, Memorial, Montréal, New Brunswick, Queen's, Regina, Toronto, UBC, Victoria, Waterloo, Western, and York) and abroad (Copenhagen, New South Wales, University College London).

Entrepreneurship, Liquidity Constraints and Start-up Costs [1]

Raquel Fonseca, RAND [2]
Pierre-Carl Michaud, RAND [3]
Thepthida Sopraseuth, EPEE-PSE-CEPREMAP [4]

Abstract:
We study the effects of liquidity constraints and start-up costs on the relationship between wealth and the fraction of entrepreneurs in an economy. We develop a dynamic occupational choice model that yields predictions that can be tested on cross-sectional data with exogenous variation in liquidity constraints (e.g. access to credit) and start-up costs. We use three highly comparable micro datasets (SHARE, ELSA and HRS) focusing on the population age 50+ in 9 countries. These countries have very different levels of start-up costs and potential liquidity constraints. Reduced form results support our theoretical predictions. While higher liquidity constraints yield a steeper wealth profile for the fraction of workers in entrepreneurship, startup costs flatten this relationship by depressing the marginal value of being an entrepreneur as a function of wealth. Countries with high start-up costs such as Italy, Spain and France have flatter wealth gradients.

Keywords: entrepreneurship, liquidity constraints, start up costs, occupational choice, cross-country comparisons

JEL Classification: E21, E23, J2

Résumé:
Nous étudions dans cet article l'effet des contraintes de liquidité et des coûts de création d'entreprise sur la relation entre la richesse et la proportion d'entrepreneurs dans l'économie. Nous proposons en premier lieu un modèle théorique dynamique visant à comprendre la décision de devenir entrepreneur dans un environnement où les agents font face à des contraintes de liquidité. Le modèle prédit une relation croissante entre le niveau de richesse la proportion d'entrepreneurs dans l'économie. Cette courbe s'aplatit en présence de coûts élevés de création d'entreprise. Nous utilisons ensuite trois bases de données (SHARE, ELSA et HRS) qui fournissent des informations comparables sur les individus de plus de 50 ans dans 9 pays caractérisés par des niveaux très hétérogènes de coûts de création d'entreprise. Les estimations confirment le résultat théorique : l'estimation d'un logit multinomial tenant compte des caractéristiques individuelles confirme que les coûts de création d'entreprise et les contraintes de liquidité pèsent sur la création d'entreprise. Toutefois, l'effet des coûts de création d'entreprise affecte en particulier les individus dont la richesse se situe au milieu de la distribution.

---

[1] We thank audiences in RTN Paris 2006, SHARE – ELSAE – HRS Conference Los Angeles 2006.

[2] RAND, 1776 Main Street, PO Box 2138, Santa Monica, CA 90407, Etats-Unis. email: fonseca@rand.org.

[3] RAND, 1776 Main Street, PO Box 2138, Santa Monica, CA 90407, Etats-Unis. email: michaud@rand.org.

[4] EPEE, Université d'Evry, CEPREMAP et PSE Jourdan, ENS – 48 Bd Jourdan, 75014 Paris, France. email: tsoprase@univ-evry.fr

1. Introduction

Over the last two decades, self-employment and entrepreneurship have attracted attention in public policy circles as well as in labor economics. Self-employment is seen by many as a form of employment that may help resolve aging-related fiscal problems since such workers tend to retire later. It is also seen as an engine of entrepreneurial activity that has the potential to deliver more jobs in the future. Self-employment is not marginal phenomena in most OECD countries (Blanchflower, 2000) and it can be asked if prevailing institutions met the needs of self-employed workers

We are interested in to study self-employment as a marker of entrepreneurial spirit, even if it is not always trivial to disentangle this in self-employment data. In a recent study, Hochguertel (2005) finds that very little of the difference in self-employment rates across European countries is explained by observable characteristics of workers. This leaves considerable room for institutions to play a role. Fonseca et al. (2001) show at a theoretical level that less individuals become entrepreneurs when start-up costs are higher. Nicoletti et al. (1999) document large cross-country differences in start-up costs. On the other hand, Evans and Jovanovic (1989) show that under liquidity constraints, the probability of entrepreneurship increases with assets. Evans and Leighton (1989) find support for this hypothesis on U.S. data. The importance of liquidity constraints and access to capital is supported by empirical evidence presented by Blanchflower et Oswald (1998) and Guiso, Sapienza et Zingales (2002).[5]

We build on dynamic occupational choice models of Cagetti and De Nardi (2005) and Luo (2005) to study how liquidity constraints and start-up costs affect the relationship between wealth and the fraction of entrepreneurs in an economy. The model yields testable predictions on the stationary distribution of wealth that can be tested using cross-sectional data where variation in liquidity constraints (access to capital) and start-up costs is available. We use three comparable micro datasets (HRS, SHARE and ELSA) focusing on the population age 50+ in 9 countries. These countries have very different levels of start-up costs and liquidity constraints measured by the facility with which entrepreneurs have access to capital. We use various indices from the literature to characterize the institutional setup in

[5] Hurst and Lusardi (2004) challenge the hypothesis that liquidity constraints play a role. Their key argument is that the probability of entrepreneurship in the U.S. increases only for extremely rich individuals, less likely to be liquidity constrainted. Cagetti and DeNardi (2005) show that this may have something to do with the definition of entrepreneurship used in their analysis.

each country (La Porta et al., 1998; Nicoletti et al., 1999; Fonseca et al., 2001; Acs et al., 2004).

Empirical results support our theoretical predictions. While liquidity constraints yield a steeper wealth gradient for the fraction of workers in entrepreneurship, start-up costs flatten this relationship by depressing the marginal value of being an entrepreneur as a function of initial wealth. Countries with high start-up costs such as Italy, Spain and France have flatter wealth gradients for the fraction of entrepreneurs in this age group.

In Section 2 and 3, we present the data used to test predictions. In section 4, we set up the model, calibrate it to one particular economy and generate predictions on the effect of liquidity constraints and start-up costs on the relationship between wealth and the fraction of entrepreneurs in an economy. In section 5, we discuss the identification strategy and discuss the results. Section 6 concludes with further comments.

2. Entrepreneurs in Europe and US

We use three comparable datasets composed of age 50+ individuals in 9 countries. The Survey of Health, Ageing and Retirement in Europe (SHARE) was fielded in 2004 and composed of representative samples of the population in 10 European countries. For analysis, we keep Germany, Sweden, The Netherlands, Spain, Italy, France and Denmark. Because of small sample size we decided not to use data from Switzerland. In addition, because we could not find good comparable measures of the regulatory environment facing entrepreneurs in Austria and Greece we did not include those either in our analysis. Two additional countries can be included because of the availability of comparable datasets; the United States using the Health and Retirement Study (HRS) and England using the English Longitudinal Study of Ageing (ELSA). We use the 2002 wave from the HRS and the 2003 wave from ELSA. We only keep respondents between 50 and 80 years old, 50 is the minimum age to be eligible to the survey and 80, because there are very few people into the labor market after this age. An analysis over the whole life-cycle would be preferable but no data as rich as the ones used here are available to perform such analysis. Hence, we concentrate on older respondents. Definitions of variables are displayed in Appendix A.

We use the definition self-employment as our definition of entrepreneurship.[6] Although this definition has drawbacks it avoids having to deal with the joint ownership of

[6] Self-employed working for pay. Then, we do not consider unpaid self employed. This group is included in inactivity.

business assets and other complicated arrangements. We denote these self-employed workers as entrepreneurs. In Table 1, we show the fraction of respondents not working, working for pay, and entrepreneurs. We can point out that the percentage of entrepreneurs varies considerably across countries. For example, among the population aged 50-80, there are only 5.2% entrepreneurs in France while there are 11.76% entrepreneurs in Italy, 10.89% in Spain and 10.4% in United States. The fraction in inactivity also varies remarkably. In Italy and in Spain, almost two thirds of the non working population is inactive at this age while less than a half is inactive in United States, in Sweden and in Denmark.

Table 1 Occupational Status by Country Population Aged 50-80

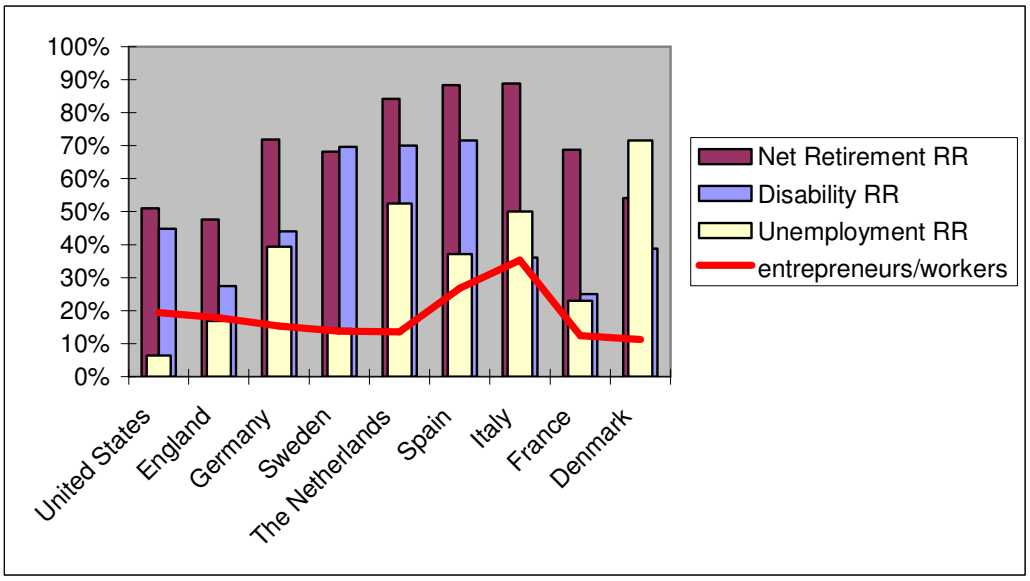
Country	non working	workers	entrepreneur
United States	46.7	42.94	10.36
England	50.05	40.06	9.89
Germany	59.37	33.66	6.97
Sweden	41.35	50.08	8.57
The Netherlands	57.19	36.5	6.31
Spain	63.24	25.88	10.89
Italy	68.54	19.7	11.76
France	59.67	35.09	5.24
Denmark	45.74	47.66	6.6

Source: HRS, ELSA and SHARE, population below 80 and older than 50 years old, weighted

Given the huge importance of the non working population in some countries, we must explore the generosity of outside options for entrepreneurs as generous replacement ratios for retirement or other "opportunities" on the labor market (Italy, Spain, Denmark and France have higher unemployment rates than the average). On average across countries more than 14% of individuals are involved in entrepreneurship as a fraction of the working population. This ranges from near 30% in Spain and Italy to 11% in Denmark. As a fraction of workers, these differences are exacerbated in Italy and Spain since the fraction in paid employment is rather low. Inactivity benefits in old age include retirement, disability and unemployment. We report on the vertical axis of Figure 1 the replacement ratio of each inactivity scheme (as reported by Blondal and Scarpetta (1999)) for the countries of our sample. The share of entrepreneurs as a fraction of workers (own computations of HRS-ELSA-SHARE datasets) is displayed with a line. Figure 1 suggests that there is no a clear relationship between the share of entrepreneurs and the generosity level of any of the inactivity benefit. One exception is Italy and Spain. Both countries have very high net retirement replacement rates which probably explain the low participation rates. But the Netherlands have also high replacement

rates, and the fraction of entrepreneurs is closer to countries such as England and United States. We will then take into account the outside options in our analysis both at theoretical and empirical level.

Figure 1 Entrepreneurs and replacement ratios as outside options: Non-employment benefit schemes, generosity indicators for aged workers



One of the major strengths of each dataset is that they provide comparable measures of financial wealth. For entrepreneurs we have information on their current wealth. Hence, evidence of liquidity constraint cannot be simply inferred from cross-sectional variation across individuals in the probability of entrepreneurship and wealth as in studies that look explicitly at ex ante wealth and the subsequent entry probability. As we show later, we can identify the effect of institutions by using cross-country variation.

We define wealth as the sum of the net value of housing, stocks, bonds, saving accounts, private retirement accounts and other annuities minus all debt the household may have.[7] This definition does not include business assets which is coherent with the definition that we will use in the model in the next section 4. We adjust wealth levels for exchange rate and power purchasing parity using OECD figures.

[7] See table A.2. for more details.

Table 2 Net Wealth by Occupational Status and Percentiles

Net Wealth	p5	p10	p25	p50	p75	p90	p95	p99
non working	0.416	2.948	35.753	130.221	264.206	470.413	670.443	960.772
workers	3.570	9.784	54.601	141.551	282.143	477.605	641.757	928.225
entrepreneur	3.824	20.357	89.917	219.873	401.111	632.117	779.951	971.276
Total	1.124	5.670	45.991	139.572	283.117	493.513	676.218	955.333

Source: HRS, ELSA and SHARE, population below 80 and older than 50 years old, weighted. Net Wealth by occupation status and percentiles

Net wealth by occupational status and percentiles (over all countries) is shown in table 2. From these figures, it is clear that entrepreneur have more financial wealth then other respondents, although differences seem to vanish at the top of the wealth distribution. This can reflect differences in ability or ex ante wealth (wealth prior to entry) or ex post differences in the returns to entrepreneurship. The theoretical model we present latter addresses these issues.

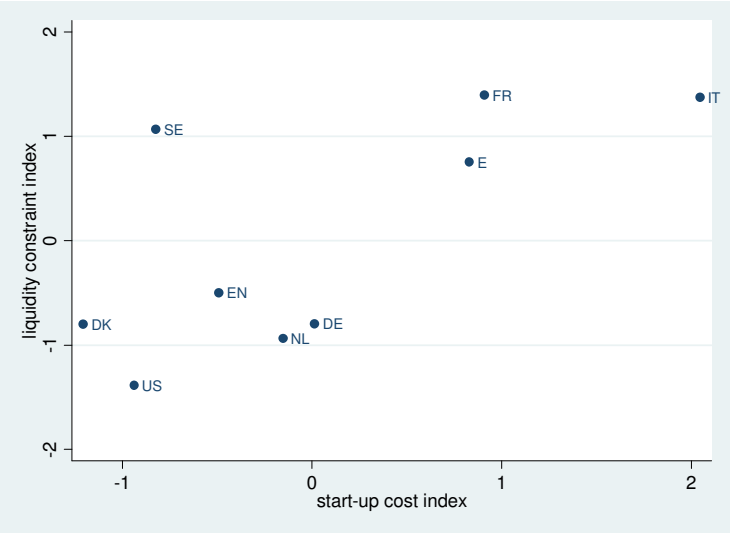
3. Institutional variables

In SHARE, only one wave of data is available although it is projected to follow respondents over time in the future. With a panel, we could study the probability of entry into entrepreneurship as a function of initial wealth. However, we claim that we can use institutional variation, for example in start up costs and liquidity constraints to show how the relationship between wealth and the probability of entrepreneurship varies across countries.

We first document whether start-up costs and financial barriers to entrepreneurship are different across countries. There is a considerably large literature devoted to the construction of various indices of start-up costs and financial barriers to entrepreneurship. Because each index measures different dimensions of barriers, we aggregate them in two families using principal component analysis. The first index measures start-up costs. It is constructed from indices provided in Nicoletti et al. (1999) and Fonseca et al. (2001). The second index measures the extent of potential liquidity constraints across countries. It is constructed from La Porta et al. (1998), Reynolds et al.(2005) and Acs et al. (2006).[8] Figure 3 gives the values assigned to each country along the two dimensions we look at.

[8] Each index is centered on zero and normalized to have unit variance. Details on the construction of these indices can be found in Appendix A.

Figure 3 Indices of Start-up Costs and Liquidity Constraints



Notes: indices defined in Appendix C. DK = Denmark, US = U.S., SE = Sweden, EN = England, NL = Netherlands, DE = Germany, E = Spain, FR = France, IT = Italy.

From Figure 3, we see that indices are positively correlated. High start-up costs are usually associated with high potential for liquidity constraints. Southern European countries are clearly distinct from Anglo-Saxon and Germanic countries in this regard. Sweden stands out as different with relatively higher potential for liquidity constraints but low start-up costs (Reynols et al. (2005) and Acs et al., 2006). This shows that the set of countries we consider areheterogeneous in terms of start-up costs and liquidity constraints.

4. A Simple Model of Entrepreneurship

We build a simple model of entrepreneurship along the lines of Cagetti and De Nardi (2005), Luo (2005) and Quadrini (2000). In particular, following Cagetti and De Nardi (2005) and Luo (2005), we consider a model of heterogeneous agents with occupational choice. Wealth and entry into entrepreneurship are endogenous. Entrepreneurs can borrow capital from banks to expand their business. However, because of limited enforceability of loan contracts, banks are reluctant to grant credit to entrepreneurs with low levels of wealth. Wealth plays the role of collateral and limits default. We add start up costs to the model.

In addition to savings and entrepreneurial choices, we allow the individual to consider inactivity. Indeed, old individuals may withdraw from the labor force rather than continuing

activity. This allows getting a complete picture of occupational choices in old age as a less generous old age pension may entice individuals to delay retirement and consider starting their own business. They can also have big incentives to be inactivity (retirement, unemployment or disability can be here interpreted as being inactive). In addition, start up costs, by shifting the expected entrepreneurial gains, may actually affect these choices.

Each person possesses two abilities, entrepreneurial and worker, which we take to be exogenous, positively correlated over time, and uncorrelated with each other.[9]

- Entrepreneurial ability (θ) is the capacity to invest capital more or less productively,
- Working ability (ε) is the capacity to produce income out of labor.

4.1 Corporate Sector

The non-entrepreneurial technology is represented by a standard Cobb-Douglas production function

$$F(K_c, L_c) = A_c K_c^{\alpha} L_c^{1-\alpha}$$

where K_c and L_c are the total capital and labor inputs in the non-entrepreneurial sector and A is a constant capturing the technology scale. In both sectors, capital depreciates at a rate δ. The scalar α represents the share of capital in production. The problem solved by the non-entrepreneur sector is

$$\underset{L_c, K_c}{Max}\ \Pi = AK_c^{\alpha} L_c^{1-\alpha} - wL_c - (r+\delta)K_c$$

which has the usual first-order conditions,

$$w = (1-\alpha)\frac{F(K_c, L_c)}{L_c}$$

$$r + \delta = \alpha \frac{F(K_c, L_c)}{K_c}.$$

where w and r are the wage and interest rate respectively.

4.2. Entrepreneurs

[9] In future drafts, we plan to allow abilities to be correlated.

Entrepreneurs can borrow and invest capital in a technology whose return depends on the entrepreneurs' own entrepreneurial ability: those with higher ability levels have higher average and marginal returns from capital. When the entrepreneur invests some working capital *k*, production is

$$A\theta k^{\nu}, \quad 0 \le \nu \le 1.$$

The scalar ν is set smaller than one to reflect decreasing returns from investment, as entrepreneur's managerial skills become gradually stretched over larger and larger projects. Hence, while entrepreneurial ability is exogenously given, the entrepreneurial rate of return from investing in capital is endogenous and is a function of *k* the size of the project that the entrepreneur implements.

Following Cagetti and De Nardi (2005) and Luo (2005), we assume that entrepreneurs work on their own project without hiring labor and that all of the workers are hired by the non-entrepreneurial sector. Imperfect enforceability of contracts means that the creditors will not be able to force the debtors to fully repay their debts as promised, but that the debtors fully repay only if it is in their own interest to do so. Since both parties are aware of this feature and act rationally, the lender will lend to a given borrower an amount (possibly zero) that will be in the debtor's interest to repay as promised.

To invest *k*, the entrepreneur borrows $(k-a)$ from a financial intermediary at the interest rate *r*, which is the risk-free interest rate at which people can borrow and lend in this economy. At the beginning of the current period, after observing the ability shocks, the entrepreneur determines the demand for capital to maximize his profits, given his financial asset *a.* His profit function is :

$$\underset{k}{Max} \quad \pi(\theta,a) = A\theta k^{\nu} - \delta k - r\underbrace{(k-a)}_{borrowing}$$

subject to

$$\pi(\theta,a) \ge \underbrace{(1-\kappa)\pi(\theta,a) + (1+r)(k-a)}_{entrepreneur's\,income\,if\ default} \qquad with\ 0 \le \kappa \le 1, k \ge 0.$$

The constraint captures the incentive compatibility constraint implying that total entrepreneur's profits need to be higher than entrepreneur's income if he defaults, i.e., we cannot observe any default in equilibrium. The first term of the right hand side of that equation is the profit that the household keeps for herself and the second term is the amount of payments to the financial intermediary that it saves because of default.

The scalar κ denotes the fraction kept by the bank in case of default, thereby capturing the tightness of borrowing constraints or the degree of the enforceability of the loan contract. As κ increases, the entrepreneur's income in case of default falls, thereby reducing the incentive to default: the enforceability of the loan contract improves, the bank is willing to lend more to finance entrepreneurial activities which allows entrepreneurs to expand their business.

The compatibility constraint can be rewritten as

$$\kappa\pi(\theta, a) \geq (1+r)(k-a)$$

The compatibility constraint defines the maximum amount that can be borrowed by the entrepreneur. Entrepreneurs are endogenously divided into two groups, depending on their incentive to default.

Group 1: The constraint is $\kappa\pi(\theta,a) \leq (1+r)(k-a)$. The incentive constraint is not binding. The unconstrained household chooses the amount of invested capital $k_{unconstr}$ such that the cost of capital equals the marginal productivity of capital.

$$A\theta\nu k^{\nu-1} = (r+\delta)$$

$$k_{unconstr} = \left(\frac{A\theta\nu}{r+\delta}\right)^{\frac{1}{1-\nu}}.$$

This demand for capital does not depend on initial wealth but only on technological parameters. With only one level of entrepreneurial ability and in absence of borrowing constraint, there would be only one optimal investment size. Without limited liability, as entrepreneurs can borrow any amount from the bank, occupational choice would not depend on wealth.

Group 2: The constraint is $\kappa\pi(\theta,a) = (1+r)(k-a)$, the incentive constraint is binding. The capital demand is constrained. The no default condition implies

$$\kappa\pi(\theta,a) = (1+r)(k_{constr} - a)$$

which defines an upper bound to the investment project *k* implemented by the entrepreneur. The demand for capital depends on ex ante wealth *a*, indicating that the loan granted to the entrepreneur depends on the household wealth that can be pledged as collateral. In our framework, wealth plays the role of collateral and limits default: the higher is the amount of household wealth invested in the business, the larger is the sum that the bank is able to

recover. [10] With limited liability, the demand for capital becomes increasing in wealth for constrained entrepreneurs until the entrepreneur has enough wealth to operate at the unconstrained level.

4.3. Value Functions

At the beginning of each period, current ability levels are known with certainty, while next period's levels are uncertain. Each individual starts the period with assets a, entrepreneurial ability θ, working ability ε and chooses whether to remain an entrepreneur or a worker or being inactive during the next period. The entrepreneur's problem is thus

$$V_e(a,\varepsilon,\theta) = \underset{c,\,a'}{Max}\left\{ u(c) + \beta E \;\; Max\left(V_e(a',\varepsilon',\theta'), V_w(a',\varepsilon',\theta'), V_r(a',\varepsilon',\theta')\right)\right\}$$

$$a' = \pi(\theta,a) + (1+r)a - c$$
$$a \geq 0$$

The expectation term in value functions capture the idiosyncratic uncertainty regarding next period's abilities. The worker's problem is written as

$$V_w(a,\varepsilon,\theta) = \underset{c,\,a'}{Max}\left\{ u(c) + \beta E \;\; Max\left(V_e(a',\varepsilon',\theta') - \Psi, V_w(a',\varepsilon',\theta'), V_r(a',\varepsilon',\theta')\right)\right\}$$

$$a' = w\varepsilon\bar{l} + (1+r)a - c$$
$$a \geq 0$$

The term $\bar{l}$ is labor input which is inelastically provided by the worker. The parameter Ψ denotes start-up costs that are paid in terms of utility if the worker decides to start his own business [11]. We choose to capture start-up costs in utility terms as these costs involve administrative time-consuming procedures.[12] They could also be introduced in monetary terms in the budget constraint or, if leisure is included in the utility function, in terms of opportunity cost. We only consider the psychic/utility costs without specifying the mechanism.

Finally, the inactive worker's value function is given by

[10] Paulson, Townsend and Karaivanov (2006) consider a model of occupational choice when financial constraints stem from two sources: limited liability and moral hazard. In our framework, we will consider only the limited liability environment.

[11] The introduction of start-up costs in heterogeneous agent model of occupation choice is mentioned in a footnote in Cagetti and De Nardi (2005) as a check for the robustness of their results. Luo (2005) argue that start – up costs are introduced in his model. However, they are calibrated to 0. In both papers, the interplay between start-up costs, wealth and entry into entrepreneurship is not studied.

[12] We have also introduced star-up costs in the budget constraints. The main results are not modified.

$$V_r(a,\varepsilon,\theta) = \underset{c,a'}{Max}\left\{ u(c) + \beta E \;\; Max\left(V_e(a',\varepsilon',\theta') - \Psi, V_w(a',\varepsilon',\theta'), V_r(a',\varepsilon',\theta')\right) \right\}$$

$$a' = \bar{p} + (1+r)a - c$$
$$a \geq 0$$

with $\bar{p}$ the average pension level or non employment benefit. Inactive people may decide to go back to the labor market.

Notice that the inactive's value function $V_r(a',\varepsilon',\theta')$ is the same for the entrepreneur and the worker. We are aware that, in the countries of our sample, the pattern of inactivity benefits differ for workers and self-employed. However, in order to keep the model tractable, we calibrate the inactivity to similar values for the worker and the entrepreneur, which reduces the number of value functions and state variables in the model. This makes the economic mechanisms of the model more transparent and we leave this extension for future research.

4.4. Definition of Equilibrium

Our heterogeneous agent model is based on a steady state economy without aggregate uncertainty. The stationary equilibrium consists of agents' choices for consumption, savings and occupational choice $\{c(a,\varepsilon,\theta), a(a,\varepsilon,\theta), \Gamma(a,\varepsilon,\theta)\}$, value functions $\{V_w(a,\varepsilon,\theta), V_w(a,\varepsilon,\theta)\}$, a stationary distribution of households $\lambda(a,\varepsilon,\theta)$ and a set of aggregate variables $\{A, L, K\}$ such that

i. Entrepreneurs maximize their profits, thereby choosing an investment size $k(a,\varepsilon,\theta)$.

ii. Saving decisions for workers $a' = g_w(a,\varepsilon,\theta)$ and entrepreneurs $a' = g_e(a,\varepsilon,\theta)$ as well as occupational choice $\gamma = \Gamma(a,\varepsilon,\theta)$ are solutions to workers and entrepreneurs' maximization problems where

$$\Gamma(a,\varepsilon,\theta) = \begin{cases} 1 & if \;\; E\left[V_e(a,\varepsilon,\theta)\right] > E\left[V_w(a,\varepsilon,\theta)\right] \\ 0 & otherwise \end{cases}$$

for all ability levels (ε,θ). The household's policy function $a' \equiv \Omega(a,\varepsilon,\theta)$ eventually depends on occupational decision such that

$$\Omega(a,\varepsilon,\theta) = \Gamma(a,\varepsilon,\theta) g_e(a,\varepsilon,\theta) + \left[1 - \Gamma(a,\varepsilon,\theta)\right] g_w(a,\varepsilon,\theta)$$

iii. The endogenous invariant distribution $\lambda(a,\varepsilon,\theta)$ consistent with optimal household's decisions $\Omega(a,\varepsilon,\theta)$ is such that

$$\lambda(a',\varepsilon',\theta') = \sum_{s} \sum_{\{a:a'=\Omega(a,\varepsilon,\theta)\}} \lambda(a,\varepsilon,\theta)\pi(\varepsilon',\theta'/\varepsilon,\theta)$$

where $\pi(\varepsilon',\theta'/\varepsilon,\theta)$ denotes the Markov processes governing changes in ability levels.

iv. The real interest rate and wage are such that capital and labor markets clear. The equilibrium aggregate capital supply and demand are denoted *A* and *K* respectively. Supply of capital given by optimal saving choices equals the demand for capital from the entrepreneurial and corporate sectors:

$$\sum_{\varepsilon,\theta} \sum_{a} \lambda(a,\varepsilon,\theta)k(a,\varepsilon,\theta) + K_c = \sum_{\varepsilon,\theta} \sum_{a} \lambda(a,\varepsilon,\theta)g(a,\varepsilon,\theta)$$

Labor demand stems from the corporate sector and equals the labor supplied by workers. The equilibrium aggregate labor is denoted *L*.

$$L_c = \sum_{\varepsilon} \sum_{a} \lambda(a,\varepsilon,\theta)\bar{l}\varepsilon$$

v. The wage and interest rate are given by the marginal productivity of each factor of production.

4.5. Calibration

We calibrate the economy on US data as a benchmark in order to stress the specific impact of key parameters of our model: start-up costs (Ψ) and the tightness of borrowing constraints (κ). In the benchmark calibration, start-up costs are set to 0 before increasing to 0.5. κ is calibrated to a middle value of 0.6. Other parameter values are based on Cagetti and De Nardi (2005)'s and Luo (2005)'s. Utility is log: $u(c) = \log(c)$. Table 3 summarizes the calibration.

Table 3 Calibration of Parameters

Parameter	Definition	Value
Technology :		
δ	Depreciation rate	0.08
α	Share of capital in the corporate sector	0.36
ν	Return to scale in entrepreneurial sector	0.88
Preferences:		
β	Discount factor	0.95
$\bar{l}$	Labor supply	$1/3$

Ability shocks follow exogenous and independent Markov processes estimated by Luo (2005) based on PSID data. Grid points for working abilities (normalized to an average of one) are

$$\varepsilon = [0.57; 0.93; 1.51]$$

The transition matrix $\pi(\varepsilon'/\varepsilon)$ is

$$\begin{bmatrix} 0.75 & 0.24 & 0.01 \\ 0.19 & 0.62 & 0.19 \\ 0.01 & 0.24 & 0.75 \end{bmatrix}$$

Entrepreneurial talents evolve according to a Markov matrix that is independent of working abilities.

$$\theta = [1; 1.26; 1.68]$$

with

$$\pi(\theta'/\theta) = \begin{bmatrix} 0.9 & 0.1 & 0 \\ 0.1 & 0.7 & 0.2 \\ 0.265 & 0.265 & 0.47 \end{bmatrix}.$$

Considering 3 working abilities and 3 levels of entrepreneurial talents, we have 9 possible combinations of abilities (ε, θ). Finally, the steady state equilibrium interest rate in the economy without start-up costs equals 5%, which is consistent with long run data in OECD countries. Inactivity income is set at 40% of average income in the economy, which is consistent with Cagetti and De Nardi (2005).

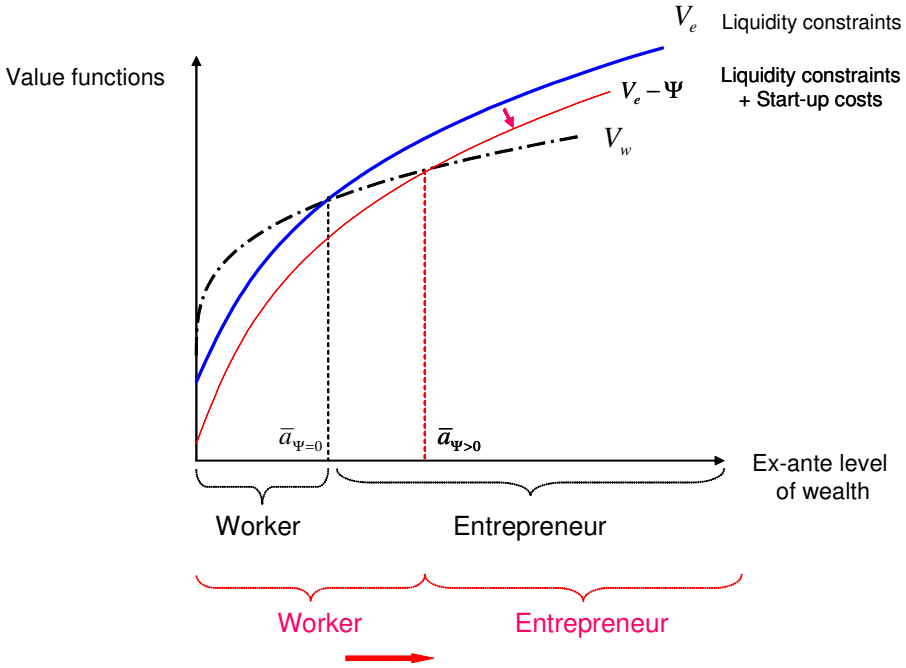
The model cannot be solved analytically. Numerical methods based on value function iterations are implemented using a grid for asset holdings *a*. For a given interest rate and wage: (1) We solve the entrepreneur's profit maximization problem taking into account the occasionally binding borrowing constraint. We then get the demand for capital and the profit function, (2) We solve worker's and entrepreneur's maximization problem, yielding saving

decisions and occupational choice, (3) We use decisions rules to compute the distribution of wealth and iterate until convergence of the distribution.

4.6. Occupational Choice as a Function of Wealth

Occupational decisions are made by comparing the expected utility of working in the corporate sector versus going into entrepreneurship. Expected indirect utilities are captured by value functions displayed in Figure 4. We first present the occupational choice without inactivity option to illustrate how start-up costs affect the choice to become entrepreneur. The individual must choose between being worker or entrepreneur.

Figure 4: Occupational Choice as a Function of Wealth
(without retirement as an outside option, with start up costs)



Bold solid line: expected value function of an entrepreneur without start-up cost
Solid line: expected value function of an entrepreneur with start-up cost
Dash dot line: expected value function of a worker

Let us first consider expected utilities for a worker V_w and an entrepreneur V_e in a liquidity constrained environment without start – up costs ($\Psi = 0$). Both curves intersect once, thereby defining a threshold level of wealth $\bar{a}_{\Psi=0}$. Individuals with low asset holdings ($a < \bar{a}_{\Psi=0}$) prefer to be workers since they cannot borrow enough capital to start their own

business. When they are wealthy enough to provide collateral to the bank, entrepreneurial activities become an attractive choice, all the more so as any increase in wealth allows entrepreneurs to borrow more and expand their own business.

With the introduction of start-up costs ($\Psi > 0$), the expected utility of entrepreneurship shifts downward thereby increasing the threshold wealth level beyond which the individual decides to run his own business. Working in the corporate sector is preferred to starting one's own business for a wider range of wealth. In a nutshell, higher start-up costs depress the marginal value of a dollar of additional wealth under liquidity constraints. This not only shifts down the fraction of entrepreneurs for all levels of wealth but also flattens the slope of the wealth profile.

Figure 4 actually captures the occupational choice of individual with highest entrepreneurial activities. However, two types of agents never choose to be self - employed (i.e. at all levels of wealth, $V_w > V_e$: the value function of working in the corporate sector is higher than the one derived from entrepreneurial activities).

- First, agents with low abilities as entrepreneurs are all workers. Due to their lack of talent as entrepreneurs, they would rather remain workers whatever their level of wealth.
- In addition, individuals with high abilities as workers discard entrepreneurial activities since they can earn enough from the corporate sector and accumulate financial income from asset holding. They indeed enjoy the highest wages in the economy and are thus unwilling to give up the high outside opportunity to work in the corporate sector.

The value functions suggest that some self selection is at work in the model: untalented entrepreneurs as well as individuals with high ability as workers discard the option of starting their own business. As a result, the introduction of start-up will not modify their occupational choice.

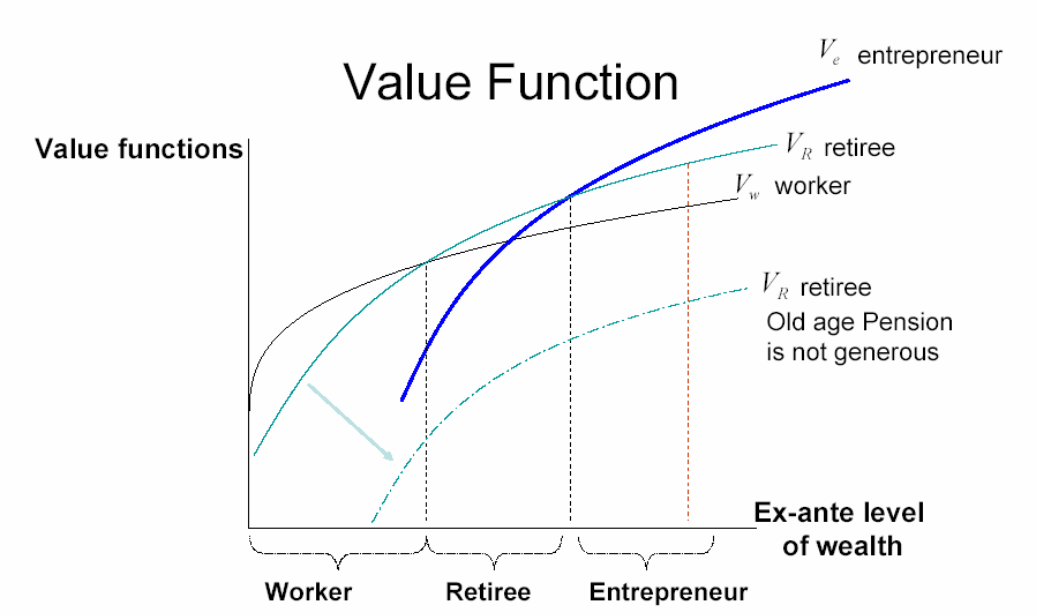
Moreover, we get that low ability entrepreneurs and high ability workers are respectively located at the left and right hand sides of wealth distribution, while figure 1 illustrates occupational choice in the middle of wealth distribution. We develop this intuition assuming that low ability entrepreneurs are on the left hand side of wealth distribution while high ability workers are located at the other tail of wealth distribution. However, in our model, abilities are not perfectly correlated with wealth.[13] With endogenous wealth and entry into

[13] In contrast, Paulson, Townsend and Karaivanov (2006) assume that talent is a function of wealth and education. In our framework, abilities follow exogenous Markov processes that are ex ante independent of wealth levels.

entrepreneurship, there is no one-to-one relationship between the prevalence of self-employment and wealth levels. The distribution of abilities across levels of wealth is actually given at the steady state by the endogenous equilibrium distribution.

When the individual has to choose between entrepreneur, worker and retiree, this choice is based on a comparison between 3 value functions (figure 5). When old age pension is not generous, the expected utility associated with retirement is very low. The occupational decision is then similar to the one presented in figure 1. In contrast, with generous pension schemes, the occupational choice is based on the intersection between 3 utility levels. The intersections between the 3 expected utility levels define 2 wealth thresholds. When the individual is poor, he chooses to work. If he is richer, he chooses to retire. The richest choose to become entrepreneurs.

Figure 5: Occupational Choice as a Function of Wealth
(with retirement as an outside option, no start-up costs)



With start-up costs (figure 6), the entrepreneur's expected utility shifts downward (as in figure 1), which increases the 2nd wealth threshold beyond which entrepreneurial activities becomes a valuable option. With the increase in start-up costs, more individuals retire rather than start-up their own business.

Figure 6: Occupational Choice as a Function of Wealth
(with retirement as an outside option, with start-up costs)

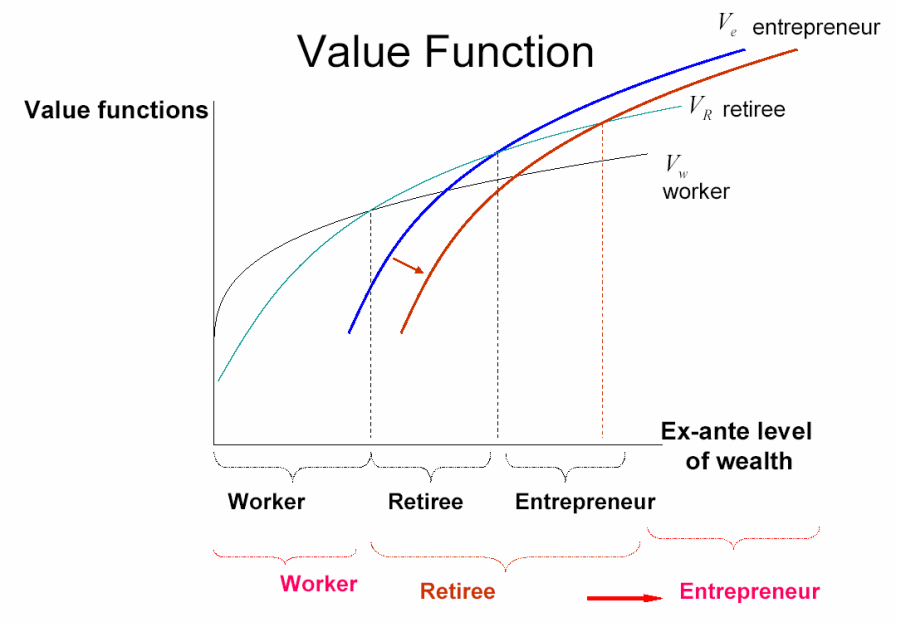
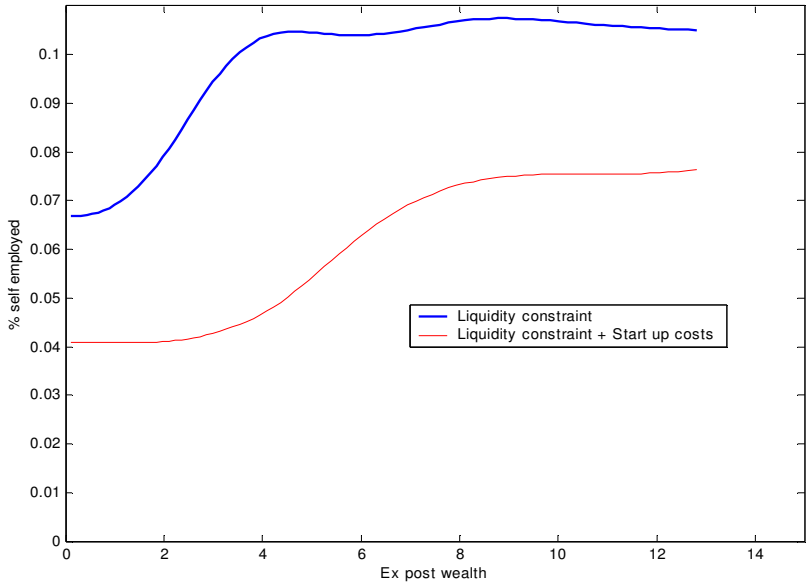


Figure 4 displays the fraction of entrepreneurs for each level of wealth given by the endogenous steady state wealth distribution. Notice that, while figures 4-6 illustrate the mechanisms behind occupational choices as a function of *ex-ante* wealth, figure 7 reports a measure of the prevalence of self – employment for each level of *ex-post* wealth. With limited liability, our model is consistent with Cagetti and De Nardi (2005)'s findings: the proportion of self employment increases with wealth. The model matches the current US fraction of self employed business owners (8.9% in the model versus 7.6% in the data, reported in Cagetti and De Nardi (2005)). In absence of financial market imperfections, with one entrepreneurial ability level, the curve would have been totally flat. Limited liability indeed makes the model consistent with the view that higher wealth helps relax borrowing constraints and allows an expansion of private businesses.

Figure 7: Simulation of Fraction of Entrepreneurs as a Function of Ex Post Wealth



The introduction of start-up costs shifts the curve downward as the economy is characterized by a lower aggregate proportion of self-employment[14]. Notice that the curve flattens in the middle of the distribution while the slope of the curve is left unchanged at the tails of wealth distribution: in the middle of the distribution, the introduction of start-up costs widens the range of wealth for which working in the corporate sector is preferable to entrepreneurial business. In addition, since the threshold occurs at higher wealth and value functions are concave in wealth, the marginal value of a dollar to a future entrepreneur decreases with higher start-up costs. In contrast, low ability individuals as entrepreneurs at the bottom of the distribution and wealthy high ability workers always discard the option of going into the non corporate sector, whatever the start-up costs.

5. The estimation approach

The average level of entrepreneurship results from theoretical prediction can be testable using cross-sectional data. Our empirical strategy is to look for a different relationship between the fraction of entrepreneurs and wealth in countries that have different potential for liquidity constraints and start-up costs. The relationship is positive, more wealthy respondents are likely to be entrepreneurs. The prediction from the theoretical model is that

[14] Start up costs increase from 0 to 0.5. The proportion of self employment in the steady state economy is then divided by 2.

the fraction of entrepreneur increases with wealth with liquidity constraints but that this relationship is attenuated with the presence of start-up costs (high start-up costs). Also, simulations from the model show that predictions held when looking at the stationary distribution of wealth in entrepreneurship and in paid work and they take into account the outside option of non working. Hence we perform our analysis on the stock of entrepreneurs and workers and non working population in a given year and look at differences in the wealth distributions among the three groups.

An important assumption we make is that all other parameters of the model are constant (rate of interest, preferences, transition matrices). At first sight, this might appear restrictive. Our empirical strategy will be to control for various demographic characteristics as well as proxies for outside options (age fixed effect for retirement incentives) to take account of these differences.

5.1. Parametric strategy

We use a parametric multinomial to control for observed individual characteristics (e.g. age, sex, education, marital status, household size, health status). An individual can choice to work as worker, entrepreneur or to be inactive. We use quintile dummies for net wealth although we have experimented with a variety of other functional forms with the same results. When interacted with institutional indices, the theory tells us that

1) with more liquidity constraints the effect of wealth should be stronger
2) with more start-up costs, the effect should be lower

Hence, the proper test is one where we look at the sign of the parameters on the interactions between the wealth quintile dummies and the regulatory indices.

For each alternative *m=0,1,2 (0 = non working, 1 = worker, 2 = entrepreneur)*, the value is given by

$$d^*_{ij,m} = x_{ij}\beta_m + \sum_{k=2}\gamma_{k,m}q_{ij,k} + \sum_{k=2}\delta_{k,m}q_{ij,k}\times r_j + \alpha_{j,m} + \varepsilon_{ij,m}$$

And we observe this choice if the value of the alternative m is larger or

$$d_{ij} = m \text{ if } d^*_{ij,m} > d^*_{ij,m'} \ \forall m' \neq m$$

Where

- d_{ij} denotes whether respondent *i* in country *j* is entrepreneur, worker or non worker.

- x_{ij} denotes individual characteristics of respondent *i* in the country *j*: age, age squared, education, health, family type and size, sex ,…
- $q_{ij,k}$ takes value 1 if the individual's net wealth in the country *j* is in the *k*th quintile (of the distribution across countries).
- r_j denotes the liquidity constraint index (LC) and they interact with the quintile of the individual's net wealth (we will also add to the estimation s_j, which the start-up cost index (SC) $\sum_{k=2} \partial_k q_{ij,k} \times s_j$))
- While α_j denotes country fixed effects capturing other differences across countries (α_j takes value 1 if the individual *i* is in the country *j*, 0 otherwise).
- To take into account the outside options (in financial terms) associated to be retiree, disable or unemployed, we include a quadratic in age as well as a dummy for the normal retirement age. Parameters of the quadratic in age are allowed to vary by country.
- The unobserved differences of individual characteristics are captured by ε_{ij}, which follows an extreme value distribution. This hypotheses allows us to write the probability of the alternatives *m*, as indicate as follows

$$v_{ij,m} = x_{ij}\beta_m + \sum_{k=2} \gamma_{k,m} q_{ij,k} + \sum_{k=2} \delta_{k,m} q_{ij,k} \times r_j + \alpha_{j,m} \text{ , as given}$$

$$P(d_{ij} = m \mid v_{ij,1}, ..., v_{ij,M}) = \frac{\exp(v_{ij,m})}{\sum_{m'} \exp(v_{ij,m'})}$$

Our aim is to measure the effect of the liquidity constraints (LC) and the start-up costs (SC). To do that, we add these institutional aspects as control variables with an interaction between them and wealth. We use quintiles of wealth in order to avoid any other particular non linear form (i.e. a polynomial form). The interaction can be interpreted as a weakening (or strengthening) of the relationship between the probability of being entrepreneur and the level of wealth as LC or SC change. We use inactivity as the comparison alternative. The parameters show the desire of choosing one or other option (worker/entrepreneur) respect to the comparison alternative (inactivity). Our hypothesis is that parameters δ are positive if wealth is interacted with LC and negative if interacted with SC. For example, to test if the relationship between the probability of being entrepreneur and the wealth is attenuated in countries with large start up costs, it must be verified that $\delta_{k,2} < \delta_{k,1} < 0, \ \forall$k . This test can be

done as a joint test with the interaction parameters. The same test applies for interactions with liquidity constraints.

5.2. Empirical Results

We first test our first hypothesis estimating the model when wealth is interacted only with the liquidity constraint index. (A complete presentation of results is shown in Appendix C). The results do not show a strong positive relationship between the wealth and the probability of being entrepreneur in countries with more liquidity constraints (table 4) as we had theoretically predicted. Although positive in the 5th quintile, the interactions remain largely statistically insignificant. However, countries with more liquidity constraints are also characterized with high start-up costs. From the theoretical prediction of the model, we know that higher start-up costs push the value function of being an entrepreneur outward hence increasing the wealth threshold where one wishes to be entrepreneur. Since the value function is concave, this shift decreases the marginal incentive of one dollar of wealth. In other words, the relationship between the wealth and the probability of being entrepreneur is attenuated with higher start-up costs. Therefore, the omission of the start up cost can hide the positive relationship that exits between the liquidity constraints and the relation wealth-entrepreneurship.

Table 4 Multinomial Logit Analysis: Choice between Non Working, Working and Entrepreneur in Function of their Wealth and Liquidity constraints

	Comparison: inactivity		
Interaction with liquidity constraint index	workers	entrepreneur	test difference
Q2 wealth X LC	-0.111	**-0.276**	
	-1.66	-2.32	
Q3 wealth X LC	-0.054	-0.122	Chi2(4) = 5.89
	-0.82	-1.06	p-val = 0.2075
Q4 wealth X LC	0.007	-0.198	
	0.11	-1.75	
Q5 wealth X LC	**0.202**	0.108	
	2.77	0.95	
Fixed effects country/age	yes	yes	
Individual features	yes	yes	
N	26949		
Pseudo R2	0.236		

Notes: estimation logit multinomial. Parameters and Student Statistics are used with corrected standard deviations with household cluster. We include country and fixed effects. Moreover we control of individual features such as education, health, quintiles of net wealth and marital status. The Test differences compute the Chi2 value with the test of the null hypotheses where coefficients are the same in both equations.

In table 5, we include interactions with SC and LC jointly. The results confirm the theoretical predictions. The relationship between wealth and entrepreneurship appears to be steeper with higher liquidity constraints. Coefficients are positive and statistically significant. The interaction with the liquidity constraint index, the result becomes positive and significant at the 1% level in the 3rd quintile, in the 4th quintile and in the 5th quintile. We have also experimented with limited heterogeneity in the effects of observed characteristics across countries with practically the same results. On other hand, when we include the wealth gradient is attenuated by higher start-up costs, particularly in the 4th and 5th quintile of the wealth distribution where it is statistically significant at the 1% level. That means that inclusions of start-up cost are important to understand the relationship of being entrepreneur and wealth. Empirical results, in the same line that theoretical predictions show that in countries with high start-up cost for the fraction of workers in entrepreneurship, flatten this relationship by depressing the marginal value of being an entrepreneur as a function of initial wealth. The interaction with SC is negative in the middle of the wealth distribution for workers and entrepreneurs. However, it is more pronounced for entrepreneurs than for workers. And this difference is statistically significant. Moreover, the interaction with LC is positive and stronger in the last quintile, where it is more pronounced the fraction of being entrepreneur and wealth. And this difference is also statistically significant.

Table 5 Multinomial Logit Analysis: Choice between Non Working, Working and Entrepreneur in Function of their Wealth, Administrative and Liquidity Constraints

	Comparison: inactivity		
Interaction with liquidity constraint index	workers	entrepreneur	test difference
Q2 wealth X LC	**0.229**	0.244	
	2.49	1.23	
Q3 wealth X LC	**0.271**	**0.595**	Chi2(4) = 9.53
	2.88	3.04	p-val = 0.0492
Q4 wealth X LC	**0.353**	**0.559**	
	3.67	2.86	
Q5 wealth X LC	**0.464**	**0.773**	
	4.2	3.83	
Interaction with startup costs index			
Q2 wealth X SC	**-0.587**	**-0.619**	
	-5.22	-3.03	
Q3 wealth X SC	**-0.509**	**-0.935**	
	-4.61	-4.71	
Q4 wealth X SC	**-0.534**	**-0.984**	Chi2(4) = 15.28
	-4.81	-4.98	p-val = 0.0042
Q5 wealth X SC	**-0.410**	**-0.855**	
	-3.13	-4.21	
Fixed effects country/age	yes	yes	
Individual features	yes	yes	
N	26949		
Pseudo R2	0.236		

Other studies have pointed out individual patterns as Blanchflower (1998), Hochguertel (2004) and Zissimopoulos and Karoly (2006). We find the same patters at descriptive level. We have included the most important control variables that we think that can matters in our regressions (a table C.1. displays statistic descriptive in Appendix C). We have tried other control variables and robustness that other studies use without any large differences in the results.[15]

We have also take into account the outsider options (in financial terms) associated to be retiree, disable or unemployed, including dummy variables for each age between 50 and 80, where parameters vary by country. We have also taken into account a dummy for the normal retirement age.

6. Summary

In this paper, we have developed a simple occupational choice model of entrepreneurship with liquidity constraints and start-up costs that yields testable predictions on the cross-section distribution of entrepreneurs in the wealth distribution. Our main

[15] i.e. different education definitions, individual health insurance situation, more disaggregated health measures and job characteristics. We have also tried our institutional measures, LC and SC, in interaction with wealth one by one.

prediction was that although liquidity constraints yield an increasing wealth profile of entrepreneurs, start-up costs depress this profile. Intuitively this is due to the fact that with start-up costs, the threshold of wealth necessary to transit to entrepreneurship increases to a flatter portion of the value of being en entrepreneur. Hence, the marginal value of an additional dollar of wealth for entrepreneurship decreases with start-up costs, yielding a flatter wealth profile. Parametric evidence using comparable micro-data from 9 countries support this prediction. In countries where start-up costs are higher, the wealth profile of entrepreneurs is flatter while it is steeper in countries where more financial barriers are present.

References

Acs Z.J., Arenius P., Hay M. and Minniti M. (2006) Global Entrepreneurship Monitor, Executive Report, London Business School, Babson, 2004.to Update

Blanchflower D. G. and A. Oswald, (1998) "What makes an entrepreneur? " Journal of Labor Economics, January, 16(1) pp. 26-60, 1998.

Blanchflower D. G. (2000) "Self-Employment in OECD Countries", Labour Economics, 7, September 2000, pp. 471-505.

Blondal, S. and S. Scarpetta (1999) "The Retirement Decision in OECD Countries", OECD Department Working Papers, n. 202.

Cagetti, M. and De Nardi, M. (2005): "Entrepreneurship, frictions, and wealth," Staff Report 322, Federal Reserve Bank of Minneapolis.

Evans D. and B. Jovanovic (1989) An Estimated Model of Entrepreneurial Choice Under Liquidity Constraints. Journal of Political Economy 97(4): 808-27.

Evans S. and L. Leighton (1989) "Some empirical aspects of entrepreneurship", American. Economic Review, 79(3), 519-535.

Fan, J. (1993): "Local Linear Regression Smoothers and their Minimax Efficiencies", The Annals of Statistics, Vol. 21:1, pp. 196-216.

Fonseca R., P. Lopez-Garcia and C.A. Pissarides (2001). "Entrepreneurship, Start-up Costs and Employment", European Economic Review, 45, 692-705.

Guiso, L., P. Sapienza and L. Zingales (2002): "Does Local Financial Development Matter?," NBER Working Papers 8923, National Bureau of Economic Research, Inc

Hochguertel, S. (2005): "Self-Employment around Retirement in Europe", presented at the SHARE-ELSA,HRS user conference in Lund. *Economy,* April 2004, Vol. 112(2), pp. 319-347.

Hurst, E. and A. Lusardi (2004), "Liquidity Constraints, Household Wealth and Business Ownership," Journal of Political Economy, 112, 319-347.

Kapteyn, A. and C. Panis. (2003), "The Size and Composition of Wealth Holdings in the United States, Italy, and the Netherlands." NBER Working Paper Series, 10182. Cambridge, MA. December.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R.W. Vishny, (1998) "Law and Finance," Journal of Political Economy, 106(6), 1113-55.

Luo, Y. (2005): "Uninsurable Entrepreneurial risks, capital market Imperfections, and Heterogeneity in macroeconomy" Princeton University, Working Papers.

Nicoletti, G., S. Scarpetta and O. Boylaud (1999), "Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation" OECD Economics Departement, Working Papers, 226.

Paulson A. L., Townsend, R.M. and Karaivanov A. (2006): "Distinguishing Limited Liability from Moral Hazard in a Model of Entrepreneurship." Journal of Political Economy 114(1): 100–144.

Quadrini, V. (2000). "Entrepreneurship, Saving and Social Mobility,"" Review of Economic Dynamics 3(1): 1-40.

Reynolds P., N. Bosma, E. Autio, S. Hunt, N. De Bono, I. Servais, P. Lopez-Garcia and N. Chin (2005) "Global Entrepreneurship Monitor: Data Collection Design and Implementation 1998–2003" Small Business Economics (2005) 24: 205–231

Zissimopoulos, J. and L, Karoly (forthcoming). **"**Transitions to Self-Employment at Older Ages: The Role of Wealth, Health Insurance and Other Factors" in *Labour Economics.*

Appendix A Definitions of Variables
Table A1 Definition variables

Variables	Definitions
	and HRS.
Dependent variable	
	Self-employment is a self-reported variable, working are wage paid and non working are retirees, unemployed, disables and others.
rself_stat	Multilogit analysis we have use non working in the base outcome versus self employed and working. It is our benkmark
Independent variables	
Demographic variables	
Age	with more than 50 years old and less of 80 years old
Sex	Gender as control variable is considered, (male dummy)
Marital Status	Marital Status as control variable is considered, (married dummy)
Education	We consider two education levels, following the ISCE-1997 for SHARE and For ELSA High skilled is nvq4/nvq5/degree or equiv Middle skilled higher ed below degree, nvq3/gce a level equiv and nvq2/gce o level equiv and low skilled are nvq1/cse other grade equiv, foreign/other and no qualification. In the case of HRS we consider High skilled are some college and college and above, middle skilled is high-school graduate and low skilled are lt high-school and ged. We study low and middle skilled together versus high educated.
Household size	Household size is also considered as control variable
Health variables	Three levels of health self-reported to complete. Very good health, good Health and fair/poor health. The omitted variable is very good health.
Main variables	
Quantiles of net wealth	wealth analysis and comparison across data base reported as in table A.1
net wealth to institituional variables	Omitted variable the first quantile.
Institutional variables	Start up index and Liquidity constraint index. More information in Appendix B
country dummies	
age dummies	
Interactions between country dummies and age dummies as well as normal retirement age dummy are considered.	

Table A2 Classification of Assets

Assets		Liabilities	
Risky Assets (stocks, bonds)	ha_r	Debt (mortage+other)	ha_d
Safe Assets (cash, savings account)	ha_s	Net Worth	ha_nw
Gross housing (equity + mortage)	ha_h		
other (transportation, other real assets)	ha_o		
business assets	ha_b		
Gross wealth	ha_gw	Gross wealth	ha_gw

Notes: Adapted from Kapteyn and Panis (2003)

Appendix B Regulation Indices

We build two kind of indexes based on principal-component factors: (i) index to start-up costs and (ii) index to liquidity constraints. The index of start-up costs is based on regulatory and administrative opacity, administrative burdens on start-ups (see Nicoletti et al. 1999) and start ups cost index pondering procedures and week to open a establishment (see Fonseca et al., 2001)[16]. The index of liquidity constraints is based on government subsidies, Angel investments and Venture Capital, finance help from start-ups (see Acs et al.(2004)) and creditor rights, different constraints, bankruptcy and reorganization laws (see La Porta et al. (1998))

Table B.1 Construction of Indices

	Start-up cost index			
Country	Burdens	Opacity	Index Proc./weeks	Start-up costs index
United States	0.75	2.11	3.1	-0.937
England	0.78	0.09	3.9	-0.49
Germany	2.53	2.69	6.4	0.014
Sweden	1.04	3.56	4.9	-0.821
The Netherlands	1.59	1.39	5.9	-0.152
Spain	2.79	1.23	9.9	0.829
Italy	4.49	0.63	13.9	2.044
France	3.93	2.6	9.4	0.908
Denmark	0.43	2.51	2.4	-1.204

	Financial barriers index			
Country	Government subsidies	Finance help	Credit Rights	Financial barriers Index
United States	11	11	1	-1.389
England	6	7	4	-0.5
Germany	8	8	3	-0.798
Sweden	1	4	2	1.068
The Netherlands	9	9	2	-0.939
Spain	4	3	2	0.754
Italy	2	1	2	1.37
France	3	2	0	1.395
Denmark	10	6	3	-0.804

[16] Start-up costs index = no. of weeks + no. of procedures/average procedures per *week)/2. Both Fonseca et al. (2001) and Nicoletti et al. (1999) use LOGOTECH data from the European Commission.

Appendix C Descriptive Statistics and Detail Results of Estimations

Table C.1. Individual Characteristics

		Mean	Standard Deviations
Non working	male	42%	49%
	married	71%	45%
	household size	2.21	1.01
	high educated	19%	39%
	health good	39%	49%
	health fair/poor	37%	48%
workers	male	52%	50%
	married	72%	45%
	household size	2.38	1.12
	high educated	40%	49%
	health good	38%	49%
	health fair/poor	14%	35%
entrepreneur	male	65%	48%
	married	75%	43%
	household size	2.46	1.15
	high educated	38%	49%
	health good	41%	49%
	health fair/poor	13%	34%
Total	male	48%	50%
	married	72%	45%
	household size	2.29	1.07
	high educated	28%	45%
	health good	39%	49%
	health fair/poor	27%	44%

Table C.2. Results with Liquidity Constraints Interactions

	comparison: inactivity	
Interaction with liquidity constraint index	worker	entrepreneur
Country Fixed	yes	yes
age	0.382	0.081
	3.04	0.43
age*country dummies	yes	yes
age square	-0.004	-0.002
	-4.34	-1.04
age square*country dummies	yes	yes
normal age of retirement dummy	-0.224	-0.082
	-2.9	-0.77
male	0.584	1.170
	18.38	24.51
married	-0.199	-0.318
	-4.48	-4.69
household size	0.040	0.010
	2.25	0.36
high educated	0.510	0.420
	12.98	7.22
health good	-0.430	-0.384
	-11.63	-7.12
health fair/poor	-1.472	-1.380
	-31.05	-17.72
Q2 wealth	0.491	0.629
	6.56	5.04
Q3 wealth	0.549	0.828
	7.51	6.9
Q4 wealth	0.467	1.062
	6.34	8.86
Q5 wealth	0.276	1.454
	3.31	11.78
Q2 wealth X LC	-0.111	**-0.276**
	-1.66	-2.32
Q3 wealth X LC	-0.054	-0.122
	-0.82	-1.06
Q4 wealth X LC	0.007	-0.198
	0.11	-1.75
Q5 wealth X LC	**0.202**	0.108
	2.77	0.95
constant	-7.014	-1.677
	-1.83	-0.29
N	26949	
Pseudo R2	0.236	

Table C.3. Results with Liquidity Constraints and Start up Costs Interactions

	comparison: inactivity	
Interaction with LC and SC index	worker	entrepreneur
Country Fixed	yes	yes
age	0.382	0.081
	3.04	0.43
age*country dummies	yes	yes
age square	-0.004	-0.002
	-4.34	-1.04
age square*country dummies	yes	yes
normal age of retirement dummy	-0.227	-0.085
	-2.94	-0.79
male	0.586	1.172
	18.42	24.56
married	-0.205	-0.331
	-4.62	-4.88
household size	0.041	0.011
	2.3	0.38
high educated	0.510	0.417
	12.95	7.15
health good	-0.427	-0.375
	-11.51	-6.96
health fair/poor	-1.468	-1.376
	-30.93	-17.64
Q2 wealth	0.449	0.783
	6.03	5.92
Q3 wealth	0.552	0.961
	7.75	7.51
Q4 wealth	0.476	1.208
	6.66	9.47
Q5 wealth	0.285	1.595
	3.51	12.17
Q2 wealth X LC	**0.229**	0.244
	2.49	1.23
Q3 wealth X LC	**0.271**	**0.595**
	2.88	3.04
Q4 wealth X LC	**0.353**	**0.559**
	3.67	2.86
Q5 wealth X LC	**0.464**	**0.773**
	4.2	3.83
Q2 wealth X SC	**-0.587**	**-0.619**
	-5.22	-3.03
Q3 wealth X SC	**-0.509**	**-0.935**
	-4.61	-4.71
Q4 wealth X SC	**-0.534**	**-0.984**
	-4.81	-4.98
Q5 wealth X SC	**-0.410**	**-0.855**
	-3.13	-4.21
constant	-7.043	-1.678
	-1.83	-0.29
N	26949	
Pseudo R2	0.236	

Number	Title	Author(s)
(2004)		
No. 114:	The Politics of Protest Avoidance: Policy Windows, Labor Mobilization, and Pension Reform in France	D. Béland P. Marnier
No. 115:	The Impact of Differential Cost Sharing of Non-Steroidal Anti-Inflammatory Agents on the Use and Costs of Analgesic Drugs	P.V. Grootendorst J.K. Marshall A.M. Holbrook L.R. Dolovich B.J. O'Brien A.R. Levy
No. 116:	The Wealth of Mexican Americans	D.A. Cobb-Clark V. Hildebrand
No. 117:	Precautionary Wealth and Portfolio Allocation: Evidence from Canadian Microdata	S. Alan
No. 118:	Financial Planning for Later Life: Subjective Understandings of Catalysts and Constraints	C.L. Kemp C.J. Rosenthal M. Denton
No. 119:	The Effect of Health Changes and Long-term Health on the Work Activity of Older Canadians	D. Wing Han Au T.F. Crossley M. Schellhorn
No. 120:	Pension Reform and Financial Investment in the United States and Canada	D. Béland
No. 121:	Exploring the Returns to Scale in Food Preparation (Baking Penny Buns at Home)	T.F. Crossley Y. Lu
No. 122:	Life-cycle Asset Accumulation and Allocation in Canada	K. Milligan
No. 123:	Healthy Aging at Older Ages: Are Income and Education Important?	N.J. Buckley F.T. Denton A.L. Robb B.G. Spencer
(2005)		
No. 124:	Exploring the Use of a Nonparametrically Generated Instrumental Variable in the Estimation of a Linear Parametric Equation	F.T. Denton
No. 125:	Borrowing Constraints, The Cost of Precautionary Saving, and Unemployment Insurance	T.F. Crossley H.W. Low

SEDAP RESEARCH PAPERS: Recent Releases

Number	Title	Author(s)
No. 126:	Entry Costs and Stock Market Participation Over the Life Cycle	S. Alan
No. 127:	Income Inequality and Self-Rated Health Status: Evidence from the European Community Household Panel	V. Hildebrand P. Van Kerm
No. 128:	Where Have All The Home Care Workers Gone?	M. Denton I.U. Zeytinoglu S. Davies D. Hunter
No. 129:	Survey Results of the New Health Care Worker Study: Implications of Changing Employment Patterns	I.U. Zeytinoglu M. Denton S. Davies A. Baumann J. Blythe A. Higgins
No. 130:	Does One Size Fit All? The CPI and Canadian Seniors	M. Brzozowski
No. 131:	Unexploited Connections Between Intra- and Inter-temporal Allocation	T.F. Crossley H.W. Low
No. 132:	Grandparents Raising Grandchildren in Canada: A Profile of Skipped Generation Families	E. Fuller-Thomson
No. 133:	Measurement Errors in Recall Food Expenditure Data	N. Ahmed M. Brzozowski T.F. Crossley
No. 134:	The Effect of Health Changes and Long-term Health on the Work Activity of Older Canadians	D.W.H. Au T. F. Crossley M.. Schellhorn
No. 135:	Population Aging and the Macroeconomy: Explorations in the Use of Immigration as an Instrument of Control	F. T. Denton B. G. Spencer
No. 136:	Users and Suppliers of Physician Services: A Tale of Two Populations	F.T. Denton A. Gafni B.G. Spencer
No. 137:	MEDS-D USERS' MANUAL	F.T. Denton C.H. Feaver B.G.. Spencer

Number	Title	Author(s)
No. 138:	MEDS-E USERS' MANUAL	F.T. Denton C.H. Feaver B.G. Spencer
No. 139:	Socioeconomic Influences on the Health of Older Canadians: Estimates Based on Two Longitudinal Surveys (Revised Version of No. 112)	N.J. Buckley F.T. Denton A.L. Robb B.G. Spencer
No. 140:	Developing New Strategies to Support Future Caregivers of the Aged in Canada: Projections of Need and their Policy Implications	J. Keefe J. Légaré Y. Carrière
No. 141:	Les Premiers Baby-Boomers Québécois font-ils une Meilleure Préparation Financière à la Retraite que leurs Parents? Revenu, Patrimoine, Protection en Matière de Pensions et Facteurs Démographiques	L. Mo J. Légaré
No. 142:	Welfare Restructuring without Partisan Cooperation: The Role of Party Collusion in Blame Avoidance	M. Hering
No. 143:	Ethnicity and Health: An Analysis of Physical Health Differences across Twenty-one Ethnocultural Groups in Canada	S. Prus Z. Lin
No. 144:	The Health Behaviours of Immigrants and Native-Born People in Canada	J.T. McDonald
No. 145:	Ethnicity, Immigration and Cancer Screening: Evidence for Canadian Women	J.T. McDonald S. Kennedy
No. 146:	Population Aging in Canada: Software for Exploring the Implications for the Labour Force and the Productive Capacity of the Economy	F.T. Denton C.H. Feaver B.G. Spencer
(2006)		
No. 147:	The Portfolio Choices of Hispanic Couples	D.A. Cobb-Clark V.A. Hildebrand
No. 148:	Inter-provincial Migration of Income among Canada's Older Population:1996-2001	K.B. Newbold
No. 149:	Joint Taxation and the Labour Supply of Married Women: Evidence from the Canadian Tax Reform of 1988	T.F. Crossley S.H. Jeon
No. 150:	What Ownership Society? Debating Housing and Social Security Reform in the United States	D. Béland

Number	Title	Author(s)
No. 151:	Home Cooking, Food Consumption and Food Production among the Unemployed and Retired Households	M. Brzozowski Y. Lu
No. 152:	The Long-Run Cost of Job Loss as Measured by Consumption Changes	M. Browning T.F. Crossley
No. 153:	Do the Rich Save More in Canada?	S. Alan K. Atalay T.F. Crossley
No. 154:	Income Inequality over the Later-life Course: A Comparative Analysis of Seven OECD Countries	R.L. Brown S.G. Prus
No. 155:	The Social Cost-of-Living: Welfare Foundations and Estimation	T.F. Crossley K. Pendakur
No. 156:	The Top Shares of Older Earners in Canada	M.R. Veall
No. 157:	Le soutien aux personnes âgées en perte d'autonomie: jusqu'où les baby-boomers pourront-ils compter sur leur famille pour répondre à leurs besoins ?	J. Légaré C. Alix Y. Carrière J. Keefe
No. 158:	Les générations X et Y du Québec, vraiment différentes des précédentes ?	J. Légaré P.O. Ménard
No. 159: French	La diversification et la privatisation des sources de revenu de retraite au Canada	L. Mo J. Légaré L. Stone
No. 159: English	The Diversification and the Privatization of the Sources of Retirement Income in Canada	L. Mo J. Légaré L. Stone
No. 160:	Evaluating Pension Portability Reforms: The Tax Reform Act of 1986 as a Natural Experiment	V. Andrietti V.A. Hildebrand
No. 161:	Estimating a Collective Household Model with Survey Data on Financial Satisfaction	R. Alessie T.F. Crossley V.A. Hildebrand
No. 162:	Physician Labour Supply in Canada: A Cohort Analysis	T.F. Crossley J. Hurley S.H. Jeon
No. 163:	Tax Incentives and Household Portfolios: A Panel Data Analysis	S. Alan S. Leth-Petersen

SEDAP RESEARCH PAPERS: Recent Releases

Number	Title	Author(s)
No. 164:	The Healthy Immigrant Effect and Immigrant Selection: Evidence from Four Countries	S. Kennedy J.T. McDonald N. Biddle
No. 165:	Well-Being Throughout the Senior Years: An Issues Paper on Key Events and Transitions in Later Life	M. Denton K. Kusch
No. 166:	Satisfied Workers, Retained Workers: Effects of Work and Work Environment on Homecare Workers' Job Satisfaction, Stress, Physical Health, and Retention	I.U. Zeytinoglu M. Denton
No. 167:	Contrasting Inequalities: Comparing Correlates of Health in Canada and the United States	H. Armstrong W. Clement Z. Lin S. Prus
(2007)		
No. 168:	Health human resources planning and the production of health: Development of an extended analytical framework for needs-based health human resources planning	S. Birch G. Kephart G. Tomblin-Murphy L. O'Brien-Pallas R. Alder A. MacKenzie
No. 169:	Gender Inequality in the Wealth of Older Canadians	M. Denton L. Boos
No. 170:	The Evolution of Elderly Poverty in Canada	K. Milligan
No. 171:	Return and Onwards Migration among Older Canadians: Findings from the 2001 Census	K.B. Newbold
No. 172:	Le système de retraite américain: entre fragmentation et logique financière	D. Béland
No. 173:	Entrepreneurship, Liquidity Constraints and Start-up Costs	R. Fonseca P.-C. Michaud T. Sopraseuth