

Self–Employment Rates and Business Size: The Roles of Occupational Choice and Credit Market Frictions*

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Abstract

Self-employment rates and project size vary greatly across countries. The main message of this paper is that these broad regularities are consistent with an environment in which a common self-employment technology is available world-wide, but where (a) financial intermediation costs and (b) alternatives in “paid” work differ greatly. Our model indicates that alternatives in paid work are crucial for explaining self-employment *rates*, whereas high financial intermediation costs primarily affect the *scale* of projects. We also show that credit use is not informative for predicting either rates of self-employment or the scale of self-employment projects.

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1 Introduction

Self-employment activity varies substantially across nations. For example, the fraction of the labor force that is self-employed has been measured at approximately 8% in the US, 44% in Greece, and 51% in the Philippines (see e.g. Gollin (2008)). Even within sectors, there is significant variation in self-employment rates across countries. For instance, in Ghana, Bangladesh, and Nigeria, the self-employment rate in manufacturing reaches 80% of workers, compared with fewer than 2% in the United States. Furthermore, Gollin (2002) finds that worldwide, there is a strong negative relationship between per-capita income levels and self-employment rates even within sectors. By contrast, establishment size has a strongly positive correlation with per-capita income. In early work, Kuznets (1966) and Lucas (1978) noted that average business size grows with overall development. More recently, estimates of Tybout (2000) and Quintin (2003) show that establishment size for a large number of sectors in Mexico is smaller than that in the U.S..

It is widely believed by policymakers that credit conditions are pivotal in self-employment decisions. Even in the U.S., where credit markets are apparently well-functioning, public policy towards self-employment strongly emphasizes the need to supplement private financial intermediation. Notably, the U.S. Small Business Administration exists solely for the purpose of boosting credit access to the would-be self-employed. To the extent that external finance is important in self-employment decisions, a candidate explanation for the preceding facts may lie in the wide variation in credit costs observed around the world. Erosa (2001), for example, finds that the average cost of intermediating one unit of funds is nearly four times higher in poor countries than in rich ones.

Two underlying sources of higher credit costs are: (i) enforcement-related costs, and (ii) taxes on financial intermediation. As an example of the former, Djankov et al. (2002) report that it takes about 300 days to collect on a bad check on average in Argentina, compared to only 50 days in the U.S. As an example of the latter, Erosa (2001) reports that in 1984, tax policies of the Philippine government created a wedge of 12 percentage-points for loans over the risk-free rate. Similarly, Chamley and Honohan (1990) estimate that total financial intermediary taxation was 7% of GDP in a sample of African countries. If these impediments on financial contracting increase the cost of credit, we should expect less self-employment in these countries, all else equal (see Banerjee and Newman, 1991; Quadrini, 2000).

The preceding observations are not trivial to reconcile; financial frictions are alleged to matter for self-employment, and yet, self-employment rates are much higher in pre-

cisely those countries where these frictions are the largest. In other words, if credit matters so much, why do developing countries have such high self-employment rates? In this paper, we propose a quantitative theory that combines the role played by financial frictions with a second, potentially key ingredient: occupational choice. Specifically, we emphasize the fact that self-employment decisions are made in response to the relative attractiveness of alternative labor market opportunities. An obvious observable measure of labor market opportunities lies in average wages. The large disparity in wages between the U.S. and less developed countries (hereafter LDCs) then suggests that observed differentials in self-employment rates are a natural result. However, to the extent that financial frictions are more severe in LDCs, the ability to start a business using external funds falls. In addition, low returns in “paid” work inhibit potential entrepreneurs from accumulating enough wealth to overcome financial frictions, further suppressing both the self-employment rate as well as project size. In sum, financial frictions and low wages seem capable of explaining both the high rate of self-employment and the smaller project size observed in LDCs.

Our work is most closely related to Gollin (2008), who employs the Lucas’ span-of-control approach to evaluate the role of productivity growth on self-employment choices. In Gollin (2008), capital accumulation generates wage growth, leading to lower self-employment rates and self-employment project size. However, his work abstracts from both credit market frictions and uncertainty, and therefore their interaction with wage growth. By contrast, our focus is precisely on the interaction between wage growth and credit market frictions when both labor income and self-employment income are risky.

Our study is one of quantitative theory, as we intend our results to be informative for understanding the relative strengths of two key determinants of self-employment behavior. However, we do not intend the model to be a definitive “case study” of cross-country differences, as nations differ along an enormous number of dimensions not modeled here. Nonetheless, our main findings do appear consistent with the stylized observations above.

Our model indicates that alternatives in paid work are crucial for explaining self-employment *rates*, whereas high financial intermediation costs primarily affect the *scale* of projects. Moreover, we find that high rates of self-employment do not imply well-functioning credit markets. In fact, we show that, given observed wage differentials in paid work, more severe frictions in financial markets are required to account for the stylized facts on relative self-employment rates and establishment size. We also show that the fact that self-employment projects are smaller in LDCs does not mean that self-employment technologies vary across countries. Rather, we find that under even

relatively low wages, high transactions costs in financial intermediation substantially impede borrowing, and in turn, the scale of self-employment projects. With respect to credit markets, we find that the absence of borrowing does not imply inefficient production. Moreover, the converse is also true; when wages are low, many self-employed borrow, but run inefficiently small projects.

The remainder of the paper is organized as follows. Sections 2 and 3 present and parameterize the model; Section 4 reports and discusses results. Section 5 concludes.

2 Model

The model is based on the occupational choice framework used in Akyol and Athreya (2007), but differs along two key dimensions. First, in the latter, wages were held fixed throughout, ruling out the analysis of the role played by economywide changes in the alternatives to self-employment. Second, a main goal of the current study is to better understand the role of financial frictions arising from technological and tax considerations, while the focus of the latter was on the effects of default regulations. As argued in Akyol and Athreya (2007), default can provide insurance to borrowers, making a portion of borrowing costs payment for a form of insurance. Our approach here is aimed at allowing us to study the effects of impediments created by “pure” transactions-related costs, as opposed to premia arising from default-risk. In turn, we abstract from default and study instead the consequences of changes in the “spread” between interest rates on risk-free borrowing and savings.

2.1 Preferences

There is a continuum of ex-ante identical agents who maximize the expected utilities from consumption, and supply labor inelastically. All households begin life with zero wealth, work for J – periods and then retire. Working age is indexed by $j = 1, 2, \dots, J$. There is a single consumption good. Consumption in age- j is denoted by c_j . In each period, utility from consumption is governed by the function $u(\cdot)$, which is strictly increasing and strictly concave. We denote wealth taken into retirement at age j by a_{j+1} . Resources sent into ‘retirement’ are valued according to the function $\phi(\cdot)$. We assume that $\phi(\cdot)$ is strictly increasing and strictly concave. Thus, given the discount factor $\beta_h \in (0, 1)$, households maximize:

$$E_0 \sum_{j=1}^J \beta_h^{j-1} u(c_j) + \phi(a_{J+1}). \quad (1)$$

2.2 Occupational Choice

Households choose in every period between being a worker or an entrepreneur. A household first draws a realization of stochastic productivity in paid/corporate-sector work, and so knows the value of paid work. If instead, they choose to operate a self-employment project, they face a known probability distribution of entrepreneurial productivity. Both entrepreneurial and corporate-sector productivity are increasing functions of human capital, denoted by h . Human capital is exogenously determined prior to the first period of the agent's working life, and generates permanent productivity differences between agents. Human capital may be interpreted as an agent's education level, e.g. college graduate vs. non-college graduate. Therefore, a useful interpretation of h , when it is employed in entrepreneurial activity, is that it captures the ability high-skilled agents to generate and execute productive ideas for an entrepreneurial project.

2.2.1 Paid Work

Paid work and is also risky, age-dependent, and not directly insurable. Incorporating a life-cycle profile and realistic uninsurable wage risk are both important, as the role played by frictions in credit markets will depend on the wealth held by households. Wealth, in turn, is affected both by age, and the attempts of households to self-insure. Labor productivity is age- j , denoted, ϵ^j , takes on values in a finite set, i.e. $\epsilon^j \in \{\epsilon_1^j, \epsilon_2^j, \dots, \epsilon_N^j\}$, for $j = 1, \dots, J$. In each period a shock is drawn according to the age-dependent probability distribution $g_j(\epsilon)$. We denote the mean level of corporate sector productivity at age- j , for human capital h , by $\mu^{Corp}(j, h)$. Our specification of $g_j(\epsilon)$ captures variations in the life-cycle path of productivity in paid work, as widely documented (see e.g. Hansen, 1993). The labor income of an agent is then given by $\epsilon_n \mu^{Corp}(j, h)$.

2.2.2 Self-Employment

Those who choose entrepreneurship operate a stochastic production technology $\mathcal{F}(\cdot)$ that depends on the productivity shock, θ , and capital stock, k . Entrepreneurial productivity takes values in a finite set, i.e. $\theta \in \{\theta_1, \dots, \theta_N\}$, and has a human capital-specific probability density function is given by $\pi_h(\theta)$. Project size, k , lies in the set $k = [0, \bar{k}]$ where \bar{k} is an (endogenous) upper bound. As mentioned earlier, insurance against project risk is assumed unavailable. Moreover, we assume that productivity across salaried work and self-employment is uncorrelated, which keeps the interpretation of model outcomes easier.

All households have access to the same self-employment technology, though productivity does depend on human capital. Thus, we set the random variable for productivity θ , and returns-to-scale parameter α , to the values calibrated in the benchmark model. That is, we assume that for small-scale operations typical of self-employment, the available technology is common, i.e. “blueprints” for small-scale enterprises are available worldwide. This assumption reflects two goals. First, we seek to avoid introducing additional unobservable heterogeneity into our model. Technology in general, and especially that used by the self-employed, is not directly observable. Second, following Parente and Prescott (2000), we associate differentials in TFP across nations as arising from specific policies applying primarily to the organized “corporate” sector, especially policies applicable to the treatment of labor.¹ Our model therefore captures the incentives to choose self-employment that may arise in large part from the regulatory hurdles that effectively lower the payoff to “paid” corporate-sector work. In summary, we focus on accounting for differences in outcomes created by the most directly observable features of the household’s environment: opportunities in “paid work”, and the costs of financial intermediation.

2.2.3 Financial Market Arrangement

There is a competitive market for savings and loans. Let $(1 + r^f)$ denote the gross risk-free interest rate on savings. Let τ denote proportional transactions costs associated with the intermediation of funds. A primary focus of the paper is on the impact of this cost on self-employment and credit-market outcomes. The cost of collecting one unit of funds by the lender is given by $(1 + r^f + \tau)$. Given $(1 + r^f + \tau)$, the zero-profit discount rate on a risk-free loan, which we denote by q , is given as follows. Competition in financial markets requires zero expected profits on each loan, which requires in turn that the equilibrium discount rate on bonds issued by a household is:

$$q = \frac{1}{1 + r^f + \tau} \quad (2)$$

Similarly, the discount rate on savings, which is not subject to the transactions cost τ , is defined as

$$q^s = \frac{1}{1 + r^f} \quad (3)$$

Those who become self-employed in period t , may finance the project with any internal wealth $a \geq 0$, or through external borrowing through borrowing $b \geq 0$. To

¹Parente and Prescott (2000) note that in India, for example, firing costs grow rapidly and non-linearly with the size of the labor force employed in a production unit.

capture the uninsurable nature of self-employment income, equity contracts are assumed to be unavailable. Given the discount rate, bond issue of face value b generates a loan of qb units of capital. The entrepreneur's project size is then simply the sum of the loan and internal funds, whereby $k \equiv qb + a$. The entrepreneur then observes the productivity realization θ which determines output. The loan, b must then be repaid after which the household divides remaining resources by choosing current consumption c_j and wealth a_{j+1} for the next period. The timing is summarized in Table 1.

At the end of age- J , the household saves wealth for retirement into retirement according to the function $\phi(\cdot)$, then retires. Each retiring household is then replaced by the next generation, which holds zero wealth. These households also realize a human capital level h' according to the function $\varsigma(h'|h)$, where h' depends explicitly on h , parental human capital.

2.3 Recursive Formulation

At the beginning of any period, $S = \{a, j, e_n^j, h\}$ denotes the state of the household, and $V(S)$ is the value of entering a period with state S . The state vector gives a household's current level of assets a , age j , and current corporate-sector wage $e_n^j h$. Let V^e denotes the option value of being an entrepreneur and V^w denotes the value of being a worker. Optimal occupational choice then implies that $V(S)$ must satisfy:

$$V(S) = \max\{V^e(S), V^w(S)\}, \quad (4)$$

Let $I(S)$ be the indicator function associated with (4), such that

$$I(S) = \begin{cases} 1 & \text{iff } V^e(S) > V^w(S) \\ 0 & \text{iff } V^e(S) \leq V^w(S). \end{cases} \quad (5)$$

Self-Employed/Entrepreneur Given a initial wealth level a , age j , a current corporate-sector wage level $e_n^j h$, the agent faces a price q when choosing the face of debt b optimally, which in turn determines the size of the project according to $k = a + qb$. Therefore, the ex-ante value of choosing entrepreneurship in the current period, $V^e(S)$, is given by:

$$V^e(S) = \max_{b_j \geq 0} E_\theta W(S, b_j, \theta). \quad (6)$$

For any realization of the productivity shock θ , let $W(S, b_j, \theta)$ be the maximal value attainable for an age- j household whose beginning-of-period state is S , who has chosen

to borrow b_j units, and who then receives productivity θ . Therefore, we have:

$$W(S, b_j, \theta) = \max_{a_{j+1}} \{u(c_j) + \beta_h EV(S')\} \quad (7)$$

$$\text{such that } c_j + q^s a_{j+1} \leq \mathcal{F}(\theta, k_j) - b_j \quad (8)$$

$$k_j = a + qb_j \quad (9)$$

$$k_j > 0, \quad c_j \geq 0, \quad a_{j+1} \geq 0, \quad b_j \geq 0, \quad \forall j = 1, J-1. \quad (10)$$

In age J , households considering self-employment solve a similar optimization problem faced by entrepreneurs at other ages except that they use the expected continuation values given by $\phi(\cdot)$, i.e.

$$W(S, b_J, \theta) = \max_{a_{J+1}} \{u(c_J) + \phi(a_{J+1})\}. \quad (11)$$

Worker The recursive problem facing a worker in the “corporate” sector is a simple consumption savings problem in which we assume that workers must hold non-negative assets. This yields the recursion:

$$V^w(S) = \max_{a_{j+1}} \{u(c_j) + \beta EV(S')\} \quad (12)$$

$$\text{such that } c_j + q^s a_{j+1} = \epsilon_n \mu^{Corp}(j, h) + a_j \quad (13)$$

$$c_j \geq 0, \quad a_{j+1} \geq 0, \quad \forall j = 1, J-1. \quad (14)$$

In age J , as above, the continuation value is given by $\phi(\cdot)$, which implies that the worker’s value functions is:

$$V^w(S) = \max_{a_{J+1}} \{u(c_J) + \phi(a_{J+1})\} \quad (15)$$

2.4 Equilibrium

Optimal behavior by households, for given prices and parameters, is defined by the decision rules governing occupational choice, borrowing, consumption, and savings. These are denoted by $I(S)$, $b(S)$, $c(S; \theta)$, and $a'(S; \theta)$, respectively. The equilibrium concept we use is standard Stationary Recursive Competitive Equilibrium (SRCE). For brevity, a formal definition is omitted. However, we define equilibrium heuristically as follows.

Definition 1 *An equilibrium is where:*

1. Decision rules $\{I(S), b(S), c(S; \theta), a'(S; \theta)\}$ solve the dynamic programs in (4) – (15).

2. *Lenders make zero expected profits on each loan, i.e. the discount rate q is given by (2).*
3. *The distribution of households over the state is stationary under shocks and optimal individual behavior.*

Our partial equilibrium approach is motivated by two considerations. First, from any given household’s perspective, it is wages in paid work relative to income in self-employment that governs occupational choice. Our experiments therefore directly yield the effect of equilibrium wages on self-employment decisions. Second, in order to understand the effects of wages on self-employment behavior, one approach would be to alter total factor productivity, and then derive equilibrium wage and self-employment responses. However, this approach requires us to take a stand on wage determination. Our emphasis on the life-cycle makes the relevant mapping one from TFP to wages over the entire life-cycle. The latter is something which clearly hinges on the extent to which labor contracts are continuously set in spot markets, or reflect other, longer-term relationships.

Unlike wage levels, transactions costs of intermediation are not themselves endogenous variables. Therefore, variations in these costs may influence equilibrium wages, and equilibrium self-employment decisions. However, such changes make it difficult to isolate the direct effect of transactions costs from the indirect effect coming from changes in equilibrium wages. We therefore find the transparency of partial equilibrium to be more instructive.

3 Parameters

The model’s parameters are set to approximate income, wealth, and occupational choices of US households. The benchmark calibration follows very closely that of Akyol and Athreya (2007), and the reader is referred there for details. All parameters are listed in Table 2, and measures of the fit of the benchmark model are displayed in Figures 1, 2, and 3.

3.1 Skills

Human capital takes two levels, representing college-educated and high-school educated (non-college) households respectively, and is denoted by $h = \{h_c, h_{hs}\}$. We will use the terms “skilled” and “unskilled” interchangeably with “college-educated”, and “high-school-educated”, respectively. As stated above, in the benchmark model, we

identify the underlying skill composition by educational attainment in the US. In the experiments, however, we assume that this skill composition is invariant across wage levels and transactions costs. Nonetheless, our results are likely to be quite robust along this dimension, for two reasons. First, our results with respect to behavior within a given skill group *cannot* be affected as all generations start working-life with zero wealth. Second, our results make clear that the changes in self-employment decisions for each skill group across different wage and intermediation costs are very similar, rendering population weights relatively unimportant. We therefore set transition probabilities across generations at $\zeta(h' = h_c|h = h_c) = 0.61$, and $\zeta(h' = h_c|h = h_{hs}) = 0.21$, respectively. These probabilities allow us to match the fractions of college-educated households (35%), and high-school educated households (65%) reported in Terajima (2004).

3.2 Preferences

All households have identical preferences, where within-period utility is given as:

$$u(c) = \frac{c^{1-\xi}}{1-\xi} \quad \text{if } \xi > 1 \quad (16)$$

where ξ denotes the coefficient of relative risk aversion. We set ξ equal to 2, as is standard. The model period corresponds one calendar year, and our benchmark calibration sets $\beta_h = \{0.985, 0.970\}$ for college and non-college agents respectively. We parameterize the retirement-wealth valuation function by the following.

$$\phi(a_{J+1}) = \psi_h \frac{a_{J+1}^{1-\rho}}{1-\rho} \quad (17)$$

Given wealth accumulation patterns during working life, this specification allows us to approximate median wealth among 65-year old household while eliminating an additional free parameter. We calibrate the human capital-specific parameter using $\psi_h = \{\psi_c, \psi_{hs}\} = \{15, 7.5\}$ for skilled and unskilled agents respectively, and set $\rho = 2$.

3.3 Productivity Risk in Paid Work and Self-Employment

To parameterize age- and skill-specific life-cycle productivity risk, we first set mean productivity for college-educated workers by linear interpolation of the estimates of Hansen (1993). Wage risk in the corporate sector is then parameterized by setting the standard deviation of shocks to approximate the (unconditional) cross-sectional variance of log-earnings as estimated by Hansen (1993). With respect to entrepreneurial production, we follow Polkovnichenko (2003), by assuming human capital is not occupation-specific and durable, in that it does not depreciate in the event of entry into or exits

from entrepreneurship. We use Cobb-Douglas, as is standard (see e.g. Cagetti and De Nardi, 2006) for the entrepreneurial production technology, implying that gross output is simply: $\mathcal{F}(\theta, k) \equiv \theta k^\gamma + (1 - \delta)k$. The production parameter γ is common to all entrepreneurial ventures, and is set to 0.75, close to the value in Cagetti and De Nardi (2006). Depreciation is set to $\delta = 0.11$.

In fixing the magnitudes of production risk, θ , we follow Davis and Willen (2002) and impose zero correlation between the corporate-sector and entrepreneurial-sector productivity, and allow the distribution of shocks to the entrepreneurial project to be different across skill-levels. Productivity in self-employment is also i.i.d. intertemporally, and cross-sectionally, and is Gaussian with mean $\mu_{\theta_c} = -1.35$, and standard deviation $\sigma_{\theta_c} = 0.83$ for skilled agents, while for unskilled households, we set $\mu_{\theta_{hs}} = -1.44$, and $\sigma_{\theta_{hs}} = 0.83$. For financial markets, we set the risk-free rate $(1 + r^f) = 1.04$, following Mehra and Prescott (1985), which implies a price on savings of approximately $q^s = 0.96$, and set the benchmark transactions cost at $\tau = 0.0225$.

4 Results

Our goal is to understand the roles played by intermediation costs and the payoff from “paid work” on the rate and scale of self-employment. Our benchmark calibration aims at matching the age-profiles of self-employment rates and median wealth holdings for US households, as well as the wage earnings of workers. We display benchmark outcomes and their empirical counterparts in Figures 1 to 3. We report the outcomes from four classes of experiments aimed at isolating the contributions of the alternatives to self-employment and conditions in the loan market.

4.1 The Role of Intermediation Costs

The first set of results, given in Tables 3 and 4, highlights the importance of financial frictions in self-employment outcomes. In particular, we study the effects of transactions premia on borrowing relative to the risk-free rate. We vary premia from a lower bound of $\tau = 0.0225$ (the current US level) and increase premia to $\tau = 0.15$, an upper bound motivated by the 12-percentage point premium obtaining in the Philippines, as reported in Erosa (2001). In order to isolate the effects of financial market frictions, we fix the wage process throughout this set of experiments to current US levels. Therefore, this set of results is most informative about the importance of financial frictions on self-employment behavior for developed countries.

Our first finding, seen in 3 is somewhat surprising: although the rate of self-

employment does depend on the presence of premia on external finance, the effects are not very large. Specifically, despite the large changes in “intensive” margin, whereby project size, and external finance fall dramatically with higher intermediation costs, the overall *rate* of self-employment falls only slightly, from 12% to 9%. Moreover, these effects are fairly similar across households with low and high human capital levels. In the former case, the rate falls from 10% to 7%, and in the latter, from 16% to 13%.

Table 4 shows next that the average size of self-employment projects falls substantially as intermediation costs rise. The fall is also nonlinear. An increase in intermediation costs from US-levels to 5% reduces the mean project size by approximately \$20,000, while an increase in τ from 10% to 15% generates only minor changes (roughly \$1,000). The proximate causes of the response of project size to financial frictions are twofold. First, as seen in Table 3, there are changes along the ‘extensive’ margin, whereby the self-employed borrow less frequently. Second, along the ‘intensive’ margin, Table 4 shows that when they do borrow, they borrow less. For example, under US-levels of transactions costs, more than half (51.36%) of the self-employed use credit, while none do when $\tau = 0.15$. In terms of magnitude, average debt declines from \$63,000 to \$0. The declines in borrowing and loan size are largest initially, consistent with the overall behavior of self-employment project size. Given that the cost of credit has a non-trivial impact on the use of credit, a natural outcome is that those who participate in self-employment must wait until they are able to (at least partially) internally finance their projects. This is reflected in Table 3 which shows the large increase in unconditional average age of the self-employed, which grows from approximately 30.9 years to 33.4 years over the same interval of intermediation costs. Note also that along the dimension of mean age, the skilled are less affected than the unskilled.

Our results indicate that financial frictions, while important in altering the decisions of those already engaged in self-employment, are far less important in determining occupational choice itself. If anything, these financial frictions imply the opposite of what is observed in LDCs, in terms of the self-employment rate. Therefore, the heterogeneity in self-employment rates across countries is likely to be a direct consequence of the relative attractiveness of paid work, the effects of which we evaluate next.

4.2 The Role of Alternatives to Self-Employment

We evaluate next the importance of alternatives to self-employment, by varying wages in paid work. We set all model parameters *at current US levels*. In particular, we keep the intermediation costs fixed at $\tau = 0.0225$. We then vary the mean of corporate sector wages, as a percentage of US mean wages, within the set $\mu^c(j, h) = \{\kappa\mu_{US}^c(j, h)\}$

$\kappa = 0.20, 0.33, 0.50, 0.80, 1.00\}$. This range covers a substantial portion of the variation in average wages observed across LDCs and the developed world. Our findings are presented in Tables 5 and 6.²

The results suggest an extremely important role for alternatives to self-employment. In particular, when mean wages are one-fifth of current US levels, nearly all households choose self-employment (77%). Though this is an extreme case, the results are still instructive in showing how strongly wages affect self-employment decisions. Specifically, in Table 5, we see that even when wages are 80% of US levels, the model predicts an overall self-employment rate of 20%, which is substantially higher than the US. This prediction is consistent with self-employment rates observed in both Italy and Canada, where wages are roughly 80% of US levels (see, e.g., Kamhi and Leung (2005) for Canada, and Torrini (2002), for Italy). Moreover, at least in the case of Canada, it is plausible that credit market frictions are similar to the US, making wages a key factor.

A second result is that in general, as wages rise, so does the use of credit markets by low-skilled households. Notably, Table 5 shows that when households earn only 1/5th of the US counterparts in paid work, 51% of low-skilled households who enter self-employment borrow, while 57% do so when wages are 80% of US-levels. Meanwhile, for skilled households, the payoff to paid work has the *reverse* effect, when wages are very low, more skilled households borrow than when wages are high. This shows that the use of credit markets itself depends on wages, and should therefore be a source of caution when assessing the extent to which households are “credit constrained”.

A striking feature of the results in Table 5 is that the probability of borrowing is virtually constant, at roughly 50%, across wage levels. In contrast, 6 shows that the average size of loans declines by more than 50%, from approximately \$63,000 to roughly \$27,000, as wages fall from the benchmark to 20% of US levels. At the same time, the average wealth of borrowers also falls dramatically by more than 50%. These findings, taken together, suggest that while all households face the same marginal cost of external finance, the wealthy are willing to take on more non-state-contingent debt as they are better able to bear the increased risk of low project output than their poorer counterparts. Moreover, when wages are high, agents can accumulate wealth more quickly than otherwise. Given that default is prohibited, using debt finance is risky since repayment is mandatory regardless of project returns. Therefore, wealthy households will again be more willing to use debt than their poorer counterparts.

Another way to see the role of occupational choice, is by observing that when paid

²Due to the lack of precise cross-country evidence on skill premia, we maintain a fixed skill premium across all experiments. That is, for a given κ , the ratio of skilled (college educated) wages to unskilled wages is held fixed at current US levels.

work is unproductive, households choose self-employment earlier in the life-cycle. In particular, 5 shows that the mean age of the self-employed when wages are low (e.g. when wages are 20% or 33% of US levels), is up to nearly 4 years lower than in the US. Moreover, these effects are symmetric across skill groups.

The effect of wages in paid work is also important for the “intensive” margin of self-employment, as seen in Table 6. Mean project size across skill groups falls with mean wages. The decreases are substantial, at around 50% in both cases. Thus, our model captures the qualitative regularity that households in countries with low average incomes also operate smaller projects when self-employed. Secondly, the median wealth of self-employed grows with mean wages, which is natural, and in both cases roughly doubles when wages rise from 10% of US levels to 100% of US levels. Given the earlier finding from Table 5 that the mean age of the self-employed is between 27 and 30 years of age, a regularity predicted by the model is the self-employed are always the “rich”. The preceding observation is holds disproportionately when average wages are low. Our interpretation of this result is that even though self-employment provides an escape from low wages, it is *fundamentally risky*, and as a result is chosen primarily by the rich, especially when wages are low relative to the US.

4.3 Do the effects of financial frictions depend on the level of wages?

The results so far suggest that financial intermediation plays a secondary role to wages in the corporate sector in determining the self-employment rate, but matters significantly for project size. However, will financial frictions have much stronger effects on self-employment when wages are much lower than US levels? To evaluate this question, we study outcomes obtaining under various premia for borrowing in an economy where mean wages in paid work are set to 1/3rd of their US level. Tables 7 and 8 present the results. First, the effects of financial intermediation costs on self-employment rates are *far larger* when wages are lower than US levels. Comparing outcomes in Table 3 with those in Table 7 demonstrates this result. For both skill groups, the absolute size of the fall in self-employment rate is of the order 14-percentage points for the skilled, and 20-percentage points for the unskilled when wages are 1/3rd of US-levels, while it was only 3-percentage points under US wage levels. The model therefore suggests that financial frictions are much more pivotal in driving self-employment decisions when alternatives to self-employment are poor. In part, this arises from the fact that when overall wages are low, it is difficult to accumulate enough wealth to run projects efficiently. A feature consistent with this force is seen in the larger impact of financial intermediation costs

on the mean age of the self-employed, as seen by comparing Table 7 with Table 3. In the former, wages are low, and the mean age grows from approximately 27 to 31 years of age. In the latter, when wages are high, the rise is smaller, from 31 years of age to 33. Additionally, comparing the results in Tables 5 and 6 with those in Tables 7 and 8 shows, interestingly, that while high borrowing premia eliminated borrowing under high wages (see Tables 3 and 4), but does not do so under low wages, as seen in Tables 7 and 8. In sum, the findings in this section suggest that the effects of financial frictions are likely to be substantially more important in self-employment decisions in low-wage economies. Furthermore, transaction costs affect self-employment rates *only* at particularly low wages. The drop in project size changes dramatically as well. Specifically, when transaction costs rise from US levels to 0.15, project size falls by 12%, as seen in Table 4, while Table 8 shows that under low wages, the drop is much larger, at roughly 29%.

4.4 Do the effects of wages in paid work depend on the level of financial frictions?

Having documented that wage levels matter for the importance of costs of financial intermediation, we evaluate the extent to which the converse is true. Namely, does the role played by alternatives to self-employment hinge on credit conditions? The answer, in a nutshell, is “no”. As seen by comparing the results in Tables 9 and 10 with those in Tables 5 and 6, we see that in both cases, increases in overall wages produce rapid drops in self-employment, irrespective of the costs of borrowing. Table 9 makes clear that the probability of borrowing is 9% when wages are 20% of the US level, but falls to 0% under US wages. By contrast, under benchmark transactions costs of $\tau = 0.0225$, we showed earlier in Table 5 that wage levels had virtually no effect on the likelihood of borrowing.

Therefore, the natural question is “when transactions costs are high, why do low wage households borrow more often and in larger amounts, than high wage households?”. First, in the case where project risk could be diversified, the efficient scale of the project will fall with higher transactions costs, as long any borrowing occurs. In low-wage settings, many households will also hold relatively wealth levels. These low-wealth individuals, if they do not borrow, will have projects with relatively high expected marginal product. Therefore, borrowing remains attractive, even under high transactions costs. Conversely, when wages are high, it is relatively easy for households to accumulate enough wealth to pursue self-employment projects. These households are, as a result, sensitive to the premium on external finance, and therefore choose not

to borrow.

5 Concluding Remarks

The main message of this paper is that the broad regularities of self-employment across countries is consistent with a setting in which a common self-employment technology is available worldwide, but where financial intermediation and alternatives in “paid” work differ greatly. In particular, our model generates substantially higher self-employment rates in countries with low wages, but suggests that intermediation costs are critical as well. Specifically, when wages are very low relative to the US, and intermediation costs are held at US levels, far too many households choose self-employment. Moreover, an interesting conclusion that follows from the preceding findings is that high rates of self-employment do not imply well-functioning credit markets. In fact, we show that given observed wage differentials in paid work, more severe frictions in financial markets are required to account for the stylized facts on relative self-employment rates and establishment size in low-wage, rather than high-wage, settings.

Our model is also successful in producing the regularity that mean wages in paid work are positively correlated with project size; this result obtains even through the technology for self-employment is held to be common across countries. We find also that though intermediation costs are very important for the use of credit, it is relative wages in paid work, rather than a premium for borrowing, that matter most for the overall rate of self-employment. Our model suggests that the risk of production in self-employment acts as a deterrent, especially in cases where wages are particularly low relative to the US. Lastly, though we motivated our inquiry with reference to US-LDC comparisons, our experiments reveal that our model is able to replicate outcomes for some developed countries as well.

Future work should more precisely evaluate the implications of specific policy choices on the availability, characteristics, and price of credit. Given the richness of the environment, empirical work may also assess the extent to which the life-cycle features of LDC self-employment are as predicted in our model. Lastly, it may well be the case the underlying technologies available to the would-be self-employed differ substantially as well. Even abstracting from agricultural self-employment, where such differences do seem plausible, LDC households may face difficulties accessing physical capital that reflects state-of-the-art technology, such as computers. Research that enriches the present framework along each of these dimensions seems important prior to arriving at a judgement on the determinants of, and the role played by, self-employment.

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Table 1: Sequence of Events in a Given Period

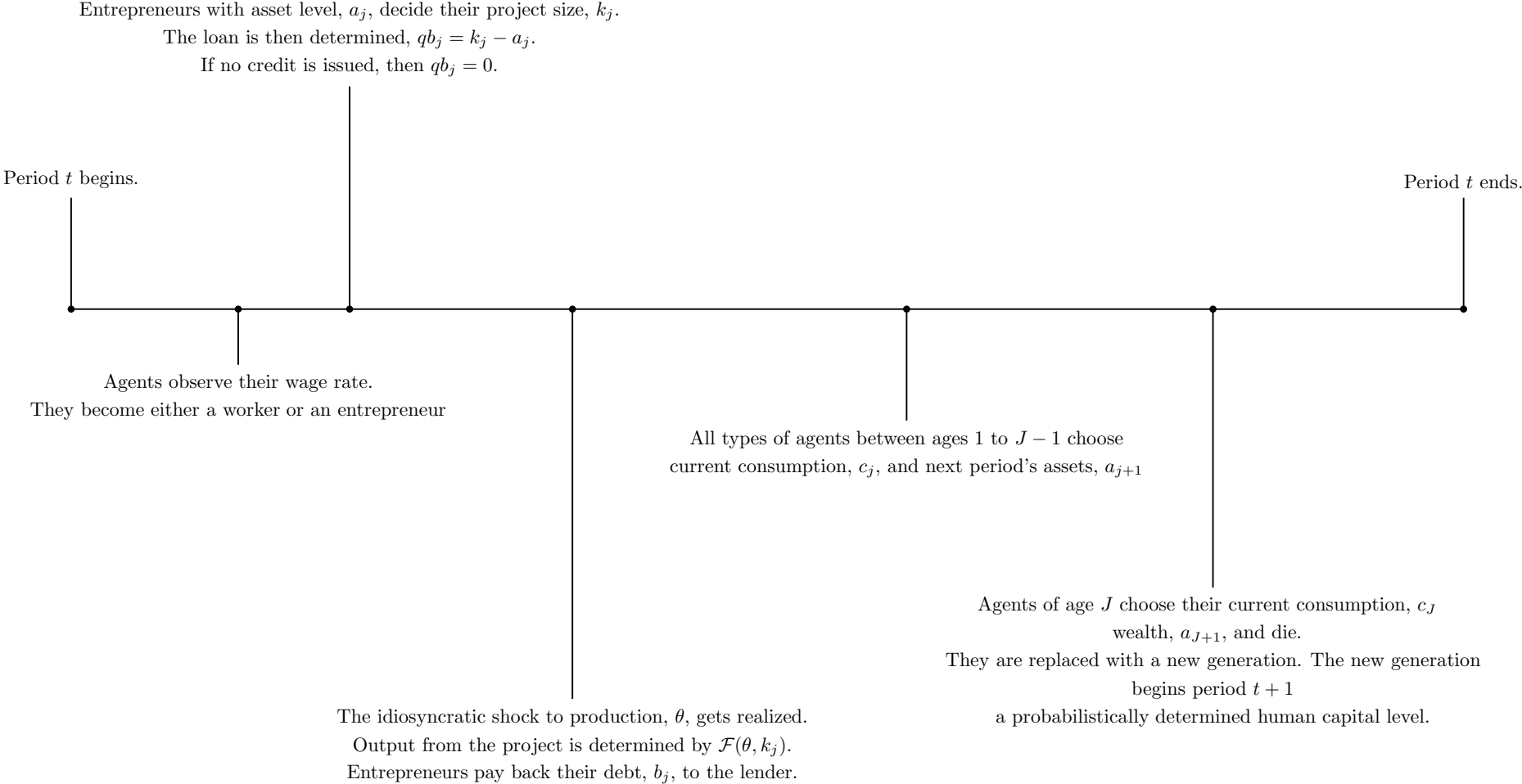


Table 2: Parameters

Preferences		
$\{\beta_c, \beta_{hs}\}$	$\{0.985, 0.970\}$	calibrated
$u(c) = \frac{c^{1-\xi}}{1-\xi}$	$\xi = 2$	calibrated.
$\phi(a_{J+1}) = \psi_h \frac{a_{J+1}^{1-\rho}}{1-\rho}$	$\rho = 2, \psi_h = \{\psi_c, \psi_{hs}\} = \{15, 7.5\}$	calibrated.
Labor Productivity		
$h = \{h_c, h_{hs}\}$	$\zeta(h' = h_c h = h_c) = 0.61,$ $\zeta(h' = h_c h = h_{hs}) = 0.21$	calibrated.
$\mu^{Corp}(j, h)$	calibrated	Hansen (1993).
Entrepreneurial Production		
$\mathcal{F}(\cdot) \equiv \theta k^\gamma + (1 - \delta)k$	$\gamma = 0.75, \delta = 0.11$	calibrated.
$\log \theta \sim N(\mu_{\theta_h}, \sigma_{\theta_h})$	$\mu_{\theta_c} = -1.35, \sigma_{\theta_c} = 0.83.$	
$h = \{c, hc\}$	$\mu_{\theta_{hs}} = -1.44, \sigma_{\theta_{hs}} = 0.83.$	calibrated.
Credit Markets		
q^f	0.96	Mehra and Prescott (1985).
τ	0.0225	calibrated

Table 3: The Effect of Transactions Costs Under US Wages: Extensive Margin

	Transaction Costs, τ ($\tau_{US} = 0.0225$)				
	0.0225	0.05	0.075	0.1	0.15
Self-Employment Rate	0.12	0.10	0.10	0.09	0.09
Self-Empl. Rate Low-Skill	0.10	0.08	0.08	0.07	0.07
Self-Empl. Rate High-Skill	0.16	0.13	0.14	0.13	0.13
Probability of Borrowing	0.51	0.21	0.09	0.03	0.00
Prob of Borr Low-Skill	0.57	0.25	0.11	0.03	0.00
Prob of Borr High-Skill	0.38	0.13	0.06	0.02	0.00
Mean Age of Self-Empl.	30.92	32.86	33.33	33.76	33.42
Mean Age of Self-Empl. Low-Skill	30.69	32.59	33.14	33.23	33.29
Mean Age of Self-Empl. High-Skill	31.04	33.01	33.42	34.03	33.49

Table 4: The Effect of Transaction Costs Under US Wages: Intensive Margin

	Transaction Costs, τ ($\tau_{US} = 0.0225$)				
	0.0225	0.05	0.075	0.1	0.15
Project Size in \$	180829	162056	158937	153830	157844
Project Size Low-Skill in \$	151332	131185	126335	120881	128051
Project Size High-Skill in \$	238927	222858	223151	218726	216523
Wealth Borrowing in \$	83303	57730	42798	27032	NaN
Wealth Borr & Low-Skill in \$	69947	49463	36124	23405	NaN
Wealth Borr & High-Skill in \$	109607	74014	55943	34175	NaN
Use of Credit in \$	-62274	-38333	-21449	-10483	NaN
Use of Credit Low-Skill in \$	-54496	-31110	-17091	-7912	NaN
Use of Credit High-Skill in \$	-77594	-52559	-30034	-15546	NaN
Debt-to-Capital Ratio	0.22	0.08	0.03	0.01	0.00
Debt-to-Capital Ratio Low-Skill	0.16	0.06	0.02	0.01	0.00
Debt-to-Capital Ratio High-Skill	0.25	0.09	0.03	0.01	0.00

Table 5: The Effect of Wages Under $\tau = 0.0225$ (US-level): Extensive Margin

	Mean Wage as a % of the US level				
	20%	33%	50%	80%	100%
Self-Employment Rate	0.77	0.65	0.45	0.20	0.12
Self-Empl. Rate Low-Skill	0.76	0.63	0.43	0.18	0.10
Self-Empl. Rate High-Skill	0.79	0.69	0.50	0.25	0.15
Probability of Borrowing	0.49	0.46	0.46	0.52	0.50
Prob of Borr Low-Skill	0.51	0.49	0.49	0.57	0.55
Prob of Borr High-Skill	0.45	0.42	0.41	0.44	0.40
Mean Age of Self-Empl.	26.47	27.11	28.50	29.76	30.62
Mean Age of Self-Empl. Low-Skill.	26.24	26.88	28.48	29.59	30.49
Mean Age of Self-Empl. High-Skill	26.58	27.23	28.52	29.85	30.68

Table 6: The Effect of Wages Under $\tau = 0.0225$ (US-level): Intensive Margin

	Mean Wage as a % of the US level				
	20%	33%	50%	80%	100%
Project Size in \$	139496	158043	169929	177753	183648
Project Size Low-Skill in \$	118617	134052	146653	152774	156297
Project Size High-Skill in \$	180618	205297	215772	226950	237518
Wealth Borrowing in \$	41536	49178	59352	71478	83980
Wealth Borr & Low-Skill in \$	35830	42013	50852	61295	69941
Wealth Borr & High-Skill in \$	52773	63291	76092	91534	111631
Use of Credit	-27121	-39283	-50630	-64322	-62898
Use of Credit Low-Skill in \$	-23047	-33909	-43835	-55838	-55519
Use of Credit High-Skill in \$	-35145	-49867	-64013	-81032	-77433
Debt-to-Capital Ratio	0.26	0.25	0.24	0.26	0.22
Debt-to-Capital Ratio Low-Skill	0.24	0.23	0.21	0.22	0.17
Debt-to-Capital Ratio High-Skill	0.27	0.26	0.26	0.28	0.25

Table 7: The Effect of Transactions Costs Under Low Wages: Extensive Margin

	Transaction Costs, τ ($\tau_{US} = 0.0225$)				
	0.0225	0.05	0.075	0.1	0.15
Self-Employment Rate	0.65	0.57	0.52	0.48	0.46
Self-Empl. Rate Low-Skill	0.63	0.54	0.50	0.46	0.43
Self-Empl. Rate High-Skill	0.68	0.62	0.56	0.54	0.54
Probability of Borrowing	0.46	0.35	0.23	0.17	0.06
Prob of Borr Low-Skill	0.48	0.37	0.25	0.19	0.06
Prob of Borr High-Skill	0.42	0.30	0.19	0.13	0.05
Mean Age of Self-Empl.	27.18	28.23	29.23	29.96	30.89
Mean Age of Self-Empl. Low-Skill	27.12	27.93	29.34	29.82	30.30
Mean Age of Self-Empl. High-Skill	27.21	28.39	29.18	30.03	31.19

Table 8: The Effect of Transactions Costs Under Low Wages: Intensive Margin

	Transaction Costs, τ ($\tau_{US} = 0.0225$)				
	0.0225	0.05	0.075	0.1	0.15
Project Size in \$	158152	132379	123515	112517	112785
Project Size Low-Skill in \$	137199	109211	103391	96216	90621
Project Size High-Skill in \$	199422	178011	163151	144621	156438
Wealth Borrowing in \$	48663	33271	25616	19894	12662
Wealth Borr & Low-Skill in \$	41401	27993	22106	17674	10612
Wealth Borr & High-Skill in \$	62966	43667	32529	24268	16700
Use of Credit in \$	-39717	-27286	-20457	-15222	-8557
Use of Credit Low-Skill in \$	-34445	-23410	-17718	-13069	-7590
Use of Credit High-Skill in \$	-50101	-34920	-25851	-19462	-10462
Debt-to-Capital Ratio	0.25	0.18	0.12	0.08	0.03
Debt-to-Capital Ratio Low-Skill	0.23	0.16	0.10	0.07	0.02
Debt-to-Capital Ratio High-Skill	0.27	0.20	0.13	0.09	0.03

Table 9: The Effect of Wages Under $\tau = 0.15$: Extensive Margin

	Mean Wage as a % of the US level				
	20%	33%	50%	80%	100%
Self-Employment Rate	0.61	0.46	0.30	0.14	0.09
Self-Empl. Rate Low-Skill	0.59	0.42	0.26	0.11	0.07
Self-Empl. Rate High-Skill	0.67	0.53	0.38	0.19	0.13
Probability of Borrowing	0.09	0.06	0.03	0.00	0.00
Prob of Borr Low-Skill	0.08	0.07	0.03	0.00	0.00
Prob of Borr High-Skill	0.10	0.05	0.02	0.01	0.00
Mean Age of Self-Empl.	29.09	30.84	32.27	33.47	33.42
Mean Age of Self-Empl. Low-Skill	28.57	30.31	31.96	33.08	33.29
Mean Age of Self-Empl. High-Skill	29.36	31.10	32.43	33.67	33.49

Table 10: The Effect of Wages Under $\tau = 0.15$: Intensive Margin

	Mean Wage as a % of the US level				
	20%	33%	50%	80%	100%
Project Size in \$	94208	108712	125340	141927	157844
Project Size Low-Skill in \$	75884	86283	99090	110961	128051
Project Size High-Skill in \$	130300	152889	177042	202917	216523
Wealth Borrowing in \$	8351	12590	14807	9238	NaN
Wealth Borr & Low-Skill in \$	6487	10527	13074	5688	NaN
Wealth Borr & High-Skill \$	12023	16655	18221	16230	NaN
Use of Credit in \$	-7282	-8577	-7635	-2996	NaN
Use of Credit Low-Skill in \$	-6900	-7586	-6347	-2438	NaN
Use of Credit High-Skill in \$	-8037	-10530	-10172	-4097	NaN
Debt-to-Capital Ratio	0.05	0.03	0.01	0.00	0.00
Debt-to-Capital Ratio Low-Skill	0.05	0.02	0.01	0.00	0.00
Debt-to-Capital Ratio High-Skill	0.05	0.03	0.01	0.00	0.00

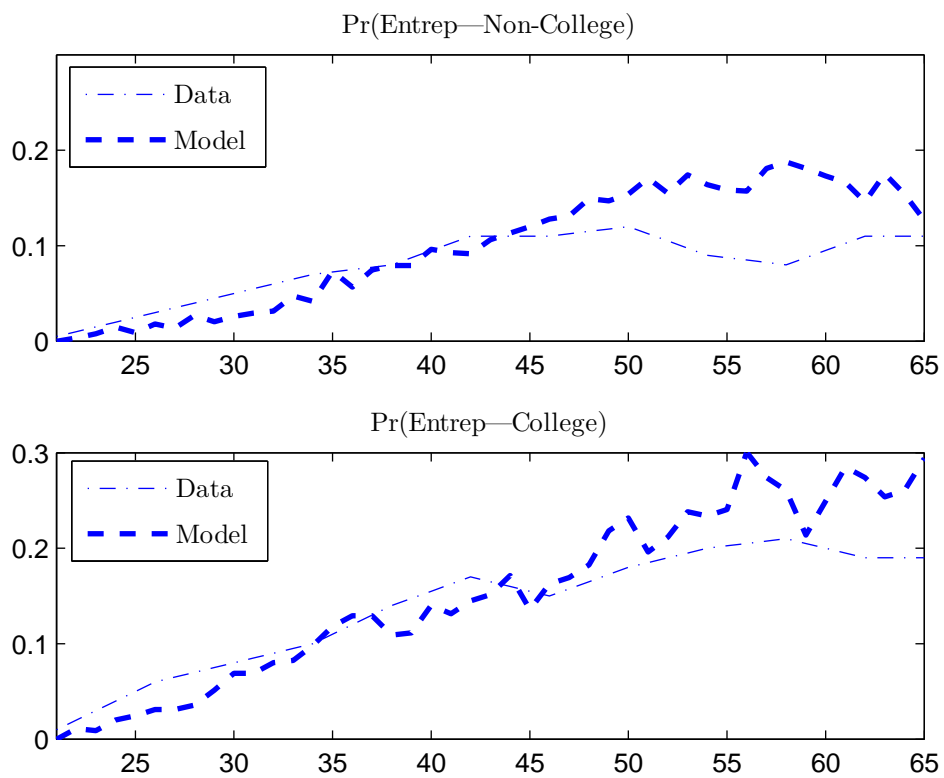


Figure 1: Age Distribution of Self-Employment Rate

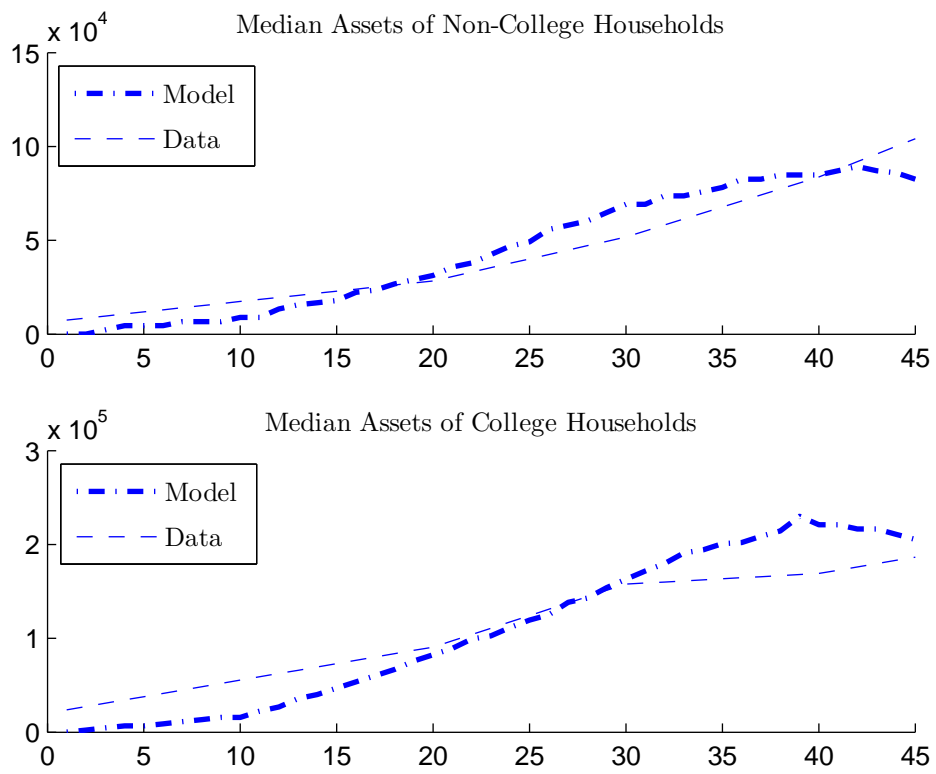


Figure 2: Median Wealth

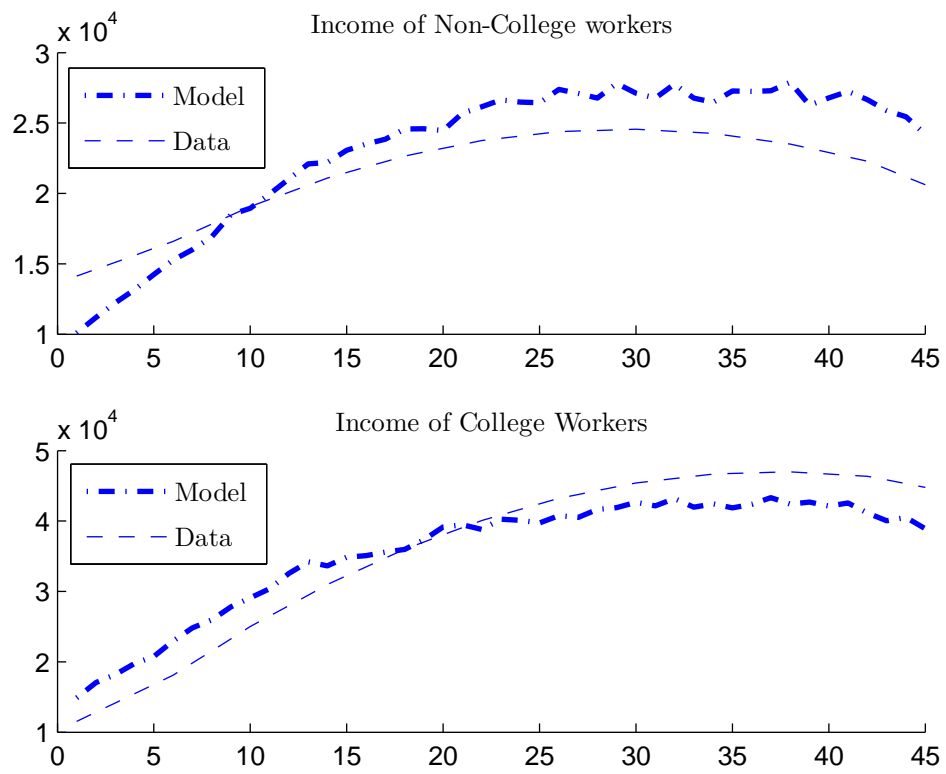


Figure 3: Income of Workers