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**EMPLOYMENT OR SELF EMPLOYMENT:
A DYNAMIC UTILITY MAXIMIZING MODEL**

MOREN LÉVESQUE

Lally School of Management and Technology

Rensselaer Polytechnic Institute

Troy, NY 12180-3590

Phone: 518-276-2785

DEAN A. SHEPHERD

College of Business

University of Colorado

Boulder, CO 80309-0419

Phone: 303-735-5423

EVAN J. DOUGLAS

Head, Brisbane Graduate School of Business

Queensland University of Technology

GPO Box 2434, Brisbane, Australia 4001

Phone: 61-7-3864-1126

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**EMPLOYMENT OR SELF EMPLOYMENT:
A DYNAMIC UTILITY MAXIMIZING MODEL**

EXECUTIVE SUMMARY

There is a considerable literature on careers from a variety of disciplines that focuses almost exclusively on job mobility patterns within and across established firms. While these scholars of career mobility patterns have made a substantial contribution to our knowledge of career changes they have all but ignored self-employment as a career choice. This is surprising as self-employed persons represent a substantial portion of a country's labor force.

This article presents a dynamic utility maximizing model of career choice between self employment and employment. The model builds on previous economic models that suggest that jobs differ in terms of income, work required, risk involved and independence allowed (especially between self employment and employment). People are believed to differ in terms of their attitudes to these job attributes, which helps explain why some people choose to be self employed while others choose to be employed. While this previous research has increased our understanding of career choice involving self employment, there is an implicit assumption that a person's attitudes to these job attributes are constant.

Research on life cycle and career stage models have indicated that as people age (mature) their attitudes change and this impacts their assessments and decisions. We argue that as people age their attitudes towards income, work, risk and independence change, as does the ability to complete the task and these changes impact their career choices. We provide a dynamic model of career choice that takes into consideration the differences among people in terms of their initial utility toward job attributes and the likely changes to those attitudes as they mature.

Specifically we argue that people differ in terms of their: initial utility for self employment over employment, initial utility from the assessment of the maximum difference in income for self employment over employment, the marginal reduction in

utility for self employment over employment from aging, and the final utility for self employment over employment. These differences between people effect the career path that maximizes their utility - - five optimal career paths are offered. For example, a group of people with similar attitudes and maturation process may find it utility maximizing to begin their careers in employment but then shift to self employment for the middle stage of their careers and then back to employment for the final stage of their career. Another group may find it utility maximizing to always be employed.

This article makes a step towards increasing our understanding of why people become self employed but importantly why and when some self employed people might switch to employment. We argue that this is due, in part, to people's attitudes (their utility or disutility weights) and that these attitudes change over time impacting career choice. However, we are not deterministic and point out that attitudes can be changed by factors other than time, for example, education or access to resources and therefore there is much interesting research that still needs to be conducted.

**EMPLOYMENT OR SELF EMPLOYMENT:
A DYNAMIC UTILITY MAXIMIZING MODEL**

ABSTRACT

This article presents a dynamic utility maximizing model of career choice between self employment and employment that takes into consideration the differences among people in terms of their initial utility toward job attributes and the likely changes to those utility weights as they mature. These differences between people effect the choice of career that maximizes their utility and leads to five optimal career paths. This dynamic utility maximizing model helps increase our understanding of why some people become self employed but importantly why and when some self employed switch to employment.

INTRODUCTION

There is a considerable literature on careers from a variety of disciplines (e.g., labor economists, organizational behaviorists and sociologists) that focuses almost exclusively on job mobility patterns within and across established firms (Borjas 1986; Carroll and Mosakowski 1987). While these scholars of career mobility patterns have increased our understanding of career changes they have all but ignored self-employment as a career choice. This is surprising as self-employed persons represent a substantial portion of the labor force (almost 12% according to Carroll and Mosakowski 1987; Manser and Picot 1999). There is a need for more career research on self employment.

Recently the application of economic principles to the intention to be self employed has made a significant contribution to the field and provides a framework from which other scholars can build. For example, Douglas and Shepherd (1999) represent an individual's choice to be self employed by a utility maximizing model where people

intend to be self employed when the combination of income, risk, work effort required and independence provides greater utility to this person than the combination of these attributes for the best employment option. People differ in what gives them utility and this explains why some people intend to be self employed while others intend to be employed.

Scholars modeling the intention to be self employed, by necessity, have held a number of variables constant in order to study only those parts of the decision under investigation. Douglas and Shepherd (1999) assume that a person's attitudes do not change over time and therefore an intention to be self employed (or employed) is relatively stable. We argue that this assumption may not always hold and this could significantly effect the intention to be self employed and consequently the career path that a person may follow over their life time. For example, studies based on life cycle and career stage models have indicated that determinants of job attitudes change (Lee and Wilbur 1985) and therefore a person's intention to be self employed may also change over time. This discussion leads to this article's research question: What affect does changing attitudes with age have on a person's career path, i.e., the choice between being self employed and employed?

Conceptually, past research has relied on the assumption that entrepreneurship is associated with a stable set of individual characteristics (Carroll and Mosakowski 1987) including attitudes (e.g., Douglas and Shepherd 1999). In this article we use deterministic dynamic programming to investigate career intentions (self employed or employed) over time. Mathematical models have already been used to investigate career paths^[1] and while this approach has its own limitations it does not assume temporal

^[1] For example, White (1970) utilizes Markov models to investigate the constraints on men's opportunity to move within large organizations. Lévesque and MacCrimmon (1997) utilize dynamic programming to investigate the decision to be self employed

equilibrium. Therefore, not only can we address the question of why some people choose self employment over employment but also investigate why a person may change in and out of self employment and when these changes will occur. We believe a dynamic investigation of optimal career paths will make a contribution to both the entrepreneurship and career literatures.

This study proceeds as follows: First, an economic perspective of entrepreneurship as a utility maximizing response is reviewed. Second, this static perspective of career choice is supplemented with knowledge (and assumptions) about the way people's attitudes typically change over time. This discussion leads to a number of assumptions that will be used in the formulation of our dynamic model of career choice. Third, the dynamic model is formulated and optimal career paths are described. A sensitivity analysis for key parameters is presented. Finally, implications of this article for scholars and practitioners are offered.

LITERATURE REVIEW AND MODEL ASSUMPTIONS

Stevenson and Jarillo (1990) propose that entrepreneurship research can be classified into how entrepreneurs act (i.e., what it is they do); what happens when entrepreneurs act (i.e., what are the outcomes of their actions); and why people choose to act as entrepreneurs (i.e., what motivates them to be entrepreneurs). Economic theory has been used in the entrepreneurship domain primarily to investigate what happens when entrepreneurs act and how they do it (Herbert and Link 1988; Barreto 1989) - - the first two classifications of entrepreneurship research. Only recently have scholars turned their attention toward an economics perspective of why people are motivated to be entrepreneurs.

Baumol (1990) suggests that people are motivated by the reward structure in the economy - - the rules of the game that govern the pay off. Campbell (1992) proposes that the pay off can be evaluated using a expected net present value (ENPV) and that a person

taking into consideration the entrepreneur's tolerance for work and the new venture's rate of return.

will be motivated to be an entrepreneur when the ENPV of profit from entrepreneurship is positive (profit includes a monetary evaluation of psychic costs and benefits). Whereas, Eisenhower's (1995) economic model of the decision to be an entrepreneur is based on expected utility derived from income and the working conditions of employment versus self employment.

Douglas and Shepherd (1999), following Baumol (1990), Gifford (1993) and Eisenhower (1995), demonstrated that the individual's choice to be a self employed can be represented as a utility-maximizing decision. They showed that both employment and self employment 'jobs' can be characterized by their level of income, work effort, risk, independence, and other working conditions (net perquisites) and an individual's choice between the best available alternative in employment and the best alternative in self employment depends on his/her preference (or aversion) for each of these job attributes.

Douglas and Shepherd (1999) argue that in the context of career choice, an individual expects to gain utility from income (derived from the goods and services which he/she can buy with that income), disutility from work effort and risk bearing, and either utility or disutility from independence and other working conditions. They model the individual's choice of career path out to an individual's time horizon by defining a career path as a single job held throughout the planning period, or two or more jobs in sequence over that same planning period. Thus they state:

$$O_{ij} \quad U_{ij} = F(Y_{ij}, W_{ij}, R_{ij}, I_{ij}) \quad (1)$$

where U_{ij} represents the utility anticipated in the i^{th} period from the j^{th} job;

Y_{ij} represents the income anticipated in the i^{th} period from the j^{th} job;

W_{ij} represents the work effort anticipated in the i^{th} period from the j^{th} job;

R_{ij} represents the risk anticipated in the i^{th} period from the j^{th} job;

I_{ij} represents the independence anticipated in the i^{th} period from the j^{th} job;

O_{ij} represents the net perquisites anticipated in the i^{th} period from the j^{th} job;

$i = 1, 2, 3, \dots, n$ represents the different periods out to the time horizon (n), and $j = 1, 2, 3, \dots, m$ represents the different jobs available in any period. An individual will envision $k = 1, 2, 3, \dots, z$ career paths, each comprising a single job or a sequence of jobs from the present moment out to the time horizon and will

choose among the “z” career paths, such that his/her expected utility is maximized.

We define utility as *the product of a person’s positive attitude towards an attribute (which we call a utility weight) and the absolute value of that attribute*. Disutility is *the product of a person’s negative attitude towards an attribute (which we call a disutility weight) and the absolute value of that attribute*. The overall utility of a career option is *the combination of the utilities and/or disutilities for each of the attributes in the Douglas and Shepherd (1999) career maximization model*. For example, at any age a person’s attitude toward risk (e.g., high risk aversion) can be thought of as a disutility weight and is multiplied to the absolute risk of the career alternative in order to ascertain that person’s disutility from risk. This disutility from risk must be combined with the disutility from work, utility from independence, utility from income and the utility or disutility of net perquisites in order to ascertain the overall utility of a career alternative. The overall utility for this career option is compared to other available options and the one with the highest utility is chosen. This leads to our first assumption to be used in model formulation:

Assumption 1: People choose a career path that maximizes their overall utility.

However, as described above, a critical assumption of the Douglas and Shepherd (1999) model is that people’s attitudes do not change over time and therefore a career decision will only be changed when the attributes of the decision change (holding opportunity and resources constant). While this assumption was necessary in order to

develop their model and advance our understanding of a person's motivation to be self employed, if relaxed, will likely provide additional insight. We know that as we grow older our attitudes to many things change. We argue that such attitudinal changes over a person's lifetime might help explain their career path over time including movements into and/or out of self employment. We now explore each of the attitudes (utility and disutility weights) in the Douglas and Shepherd (1999) model (ability and income; attitudes to risk; work effort; and independence), how these (dis)utility weights likely effect a career choice between self employment and employment and how these (dis)utility weights likely change over time. Such a discussion forms the basis for a series of assumptions that will be used in an optimization model of peoples' career paths over time.

Ability and Income

The term 'ability' is used here to encompass all the skills possessed by an individual which contribute to his/her productivity on the job, and include opportunity recognition and screening, business planning, creative problem solving, strategic marketing, financial management, human resource management, and leadership and persuasive skills. The higher the ability the more valuable the person is to an employer or the more profitable their own business will be (all else equal). Douglas and Shepherd (1999) demonstrate that the ability of the employee is reflected in the height of the profit curve with a 'more-able' person generating a higher profit curve (for the employer's business or their own business, all other things being equal). This argument on the relationship between ability and income has empirical support (Hayes and Schaefer 1999; Card and Lemieux 1996).

So how does this relationship between ability and income influence a person's career decision between being self employed and employed? To be self employed requires considerable and diverse abilities relative to those required to be employed (Baumol 1990; Holmes and Schmitz 1990; Gifford 1993) and those that are self employed typically earn more than those that are employed (Wright and Perrone 1977). Therefore, those that have higher skills and/or those that have a greater desire for income are more likely to choose self employment.

However, are ability and the desire for income stable characteristics of a person? We argue that they are not. Ability often increases with age. Age provides an opportunity to gain more knowledge through experience, which often translates to expertise (performance) (Schwartz and Griffin 1986; Mumpower, Phillips, Renn and Uppuluri 1987). While age can increase one's ability which in turn increases that person's income, we argue that the relative importance of income in their career decision decreases and shifts to other characteristics of the job such as independence (as will be discussed below). The above discussion leads to the following assumption to be used in the development of a dynamic utility maximizing model:^[2]

Assumption 2: (a) Income increases as ability increases. (b) Income is less in employment than in self employment. (c) Ability increases at a decreasing rate with age. (d) The utility weight for income decreases at an increasing rate with age.

Attitudes to Work Effort

Work effort is defined as the product of time spent working and an index of work intensity (Douglas and Shepherd 1999). It is generally accepted that people are averse to work (a disutility weight for work). For example, scholars of agency theory assume that people are averse to work effort with differing degrees of aversion (e.g., Alchian and Demsetz 1972; MacDonald 1984). A person with a higher degree of work aversion (i.e., higher disutility weight) derives greater marginal disutility from a job that requires additional hours of work and greater intensity of effort than someone with less work aversion. Therefore the level of aversion to work will influence the type of career chosen (Furnham and Koritsas 1990; Douglas and Shepherd 1999). We also assume that people gain greater enjoyment from those tasks in which they have higher ability. Therefore, for a given job, the work is less onerous when one is more able.

This relationship between the degree of work aversion and utility from one's career likely influences the choice between self employment and employment as entrepreneurs typically must work long and hard hours and even put their business ahead of their personal and family life (Bird and Jellinek 1988). While there is little research on how a person's aversion to work changes as they age, we assume their aversion to work increases with age (e.g., a person is more willing to work eighteen hour days at a hectic pace immediately after graduating from school than they are just prior to retirement). The above discussion leads to the following assumptions:

^[2] For each assumption all other attributes are held constant.

Assumption 3: (a) People are work averse - - they have a disutility weight for work effort. (b) The disutility weight for work effort decreases as ability increases. (c) Work effort is less in employment than in self employment. (d) The disutility weight for work effort increases at a decreasing rate with age.

Attitudes to Risk

The discussion thus far assumes that profit is a direct and unambiguous function of work effort, all other things being equal. But when profit is an uncertain function of work effort, there will be an expected profit level for each level of work effort, surrounded by a variance of profit outcomes which may eventuate due to potential changes in consumer preferences, competitors' prices and product offerings, macro-economic variables, and so on (Douglas and Shepherd 1999). Such potential profit variability introduces the risk that the employee (or the self employed) may expend additional effort without any additional remuneration for that effort. People will not generally seek out extra risk without compensation and therefore can be considered risk averse (i.e., they have a negative utility weight for risk). However, it appears that people are less averse to risk at those tasks for which they have high ability (Heath and Tversky 1991).

Furthermore, while there is heterogeneity among employment options on the level of risk (an employee typically receives a salary or a wage that may or may not have commissions and bonuses attached to that salary) self employment typically represents a more risky endeavor (Duchesneau and Gartner 1990). Risk aversion has been found to be positively associated with age (Palsson 1996). For example, a rise in average age is found to predict a rise in risk premiums (Bakshi and Chen 1994) and in an investigation of portfolio selection behavior, risk aversion was found to increase uniformly with age (Morin and Saurez 1983).

Assumption 4: (a) People are risk averse - - they have a disutility weight for risk. (b) The disutility weight for risk decreases as ability increases. (c) Risk is less in employment than in self employment. (d) The disutility weight for risk increases at a decreasing rate with age.

Attitudes to Independence

Attitude to independence refers to the preference or aversion to control their own decision-making and confidence in one's own abilities which allows independent decision making rather than frequent recourse to advisors (Douglas and Shepherd 1999). While some people may prefer to be directed and feel uncomfortable with the responsibility that comes with independence, we assume people typically have a preference for independence. We further argue one's attitude to independence becomes

more preferring as one's ability increases (the utility weight for independence increases). A possible explanation is that decision makers receive credit for success in a choice that involves judgement in an area of competence but blame for failure if the choice involves judgement in an area of relative ignorance (Heath and Tversky 1991).

Despite the self employed person still being answerable to stakeholders such as financiers and variability in the level of independence within the employment option, independence is typically higher in the self employment option (Bird 1989; Katz 1994). While there is little research on the relationship between attitudes toward independence and age we argue that as a person ages a preference for independence becomes stronger. Empirical evidence supporting this assumption occurs with older nurses who assign greater importance to flexibility in their work and lesser importance to development, career advancement and socialization than did younger ones (Proenca and Shewchuk 1998). The above discussion leads to our final assumption, which will then be used in the model formulation:

***Assumption 5:** (a) People are independence seekers - - they have a utility weight for independence. (b) The utility weight for independence increases as ability increases. (c) Independence is less for employment than for self employment. (d) The utility weight for independence increases at a decreasing rate with age.*

MODEL FORMULATION

Let t represent the age and a_t be an individual's ability at t . Ability increases at a decreasing rate with age (2a) and is mathematically expressed by

(2)

where α_0 is the initial ability and α is a scaling parameter (which represents an upper bound on the increment in ability over time).

Let y be the utility weight for (absolute) income, which decreases with age at an increasing rate (2b), that is,

$$(3)$$

To model the utility weight for income we choose the functional form

$$(4)$$

where γ_y is the initial utility weight for income.

Let j_t be the job selection at t , where $j_t \in \{E = \text{employment}, SE = \text{self employment}\}$. The absolute income is a function of ability and job selection, and it is denoted by $Y(a_t, j_t)$, where $\partial Y / \partial a_t > 0$ (2c) and $Y(a_t, E) < Y(a_t, SE)$ (2d). To model absolute income we choose the functional form

$$(5)$$

where $\beta(j_t)$ is the marginal income associated with an increase in ability if job j_t is selected at t .

Let w be the disutility weight (i.e., negative utility weight) for (absolute) work effort, which increases with age at a decreasing rate (3b) but decreases with ability (3c), that is,

(6)

To model the disutility weight for work effort we choose the functional form

(7)

where γ_w is the final (i.e., an upper bound on the) disutility weight for work effort that is due to age, A_w is the initial disutility weight for work effort that is due to ability and δ_w is the marginal disutility-weight reduction for work effort that is due to an increase in ability.^[3] The absolute work effort associated with job j_t is denoted by $W(j_t)$, with $W(E) < W(SE)$ (3d).

Let r be the disutility weight for (absolute) risk, which increases with age at a decreasing rate (4b) but decreases with ability (4c), that is,

(8)

To model the disutility weight for risk we choose the functional form

(9)

where γ_r is the final (i.e., an upper bound on the) disutility weight for risk that is due to age, A_r is the initial disutility weight for risk that is due to ability and δ_r is the marginal

^[3] To insure that at any ability level the individual has a disutility from work, $A\omega$ ισ ασσυμεδ λαργερ τηαν $\delta_w(\alpha_0 + \alpha)$.

disutility-weight reduction for risk that is due to an increase in ability.^[4] The absolute risk associated with j_t is denoted by $R(j_t)$, and $R(E) < R(SE)$ (4d).

Let i be the utility weight for independence, which increases with age at a decreasing rate (5b) but increases with ability (5c), that is,

$$(10)$$

To model the utility weight for independence we choose the functional form

$$(11)$$

where γ_i is the final (i.e., an upper bound on the) utility weight for independence that is due to age and δ_i is the marginal utility weight for independence that is due to an increase in ability. Independence associated with job j_t is denoted by $I(j_t)$, with $I(E) < I(SE)$ (5d).

The objective is to find a career path over time that maximizes utility at any age t (which we equate to maximizing total lifetime utility). The total utility at t associated with job j_t is expressed by

$$(12)$$

or, equivalently, by

$$(13)$$

An individual is best advised to select self employment at age t rather than employment if and only if $U_t(SE) > U_t(E)$, where $U_t(SE) - U_t(E)$ is the change in utility at t from selecting self employment over employment. With $\Delta\beta = \beta(SE) - \beta(E) (>0)$, $\Delta W = W(SE) - W(E) (>0)$, $\Delta R = R(SE) - R(E) (>0)$, and $\Delta I = I(SE) - I(E) (>0)$, self employment is preferred to employment whenever

^[4] To insure that at any ability level the individual has a disutility from risk, A_r is assumed larger than $\delta_r(\alpha_0 + \alpha)$.

(14)

which is equivalent to

(15)

The *marginal utility* parabola $\Delta U(e^{-t}) = a \cdot (e^{-t})^2 + b \cdot (e^{-t}) + c$ expresses over e^{-t} (which can be translated in terms of time t) the change in utility from selecting self employment over employment.

MODEL IMPLICATIONS

We next derive the roots of the quadratic function in e^{-t} that is given by (15). These two roots are

(16)

where coefficients a , b and c are as in (15). These roots exist as long as the discriminant (i.e., $b^2 - 4ac$) is non-negative. When the roots exist and are non-negative, they are associated with two critical time points, $t^* = \ln(1/r_2)$ and $t^{**} = \ln(1/r_1)$. Since a is always negative (and thus the quadratic function expressed by (15) concave in e^{-t}), these roots are non-negative whenever b is non-negative and c is non-positive (so that $b (>0) > -(b^2 - 4ac)^{1/2}$). The critical time periods are finite and positive as long as the roots belong to $(0,1)$. When at least one of the roots is negative (i.e., $b < 0$ and/or $c > 0$), the critical time points are not well defined, but the optimal career strategy can still be derived.

We are able to express over time the optimal career strategy based on the change in utility of self employment over employment. When the additional total utility from selecting self employment over employment is positive then the person should select self employment and if negative should select employment. More specifically, the additional (or change in) utility over e^{-t} from selecting self employment over employment is the parabola in (15), and thus the change in utility over time t depends on the roots of the parabola, as given by (16). Since these roots are functions of coefficients a , b , and c , the change in utility over time will depend on these coefficients.

Coefficient $-a$ (a is always negative) is the initial utility from an assessment of the maximum difference in income from selecting self employment over employment. The maximal (or upper bound) is due to increases in ability that occur with aging.

Coefficient b is the marginal (w.r.t. e^{-t}) reduction in utility from self employment over employment due to the change in decision weights indirectly from aging (via increased ability) and directly from aging. The indirect effect of aging (via increased ability) is to increase the utility weight for independence and decrease the disutility weights for risk and work. All the indirect changes of age through ability change the decision weights so that they increase the overall utility for self employment. The direct effect of aging on the decision weights is to increase the disutility weights for both risk and work and decrease the utility weight for income (decreasing the overall utility for self employment), and increase the utility weight for independence (increasing the overall utility for self employment). Therefore, an increase in the overall utility for self employment over employment (which is a decrease in coefficient b) indicates that the indirect effect of aging (via ability) outweighs the increased disutility arising from the direct effect of aging (assuming that the disutilities of risk and work from the direct effect of aging outweigh the utilities of income and independence - even though the utility weight for income has decreased it still produces utility). Otherwise, the direct and indirect effects are both utilities and increase the probability of self employment.

Coefficient c is the final (t equals infinity) utility from selecting self employment over employment. Final refers to the end of this person's career - - the point of retirement.

The combination $a + b + c \equiv \gamma_y \alpha_0 \Delta \beta + (\delta_w \alpha_0 - A_w) \Delta W + (\delta_r \alpha_0 - A_r) \Delta R + \delta_i \alpha_0 \Delta I$ represents the initial ($t=0$ or, equivalently, $e^{-t}=1$) utility from selecting self employment over employment.

The implications of the model (Cases 1 to 5) are presented in Table 1. Each case is associated with a condition on the sign of the discriminant $b^2 - 4ac$ and additional conditions on coefficients a , b , and c as it appears in each cell of Table 1. Appendix A offers a diagrammatic representation of Cases 1 to 5 based on these combined conditions on the coefficients. Moreover, for each Case the sign of the additional total utility (ΔU) from self employment over employment (with reference to the two critical time points that are based on the signs of the two roots) is determined and demonstrated in Figures 1 to 11.

Only when the marginal utility parabola crosses the X-axis can a change in the sign of the additional total utility from selecting self employment over employment occur - - the discriminant must be non-negative. For the discriminant to be non-negative the final utility from selecting self employment over employment (c) must be greater than or equal to $-b^2/4(-a)$ which occurs for all cases except 1(c). For example, the discriminant will be non-negative if the final (t equals infinity) utility from selecting self employment over employment (c) is positive or zero (because $a < 0$). Each Case is now described.

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 Insert Table 1 About Here

Career Strategy 1

In **Case 1(a)** the final (t equals infinity) utility from selecting self employment over employment is zero ($c = 0$). The marginal (w.r.t. e^{-t}) reduction in utility from self employment over employment due to aging is non-positive ($b \leq 0$). Consequently either the two roots given by (16) are zero (when $b = 0$) or one is zero and the other is negative (when $b < 0$), as demonstrated in Figure 1 and 2, respectively. Since the function e^{-t} increases as t decreases, the figures must be read over time from right to left, that is, from t equals zero corresponding to e^{-t} equals 1 to t equals infinity corresponding to e^{-t} equals zero. Hence, in this case, the additional total utility from selecting self employment over employment is always negative within the interval (0,1). Therefore for this type of

individual there is no age for which it is utility maximizing to choose self employment over employment.

In **Case 1(b)** the final utility from selecting self employment over employment is now negative ($c < 0$) and the marginal reduction in utility from self employment over employment due to aging is negative ($b < 0$). Consequently the roots in (16) are negative. As demonstrated in Figure 3, the additional total utility from selecting self employment over employment is always negative within the interval (0,1) and again it is always utility maximizing to be employed.

In **Case 1(c)** the final utility from selecting self employment over employment is less than $b^2/4(-a)$. Consequently the roots given by (16) do not exist. As demonstrated in Figure 4, the additional total utility from selecting self employment over employment is always negative within the interval (0,1). Again, for this type of individual there is no age for which it is utility maximizing to choose self employment over employment.

In **Case 1(d)** the initial utility from selecting self employment over employment is non-positive ($a+b+c \leq 0$) and the marginal reduction in utility from self employment over employment due to aging is larger than twice the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b > -2a$) (consequently, $c < 0$). Therefore the two roots in (16) are larger than, or equal to 1. As demonstrated in Figure 5, the additional total utility from selecting self employment over employment is negative within the interval (0,1), and it is thus utility maximizing for this person to initially select employment and remain employed.

Rationale for Career Strategy 1 is based on case 1(a). For this group of people the effect of aging is to marginally decrease (or to have no effect on) the utility to be gained from self employment over employment (with $b \leq 0$ the disutility from self employment over employment (be^{-t}) increases over time). This occurs because the direct effect of aging has a greater (or equal) influence on their overall utility than does the indirect effect of aging via ability. Specifically, the increased disutility weights for risk and work from the direct effect of age match or are below the increased utility weight for independence from both the direct and indirect effect of aging, the decreased utility from income due to the direct effect of aging and the decreased disutility weights for risk and work from the indirect effect of aging. Further, this group of people are indifferent between self employment and employment at the end of their careers. Given the effect of aging (increasing the disutility of self employment over employment) and their final indifference for self employment over employment it is utility maximizing for them to begin and remain in employment for their entire career.

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Insert Figure 1 to 11 About Here

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Career Strategy 2

In **Case 2(a)** the final utility from selecting self employment over employment is zero ($c = 0$) and the marginal reduction in utility from self employment over employment due to aging is positive, but bounded above ($0 < b < -a$). Therefore the smallest root in (16) is zero and the other root belongs to (0,1). As demonstrated in Figure 6, the additional total utility from selecting self employment over employment is positive and then becomes (and stays) negative within the interval (0,1). Since the function e^{-t} increases as t decreases, it is utility maximizing for this person to select employment until a critical time point t^* (which exists, is finite and equals $\ln(1/r_2)$) and become self employed thereafter.

In **Case 2(b)** the final utility from selecting self employment over employment is now positive ($c > 0$) and the marginal loss of utility from self employment over employment due to aging is less than twice the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b < -2a$). Also, the initial ($t=0$) utility from selecting self employment over employment is negative ($a + b + c < 0$). Therefore one root is negative while the other belongs to $(0,1)$. As demonstrated in Figure 7, the additional total utility from selecting self employment over employment is positive and then becomes (and stays) negative within the interval $(0,1)$. Therefore the career strategy remains the same as that for case 2a, although the value of the critical time point t^* will be different as the combination (a,b,c) is different.

Rationale for Career Strategy 2 is based on case 2(a). For this group of people the effect of aging is to marginally increase the utility to be gained from self employment over employment (with $b > 0$ the disutility from self employment over employment (be^{-t}) decreases over time). This occurs because the indirect effect of aging (via ability) has a greater influence on overall utility than does the direct effect of aging. Specifically, the increased disutility weights for risk and work from the direct effect of age match or exceed the increased utility weight for independence from both the direct and indirect effect of aging, the decreased utility from income due to the direct effect of aging and the decreased disutility weights for risk and work from the indirect effect of aging.

This group of people also have an initial disutility from selecting self employment over employment. This initial disutility means that it is utility maximizing for them to begin with employment. However, the effect of aging (increasing the utility of self employment over employment) is sufficient to overcome this initial disutility and it then becomes utility maximizing for them to shift to self employment after the critical time point.

Career Strategy 3

In **Case 3(a)** the final utility from selecting self employment over employment is zero ($c = 0$) and the marginal loss of utility from self employment over employment due to aging is greater than or equal to the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b \geq -a$). Consequently there is initial utility from selecting self employment over employment ($a + b + c = a + b \geq 0$). Therefore one of the two roots in (16) is zero while the other is larger than or equal to 1. As demonstrated in Figure 8, the additional total utility from selecting self employment over employment is never negative, and therefore this person will maximize utility by being self employed at all stages of their career.

In **Case 3(b)** the final utility from selecting self employment over employment is now positive ($c > 0$) and the marginal reduction in utility from self employment over employment due to aging is now at least twice the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b \geq -2a$). As demonstrated in Figure 9, one root is negative and the other is larger than or equal to 1. In **Case 3(c)** the final utility from selecting self employment over employment is still positive ($c > 0$) although the marginal reduction in utility for self employment over employment from aging is now less than twice the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b \geq -2a$). Moreover, there is initial utility from selecting self employment over employment ($a + b + c \geq 0$, and thus Figure 9 still applies). Therefore, for cases 3(a), 3(b) and 3(c), the additional total utility from selecting self employment over employment is never negative and this person maximizes utility by choosing, and remaining in, self employment.

Rationale for Career Strategy 3 is based on case 3(a). As in the rationale for career strategy 2, the effect of aging on this group of people is to marginally increase the utility gained from self employment over employment. That is, the indirect effect of aging (via ability) has a greater influence on overall utility than does the direct effect of aging. Furthermore, while they are indifferent between self and employment and employment at the end of their careers, they obtain utility from self employment over employment at the beginning of their careers. Given this initial utility and the effect of aging (increasing the utility of self employment over employment), it is utility maximizing for this group of people to begin and then remain in self employment for their entire career.

Career Strategy 4

In **Case 4** the final utility from selecting self employment over employment is negative ($c < 0$) and the marginal reduction in utility from self employment over employment due to aging is less than twice the initial utility from an assessment of the maximum difference in income from selecting self employment over employment ($b < -2a$). Moreover, the initial utility from selecting self employment over employment is negative ($a+b+c < 0$). Therefore the two roots in (16) belong to $(0,1)$. As demonstrated in Figure 10, the additional total utility from selecting self employment over employment is negative, then becomes positive and negative again within the interval $(0,1)$. It is utility maximizing for this person to select employment before the critical time point t^*

and after t^{**} , and be self employed between t^* and t^{**} (the critical time points exist, are both finite and equal to, respectively, $\ln(1/r_2)$ and $\ln(1/r_1)$).

Rationale for Career Strategy 4. As in the rationale for career strategy 2 and 3 above, the effect of aging on this group of people is to marginally increase the utility to be gained from self employment over employment. That is, the indirect effect of aging (via ability) has a greater influence on overall utility than does the direct effect of aging. It is important to note, however, that the upper bound on this marginal increase in utility for self employment over employment from aging is lower than in career strategies 2 and 5.

Further, these people initially obtain disutility for self employment over employment and also at the end of their careers receive disutility from self employment over employment. Given their initial disutility, it is utility maximizing for them to pursue employment in the first stage of their career. However, the effect of aging on their decision weights (increasing the utility of self employment over employment) eventually results in the utility of self employment over employment exceeding the initial disutility. At this point in time it becomes utility maximizing for them to become self employed. Later in their careers the final disutility for self employment over employment exceeds its utility and it again becomes utility maximizing for this group to shift back to employment. Therefore the utility maximizing career path for these people is an initial period of employment, then self employment and then finally employment again.

Career Strategy 5

In **Case 5** the final utility from selecting self employment over employment is negative ($c < 0$) and the marginal reduction in utility from self employment over employment due to aging is positive ($b > 0$). Moreover, the initial utility from selecting self employment over employment is positive ($a+b+c > 0$). Therefore one root belongs to $(0,1)$ while the other is larger than or equal to 1. As demonstrated in Figure 11, the additional total utility from selecting self employment over employment is negative, then becomes positive within the remaining of interval $(0,1)$. Therefore it is utility maximizing for this person to select self employment before a critical time point t^{**} , and be employed afterwards.

Rationale for Career Strategy 5. For this group of people (and those of cases 2, 3 and 4) the effect of aging is to marginally increase the utility to be gained from self employment over employment. This is due to the indirect effect of aging (via ability) having a greater influence on overall utility than does the direct effect of aging. Further, while these people initially obtain utility from self employment over employment they receive disutility from self employment over employment at the end of their careers. Given this initial utility and the effect of aging on their utility weights (increasing the utility for self employment over employment) it is utility maximizing for this group of people to initially be self employed. However, later in their careers the final disutility for self employment over employment exceeds the utility and it becomes utility maximizing for them to shift to employment. Therefore, for this group of people, the utility maximizing career path is to begin as self employed and at a critical time point shift to being employed for the rest of their careers.

SENSITIVITY ANALYSIS

A sensitivity analysis is now conducted that increases some of the key parameters so that the resultant changes to the career strategy can be determined. To fully illustrate the sensitivity of our dynamic model we conduct the analysis using case 4 - - case 4 has two critical time points (i.e., the lower and the upper bounds) and therefore represents the case with the most career changes. A change in a critical time point influences the length of a career stage where it is utility maximizing to pursue either self employment or employment. The sensitivity analysis is conducted where r_1 and r_2 in (16) are differentiated with respect to the key model parameters, where r_1 and r_2 are functions of a , b and c , and these coefficients are in turn functions of the model parameters. As a parameter is increased a negative derivative corresponds to a decrease in the root and thus an increase in the corresponding critical time point, whereas a positive derivative corresponds to an increase in the root and thus a decrease in the corresponding critical time point. A portion of the technical details is included as appendix B. Increases in parameters and their effect on career strategy are now detailed.

Parameters: marginal reduction of disutility weight for work (δ_w) risk (δ_r) and independence (δ_i) from ability, final utility weight for independence from aging (γ_i), incremental independence from selecting self employment over employment (ΔI). An increase in any one of these parameters increases the marginal utility of self employment over employment from aging and decreases the final disutility for self employment over employment. Therefore, with increased marginal utility less time is required to exceed the initial disutility for self employment over employment (decreasing the lower bound). Further, with a decreased final disutility for self employment over employment it will take longer before the final disutility exceeds the utility for self employment over employment (increasing the upper bound). Therefore it is utility maximizing for this group of people to decrease the initial career stage of employment, decrease the final career stage of employment and increase the middle career stage of self employment.

Parameters: Final disutility weight for work (γ_w) and risk (γ_r) from aging, incremental work (ΔW) and risk (ΔR) from selecting self employment over employment. An increase in any one of these parameters decreases the marginal utility for self employment over employment from aging and increases the final disutility for self employment over employment. Therefore, with a decreased marginal utility more time is required to exceed the initial disutility for self employment over employment (increasing the lower bound). Further, with an increased final disutility for self employment over employment it will take less time before the final disutility exceeds the utility for self employment over employment (decreasing the upper bound). Therefore it is utility maximizing for this group of people to increase the initial career stage of employment, increase

the final career stage of employment and decrease the middle stage of self employment. (It must be noted that the above rationale only applies to the parameter ΔW if $(\gamma_w - \delta_w \alpha)r_2 < \gamma_w + A_w - \delta_w(\alpha_0 + \alpha)$ and $(\gamma_w - \delta_w \alpha)r_1 < \gamma_w + A_w - \delta_w(\alpha_0 + \alpha)$, and to ΔR if $(\gamma_r - \delta_r \alpha)r_2 < \gamma_r + A_r - \delta_r(\alpha_0 + \alpha)$ and $(\gamma_r - \delta_r \alpha)r_1 < \gamma_r + A_r - \delta_r(\alpha_0 + \alpha)$).

Parameters: initial utility weight from income (γ_y) and incremental income from self employment over employment ($\Delta\beta$). An increase in either of these parameters decreases the initial disutility for self employment over employment (i.e., increases the initial utility since $\partial(a+b+c)/\partial\gamma_y = \alpha_0\Delta\beta > 0$ and $\partial(a+b+c)/\partial\Delta\beta = \gamma_y\alpha_0 > 0$), increases the initial utility received from the assessment of the maximum difference in income from self employment over employment, and decreases the marginal utility of self employment over employment from aging. Despite a decrease in the marginal utility for self employment over employment the reduction in initial disutility is such that less time is required to exceed this reduced initial utility for self employment over employment (decreasing the lower bound). Further, with an increased initial utility from their assessment of the maximum difference in income from self employment over employment it will take longer before the final disutility exceeds the utility for self employment over employment (increasing the upper bound). Therefore it is utility maximizing for this group of people to decrease the initial career stage of employment, decrease the final career stage of employment and increase the middle career stage of self employment.

Parameters: initial disutility weight for work effort (A_w) and risk (A_r) from ability. An increase in either of these parameters increases the initial disutility for self employment over employment ($\partial(a+b+c)/\partial A_w = -\Delta W < 0$ and $\partial(a+b+c)/\partial A_r = -\Delta R < 0$) and increases the final disutility for self employment over employment. Therefore, with an increase in the initial disutility for self employment over employment more time is required to exceed the initial disutility for self employment over employment (increasing the lower bound). Further, with an increased final disutility for self employment over employment it will take less time before the final disutility exceeds the utility for self employment over employment (decreasing the upper bound). Therefore it is utility maximizing for this group of people to increase the initial career stage of employment, increase the final career stage of employment and decrease the middle stage of self employment.

Parameter: Initial ability (α_0). An increase in this parameter decreases the initial disutility for self employment over employment ($\partial(a+b+c)/\partial\alpha_0 = \gamma_y\Delta\beta + \delta_w\Delta W + \delta_r\Delta R + \delta_i\Delta I > 0$), decreases the marginal utility for self employment over employment from aging and decreases the final disutility for self employment over employment. Therefore, despite a decrease in the marginal utility for self employment over employment from aging the decrease in the initial utility is such that less time is required for the marginal utility for self employment over employment to accumulate and exceed the initial disutility for self

employment over employment (decreasing the lower bound). Further, with a decreased final utility for self employment over employment it will take longer before the final disutility exceeds the utility for self employment over employment (increasing the upper bound). Therefore it is utility maximizing for this group of people to decrease the initial career stage of employment, decrease the final career stage of employment and increase the middle career stage of self employment.

CONCLUSION

In this article we offer a dynamic model of career choice between self employment and employment. The model acknowledges that people differ in terms of their attitudes (utility or disutility weights) towards job attributes and this impacts their career choice. The model further incorporates the knowledge that as people age their attributes change. Therefore, we argue that people differ in terms of their: (a) initial utility for self employment over employment, (b) initial utility from the assessment of the maximum difference in income for self employment over employment, (c) marginal reduction in utility for self employment over employment from aging and (d) final utility for self employment over employment. These differences between people result in different optimal career strategies. Five optimal career strategies were offered.

The model and its five career strategies make an important contribution to both the entrepreneurship and career literatures - - we now have an explanation for why people change from employment to self employment or self employment to employment and when this might occur.

While the emphasis on this paper has been the change of utility weights from aging, we believe that a career path is not predetermined - - utility weights can be changed by factors other than age. Attitudes can be learned and therefore those entities trying to encourage people to be self employed would be well advised to understand how utility weights change over time and also how education and other environmental factors can mold attitudes. Scholars can help increase our understanding in this area.

There is a number of other research opportunities that arise from the model presented in this article. First, the assumptions underlying the model are based on

intentions research that demonstrate attitudes effect intention and intentions influence behavior. However, it must be noted that while a person might have the utility weights that would suggest that it is utility maximizing to be self employed, they also need the opportunity and the resources to realize that intention. Therefore, the above model assumes that given an intention the necessary opportunity and resources are available. Future research can incorporate opportunity and resources into this dynamic model of career choice. For example, one aspect of ability could be opportunity recognition and as we mature our ability to perceive opportunities might increase. This increased ability to recognize opportunities will likely have an impact on a person's optimal career path.

Second, another assumption of the model is that income is higher for self employment than for employment. While this is often the case there are circumstances when a person might pursue a self employment opportunity that produces lower income than employment (e.g., lifestyle businesses). Under such circumstances the 'marginal utility' parabola becomes positive and is flipped over offering a different perspective on optimal career paths.

Finally, there is also an opportunity to empirically test this dynamic model. There are already well established surveys for capturing attitudes and intentions (e.g., Cable and Judge 1996). Such research could build on this model and further increase our understanding of how utility weights change over time and how this influences which career we choose and when. This represents an important research agenda for entrepreneurship and career scholars.

Appendix A - Optimal Employment Strategies

	$b^2-4ac=0$
	$b=-2a$
	$a+b+c=0$
	c
	a
	b
	(1c)
	(1b)
	(4)
	(5)
	(1d)
(a) $c < 0$	
	$a+b=0$
	(3a)
	(2a)
	(1a)
	a
	b
(b) $c = 0$	
	$b=-2a$
	(3b,c)
	a
	b
	(2b)
	$a+b+c=0$
(c) $c > 0$	

Appendix B - Sensitivity Analysis

We illustrate our derivations for the sensitivity analysis with the initial utility weight from income (γ_y). From the chain rule,

,

which is negative (so that $t^{**} = \ln(1/r_1)$ increases) if and only if

$$(B1)$$

Since for any parabola $f(x) = ax^2 + bx + c$ with roots r_1 and r_2 one has $-b/a = r_1 + r_2$ and $c/a = r_1 r_2$, (B1) holds whenever

Similarly,

,

which is positive (so that $t^* = \ln(1/r_2)$ decreases) if and only if

The remaining derivations are conducted in a similar fashion.

REFERENCES

- Alchian, A. A. and Demsetz, H. 1972. Production, information cause, and economic organization. *American Economic Review* 62:777-795.
- Bakshi, G. S. and Chen, Z. 1994. Baby boom, population aging, and capital markets. *Journal of Business* 67:165-202.
- Barreto, H. 1989. *The Entrepreneur in Microeconomic Theory: Disappearance and Explanation*. London: Routledge.
- Baumol, W. J. 1990. Entrepreneurship: Productive, unproductive, and destructive. *Journal of Political Economy* 98:893-921.
- Bird, B. 1989. *Entrepreneurial Behavior*. Glenview and London: Scott, Foresman and Company.
- Bird, B. and Jellinek, M. 1988. The operation of entrepreneurial intentions. *Entrepreneurship Theory and Practice* 13(2):21-29.
- Borjas, G. J. 1986. The demographic determinants of demand for black labor. In R. B. Freeman and H. J. Holzer, eds., *The Black Youth Employment Crisis*. Chicago: University of Chicago Press.
- Cable, D. M. and Judge, T. A. 1996. Person-organization fit, job choice decisions, and organizational entry. *Organizational Behavior and Human Decision Processes* 67:294-311.

Campbell, D. E. 1992. *Equity, Efficiency, and Social Choice*. Oxford: Oxford University Press.

Card, D. and Lemieux, T. 1996. Wage dispersion, returns to skill, and black-white wage differentials. *Journal of Econometrics* 74:319-361.

Carroll, G. R. and Mosakowski, E. 1987. The career dynamics of self-employment. *Administrative Science Quarterly* 32:570-589.

Douglas, E. J. and Shepherd, D. A. 1999. Entrepreneurship as a utility maximizing response. *Journal of Business Venturing* (forthcoming).

Duchesneau, D. A. and Gartner, W. B. 1990. A profile of new venture success and failure in an emerging industry. *Journal of Business Venturing* 5:297-312.

Eisenhauer, J. G. 1995. The entrepreneurial decision: Economic theory and empirical evidence. *Entrepreneurship Theory and Practice* 19(4):67-79.

Furnham, A. and Koritsas, E. 1990. The Protestant Work Ethic and Vocational Preference. *Journal of Organizational Behavior* 11(1): 43-55.

Gifford, S. 1993. Heterogeneous ability, career choice, and firm size. *Small Business Economics* 5:249-259.

Hayes, R. M. and Schaefer, S. 1999. How much are differences in managerial ability worth? *Journal of Accounting and Economics* 27(2): 125-148.

- Heath, C. and Tversky, A. 1991. Preference and belief: Ambiguity and competence in choice under uncertainty. *Journal of Risk and Uncertainty* 4:5-28.
- Herbert, R. and Link, A. 1988. *The Entrepreneur--Mainstream Views and Radical Critiques* (2nd ed.). New York: Praeger.
- Holmes, T. J. and Schmitz, J. A. Jr. 1990. A theory of entrepreneurship and its application to the study of business transfer. *Journal of Political Economy* 98:265-294.
- Katz, J. A. 1994. Modeling entrepreneurial career progressions: Concepts and considerations. *Entrepreneurship Theory and Practice* 19(2):23-40.
- Lee, R. and Wilbur, E. R. 1985. Age, education, job tenure, salary, job characteristics, and job satisfaction: A multivariate analysis. *Human Relations* 38:781-791.
- Lévesque, M. and MacCrimmon, K. R. 1997. On the interaction of time and money invested in new ventures. *Entrepreneurship Theory and Practice* 22(2):89-110.
- MacDonald, G. 1984. New directions in the economic theory of agency. *Canadian Journal of Economics* 17:415-440.
- Manser, M. E. and Picot, G. 1999. The role of self-employment in U.S. and Canadian job growth. *Monthly Labor Review* 122(4):10-25.
- Morin, R. A. and Suarez, F. 1983. Risk aversion revisited. *Journal of Finance* 38:1201-1216.

- Mumpower, J. L., Phillips, L. D., Renn, O. and Uppuluri, V. R. R. 1987. *Expert Judgment and Expert Systems*. Berlin: Springer-Verlag.
- Palsson, A. .M. 1996. Does the degree of relative risk aversion vary with household characteristics? *Journal of Economic Psychology* 17(6): 771-787.
- Proenca, E. J. and Shewchuk, R.M. 1998. Are older workers really different? The effects of age, tenure, and education on work preferences of registered nurses. *International Journal of Public Administration* 21(11): 1603-1627.
- Schwartz, S. and Griffin, T. 1986. *Medical Thinking: The Psychology of Medical Judgement and Decision Making*. New York: Springer-Verlag.
- Stevenson, H. H. and Jarillo, J. C. 1990. A paradigm of entrepreneurship: Entrepreneurial management. *Strategic Management Journal* 11:17-27.
- White, H. C. 1970. *Chains of Opportunity*. Cambridge, MA: Harvard University Press.
- Wright, E. O. and Perrone, L. 1977. Marxist class categories and income inequality. *American Sociological Review* 42:32-55.

Table 1 Optimal Employment Strategies

$b^2 - 4ac < 0$		Career: employment at any age (1c)		
$b^2 - 4ac \geq 0$		r_1		
		≤ 0	$\in (0,1)$	≥ 1
r_2	≤ 0	<p>Conditions: • $c=0$ and $b \leq 0$ (1a); or</p> <p>• $c < 0$ and $b < 0$ (1b)</p> <p>Career: employment at any age</p>		
	$\in (0,1)$	<p>Conditions: • $c=0, b > 0$ and $a+b < 0$ (2a); or</p> <p>• $c > 0, b < -2a$ and $a+b+c < 0$ (2b)</p> <p>Career: employment on $(0, t^*)$, self employment otherwise, where $t^* = \ln(1/r_2)$</p>	<p>Conditions: $c < 0, 0 < b < -2a$ and $a+b+c < 0$ (4)</p> <p>Career: self employment on (t^*, t^{**}), employment otherwise, where $t^* = \ln(1/r_2)$ and $t^{**} = \ln(1/r_1)$</p>	
	≥ 1	<p>Conditions: • $c=0$ and $a+b \geq 0$ (3a); or</p> <p>• $c > 0$ and $b \geq -2a$ (3b); or</p> <p>• $c > 0, b < -2a$, and $a+b+c \geq 0$ (3c)</p> <p>Career: self employment at any age</p>	<p>Conditions: $c < 0, b > 0$ and $a+b+c > 0$ (5)</p> <p>Career: self employment on $(0, t^{**})$, employment otherwise, where $t^{**} = \ln(1/r_1)$</p>	<p>Conditions: $b > -2a$ and $a+b+c \leq 0$ (1d)</p> <p>Career: employment at any age</p>

Marginal Utility Parabolas

1
 ΔU
 e^{-t}
 e^{-t}
 ΔU
1
 e^{-t}
 ΔU
1
1
 ΔU
 e^{-t}
 e^{-t}
 ΔU
1
 e^{-t}
 ΔU
1

Figure 1
Figure 2
Figure 3
Figure 4
Figure 5
Figure 6

1
 ΔU
 e^{-t}
 e^{-t}
 ΔU
1
 e^{-t}
 ΔU
1
1
 ΔU
 e^{-t}
 e^{-t}
 ΔU
1

Figure 7
Figure 8
Figure 9
Figure 10
Figure 11