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Locus of Control in the Labor Market

How Subjective Perceptions Affect the Unemployment Rate

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“Let’s not pretend that things will change if we keep doing the same things.

A crisis can be a real blessing to any person, to any nation.

For all crises bring progress.

Creativity is born from anguish, just like the day is born from the dark night.

It’s in crisis that inventiveness is born, as well as discoveries made and big strategies. He who overcomes crisis, overcomes himself, without getting overcome. He who blames his failure to a crisis neglects his own talent and is more interested in problems than in solutions. Incompetence is the true crisis. The greatest inconvenience of people and nations is the laziness with which they attempt to find the solutions to their problems.

There’s no challenge without a crisis.

Without challenges, life becomes a routine, a slow agony.

There’s no merit without crisis. It’s in the crisis where we can show the very best in us. Without a crisis, any wind becomes a tender touch. To speak about a crisis is to promote it. Not to speak about it is to exalt conformism.

Let us work hard instead. Let us stop, once and for all, the menacing crisis that represents the tragedy of not being willing to overcome it.”

Albert Einstein

Locus of Control in the Labor Market: How Subjective Perceptions Affect the Unemployment Rate

Luciana Julia Pace

Abstract

This paper introduces the psychological concept of *Locus of Control* into the model developed by Pissarides (2000). It does so by recognizing an explicit relationship between the effort exerted by an individual who is looking for a job and the extent to which he or she believes to have control over daily occurrences. This framework implies that individuals with an internal locus of control are more inclined to put higher effort in the search process, which increases their opportunities to exit unemployment compared to their external counterparts, who believe their actions have little effects on life outcomes. Inspired by the job search model of Caliendo et al. (2015b), we provide a theoretical model in a dynamic general equilibrium setting, where both sides of the market interact. However, while the effort provided is higher, we also predict that an increase in the subjective beliefs about the impact of one's search will result in a slacker labor market, which decreases the exit rate out of unemployment. The resulting effect on the unemployment level is theoretically ambiguous, but is found to be overall positive when performing a numerical exercise.

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1 Introduction

Recently, labor economists have been interested in applying insights from psychology about social preferences, personality and individual beliefs in the analysis of labor market. Extending the nature of human motivations beyond the confines of standard assumptions in economics, such as rational preferences and perfect information, allows to integrate psychological motives into the theoretical economic framework. In the attempt to reframe theoretical and empirical models, an important strand of literature has focused attention on the role of non-cognitive skills, namely those abilities related to motivation, self-esteem and interpersonal interactions that are considered at least as valuable as cognitive skills for both individual development and labour market success. Judge et al. (2001), for instance, demonstrated that the core self-evaluation traits are related with job satisfaction and job performance, two central concepts both in economics and psychology. More recently, Becker et al. (2012) show that social preferences (reciprocity, trust and altruism) and measures of personality (locus of control and the Big Five) have complementary predictive power in explaining a wide range of life outcomes, such as unemployment, earnings, health, education and life satisfaction. Detailed information on the core self-evaluation traits and on the Big Five Model can be found in the following frame box.

Core self-evaluation refers to the fundamental assessment each individual has about himself and his self-worth and is characterized by four elements, defined by Judge et al. (2001) as:

1. Self-esteem: overall value that one places on oneself as a person;
2. Generalized self-efficacy: self estimate of own ability to cope, perform and be successful;
3. Emotional stability: tendency to be confident, secure and steady;
4. Locus of control: degree of control that one believes to have on external factors.

The Five-Factor Model, also known as Big Five Model, is a broadly accepted taxonomy of personality traits in the empirical economics literature, whose domains at the highest level of organization are:

1. Agreeableness: the tendency to act in a cooperative, unselfish manner;
2. Conscientiousness: the tendency to be organized, responsible and hardworking;

3. Neuroticism: a chronic level of emotional instability and proneness to psychological distress;
4. Extraversion: the orientation of one's interests and energies toward the outer-world of people and things rather than the inner-world of subjective experience;
5. Openness: the tendency to be open to new aesthetic, cultural and intellectual experiences.

Each of these factors is considered *big* in the sense that incorporates several other dimensions of more narrowly defined personal attributes. These definitions are reproduced from Becker et al. (2012).

Within economics, a growing body of literature has devoted considerable attention to the personality construct of the locus of control as a mean for understanding a wide range of individual decisions. This concept sinks its roots in the second half of the 20th century and has conceptual links with both motivation and self-control. As conceived by Rotter (1966), the locus of control reflects the degree to which individuals perceive success or failure as being dependant on their own actions (i.e. an internal locus of control), as opposed to perceiving themselves in a passive role with regard to the external environment (i.e. an external locus of control). It is measured by Rotter using a scale of 29 items which do not directly address the preference for internal or external control, but rather measure a generalize expectancy that “may correlate with the value the subject place on internal control” (Rotter, 1996). This scale is summarized in Table 1 in the Appendix. Psychologists usually adopt measures of locus of control that vary according to the domain of interest (i.e. health, work, finance), while economists often rely on a much general measure of perceived control, according to the availability of the data. Although this approach to measurement lacks a certain degree of complexity, it allowed a vast body of work to emerge (Cobb-Clark, 2015).

Many researchers have long recognised the relationship between personality traits and labor market, and recently the role played by the locus of control has been intensively investigated in a variety of settings, among which labor market success, human capital investments and hiring decisions¹. For instance, Becker et al. (2012) find an internal locus

¹For an extensive review of the literature, see Cobb-Clark (2015).

of control to be strongly predictive (at the 1% level) for being employed, wealthy, educated, healthy and satisfied in life, even after controlling for risk and time preferences. It is easy to envision that having an internal locus of control, that is, perceiving a causal link between own actions and what happens afterwards, increases the potential for economic success. Ample evidence shows that internal individuals have higher levels of job motivation, job performance, job satisfaction, and leadership (Spector, 1982); moreover they have more favourable core-self evaluations (Judge et al., 1998) and generate better well-being (Ng et al., 2006). However, it is worth noting that having an internal locus of control is not always a positive attribute in the workplace (Cobb-Clark, 2015). Indeed, employees with this type of personality are less likely to conform with co-workers, respect rules and respond to their superiors.

Our research is motivated by the awareness that individuals differ with respect to economic preferences and personality traits, and therefore make different decisions concerning the kind of occupation they want to obtain and how much to invest in job search, in accordance with the fact that human nature is psychologically more complex and complete than the one depicted by mainstream economics. In the present study, we formally investigate the interplay between beliefs and effort provision of the job-seekers in an equilibrium matching framework. We do so by extending the standard Pissarides (2000) model for endogenous search intensity and locus of control. These extensions are crucial in so far as they allow a much accurate analysis of workers' behaviour. Specifically, we draw inspiration from the paper of Caliendo et. al (2015b), according to which individuals' beliefs affect the job offer arrival rate through the search behaviour. Using a partial equilibrium model, they predict job-seekers with a more internal locus of control to search harder, as they have higher returns to search effort. Furthermore, the authors provide empirical evidence that internal job-seekers have higher reservation wages, provide more effort and believe to receive a higher number of offers in the future period.

The aim of this study is to analyze how changes in the locus of control affect the equilibrium outcomes in a general equilibrium setting and illustrate the subsequent implications on the unemployment rate. Such route is promising since it allows to explore

additional channels that are ignored by partial equilibrium analysis. In particular, we are able to disentangle the effect that individuals' subjective beliefs provoke on job search effort from the one on labor market tightness and, consequently, on the exit rate out of unemployment. This mechanism results from the interaction between workers and firms and is of paramount importance when studying the indirect response of the unemployment rate to changes in individuals' behavior on the labor market. Therefore, our main variables of interests throughout the analysis are the effort level, market tightness and the unemployment rate.

We begin by investigating the interplay between locus of control, effort and exit rate out of unemployment, questioning the result of Caliendo et. al (2015b) in a context where firms are assumed to have perfect information, while workers are assumed to have subjective beliefs about the returns to search. These beliefs depend on their locus of control. We provide two different theoretical frameworks, according to the impact of individuals beliefs on search effort. The *baseline model* predicts that internal workers will be more inclined to put higher effort in the search process with respect to their external counterparts because their subjective utility is higher. However, this does not lead to a higher arrival rate of job offers. On the contrary, since an increase in the subjective beliefs about the impact of one's search results in a slacker labor market, the exit rate out of unemployment decreases. The *alternative model*, instead, predicts job-seekers' beliefs to affect the exit rate independently of search effort. As all individuals provide the same level of effort but internal ones expect higher returns, labor market tightness decreases and so does the arrival rate. Then, we analyze the implications of locus of control on the unemployment rate. The result for the baseline model is theoretically ambiguous, because two competing effects arise: a positive one induced by effort, which reduces the unemployment level, and a negative one induced by tightness, which increases the overall unemployment rate. However, when simulating the theoretical model, we find that the beneficial effect of effort strongly prevails, although its magnitude is reduced as locus of control increases. The alternative model, instead, predicts a clear-cut increase in unemployment for workers with an internal locus of control.

The remainder of this paper proceeds as follows. Next section presents the psychological and the economic literature related to this concept. Section 3 introduces and develops a matching model in which search effort is endogenous and locus of control drives individuals' subjective beliefs about the effect of search effort on the exit rate out of unemployment. In Section 4 we analyse the labor market equilibrium, while the alternative theoretical model is provided in Section 5. Section 6 considers the relation between locus of control and the unemployment rate and provides a numerical simulation of the model. Finally, section 7 concludes.

2 Related Literature

2.1 A Psychological Concept

“A generalized attitude, belief, or expectancy regarding the nature of the causal relationship between one’s own behavior and its consequences might affect a variety of behavioral choices in a broad band of life situations.” Rotter (1996)

The *Locus of Control* construct was firstly introduced within the framework of the social learning theory of personality (Rotter, 1954), which shed light on the pivotal roles of modeling² and reinforcement. It assesses how much individuals believe to have control over their life outcomes and over the environment. Such cognitive-based construct helped reinterpret behavioural problems that had been earlier attributed to faulty motivation (Lefcourt, 1992).

In his dissertation on the Generalized Expectancies for Internal versus External Control of Reinforcement (1996), the American psychologist Julian B. Rotter recognizes the crucial role of reinforcement, reward or gratification in the acquisition of skills and consciousness. Particularly, he considers determinant how individuals perceive such reinforcement or reward as contingent upon their own behaviour or independent of it, namely whether they recognize the existence of a causal relationship between actions (behaviour) and

²Modelling is a form of observational learning that does not need reinforcement, but occurs through observing the behaviour of other individuals, considered indeed social models.

consequences (reward). At the extremes, there are two dimensions of awareness. On the one hand, individuals who believe life outcomes to be at least partly dependent on their own initiative or personal skills are said to have an *internal control*. On the other hand, those who perceive reinforcement as the result of luck, chance or other external forces have an *external control*. They tend to consider what happens relatively beyond their management, while the formers consider themselves as masters of their success.

According to Rotter, the mechanism of reinforcement operates by strengthening the expectancy that a particular behaviour or event will be followed by the same reinforcement at a future time. The expectancy is reduced in case the reinforcement fails to occur. Following this logic, Rotter argues that individuals would differ in the extent they perceive reinforcement to be dependent on their own actions. When they believe that reinforcement is indeed contingent upon their behaviour, then the same behaviour is expected to occur (not occur) in a similar situation in case there is a positive (negative) reinforcement. On the contrary, if reinforcement is considered external, then their behaviour is less likely to be reinforced at all. What is more, individuals with an internal locus of control tend to value reinforcement for skills more than luck, while those who are likely to have an external control do not significantly differentiate the two spheres. These beliefs regarding the internal versus external nature of reinforcement constitute a personality trait. Indeed, while control beliefs might partly arise from social circumstances, “some people have the dispositional tendency to believe that they have more control over the external environment than others” (Ng et al., 2006).

2.2 Locus of Control and Economic Implications

This article builds on several existing bodies of the literature. A first one investigates the effect of non-cognitive skills on labor market outcomes. Using the Rotter scale, Osborne Groves (2005) shows that earnings of US females are negatively related to externality, while Semykina and Linz (2007) find a positive association between females earning and an internal locus of control in Russia. This triggered the interest in exploring empirical associations that might justify success on the workplace. To this purpose, Heineck and Anger

(2010) provide the first joint analysis on personality traits, cognitive skills and earnings in Germany, underlining the great importance of an external locus of control in explaining wage penalties for both men and women. They find substantial wage differentials between individuals with high and low external locus of control. Finally, some authors assess data from the German Socio-Economic Panel (SOEP) to establish that internality is associated with higher probability of reemployment (Gallo et al., 2003), less unemployment risk (Blázquez Cuesta et Budria, 2012) as well as higher propensity to become entrepreneurs (Caliendo et al., 2014).

A second strand of literature delves into the underlying mechanism that relates locus of control and returns to investment decisions. An influential empirical study in this field is conducted by Coleman and DeLeire (2003), who examine the effect of teenagers' locus of control on their educational investment decisions using the National Education Longitudinal Study (NELS). Interestingly, their results suggest that the locus of control operates by altering expectations of the return to investment in human capital. Specifically, they find that teenagers with an internal locus of control believe to have higher probability of earning more when receiving a high-school diploma and going to college with respect to their external peers. Differently, using the National Longitudinal Survey of Youth (NLSY), Cebi (2007) fails to address the prediction that locus of control affects educational attainment, once cognitive ability is controlled for. Nonetheless, her results show that having an internal locus of control is rewarded in the labor market at a later point in life. Finally, Piatek and Pinger (2016) find that the effect of locus of control on wages merely operates through schooling. In their empirical analysis, they observe that an individual's pre-market locus of control, namely a measure for locus of control independent of labor market experience, raises substantially the probability of choosing higher education.

More recent studies have assessed the idea that the notion of locus of control can bias transitions into employment through individual's beliefs about the returns to job search. McGee (2015) makes an attempt to disentangle the intrinsic effects of locus of control from the ones induced by human capital formation. First, he assumes that locus

of control influences beliefs about the arrival rate of job offers conditional on search effort. Then, he provides empirical evidence that unemployed males in the US endowed with an internal locus of control set higher reservation wages and exert more effort when looking for a job. Even if he is not able to measure individuals' beliefs about the payoff of searching directly, he estimates job-seekers' probability to receive an offer conditional on having made a contact with the employee. He concludes that, when converting job effort into offers and finding employment, there is no compelling evidence of a difference between workers with an internal and an external locus. Following this lead, Caliendo, Cobb-Clark and Uhlendorff (2015b) develop two competing models relating locus of control with search behaviour. In the first one, locus of control drives individual perceptions about the return to search through the job offer arrival rate, predicting higher search intensity and higher reservation wage for internal individuals. In the second model, the influence of locus of control on the arrival rate of job offers is independent of search effort, revealing that individuals will engage in less job search. Interestingly, the authors provide direct empirical evidence that locus of control affects beliefs on the return to search, with the result that internal unemployed workers believe each additional application to increase their probability of receiving an offer by more than their external counterparts. Both studies are consistent with a laboratory experiment conducted by McGee and McGee (2016). They find that subjects who are not aware of the relationship between search effort and search outcomes show the presence of an interaction between locus of control and returns to job search. By contrast, when full information about the search process is provided, neither reservation wages nor search effort are found to be affected by personal beliefs.

Finally, it is interesting to see how the research agenda on locus of control is currently evolving. In a paper under discussion (2015a), Caliendo, Cobb-Clark and Uhlendorff, together with Hennecke, expand their model of job search and locus of control to account for migration decisions. They adopt the same behavioural approach to model job search as in their previous work, but characterize effort as a geographic distance instead of the number of applications sent. They find that individuals with an internal locus of control

have a higher propensity to migrate across regions but also to migrate more frequently in general, and that such behaviour results from a successful job search.

Heywood et al. (2016) join the literature examining the relation between personal characteristics and performance pay, investigating three different hypotheses. The first one is that workers with an internal locus of control sort into jobs with performance appraisal, especially when such appraisal has financial implications. The second one implies that this happens because more internal workers expect to perform better and, consequently, receive a positive feedback, which reinforces their motivation and self-esteem. The third one assumes that the interaction between locus of control and risk tolerance varies the propensity of workers to sort into jobs with performance appraisal. Their empirical results show that, depending on the cultural context, both extrinsic rewards and intrinsic motivation contribute to the sorting into jobs with performance appraisal.

A last relevant contribution of Caliendo et al. (2016) relates locus of control and training investment decisions, underlining the importance of personality traits in the design of training programs. Their model predicts internal workers to engage more in general but not in specific training, since their personal returns to investment from general training are higher than the ones of external workers but returns to specific training mostly accrue to the firms. Moreover, evidence shows that locus of control influences participation in general training by changing expectations on future wage distribution; the same does not hold true in the case of specific learning.

This summary suggests that the perception individuals have about their own returns to education, job search, internal migration and work-related training is critical in understanding their behaviour within the labor market.

3 The Model

3.1 The Matching Technology with Search Intensity

As in the standard matching model *à la Pissarides*, there is a continuum of infinitely-lived risk neutral homogeneous workers and firm owners. In this setting, however, the

homogeneous workforce is endowed with a unique exogenous attribute, the locus of control, incorporating individuals' subjective beliefs about their return to search effort. Search intensity is endogenous (Chapter 5 of Pissarides, 2000; Lehmann and Van der Linden, 2006).

Only two goods are present in the economy: a good produced by the firms and sold in a competitive market, which is the *numeraire*; and labor, the unique factor of production. There is an exogenous and strictly positive discount rate r homogeneous across agents, at which firms can borrow and lend from perfect capital markets. Time is continuous and normalized to one. Each firm is made of a single vacant or filled job and the number of jobs is endogenous. At the beginning, all workers are unemployed and search for a job. By assumption there is no on-the-job search, so that the only job applicants are unemployed individuals. Vacant jobs and unemployed workers are paired through an imperfect and random matching process. This process reproduces the instantaneous flow of hires H at a given date and is formalized by a matching function, which relates total contacts per unit of time to the seekers on each side of the market.

Let e_i be an indicator of the effort which individual i puts into his job search. The intensity of search of the representative worker is the market average $\bar{e} = e$, since in a symmetric equilibrium everyone chooses the same level of effort and has no incentive to deviate³. The number of employer–worker contacts⁴ per unit of time is given by:

$$H = M(V, eU) \geq 0$$

where $V \geq 0$ and $U \geq 0$ designate respectively the stock of vacant jobs and the stock of persons looking for work, i.e. the unemployed persons. The matching function $M(\cdot, \cdot)$ is strictly increasing and concave with respect to each of its argument, twice continuously differentiable and linearly homogeneous. As standard in the literature, it is assumed to have constant returns to scale. Moreover, at least one job and one applicant are needed

³Note that the probability for individual i to find a job is $\frac{e_i M(v, \bar{e}U)}{\bar{e}U}$, so that his opportunities increase the higher his relative level of effort: $\frac{e_i}{\bar{e}}$.

⁴A contact does not necessarily lead to a new hire.

for a match to occur:

$$M(0, eU) = M(V, 0) = 0$$

The parameter θ is a measure of the *tightness* present in the labor market, which equals the ratio of the number of vacant positions to the number of unemployed workers providing the average level of effort

$$\theta \equiv \frac{V}{eU}$$

The probability per unit of time for a vacant job to meet an unemployed worker is a direct function⁵ of the labor market tightness θ and is defined as:

$$\frac{M(V, eU)}{V} = M\left(1, \frac{eU}{V}\right) = m(\theta)$$

with $m'(\cdot) < 0$. Similarly, the rate at which a job seeker, weighted by his effort, meets a vacancy is:

$$\frac{M(V, eU)}{eU} = \frac{V}{eU} \frac{M(V, eU)}{V} = \theta m(\theta) = p(\theta)$$

with $p'(\theta) > 0$. Hence, while vacant jobs are filled at a diminishing rate with respect to labor market tightness, the exit rate is increasing in θ . As standard, we assume the following Inada conditions:

$$\begin{aligned} \lim_{\theta \rightarrow 0} m(\theta) &= +\infty & \text{and} & & \lim_{\theta \rightarrow +\infty} m(\theta) &= 0 \\ \lim_{\theta \rightarrow 0} p(\theta) &= 0 & \text{and} & & \lim_{\theta \rightarrow +\infty} p(\theta) &= +\infty \end{aligned}$$

3.2 The Beveridge Curve

In the theory of the search and matching model, where workers and firms engage in a costly search to find a random matching, the steady state is depicted by the Beveridge curve. It represents a downward sloping locus of the unemployment-vacancy combinations in the (u, v) space. The size of the labour force is normalized to 1. The dynamic level of unemployment, $\dot{U} = \frac{dU}{dt}$, is defined as the flows of individuals who lose their jobs minus the flows of individual who find a new job by exerting a level of effort e :

$$\dot{U} = qL - e\theta m(\theta)U$$

⁵This result follows from the linear homogeneity of the matching function.

where $L = 1 - U$ is the stock of unemployed persons and q is the job destruction rate. By the law of large numbers,

$$\dot{u} = q(1 - u) - \theta m(\theta)eu$$

In steady state $\dot{u} = 0$, therefore the matching is generated by the equilibrium between inflows into unemployment and outflows from it. Recalling that $\theta = \frac{v}{eu}$, the stationary value of the unemployment rate can be expressed as:

$$u = \frac{q}{q + e\left(\frac{v}{eu}\right)m\left(\frac{v}{eu}\right)} \quad (3.1)$$

The decreasing and convex curve in Figure 1 is the Beveridge curve, which shows the equilibrium relationship between the vacancy rate v and the unemployment rate u . Generally speaking, the position of the economy on the Beveridge curve defines the state of the labor market, where vacancies and unemployment coexist: a high level of vacancies and a low level of unemployment indicate a tight market, whereas the opposite situation is suggestive of a slack labor market.

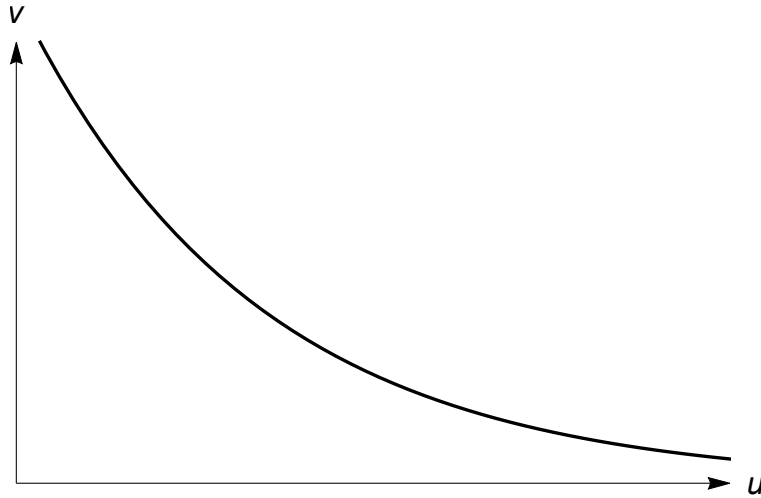


Figure 1: The Beveridge Curve: relationship between v and u

When search effort is accounted for, the following statements help characterize the Beveridge curve.

Proposition 1. *The negative relationship between vacancies and unemployment rate persists at any given level of effort.*

Proposition 2. *When search effort increases, since unemployed individuals search jobs more intensively, the matching increases and so does the job finding rate. This implies that, at any given number of vacancies, the unemployment level decreases.*

Proof. Totally differentiating equation (3.1) with respect to u , v and e :

$$\underbrace{\left[q - \frac{v^2}{eu^2} m'(\theta) \right]}_{>0} du + \underbrace{\left[m(\theta) + \frac{v}{eu} m'(\theta) \right]}_{m(\theta)[1-\eta(\theta)]>0} dv + \underbrace{\left[-\frac{v^2}{e^2u} m'(\theta) \right]}_{>0} de = 0$$

where $\eta(\theta) = \left(-\frac{m'(\theta)}{m(\theta)} \frac{v}{eu} \right)$, $|\eta(\theta)| < 1$, is the elasticity of the rate m of filling a vacancy with respect to tightness θ . It follows that, at any given level of effort:

$$\frac{du}{dv} = -\frac{m(\theta) + \frac{v}{eu} m'(\theta)}{q - \frac{v^2}{eu^2} m'(\theta)} < 0$$

and, at any given number of vacancies:

$$\frac{du}{de} = \frac{\frac{v^2}{e^2u} m'(\theta)}{q - \frac{v^2}{eu^2} m'(\theta)} < 0$$

□

3.3 The Role of Locus of Control in Job Creation

In this section we advance the notion of locus of control. While in the standard setting the unemployed person is able to predict perfectly the probability of exiting unemployment, in the current context we introduce a personal belief, denoted by $p^*(e, \theta, loc)$, about how his own effort e can affect such probability, which partly depends on one's locus of control, denoted by loc .

As common in the literature, higher values of locus of control are associated with internality. Indeed, the higher the loc , the more an individual perceives himself as internal and, as such, believes to have more opportunities of becoming employed by increasing his search effort. On the other hand, individuals with an external locus of control do not believe in their own ability to shape future outcomes and, therefore, have a lower level of confidence and are not willing to provide a lot of effort.

We model this dichotomy by adopting a multiplicative specification for the relationship between the perceived probability of exiting unemployment and the locus of control:

$$p^*(e, \theta, loc) = e\theta m(\theta) * f(loc)$$

where $loc \in [0, 1]$, $f(loc)$ is positive and increasing with locus of control and $f(0) = 0$. When $loc = 0$, the individual is completely external and his expectations of finding a job only rely on luck and other people since he does not put any level of effort in job search, $e = 0$. On the contrary, when $loc = 1$, the individual is completely internal and expects to find a job with probability one, providing his maximum level of effort. We further assume that for individuals with a more internal locus of control, $\frac{\partial p^*(e, \theta, loc)}{\partial e}$ has a relatively higher value with respect to more external individuals, that is, the expected marginal returns to search are increasing with locus of control: $\frac{\partial^2 p^*(e, \theta, loc)}{\partial e \partial loc} > 0$.

3.3.1 Workers

Let V_e and V_u denote respectively the expected utility of an employed and unemployed worker, with $V_u \leq V_e$. When employed, each worker gets a real wage $w > 0$ per unit of time. Jobs are destroyed with probability $q > 0$ per unit of time. The cost of effort in employment is ideally normalized to 0. At stationary equilibrium, it holds:

$$rV_e = w + q(V_u - V_e) \quad (3.2)$$

Each unemployed worker receives unemployment benefits b and faces various costs $c(e)$ attached to searching for a job (commuting, extra-training, time spent sending applications). Such costs are increasing in search effort and convex, that is $c'(\cdot) > 0$ and $c''(\cdot) > 0$, with $c(0) = 0$, so that higher search effort will result in a lower net gain, $b - c(e)$ ⁶. The level of effort chosen by the agent maximises the *subjectively perceived* discounted expected utility when unemployed:

$$\begin{aligned} rV_u &= \max_e b - c(e) + p^*(e, \theta, loc)(V_e - V_u) \\ &= \max_e b - c(e) + e\theta m(\theta)f(loc)(V_e - V_u) \end{aligned} \quad (3.3)$$

The discounted lifetime utility in unemployment, for a given level of effort and a given market tightness, depends on one's perceived sense of control. At a given $(V_e - V_u)$, the optimal level of effort e^* satisfies:

$$c'(e^*) = \theta m(\theta)f(loc)(V_e - V_u) \quad (3.4)$$

⁶Note also that $\lim_{e \rightarrow 0} c'(e) = 0$ and $\lim_{e \rightarrow +\infty} c'(e) = +\infty$.

Equation (3.4) implies that unemployed workers choose their optimal level of effort by equating the perceived marginal cost of search, on the left hand side, to the perceived marginal benefit associated with additional search, on the right hand side.

3.3.2 Firms

Posting vacancies for firms costs $h > 0$ per unit of time, whereas filled jobs produce $y > 0$ units of the numeraire good per unit of time. At every instant, a firm's real discounted expected return from a vacant job is given by Π_v , while the real discounted expected return from an occupied job is Π_e . In steady state, the following standard Bellman equations hold:

$$r\Pi_e = y - w + q(\Pi_v - \Pi_e) \quad (3.5)$$

$$r\Pi_v = -h + m(\theta)(\Pi_e - \Pi_v) \quad (3.6)$$

New entrepreneurs will enter the labor market until the expected profit from a vacant job becomes zero, $\Pi_v = 0$ ⁷. When this free entry condition is satisfied, the previous equations can be respectively expressed as:

$$\Pi_e = \frac{y - w}{r + q} \quad (3.7)$$

$$\Pi_e = \frac{h}{m(\theta)} \quad (3.8)$$

Equalizing these values of Π_e determines the *labor market demand*, where the average cost of a vacant job, on the left hand side, equals the expected profits from a filled job, on the right hand side:

$$\frac{h}{m(\theta)} = \frac{y - w}{r + q} \Leftrightarrow w = y - \frac{h(r + q)}{m(\theta)} \quad (3.9)$$

This equation portrays a downward sloping relationship between wage w and labor market tightness θ . As wage increases, the value of a filled job decreases and, as a consequence, the number of vacancies and tightness decrease as well. It is worth noting that the labor demand is unaffected by the locus of control, the latter being an attribute that defines workers only.

⁷Note that solving the system of equations (3.5) and (3.6) yields an expression for Π_v which is decreasing in θ . The Inada conditions guarantee that: $\lim_{\theta \rightarrow 0} \Pi_v > 0$ and $\lim_{\theta \rightarrow +\infty} \Pi_v < 0$.

3.4 Ex-post Wage Bargaining

Matching frictions make it costly for the firm and the worker to find a partner. When a successful match occurs, the disposable rent is shared between the parts according to their relative bargaining power. We assume that, in a Nash bargaining process⁸, the unemployed worker bargains with his subjective lifetime utility as a relevant subjective fall-back position.

Let γ be the exogenous bargaining power of the worker, with $0 \leq \gamma \leq 1$. The value of the wage negotiated at each moment is the solution to the following Nash product maximization:

$$\max_w (V_e - V_u)^\gamma (\Pi_e - \Pi_v)^{(1-\gamma)} \quad (3.10)$$

The first-order condition of this problem is:

$$\frac{\gamma}{V_e - V_u} = \frac{1 - \gamma}{\Pi_e - \Pi_v} \quad (3.11)$$

Recall that, from equations (3.2) and (3.5), we respectively obtain:

$$V_e - V_u = \frac{w - rV_u}{r + q} \quad \text{and} \quad \Pi_e - \Pi_v = \frac{y - w - r\Pi_v}{r + q}$$

Substituting these values into equation (3.11), whilst the free entry condition is satisfied, it is possible to find the following expression for wages:

$$w = rV_u + \gamma(y - rV_u) \quad (3.12)$$

We now proceed with the approach used by Pissarides (2000) to relate wages with the other parameters of the model. First, we substitute the value $(V_e - V_u)$ obtained from equation (3.11), under free entry, in (3.3):

$$rV_u = b - c(e) + e\theta m(\theta) f(\text{loc}) \frac{\gamma}{1 - \gamma} \Pi_e \quad (3.13)$$

Then, we substitute the expected return from an occupied job given by equation (3.8):

$$rV_u = b - c(e) + e\theta f(\text{loc}) \frac{\gamma}{1 - \gamma} h \quad (3.14)$$

⁸The wage in the bargaining set is selected through an axiomatic Nash bargaining (Nash, 1953).

Finally, we use (3.14) into equation (3.12) to obtain the following *wage curve*:

$$w = (1 - \gamma)(b - c(e)) + \gamma[y + ef(loc)\theta h] \quad (3.15)$$

Combining the wage curve and the labor demand to get rid of w yields:

$$\frac{h}{m(\theta)} = \frac{(1 - \gamma)[y - (b - c(e))]}{[r + q + \theta m(\theta)\gamma ef(loc)]} \quad (3.16)$$

The left hand side of this equation is increasing with θ and represents the expected cost of a vacant job, which equals the instantaneous cost h of posting a vacancy multiplied by the average filling duration $\frac{1}{m(\theta)}$. The right hand side is instead decreasing with θ and refers to the expected profit of a successful match between a vacancy and an unemployed worker, once wages are bargained over.

4 Labor Market Equilibrium

Having defined the outcome of the wage bargain, we can derive the set of equations that define the endogenous variables in equilibrium. Equation (3.16) and the optimal effort condition (3.4)⁹ can be implicitly rewritten as:

$$F(e, \theta, loc) \equiv (1 - \gamma)[y - (b - c(e))] - \gamma ef(loc)\theta h - \frac{h(r + q)}{m(\theta)} = 0 \quad (4.1)$$

$$G(e, \theta, loc) \equiv c'(e) - f(loc)\theta h \frac{\gamma}{1 - \gamma} = 0 \quad (4.2)$$

In the current section we illustrate the behaviour of these two functions in the (e, θ) space. Our goal is to explore the effects of individuals' beliefs on labor market tightness and on the optimal level of effort, to achieve a deep understanding of how the equilibrium point is affected by an increase in the locus of control. The first step is to analyze analytically and graphically the shape of equations (4.1) and (4.2), depicted in Figure 2.

Proposition 3. *Equation $G(e, \theta, loc)$ is upward-sloping in the (e, θ) plane.*

⁹We have used the same substitutions as for equation (3.14).

Proof. By the implicit function theorem, it follows that:

$$\begin{aligned} \frac{d\theta}{de} &= - \frac{dG(e, \theta, loc)/de}{dG(e, \theta, loc)/d\theta} \\ &= \frac{\overbrace{c''(e)}^{>0}}{\underbrace{f(loc)h \frac{\gamma}{1-\gamma}}_{>0}} > 0 \end{aligned}$$

All the terms on the right hand side are positive, implying that tightness positively depends on search effort. Intuitively, rising the labor market tightness determines, on the one hand, an increase in the unemployment exit rate and, on the other hand, a decrease in the probability of filling a vacancy, which results in higher returns from an occupied job and, through wage bargaining, in a higher rent for the employee ($V_e - V_u$). As a consequence, the job-seeker has more incentives to search harder and the level of effort increases. This, in turn, increases the marginal cost of search.

In order to draw equation (4.2) in the (e, θ) space, it is necessary to calculate the crossing points with the horizontal and with the vertical axes:

- If $\theta = 0$, then $G(e, \theta, loc) \equiv c'(e) = 0 \implies e = 0$
- If $e = 0$, then $G(e, \theta, loc) \equiv c'(0) - f(loc)\theta h \frac{\gamma}{1-\gamma} = 0 \implies \theta = 0$

We conclude that the function $G(e, \theta, loc) = 0$ is upward sloping and crosses the plane (e, θ) in the origin. □

Proposition 4. *Equation $F(e, \theta, loc)$ is convex and in the (e, θ) plane.*

Proof. By the implicit function theorem, it follows that:

$$\begin{aligned}
\frac{d\theta}{de} &= -\frac{dF(e, \theta, loc)/de}{dF(e, \theta, loc)/d\theta} \\
&= -\frac{\overbrace{(1-\gamma)c'(e)}^{>0} - \overbrace{\gamma f(loc)\theta h}^{>0}}{\underbrace{-\gamma e f(loc)h}_{<0} + \underbrace{\frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}} \\
&= -\frac{\overbrace{G(e, \theta, loc)(1-\gamma)}^{?}}{\underbrace{-\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}}
\end{aligned}$$

It is clear that the sign of $\frac{d\theta}{de}$ depends on the behaviour of G . At the optimal level of effort, when $c'(e^*) = f(loc)\theta h \frac{\gamma}{1-\gamma}$, the two curves have the same slope and cross at the minimum of $F = 0$. Elsewhere, the locus $F = 0$ is downward sloping at the left of the curve $G = 0$ and upward-sloping at the right of $G = 0$. Moreover, $\lim_{e \rightarrow 0} F(e, \theta, loc) = (1-\gamma)[y-b] - \frac{h(r+q)}{m(\theta)}$. \square

Definition 1. *The pair (e^*, θ^*) designates the equilibrium solution, solving the system of equations (4.1) - (4.2). Then, such an equilibrium exists and is unique.*

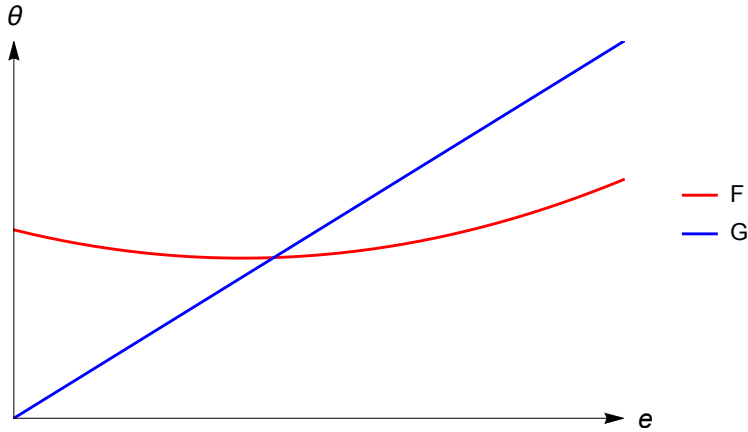


Figure 2: The locus of points $F = 0$ and $G = 0$ in the (e, θ) space

The second step consists in understanding how a change in individual's locus of control affects the equilibrium values e^* and θ^* .

Proposition 5. *An increase in the locus of control is associated with a lower market tightness and a with higher level of search effort: $\frac{d\theta^*}{dloc} < 0$ and $\frac{de^*}{dloc} > 0$.*

Proof. In order to test these results, we analyse the effect of a rise in loc on θ , conditional on search intensity:

$$F(e, \theta, loc) : \frac{d\theta}{dloc} = \frac{\overbrace{\gamma e f'(loc) \theta h}^{>0}}{\underbrace{-\gamma e f(loc) h}_{<0} + \underbrace{\frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}} < 0$$

$$G(e, \theta, loc) : \frac{d\theta}{dloc} = \frac{\overbrace{f'(loc) \theta h \frac{\gamma}{1-\gamma}}^{>0}}{\underbrace{-f(loc) h \frac{\gamma}{1-\gamma}}_{<0}} < 0$$

Figure 3 shows that a rise in the locus of control decreases the value of labor market tightness θ but has an effect which is *a priori* ambiguous on the equilibrium level of effort e . This ambiguity arises from two effects that move in opposite directions. On the one hand, a rise in the individuals' sense of control increases their lifetime utility in unemployment V_u , which increases the bargaining power of the job-seekers and their wage in employment. This, in turn, reduces the number of vacancies opened by the firm, which has a negative impact on tightness and determines a downward shift of the F curve. As there is a movement along the locus of points where $G = 0$, effort decreases. On the other hand, a rise in the sense of control increases the marginal benefit from additional search. Since the marginal benefit equalizes the marginal cost, this latter increases as well. Given the characteristics of the cost function, the effort level of the job-seekers will be higher, moving along the locus of points where $F = 0$. Being $\theta = \frac{V}{eU}$, as effort increases, the labor market becomes less tight and the G curve shifts to the right, reinforcing the previous decrease in θ . At this point, the level of effort begins to increase and it is not clear whether it will be lower, equal or higher than the initial one.

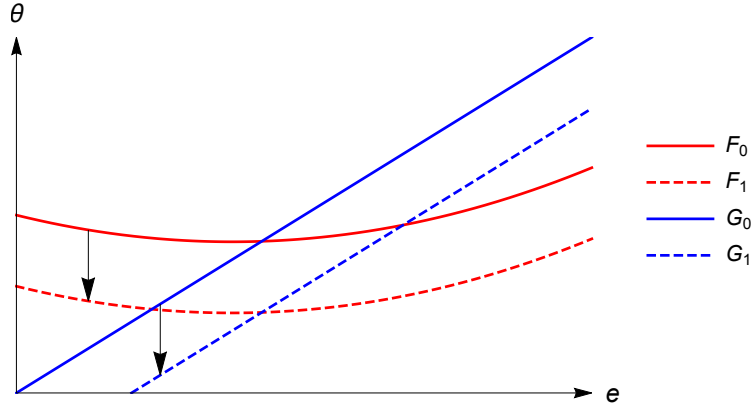


Figure 3: A priori ambiguous effect of the increase in *loc* on *e*

Nevertheless, such indeterminacy in the level of effort can be solved differentiating the system of the equations $F(e, \theta, loc) = 0$ and $G(e, \theta, loc) = 0$ with respect to e , θ and loc :

$$\begin{bmatrix} (1 - \gamma)c'(e) - \gamma f(loc)\theta h & -\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)} \\ c''(e) & -f(loc)h \frac{\gamma}{1-\gamma} \end{bmatrix} \begin{bmatrix} de \\ d\theta \end{bmatrix} = \begin{bmatrix} \gamma e f'(loc)\theta h \\ f'(loc)\theta h \frac{\gamma}{1-\gamma} \end{bmatrix} dloc$$

Since the optimal effort condition is satisfied, that is $(1 - \gamma)c'(e) - \gamma f(loc)\theta h = 0$, the first equality implies that:

$$\frac{d\theta}{dloc} = \frac{\overbrace{\gamma e f'(loc)\theta h}^{>0}}{\underbrace{-\gamma e f(loc)h}_{<0} + \underbrace{\frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}} < 0$$

Substituting such value of θ in the second equality gives the following unequivocal result¹⁰:

$$\frac{de}{dloc} = \frac{1}{\underbrace{c''(e)}_{>0}} \left[\frac{\overbrace{f'(loc)\theta \frac{\gamma}{1-\gamma} h^2(r+q) \frac{m'(\theta)}{m^2(\theta)}}^{<0}}{\underbrace{-\gamma e f(loc)h + h(r+q) \frac{m'(\theta)}{m^2(\theta)}}_{<0}} \right] > 0$$

It becomes evident that the shift of equation (4.2), driven by an increase in the marginal benefit from an extra application sent by the job-seekers, finally prevails. Thus, we conclude that an increase in the locus of control has a positive effect on the effort level overall, as depicted in Figure 4.

¹⁰Detailed calculations can be found in the Appendix.

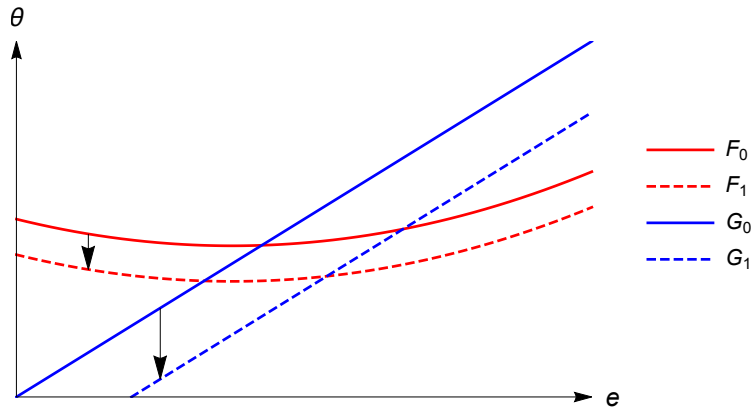


Figure 4: The increase in *loc* eventually increases *e*

□

It is straightforward that job-seekers with a more internal locus of control search harder than those with a more external locus of control, since they perceive higher returns to their search effort. Indeed, previous literature informs us that an increase in the locus of control is associated with internality, which means that individuals are more likely to believe their effort will have a concrete impact on the labor market, changing their employment condition. Therefore, it is sensible to expect that an increase in *loc* will provoke a higher level of effort. Nevertheless, while in partial equilibrium this leads unequivocally to an increase in the job offer arrival rate (Caliendo et al., 2015a, 2015b), we find that, in general equilibrium, labor market tightness decreases. As a consequence, the exit rate from unemployment decreases as well. This puzzling result emerges from the interaction of two opposite sides of the market: firms and workers. The former post vacancies and select job-seekers with the only purpose of making profit; the latter work in order to be able to consume and, if unemployed, look for an occupation. In this model, however, we introduce an important feature from the psychological literature, the locus of control, which reveals individuals' beliefs on the link between their actions and the external responses. If the homogeneous mass of unemployed workers believes to be able to master his life outcomes, then each single job-seeker will have a higher locus of control. Everything else equal, an increase in the locus of control implies a better fall-back position for the unemployed worker, which pushes wages upwards. As a consequence of the Nash bargaining process,

higher wages result in higher net gains for the employees, which correspond to lower net profits for the employers. Eventually, by this effect, firms create less vacancies that reduce labor market tightness and, in turn, the exit rate out of unemployment. Hence, in general equilibrium, an increase in internality results in a slacker labor market and in a lower arrival rate of job offers.

5 Alternative Model

Following the example of Caliendo et al. (2015b), we propose an alternative model by assuming the existence of a different mechanism through which locus of control affects job search. This specification entails a locus of control with an additive impact on the unemployment exit rate:

$$p_a(e, \theta, loc) = e\theta m(\theta) + f(loc)$$

with $f(loc) > 0$, $f'(loc) > 0$ and $f(0) = 0$. Thus, unlike the previous model, the probability of exiting unemployment is independent of the workers' locus of control, $\frac{\partial p_a(e, \theta, loc)}{\partial e} = \frac{\partial p(e, \theta)}{\partial e}$. The discounted expected utility of the unemployed workers is:

$$\begin{aligned} rV_u &= \max_e b - c(e) + p_a(e, \theta, loc)(V_e - V_u) \\ &= \max_e b - c(e) + [e\theta m(\theta) + f(loc)](V_e - V_u) \end{aligned} \quad (5.1)$$

Solving for the optimal search effort implies that:

$$c'(e^*) = \theta m(\theta)(V_e - V_u) \quad (5.2)$$

It has to be considered that, in this model, the marginal benefit of increasing effort depends only on the exit rate $\theta m(\theta)$, differently from equation (3.4). Following the procedure of the baseline model, equations (3.14) and (3.15) become:

$$rV_u = b - c(e) + e\theta \frac{\gamma}{1 - \gamma} h + f(loc) \frac{\gamma}{1 - \gamma} \frac{h}{m(\theta)} \quad (5.3)$$

$$w = (1 - \gamma)(b - c(e)) + \gamma \left[y + e\theta h + f(loc) \frac{h}{m(\theta)} \right] \quad (5.4)$$

Equating the labor demand (3.9) and the wage curve (5.4) and rearranging the result gives rise to the expression below:

$$F_a(e, \theta, loc) \equiv (1 - \gamma)[y - (b - c(e))] - e\theta \gamma h - f(loc) \gamma \frac{h}{m(\theta)} - \frac{h(r + q)}{m(\theta)} = 0 \quad (5.5)$$

Finally, substituting $(V_e - V_u) = \frac{\gamma}{1-\gamma} \frac{h}{m(\theta)}$ into (5.2), we obtain:

$$G_a(e, \theta) \equiv c'(e) - \theta \frac{\gamma}{1-\gamma} h = 0 \quad (5.6)$$

The representation of the implicit equations (5.5) and (5.6) in the (e, θ) space is qualitatively similar to Figure 2 of the baseline model¹¹. However, in this case, the *loc* parameter appears in expression (5.5) only.

Definition 2. *The pair (e^*, θ^*) designates the equilibrium solution, solving the system of equations (5.5) - (5.6). Then, such an equilibrium exists and is unique.*

Proposition 6. *For any given level of effort, an increase in the locus of control determines a reduction of labor market tightness: $\frac{d\theta^*}{dloc} < 0$. As a consequence, the F_a curve shifts downward and effort decreases along the locus of points $G_a = 0$.*

Proof. Totally differentiating equation (5.5) with respect to θ and *loc*:

$$\frac{d\theta}{dloc} = - \frac{\overbrace{-\gamma f'(loc) \frac{h}{m(\theta)}}^{<0}}{\underbrace{-\gamma eh}_{<0} + \underbrace{f(loc) \gamma \frac{hm'(\theta)}{m^2(\theta)}}_{<0} + \underbrace{\frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}} < 0$$

Since all the terms on the right hand side are negative, we can deduce that market tightness is negatively related to the locus of control. Graphically:

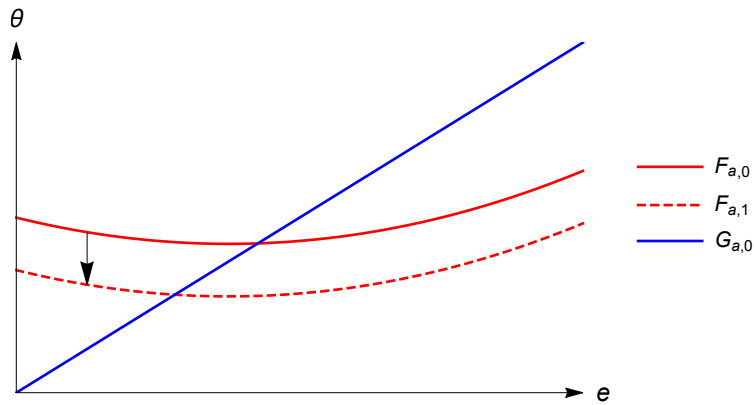


Figure 5: Effect of an increase in *loc* in the alternative model

□

¹¹Computations for the shape of F_a and G_a can be found in the Appendix.

Figure 5 shows that a rise in loc involves a shift downward of the F_a curve only, which provokes a decline in the effort provision of the unemployed. Equation (5.6) is unaffected by the employee's locus of control. This implies that, in a model where locus of control does not operate through the level of effort, the positive effect of sending an extra-application is absent. Thus, the only remaining impact comes from the increased lifetime utility in unemployment, which allows the employees to bargain a higher level of wages reducing the number of vacancies posted by the firms. As a consequence, at every level of effort, the value of labor market tightness decreases and the F_a curve shifts downward. As there is a descending movement along the locus of points where $G_a = 0$, the level of effort decreases as well. Intuitively, since their expected marginal returns to effort are equal to external job-seekers but their expected arrival rate of job offers is higher, internal job-seekers are predicted to search less intensively.¹²

6 Unemployment Rate and Locus of Control

Once the effect of the locus of control on labor market tightness is known, it is interesting to analyse its impact on the steady state unemployment rate, as defined by equation (3.1):

$$u = \frac{q}{q + e\theta m(\theta)}$$

In this section we refer to the baseline model, while the implications of locus of control on the unemployment rate for the alternative model can be found in the Appendix.

Proposition 7. *When locus of control increases, the effect on the unemployment rate is theoretically ambiguous, since $\frac{de^*}{dloc}$ and $\frac{d\theta^*}{dloc}$ move in opposite directions.*

Proof. Equation (3.1) can be rewritten as:

$$H(e^*(loc), \theta^*(loc), u) \equiv uq + ue\theta m(\theta) - q = 0$$

where $e = e^*$ and $\theta = \theta^*$ are the steady-state equilibrium values solving (4-1) and (4-2),

¹²Interestingly, Spinnewijn (2015) finds that optimistic unemployed workers overestimate how quickly they will find work and, consequently, provide a lower level of effort when searching and save too little.

hence being functions of *loc*. By total differentiation:

$$\frac{\partial H(e^*, \theta^*, u)}{\partial e} \frac{de^*}{dloc} + \frac{\partial H(e^*, \theta^*, u)}{\partial \theta} \frac{d\theta^*}{dloc} + \frac{dH(e^*, \theta^*, u)}{du} du$$

The partial derivatives of H are the following:

$$\begin{aligned} H'_u &= q + e\theta m(\theta) > 0 \\ H'_e &= u\theta m(\theta) \frac{de^*}{dloc} > 0 \\ H'_\theta &= ue \underbrace{[m(\theta) + \theta m'(\theta)]}_{m(\theta)[1-\eta(\theta)] > 0} \frac{d\theta^*}{dloc} < 0 \end{aligned}$$

Then, by the implicit function theorem:

$$\begin{aligned} \frac{du}{dloc} &= - \frac{\frac{\partial H}{\partial e} \frac{de^*}{dloc} + \frac{\partial H}{\partial \theta} \frac{d\theta^*}{dloc}}{\frac{dH}{du}} \\ &= - \frac{u\theta m(\theta) \frac{de^*}{dloc} + ue m(\theta) [1 - \eta(\theta)] \frac{d\theta^*}{dloc}}{q + e\theta m(\theta)} \end{aligned}$$

which is ambiguous, since the equilibrium marginal effects of locus of control on e^* and θ^* move in opposite directions. \square

If the positive externality from an increase in effort prevails, the unemployment rate will decrease as job-seekers become more internal. On the other hand, if the impact of tightness is of greater magnitude, the unemployment rate will increase with internality.

6.1 A Numerical Analysis

In order to solve this theoretical ambiguity, we perform a numerical exercise aimed at illustrating the link between effort, exit rate and their interaction with respect to the locus of control. Only by exploring the magnitude of these relationships it is possible to draw a conclusion about the puzzling effect of locus of control on the unemployment rate. In what follows we describe the procedure implemented.

The steady state equations used for the simulation are three: the equilibrium equations (4.1) and (4.2) and the Beveridge curve (3.1). The first step is to assign values to the parameters of the model γ, y, b, h, r, q . Productivity y is normalized to 1 and the value of leisure is normalized to $b = 0.4$ (Shimer, 2005). We think of a unit of time as representing one quarter, so that the interest rate is $r = 0.012$ (Shimer, 2012) and the separation rate

is $q = 0.10$ (Hornstein et al., 2005). We impose the bargaining power to be $\gamma = 0.5$ and the vacancy costs are set to $h = 0.324$ (Hornstein et al., 2005). Then, we specify a concrete functional form for the matching function, for the cost function $c(e)$ and for the locus of control function $f(loc)$. Following Petrongolo and Pissarides (2001), we assume the matching function to have a Cobb-Douglas specification:

$$M = \mu V^{1-\eta} (eU)^\eta$$

where μ is the matching function scale parameter and η is the elasticity. For tractability, we set $\mu = 1$ and $\eta = 0.5$. The rate of filling a vacancy and the job finding rate respectively are:

$$m(\theta) = \mu\theta^{-\eta} = (\sqrt{\theta})^{-1}$$

$$p(\theta) = \mu\theta^{1-\eta} = \sqrt{\theta}$$

We characterize the cost function as $c(e) = e^2$, so that $c'(\cdot) > 0$, $c''(\cdot) > 0$ and $c(0) = 0$, and the locus of control function as $f(loc) = \exp(loc) - 1$, so that $f(\cdot) > 0$, $f'(\cdot) > 0$ and $f(0) = 0$. Finally, we conduct the simulation. Figure 6 displays unemployment rate, job search effort, labor market tightness and exit rate as locus of control goes from 0 to 1.

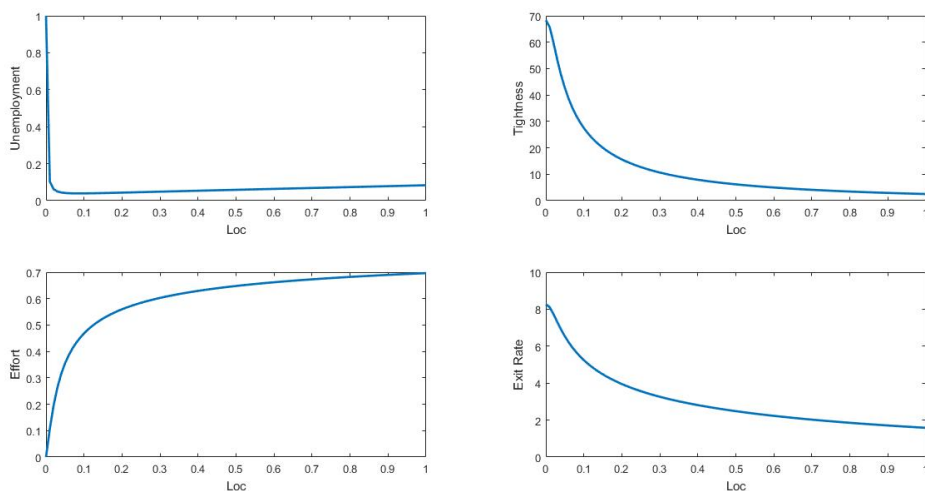


Figure 6: Numerical illustration

The behaviour of the unemployment rate is of particular interest. As individuals start to provide some effort in the job search process, that is, locus of control becomes strictly

positive, the unemployment rate sharply decreases from 1 to 0,1033. However, as locus of control increases along the horizontal axis, the beneficial effect of effort is mitigated by the negative effect induced by tightness. Indeed, the level of unemployment is slowly pushed upward until it reaches 0,0832 when $loc = 1$. Still, it is striking that the net effect on the unemployment rate is positive. Moreover, as job-seekers become more internal, effort dramatically increases while tightness displays a decreasing trend, in line with our theoretical predictions. Consequently, more internal individuals are associated with a lower exit rate out of unemployment. In other words, those who try harder to find a job stay longer in unemployment. This result is consistent with Caliendo et al. (2015b), who affirm that “job-seekers with an internal locus of control have a higher transition rate from unemployment to work”. Since highly internal individuals expect more future job offers, the expected utility of being unemployed and waiting for a better match is higher in comparison to their external counterparts, hence their lower exit rate. To sum up, even though the duration in unemployment is longer as locus of control increases, the positive effect induced by effort reduces the unemployment rate overall.

7 Conclusion

Against the background of the recent and devastating economic crisis, many individuals have found themselves unemployed and in need of economic support. The aim of this thesis is to understand how the personality trait of locus of control affects the level of unemployment, so as to comprehend the essential policy interventions. This concept, firstly elaborated in psychology, promptly spread across other disciplines such as medicine and social sciences. Particularly, in the field of behavioural labor economics it is considered a driving factor of decision-making in the workplace. Many researchers investigated the interactions between locus of control and labor market success and reached the conclusion that perceiving a causal link between own actions and further repercussions in any life domain, from work to health, is a determinant factor.

With this paper, we contribute to the existing literature introducing locus of control in a matching model with search intensity, where individuals have subjective beliefs about

the effect of their search effort on the exit rate out of unemployment. First, we shape the individual probability of exiting unemployment as a function of the locus of control using a multiplicative specification and find that, as individuals become more internal following an increase in the locus of control, labor market tightness decreases and the effort provided by the job-seekers increases. These two competing effects result in a theoretically ambiguous unemployment level. Indeed, while the positive externality induced by an extra-application sent by the job-seekers implies a lower unemployment level in the economy, a tighter labor market causes an increase in unemployment. To solve such indeterminacy, we perform a numerical exercise and show that the unemployment rate sharply decreases as job-seekers start to put effort in the search process, but then slightly increases with internality. Then, we present a second model where locus of control affects the probability of exiting unemployment in an additive way. Interestingly, in this alternative specification the positive externality vanishes out since both internal and external individuals provide the same level of effort. However, as internal job-seekers expect higher returns, labor market tightness decreases and there is a clear-cut negative effect on the unemployment level. We conclude that, in a general equilibrium framework, having an internal locus reduces tightness which, in turn, pushes down the exit rate out of unemployment. Moreover, the level of unemployment is lower only when individuals' subjective beliefs about the effect of their search effort are taken into account.

While we have shed some light on the potential effects of locus of control using a simple modification of the standard matching model, the complete mechanism of the formation of human expectations and response to external conditions remains behind economic comprehension as it is a product of individuals' personal history, motivation, self-esteem and of the general view each has of oneself.

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Appendix

Notes on the Baseline Model

Proof of Proposition 3: Details Differentiating the system of equations $F(e, \theta, loc) = 0$ and $G(e, \theta, loc) = 0$ gives rise to the following equations:

$$[(1 - \gamma)c'(e) - \gamma f(loc)\theta h] de + \left[-\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)} \right] d\theta = [\gamma e f'(loc)\theta h] dloc \quad (A1)$$

and

$$c''(e)de - \left[f(loc)h \frac{\gamma}{1-\gamma} \right] d\theta = \left[f'(loc)\theta h \frac{\gamma}{1-\gamma} \right] dloc \quad (A2)$$

From equation (A1), since $(1 - \gamma)c'(e) - \gamma f(loc)\theta h = 0$, it follows that:

$$\left[-\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)} \right] d\theta = [\gamma e f'(loc)\theta h] dloc$$

that is

$$\frac{d\theta}{dloc} = \frac{\overbrace{\gamma e f'(loc)\theta h}^{>0}}{\underbrace{-\gamma e f(loc)h}_{<0} + \underbrace{\frac{h(r+q)m'(\theta)}{m^2(\theta)}}_{<0}} < 0$$

Substituting this result in equation (A2), we obtain:

$$\begin{aligned} de &= \frac{1}{c''(e)} \left[f'(loc)\theta h \frac{\gamma}{1-\gamma} + \frac{f'(loc)\theta h \frac{\gamma}{1-\gamma} \gamma e f(loc)h}{-\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)}} \right] dloc \\ &= \frac{1}{c''(e)} \left[\frac{-f'(loc)\theta h \frac{\gamma}{1-\gamma} \gamma e f(loc)h + f'(loc)\theta h \frac{\gamma}{1-\gamma} \frac{h(r+q)m'(\theta)}{m^2(\theta)} + f'(loc)\theta h \frac{\gamma}{1-\gamma} \gamma e f(loc)h}{-\gamma e f(loc)h + \frac{h(r+q)m'(\theta)}{m^2(\theta)}} \right] dloc \end{aligned}$$

hence,

$$\frac{de}{dloc} = \frac{1}{\underbrace{c''(e)}_{>0}} \left[\frac{\overbrace{f'(loc)\theta \frac{\gamma}{1-\gamma} h^2(r+q) \frac{m'(\theta)}{m^2(\theta)}}^{<0}}{\underbrace{-\gamma e f(loc)h + h(r+q) \frac{m'(\theta)}{m^2(\theta)}}_{<0}} \right] > 0$$

Notes on the Alternative Model

Computations for the shape of the F_a and G_a curve

Recalling equations (5.5) and (5.6):

$$F_a(e, \theta, loc) \equiv (1 - \gamma)[y - (b - c(e))] - e\theta\gamma h - f(loc)\gamma \frac{h}{m(\theta)} - \frac{h(r + q)}{m(\theta)} = 0$$

$$G_a(e, \theta) \equiv c'(e) - \theta \frac{\gamma}{1 - \gamma} h = 0$$

The partial derivatives of G_a have unambiguous signs:

$$G'_{a,e} = c''(e) > 0 \quad \text{and} \quad G'_{a,\theta} = -\frac{\gamma}{1 - \gamma} h < 0$$

By the implicit function theorem:

$$G_a(e, \theta) : \frac{d\theta}{de} = -\frac{c''(e)}{-\frac{\gamma}{1 - \gamma} h} > 0$$

Moreover, if $\theta = 0$ then $c'(e) = 0 \implies e = 0$. If $e = 0$ then $c'(0) - \theta \frac{\gamma}{1 - \gamma} h = 0 \implies \theta = 0$.

Consequently, the locus of points G_a is upward sloping in the (e, θ) plane and crosses the origin. The partial derivatives of F_a are:

$$F'_{a,e} = (1 - \gamma)c'(e) - \theta\gamma h \quad \text{and} \quad F'_{a,\theta} = -e\gamma h + \frac{f(loc)\gamma hm'(\theta)}{m^2(\theta)} + \frac{h(r + q)m'(\theta)}{m^2(\theta)} < 0$$

Notice that:

$$\lim_{e \rightarrow 0} F_a(e, \theta, loc) = (1 - \gamma)[y - b] - f(loc)\gamma \frac{h}{m(\theta)} - \frac{h(r + q)}{m(\theta)}$$

By the implicit function theorem:

$$F_a(e, \theta, loc) : \frac{d\theta}{de} = -\frac{\overbrace{G_a(e, \theta)(1 - \gamma)}^?}{\underbrace{-e\gamma h + \frac{f(loc)\gamma hm'(\theta)}{m^2(\theta)} + \frac{h(r + q)m'(\theta)}{m^2(\theta)}}_{< 0}}$$

It follows that the locus of points $F_a = 0$ is decreasing to the left of $G = 0$ and increasing to the right of $G = 0$.

The effect of locus of control on the unemployment rate

Proposition 8. *Since a higher degree of internality has a negative impact on both market tightness and individual effort, the unemployment rate increases.*

Proof. This proof is equivalent to the proof of Proposition 7 in the benchmark model, except that in this case $\frac{de^*}{dloc} < 0$ and $\frac{d\theta^*}{dloc} < 0$. Thus $\frac{du}{dloc} > 0$, as shown in Figure 7.

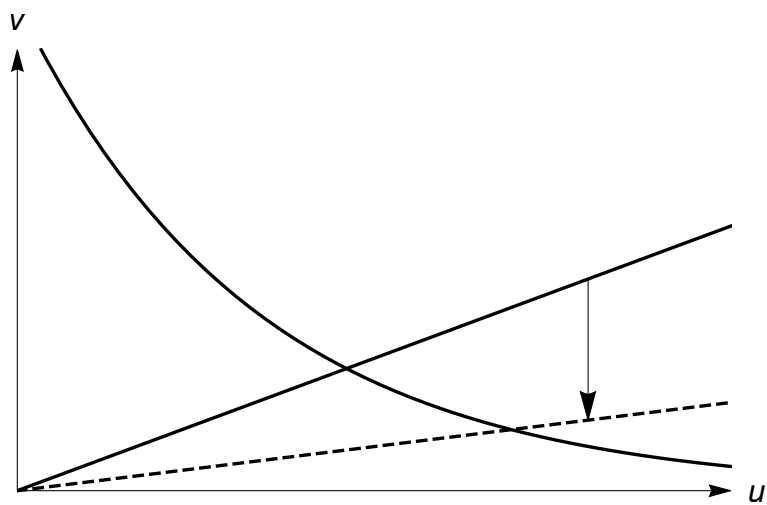


Figure 7: An increase in the locus of control causes an higher value of u^*

□

Table 1: The Rotter's Locus of Control Scale

1. a. Children get into trouble because their parents punish them too much.	b. The trouble with most children nowadays is that their parents are too easy with them.
2. a. Many of the unhappy things in people's lives are partly due to bad luck.	b. People's misfortunes result from the mistakes they make.
3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.	b. There will always be wars, no matter how hard people
4. a. In the long run people get the respect they deserve in this world	b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries
5. a. The idea that teachers are unfair to students is nonsense.	b. Most students don't realize the extent to which their grades are influenced by accidental happenings.
6. a. Without the right breaks one cannot be an effective leader.	b. Capable people who fail to become leaders have not taken advantage of their opportunities.
7. a. No matter how hard you try some people just don't like you.	b. People who can't get others to like them don't understand how to get along with others.
8. a. Heredity plays the major role in determining one's personality.	b. It is one's experiences in life which determine what they're like.
9. a. I have often found that what is going to happen will happen.	b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.	b. Many times exam questions tend to be so unrelated to course work that studying is really useless.
11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.	b. Getting a good job depends mainly on being in the right place at the right time.
12. a. The average citizen can have an influence in government decisions.	b. This world is run by the few people in power, and there is not much the little guy can do about it.
13. a. When I make plans, I am almost certain that I can make them work.	b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
14. a. There are certain people who are just no good.	b. There is some good in everybody.
15. a. In my case getting what I want has little or nothing to do with luck.	b. Many times we might just as well decide what to do by flipping a coin.
16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.	b. Getting people to do the right thing depends upon ability. Luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.	b. By taking an active part in political and social affairs the people can control world events.
18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.	b. There really is no such thing as "luck."
19. a. One should always be willing to admit mistakes.	b. It is usually best to cover up one's mistakes.
20. a. It is hard to know whether or not a person really likes you.	b. How many friends you have depends upon how nice a person you are.
21. a. In the long run the bad things that happen to us are balanced by the good ones.	b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
22. a. With enough effort we can wipe out political corruption.	b. It is difficult for people to have much control over the things politicians do in office.
23. a. Sometimes I can't understand how teachers arrive at the grades they give.	b. There is a direct connection between how hard I study and the grades I get.
24. a. A good leader expects people to decide for themselves what they should do.	b. A good leader makes it clear to everybody what their jobs are.
25. a. Many times I feel that I have little influence over the things that happen to me.	b. It is impossible for me to believe that chance or luck plays an important role in my life.
26. a. People are lonely because they don't try to be friendly.	b. There's not much use in trying too hard to please people, if they like you, they like you.
27. a. There is too much emphasis on athletics in high school.	b. Team sports are an excellent way to build character.
28. a. What happens to me is my own doing.	b. Sometimes I feel that I don't have enough control over the direction my life is taking.
29. a. Most of the time I can't understand why politicians behave the way they do.	b. In the long run the people are responsible for bad government on a national as well as on a local level.