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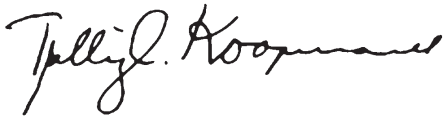

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Job Search Behaviour and Time Preferences: Evidence from the Netherlands

Thomas van Huizen
Janneke Plantenga

Universiteit Utrecht

Utrecht School of Economics

Tjalling C. Koopmans Research Institute
Utrecht School of Economics
Utrecht University

Kriekenpitplein 21-22
3584 EC Utrecht
The Netherlands
telephone +31 30 253 9800
fax +31 30 253 7373
website www.koopmansinstitute.uu.nl

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How to reach the authors

Please direct all correspondence to the first author.

Thomas van Huizen
Janneke Plantenga
Utrecht University
Utrecht School of Economics
Kriekenpitplein 21-22
3584 TC Utrecht
The Netherlands.
E-mail: t.m.vanhuizen@uu.nl
j.plantenga@uu.nl

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Thomas van Huizen
Janneke Plantenga

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Abstract

This paper examines theoretically and empirically the effects of time preferences on job search behaviour of the unemployed. The aim of the study is to test the exponential versus the hyperbolic discounting model within a labour market context. The theoretical relations between patience on the one hand and job search intensity, reservation wages and the exit rate to employment on the other hand depend on whether exponential or hyperbolic discounting is assumed. Assessing these relations empirically therefore provides a test of the two alternative models of discounting. We make use of the DNB Household Survey, a large Dutch longitudinal survey containing various indicators of job search effort, reservation wages and detailed information on individual time preferences. The results are in line with the hyperbolic discounting model.

Keywords: time preferences; unemployment; job search; hyperbolic discounting

JEL classification: D03; J64

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1. Introduction

Standard job search models assume that agents discount future costs and benefits exponentially, implying time-consistent preferences. However, a substantial amount of experimental and field evidence on intertemporal choice demonstrates that preferences are time-inconsistent and present-biased (see for a review: Frederick et al. (2002) and DellaVigna (2009)). In order to allow for time-inconsistency, hyperbolic discounting models have been proposed as an alternative for the standard exponential model (e.g. Laibson, 1997). One of the most important predictions of hyperbolic discounting models is that individuals have a tendency to procrastinate investment activities, which involve immediate costs and delayed rewards. As job search can be considered as an (unpleasant) investment activity, it can be argued that hyperbolic agents are inclined to procrastinate looking for job openings, writing resumes and sending applications. The prediction that job searchers tend to postpone job search activities is in line with the empirical finding that on average the unemployed spend just a couple of hours per week on job search activities (Krueger and Mueller, 2010).

DellaVigna and Paserman (2005) provide the first test of the exponential against the hyperbolic discounting model within a job search context. They demonstrate that the theoretical relations between patience on the one hand and job search intensity, reservation wages and the exit rate to employment on the other hand depend on whether agents discount exponentially or hyperbolically. Using US data, they examine these relations empirically and find support for the hyperbolic discounting model.

An important drawback of the study of DV&P is that their empirical assessment relies completely on behavioural proxies for patience, such as information on smoking, alcohol consumption, drug use and having a life insurance: these proxies are context specific and noisy measures of time preferences. A critical question is therefore whether their findings depend on the specific measure for patience. In order to answer this question, this study uses self-reported information on time preferences. Making use of the DNB Household Survey (DHS), a large longitudinal Dutch survey, we construct an indicator of patience which is based on items from the Consideration of Future Consequences Scale, a psychological construct to measure an individual's

future orientation. This study thus examines whether the support for the hyperbolic discounting model is robust to this alternative, more accurate patience measure. Moreover, the paper provides an analysis of the Dutch case and thereby contributes to both the labour economic literature on job search and to the behavioural economic literature on hyperbolic discounting.

Research examining hyperbolic discounting in job search models has important implications for public policy. Hyperbolic agents are mainly responsive to immediate costs and benefits, while the behaviour of exponential agents is more affected by long-run payoffs. Therefore, it can be expected that the effectiveness of social security and labour market policies depends on whether job seekers discount future payoffs exponentially or hyperbolically.

The paper is structured as follows: Section 2 reviews the previous literature on hyperbolic discounting and discusses the theoretical model proposed by DellaVigna and Paserman (2005). In Section 3, we describe the data and discuss indicators for time preferences and job search intensity. The results are presented in Section 4. The final section concludes.

2. Theoretical framework and previous literature

2.1 Time preferences

In the standard economic literature, it is assumed that individuals have well-defined preferences and try to maximize life-time utility according to a function in which individuals discount utility exponentially. This implies that individuals have time-consistent preferences. However, evidence from a wide range of laboratory experiments (e.g. Frederick et al., 2002) demonstrates that individual time preferences are dynamically inconsistent. Particularly, experiments point out that discounting is a decreasing function of time: discounting is steeper in the immediate future than in the more distant future (Thaler, 1981). To capture the idea of time-inconsistent preferences, Laibson (1997) proposes the following quasi-hyperbolic discounting model as an alternative for the exponential discounting model:

$$U^t(u_t, u_{t+1}, ..., u_T) = u_t + \beta \sum_{\tau=t+1}^{T} \delta^t u_t$$

In the exponential discounting model, $\beta = 1$ and time preferences are fully measured by δ .The difference between the exponential discounting model and this model is the introduction of β ($0<\beta\leq 1$), which indicates a preference for immediate gratification. In this alternative model, there are two parameters for time preferences: short-run patience β and long-run patience δ . In hyperbolic discounting models, individuals have present-biased preferences or are 'myopic' since the individual attaches extra weight to current utility compared to future utility. A general prediction of this type of models is that people have a tendency to postpone investment activities and to do soon leisure activities (O'Donoghue and Rabin, 1999).

In the literature on hyperbolic discounting models, the assumptions concerning an individual's beliefs about future behaviour and self-control problems play an important role (e.g. O'Donoghue and Rabin, 2001). Agents who are 'sophisticated' predict their future behaviour in the correct way and are fully aware of their self-control problems ($\widehat{\beta} = \beta$), whereas 'naives' believe they will behave as planned and are completely unaware of their self-control problems ($\widehat{\beta} = 1$). Individuals may also be partially naïve: in that case they are aware of their self-control problems but underestimate the degree ($\widehat{\beta} > \beta$). An important implication is that (partially) sophisticated people know they will have self-control problems in the future and are willing to constrain future choices, using (costly) commitment mechanisms.

2.2 Job search model

In this section, we follow the theoretical framework of DellaVigna and Paserman (2005; DV&P hereafter). Unemployed individuals choose in each period the amount of job search intensity and the level of the reservation wage. Job search intensity involves search costs ($c(s)$ [1]) and is parameterized as the probability of receiving a job offer ($s \in [0,1]$). With a probability s the job seeker receives a wage offer w, which is the outcome of a random variable W, with a known cumulative distribution F.[2]

[1] $c(s)$ is an increasing , strictly convex function of s. Moreover, zero fixed costs are assumed, so $c(o)=0$.

[2] It is assumed that F has bounded support $[\underline{x}, \bar{x}]$, strictly positive density f, does not change over time and does not dependent on the level of search intensity.

When the individual receives a wage offer which is higher than his or her reservation wage, the job seeker accepts the offer and receives w from the next period $(t+1)$ onwards. If the wage offer is below the reservation wage, the individual declines the offer and continues searching for a better job if. The model abstracts from firm behaviour and does not allow for on-the-job search.[3]

Assuming an infinite planning horizon, individuals choose job search intensity and the reservation wage in order to maximize discounted payoff streams:

$$\max_{s_t \in [0,1]} b - c(s_t) + \beta\delta \left[s_t E_F \left\{ \max \left(V_{t+1}^E(w), V_{t+1}^U \right) \right\} + (1 - s_t) V_{t+1}^U \right] \tag{3}$$

where b represents unemployment benefits, $c(s)$ the costs of search; β and δ denote short-run and long-run patience respectively. The future payoffs, which are multiplied by $\beta\delta$, consists of the probability (s) times the expected value of receiving a job offer: the worker may either accept ($V_{t+1}^E(w)$) or reject (V_{t+1}^U) the offer. Furthermore, when the individual does not find a job, he remains unemployed and receives V_{t+1}^U. The time subscripts of the value functions can be dropped because a stationary environment is assumed. So, in case the worker accepts the job, he moves into employment and obtains the following payoff:

$$V^E(w) = w + \delta \left[q V^U + (1 - q) V^E(w) \right] \tag{4}$$

where the individual receives wage w and faces a layoff probability $q \in [0,1]$ in the next period. From (3) and (4) the reservation wage in equilibrium is given by:

$$w^* = (1 - \delta) V^U \tag{5}$$

It is clear that the reservation wage increases with the utility derived from being unemployed. Moreover, expression (5) illustrates that the reservation wage is not directly affected by short-run patience. The intuition is that the reservation wage decision involves comparing delayed payoff streams: accept a job and receive the offered wage in the future or reject the offer and wait for a better job. As immediate payoffs are not affected, this decision is not directly dependent on short-run patience.

Taking the derivative of (3) with respect to s and using the expression for the reservation wage (5) leads to the first-order condition:

[3] When searching while employed is sufficiently more costly than searching while unemployed, the same theoretical results hold.

$$c'(s^*) = \frac{\beta\delta}{1-\delta(1-q)}\left[\int_{w^*}^{\bar{x}}(u-w^*)dF(u)\right] \qquad (6)$$

Expression (6) shows that, under utility maximization, the marginal costs of search are equal to the marginal benefits of search. The expression demonstrates that job search intensity is positively related to both long-run (δ) and short-run (β) patience. The choice on search effort is principally an investment decision involving immediate costs - looking for job openings, contacting employers, going to job interviews - and future rewards in terms of better job opportunities. For that reason search effort increases with the individual's degree of patience. Similarly, hyperbolic discounters search less intensively than exponential discounters with the same δ: a higher degree of 'present-biasedness' implies a lower value of the future gains of the search investment.

Hypothesis EXPO1: *patience (δ) is positively related to job search intensity*
Hypothesis HYPO1: *patience (β) is positively related to job search intensity*

Note that naïve individuals believe that future selves will exert high search effort and are thus inclined to postpone these activities. Sophisticated job seekers have the correct expectations about future (search) behaviour and are aware of their future self-control problems. They will therefore value commitment mechanisms that help them to overcome the procrastination of job search activities.

Next, consider the effect of patience on reservation wages. When the agent has searched for a job and receives a job offer, he will accept it if the offer is higher than his reservation wage. Choosing a reservation wage involves the comparison of delayed payoff streams. The job seeker either accepts the job and receives the offered wage in the future, or rejects the job offer and continues searching. As the reservation wage decision is about future rather than current payoff streams, this decision is mainly affected by long-run patience (δ): the higher the level of long-run patience, the more the job seeker is inclined to reject the offer and search for better jobs.

The relation between short-run patience and the level of reservation wages is more complex and depends on sophistication. The naïve (hyperbolic) individual believes incorrectly that he will behave as an exponential discounter in the future. The

reservation wage is determined by comparing future payoffs that are not affected by short-run patience directly (see expression (5)) or indirectly by expectations (as the naïve agent believes that β=1 in the future). However, for sophisticated hyperbolic individuals there is an indirect effect of short-term patience on reservation wages through expectations: this sophistication effect entails that the impatient job seeker is aware that future selves will not search intensively and is therefore inclined to accept lower wage offers today. More patient (higher β) sophisticated workers will thus be more selective about job offers.

Hypothesis EXPO2: *patience (δ) is positively related to reservation wage*
Hypothesis HYPO2: *for naïve agents: patience (β) is orthogonal to reservation wage; for sophisticated agents: patience (β) is positively related to reservation wage*

Finally, the effect of patience on the exit rate depends on the joint impact on search intensity and reservation wages. The exit rate consists of the probability of finding a job offer times the probability that this offer is accepted – i.e. higher than the reservation wage ($h = s(1 - F(w^*))$). For naïve workers, the effect is unambiguous: the level of search effort increases with short-term patience (β), while the effect on the reservation wage is absent. Hence, for naïve agents patience has a positive impact on the exit rate. However, for both exponential discounters and sophisticated hyperbolic discounters patience is positively related to job search intensity and the reservation wage: the former implies an increase in the exit rate, whereas the latter implies a decrease in the exit rate to employment. So, the theoretical impact of patience on the labour market transitions is not clear a priori. DV&P show that, although the direction of the effect of patience on reservation wages is similar for exponential and hyperbolic discounters, the magnitude differs. For hyperbolic discounters, the effect on the reservation wage is indirect and can be expected to be small.[4] It can be demonstrated that the search intensity effect dominates and patience is positively related with the probability of leaving unemployment when:

$$\frac{\partial E\left[W \mid W \geq x\right]}{\partial x} \leq \frac{1}{1-\beta} \text{ at } x = w^* \qquad (7)$$

[4] DV&P calibrate the model and show that the effect of short-term patience on the level of the reservation wage is quantitatively small.

DV&P illustrate that, under exponential discounting and some plausible assumptions, the reservation wage effect dominates and patience has a negative effect on exit rates. "In a nutshell, due to different time horizons, variation in δ primarily drives variation in reservation wages while variation in β primarily drives variation in search effort" (DellaVigna & Paserman, 2005, p.544).

Hypothesis EXPO3: *patience (δ) is negatively related to the exit rate*
Hypothesis HYPO3: *patience (β) is positively related to the exit rate*

DV&P test these hypotheses using two US longitudinal data sets (NLSY and PSID) and construct a measure of impatience applying factor analysis: the items included in this aggregate measure include several (lagged) behavioural proxies of time preferences.[5] The study examines the effects of this variable on search effort, measured by the number of search channels, (self-reported) reservation wages and the duration of unemployment. The empirical findings are in the direction predicted by the hyperbolic discounting model.[6] Furthermore, Ben Halima and Ben Halima (2009), applying the same empirical strategy and using similar proxies for impatience as DV&P, replicate these findings for France.

The main drawback of both studies is that they rely on rather noisy indicators of patience, which is acknowledged by DV&P (p.551). The Cronbach reliability measure and the average interitem correlation of the proxies for patience used in the study of DV&P equal 0.278 and 0.059.[7] In fact, these reliability measures are below conventional norms, indicating a low level of reliability and internal consistency. The

[5] In the analysis using the NLSY, the following indicators are used: having money in a checking or saving account; contraceptive use; having a life insurance; smoking; number of hangovers; participation in vocational clubs in high school; whether the interviewer specified that the respondent's attitude was 'impatient and restless'. To deal with endogeneity, most indicators refer to the period prior to the unemployment spell.

[6] In a later study, Paserman (2008) performs a structural estimation (using the NLSY) which he uses to evaluate several policy options.

[7] In the study of Ben Halima and Ben Halima (2009) these reliability indicators are 0.536 and 0.06 respectively.

question therefore arises whether the empirical results depend on the type of indicators used for patience.

3. Data

3.1 General

For the empirical analysis, we make use of the DNB Household Survey (DHS), a Dutch panel survey which has been collected annually by CentERdata since 1993. The panel consists of around 2500-3000 households: once a year, each household member aged 16 or older fills in a questionnaire via internet.[8] For the empirical analysis, male non-employed job seekers are selected. Students, (early) retirees and (partially) disabled individuals are not included in the sample. Furthermore, respondents below the age of 18 and above 64 are excluded from the analysis. Respondents are asked whether they are looking for a job: they are included if they report that they are either considering looking or seriously searching for a job.[9] As in the study of DV&P, an individual is considered as unemployed if he does not hold a job and is looking for (or is willing to) work.

3.2 Time preferences

The central independent variable in this study is an indicator measuring variation in patience. In order to test the exponential versus the hyperbolic discounting model, it is not necessary to distinguish empirically between short-run and long-run patience. We use an indicator for patience that may, in principle, capture variation in δ or β (or a combination of both). If this indicator captures heterogeneity in δ, the empirical results should be consistent with EXPO1-3. Job search behaviour can then be explained by the standard exponential discounting model. However, when the findings are in line with HYPO1-3, variation in δ cannot explain the results. In that case, the findings can be rationalized if the patience indicator captures heterogeneity in short-run patience. Since there is variation in β in hyperbolic discounting models

[8] It is not necessary that households have a PC or internet: when a PC is absent, access is provided through a special box which enables household members to fill in the survey via the television.

[9] Respondents are asked the question: "Are you currently looking for a(nother) job?" Potential answers are: (1)"Yes, I am seriously searching for a(nother) job"; (2)"Yes, I am considering searching for a(nother) job"; (3)"No, I just found another job"; (4)"No, I am not looking". When their answer is (1) or (2) they are included in the analyses.

but not in exponential discounting models (β=1), such results would provide support for the former and reject the latter model of time discounting. So, we exploit the theoretical predictions on the relations between patience and job search behaviour to test the two alternative models of intertemporal choice.

The indicator for patience is constructed from eleven general statements about time preferences and orientation towards the future (see Table 1 for details). These statements basically represent the Consideration of Future Consequences (CFC) Scale, a psychological construct to measure how an individual weighs immediate and future outcomes of behaviour (Strathman et al., 1994).[10] These CFC items have been used in some other economic studies (Borghans and Golsteyn, 2006; Webley and Nyhus, 2006). Respondents indicate to which extent they agree with the statement using a 7-point scale (1=completely disagree; 7=completely agree).

It can be expected that some of the FUTURE items are positively related to patience, whereas others are negatively correlated with patience. We therefore recode the latter group of variables (1 is recoded to 7, 2 is recoded to 6, etcetera) in such a way that all eleven FUTURE variables are expected to be positively correlated with one another. The average covariance (correlation) between the items is 0.44 (0.20) and the Cronbach reliability measure of these eleven items equals 0.734, pointing out internal consistency and good reliability.[11] Appendix A provides details about the correlations between these items, KMO measures and results from factor analysis. The correlation matrix shows that in general correlations between these variables are positive and highly significant: the exceptions seem to be FUTURE04 and FUTURE05. Moreover, the KMO measures vary between 0.70 and 0.82 (overall KMO of 0.77). This indicates that the FUTURE items reflect the same underlying trait.

[10] The original CFC Scale uses a 5-point scale and consists of twelve rather than eleven statements. However, this twelfth item is missing in the waves 1996-2003 and is therefore not included in the analysis.

[11] The Cronbach reliability measure and the average interitem correlation are considerably larger than the ones obtained in the study of DV&P and of Ben Halima and Ben Halima (2009). This suggests that the FUTURE items are substantially more accurate.

Table 1 Time preferences: statements and descriptive statistics

Name	Description	Mean	St. Dev.	Patience
FUTURE01	I think about how things may be in the future and I try to influence these in everyday life	4.14	1.52	+
FUTURE02	I often deal with things that will have consequences in several years	3.64	1.58	+
FUTURE03	I am only concerned about the present, assuming it will turn out all right in the future	3.65	1.55	-
FUTURE04	I only think about the immediate consequences of my actions (several days/weeks)	3.62	1.58	-
FUTURE05	Whether something is convenient determines my decisions to a large extent	4.44	1.37	-
FUTURE06	I am prepared to sacrifice my current well-being in order to achieve objectives in the future	3.56	1.48	+
FUTURE07	I think that it is important to take warnings about negative future results of my actions seriously, even if these results will materialize in the distant future	4.92	1.37	+
FUTURE08	I believe it is more important to deal with matters that will have major consequences in the future, than to deal with matters with immediate but minor consequences	4.26	1.36	+
FUTURE09	I generally ignore warnings about future problems because I assume that these problems will be solved by then	3.33	1.38	-
FUTURE10	I believe that there is no need to make sacrifices now for future issues, because these could be solved later	3.83	1.45	-
FUTURE11	I only respond to urgent problems, supposing that I can deal with future problems when they emerge	3.75	1.47	-

Note: the means and standard deviations of the non-rescaled items are for the complete (including employed) male sample (N=14074).

We performed factor analysis on all 11 future variables using the entire male sample. The model is estimated with maximum likelihood (see Appendix A for details of factor analyses). Consistent with the results discussed above, all loadings are positive but the 04-05 items have the lowest loading. retain the first factor and interpret this as a measure of patience. As the questions about time preferences are not available in the years 1993-1995 and 2008 and are in some cases missing in the other years, the following imputation strategy is applied in order to maintain a sufficient number of

observations. Because time preferences are assumed to be relatively stable over time, we calculated the average patience level for the years 1996-2007 and 2009-2010, using a five year window.[12] When this new patient variable was missing, lags and leads were imputed. For the years 1993-1995 and 2008, the patient variable is taken from the closest year. The correlation between the original patience variable and this "patience sum" variable is very high (0.90) and significant ($p<0.0001$).

Table 2 shows some descriptives of both the original patience variable (1996-2010)[13] and the patience sum variable (1993-2010) for the complete and the unemployed job seekers sample. Comparing the distribution of the original and the averaged variable, the differences are rather small for both samples. As the patience sum variable is basically the individual five-year average, variation over time within individuals is rather low and therefore this variable has a lower standard deviation than the original patience variable. Interestingly, the difference between the complete sample and the job seekers is relatively small (according to both the original and average variable). Although one may expect that less patient individuals are more likely to become unemployed, job seekers seem not to be significantly less patient than average. An explanation for this could be that the job seeker sample contains only those individuals who report to be searching for a job, thereby selecting a rather 'future-oriented' group. The complete sample includes also non-employed, non-searching individuals, who may score low on the patience indicator.

To further investigate the validity of the patience sum variable, we tested to what extent this measure is correlated with behavioural outcomes, statements about spending behaviour and statements about the financial position (Table 3). It can be

[12] To compute the five year average for the years 1998-2005, next to the patience variable of year t, two lags and two leads are used. If one of the five patience variables was missing, a four year window is used instead. This procedure is repeated, using a three year window, two year window and finally the patience level of year t. For the first and last years a four year window is used: 1996 (three leads), 1997 (one lag and two leads), 2006 (two lags and one lead), 2007 (two lags and the 2009 wave), 2008 (two lags, two leads), 2009 (one lead and two lags – the 2006 and 2007 waves) and 2010 (two lags – the 2007 and 2009 waves).

[13] For the 2008 wave, the average between the 2007 and 2009 patience variable is used. If the variable was missing in either 2007 or 2009, a lead or lag was imputed instead.

expected that, when the indicator measures patience, it is correlated with several outcomes. First of all, we would expect a positive correlation between the patience measure and the likelihood that the individual has a life insurance, a bank account or a savings account. Furthermore, a negative correlation between the patience measure and the probability that individual smokes, consumes several units of alcohol every day, has credit card debt and has any outstanding hire-purchase debt. All correlations between the patience variable and the behavioural proxies have the expected sign and are significant (except for alcohol consumption). In addition, correlations between the patience measure and various variables indicating individual statements about spending behaviour and the financial situation of the household are in line with the expectations. These findings suggest that our measure is indeed a reliable indicator of patience.

Table 2

Patience measure: summary statistics

	Obs.	Mean	Std. Dev.	Min	Max
Complete sample					
Patience	14074	0	0.949	-2.792	2.745
	24630	-0.008	0.884	-2.792	2.744
Unemployed job seekers					
Patience	234	0.007	0.976	-2.519	2.407
Patience sum	345	0.024	0.930	-2.276	2.407

	Percentiles				
	10	25	50	75	90
Complete sample					
Patience	-1.230	-0.670	-0.024	0.676	1.248
Patience sum	-1.128	-0.601	-0.024	0.575	1.120
Unemployed job seekers					
Patience	-1.378	-0.668	0.056	0.733	1.224
Patience sum	-1.236	-0.575	0.046	0.648	1.286

Several sensitivity tests have been performed using various alternative indicators of patience. For instance, the average of the 11 FUTURE items can be used instead of the factor scores or a three year instead of a five year window can be used to create an average patience variable. Furthermore, a patient variable can be constructed excluding the FUTURE04 and FUTURE05 variables. Using such alternative measures leads to similar estimation results. For most estimations presented in Section 4, we show the results for both the original patience and the patience sum variable. Next to the patience measure which is based on the CFC Scale, we also created a patience indicator using similar methods and comparable behavioural proxies as DV&P (life insurance, savings account, smokes cigarettes, and alcohol consumption). However, the analyses using this measure for patience are not discussed here, because this leads to insignificant results: this is probably due to a combination of imprecise measurement and a small sample size.

Table 3 Correlation between patience, behavioural proxies and statements

	Coefficient
Behavioural outcomes	
Life insurance	0.0722*
Savings account	0.0472*
Smoker	-0.0460*
Drinker	-0.0060
Credit card debt	0.0514*
Statements about spending behaviour and financial situation	
Spend (1-7)	0.2034*
Planning (1-7)	0.0518*
Period (1-5)	0.2833*
Financial situation (1-5)	0.0770*
Manage on income (1-5)	0.0711*

Note: The complete sample is used here. See Appendix B for details on the questions/items.

* $p<0.0001$

Note that this measure of patience is fundamentally different from those used in the previous studies on this issue. An important identifying assumption in the study of DV&P (p.545) is that "the individual's discount rate is the same across different activities". Given that the behavioural proxies are rather domain or activity specific, this seems a rather strong assumption. In this study, patience is measured using items that are rather general. Such an identifying assumption is therefore more likely to hold.

3.3 Job search intensity

In the previous literature, the intensity of job search effort has been measured by various proxies: some rely on the amount of time spent on search activities (Krueger & Mueller, 2008), others use the number applications during a specific period (Van der Klaauw & Van Vuuren, 2010), the number of different search methods (Ben Halima & Ben Halima, 2009; DellaVigna & Paserman, 2005) or a combination of different indicators (Bloemen, 2005).

Table 4 Job search effort: job applications and search channels

	# applications		# channels	
	Frequency	Percentage	Frequency	Percentage
0	105	30.43	34	9.86
1	30	8.70	101	29.28
2	33	9.57	69	20.00
3	21	6.09	53	15.36
4	16	4.64	38	11.01
5	15	4.35	26	7.54
6	7	2.03	17	4.93
7	3	0.87	6	1.74
8	21	6.09	1	0.29
9	18	5.22		
10	18	5.22		
12	16	4.64		
13	2	0.58		
≥14	40	11.59		

Different search channels		
Answered advertisements	191	55.36
Placed advertisements	8	2.32
Asked employers	87	25.22
Asked friends/relatives	114	33.04
Through job center	125	36.23
Temporary employment agency	92	26.67
Reading advertisements	142	41.16
Other way	73	21.16

In the empirical analysis, we use the following indicators of search effort: whether the respondent applied for a job during the last two months; the number of job applications made by the worker during the last two months; and the number of job search methods used by the worker during the last two months.[14] The correlation coefficient between the number of applications and the number of search method equals 0.5672 and is highly significant ($p<0.0001$). Job seekers who applied more frequently to a job in the last months have also used a larger number of search methods. This indicates that the proxies represent the same underlying variable.

Table 4 and Table 5 provide descriptive statistics of these search effort variables. Less than one third of the job seekers have not applied for a job in the last two months; around 50 per cent of this sample has made at least three job applications. Over 11 per cent of the unemployed have applied 14 or more times for a job in the past two months. The average number of job applications is between 4 and 5. Furthermore, table 4 shows that the most commonly used search channels are answering and reading advertisements. Almost one out of three job seekers have asked friend and relatives about potential job openings, demonstrating the relevance of informal networks as a job search channel. A quarter of the unemployed asked employers directly. Using job centres and temporary employment agencies is also rather common. While about 10 per cent of the job seekers have used no search channel in

[14] For these variables information is obtained from the questions "How many times have you applied for a job during the last two months" and "How have you searched for a job during the last two months?" (up to eight different methods).

the past two months – this group has not started looking for a job – the majority has used as least two job search methods.

Table 5 Descriptives: Number of channels and applications

Variable	Obs	Mean	Std. Dev.
# channels	345	2.411594	1.768222
# applications	345	4.77971	4.995131

3.4 Reservation wages

Like DV&P and Ben Halima and Ben Halima (2009), this study makes use of subjective reservation wage data. To calculate the individual's hourly reservation wage, the following questions are utilized. First, the respondents are asked how many hours per week they are willing to work. Second, they are asked about the minimal net wage for which they would accept the job offer with the preferred working hours. Third, respondents specify whether this wage should be paid per week, per four weeks, per month or per year. Respondents fill in the answers for these three questions on the same screen.

Table 6 Reservation wage: summary statistics

	Obs.	Mean	Std. Dev.	Percentiles				
				10	25	50	75	90
All	291	9.058	4.657	4.955	6.708	8.224	10.201	13.701
Age<40	98	7.229	2.776	3.801	5.367	7.200	8.563	10.630
Age≥40	193	9.987	5.127	5.812	7.230	8.823	11.176	14.821
By education level:								
Pre-vocational (VMBO) or below	90	8.116	3.743	4.843	6.120	7.539	8.941	11.225
Pre-university (HAVO/VWO)	61	7.732	3.927	3.435	5.077	7.530	8.956	12.543
Senior vocational (MBO)	50	8.077	2.777	5.522	6.779	7.830	8.568	10.738
Vocational college (HBO)	51	9.687	2.812	6.811	7.622	9.406	11.230	13.751
University	39	13.742	7.667	7.416	9.139	11.176	14.886	30.125

Table 6 reports descriptive statistics of the hourly net reservation wages, in real terms (year 2000 euro's). The table shows that the average reservation wage is over 9 euro's per hour, which is higher than the median (8.5). Moreover, as expected the reservation

wages for the older group (40 years and older) are higher than the wages for the younger group (<40). Furthermore, the level of the reservation wage rises with the educational level – higher educated are more selective, as they have generally a higher earnings potential.

3.5 Transitions

Because the DHS contains no exact information on the duration of unemployment, we make use of data on transitions from one state to another. The transition variable is 0 if the unemployed job seeker observed in year t is still unemployed in year t+1, and equals 1 if he becomes employed in year t+1. Moreover, unemployed individuals who report not to be searching for a job because they already found one are included in the analysis (see note 5): these individuals are also assumed to have made a transition when they are employed in year t+1. According to this definition, 32 percent of the individuals made a transition to employment between two consecutive years. Interestingly, there is a substantial difference in the transition rate between impatient[15] job seekers and patient job seekers: 27 percent of the former and 37 percent of the latter group moved to employment. This difference is consistent with the hyperbolic discounting model.

4. Results

4.1 Job search intensity

Theoretically, both short-run and long-run patience are positively related to job search intensity (EXPO1 and HYPO1). In order to examine the relation between patience and search effort empirically, three equations are estimated using three different dependent variables: whether the job seeker applied for a job in the last two months (estimated with a probit model), the number of applications in the last two months, and the number of search methods used in the last two months (the latter two are estimated by poisson regressions).[16]

[15] An individual is defined as patient (impatient) if he scores above (below) 0 on the patience sum variable.

[16] Since the number of applications and channels can be considered as count data, the models using these dependent variables are also estimated with a negative binomial regression. However, this leads to similar results.

The models are estimated without controls and with a set of controls, consisting of demographic characteristics (age, age squared, marital status, main earner of the household, number of children), educational level (dummies), the unemployment rate (province level), and region and year dummies (see Appendix C for the descriptives of the controls). Unfortunately, the DHS data does not provide adequate information on whether the respondent is currently on (unemployment) benefits. However, respondents report whether they received benefits in the previous calendar year. So, using information from year t+1, we created a dummy indicating whether the individual received unemployment benefits and/or social assistance in year t. Because including this additional control leads to a substantial drop in observations, separate analyses are performed using the unemployment benefits variable next to the set of controls listed above.

The estimation results are shown in Table 8. Using the patience sum variable, the relation between patience and search intensity is positive and significant for all three indicators of search intensity (without and with controls). When the benefits control is added, the coefficients increase in size and remain significant. The average marginal effects are positive for all three indicators of search effort in all specifications: in addition, the marginal effects are positive and significant at most values of the patience sum variable (see Appendix D for marginal effects). The results do not change substantially when the sample is restricted to those individuals for which information on reservation wages is available (N=291). Furthermore, when the original patience variable is used instead, the number of observations drops considerably but the coefficients of the patient variable remain positive in all but one specification. The relation is positive and generally significant in the models where the job application dummy or the number of channels is used as a dependent variable. Thus, more patient unemployed individuals invest more in job search activities: they are more likely to have applied for a job in the last two months, apply for jobs more frequently and use a larger number of search channels. These results confirm the general prediction (EXPO1 and HYPO1) that there is a positive relation between the individual's degree of patience and job search intensity. The findings are in line with the findings of DV&P and Ben Halima and Ben Halima (2009) and demonstrate that the empirical relation between patience and search effort is robust to different measures of patience as well as to alternative indicators of job search intensity (both

previous studies use only the number of search channels as a measure of search intensity).

4.2 Reservation wages

According to the theoretical predictions, long-run patience has a substantial positive effect on the reservation wage (EXPO2), whereas the relation between short-run patience and the reservation wage is small or absent (HYPO2). To examine this relation empirically, we regress the level and the log of individual reservation wages on patience and a set of other explanatory variables, estimating the models with pooled OLS.

Estimating the models without controls and using the patience sum variable, the coefficient of patience is positive and significant ($p<0.05$) in both the level and the log specification (see Table 9). This is consistent with the DV&P's result of the estimation of the model without controls (DV&P, 2005, p.565). However, when controls are included (with and without the unemployment benefits variable), the coefficient becomes insignificant. Using the original patience variable, the sign of the coefficient of patience is not consistent across specifications and the variable is insignificant in all six specifications.

This result is robust to a variety of other specifications using alternative indicators for patience (using a dummy indicating that the job seeker is patient (see note 12) or alternative methods of constructing an indicator for patience (see 3.2)). So, there is no evidence of a positive relation between patience on reservation wages, both in the level and the log specification. This finding does not provide support for the exponential discounting model (EXPO2), but is consistent with the hyperbolic discounting model with (partially) naïve individuals (HYPO2). Note however that the power of the test is rather low due to the small number of observations.

Table 8 Job search intensity

	Applied for a job (probit)			# applications (poisson regression)			# channels (poisson regression)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Patience	0.231**	0.195*	0.279**	0.0531	-0.00785	0.0351	0.125**	0.100*	0.106
	(0.0977)	(0.116)	(0.138)	(0.0723)	(0.0709)	(0.0843)	(0.0598)	(0.0514)	(0.0683)
N	240	230	152	246	234	152	246	234	152
Patience sum	0.312***	0.279***	0.517***	0.144*	0.136**	0.191**	0.139***	0.103*	0.137**
	(0.0968)	(0.0999)	(0.137)	(0.0739)	(0.0687)	(0.0768)	(0.0522)	(0.0561)	(0.0609)
N	365	345	229	365	345	229	365	345	229
Controls (without UB)	No	Yes	No	No	Yes	No	No	Yes	No
Controls (with UB)	No	No	Yes	No	No	Yes	No	No	Yes

Note: Entries represent coefficients: see Appendix D for marginal effects. Clustered (at individual level) and robust standard errors in parentheses.

Controls included: age, age squared, marital status, main earner of the household, number of children, educational level, the unemployment rate (province level), three regional dummies, year dummies. Models without controls do include year dummies.

*** p<0.01, ** p<0.05, * p<0.1

Table 9 Reservation wages

	Level (OLS)			Log (OLS)		
	(1)	(2)	(3)	(4)	(5)	(6)
Patience	0.348	-0.00122	-0.234	0.0281	-0.00516	-0.0358
	(0.446)	(0.351)	(0.469)	(0.0378)	(0.0282)	(0.0359)
N	210	199	129	210	199	129
Patience sum	0.686**	0.182	-0.0219	0.0718**	0.0304	0.0138
	(0.321)	(0.264)	(0.406)	(0.0311)	(0.0255)	(0.0357)
N	310	291	195	310	291	195
Controls (without UB)	No	Yes	No	No	Yes	No
Controls (with UB)	No	No	Yes	No	No	Yes

Note: Clustered (at individual level) and robust standard errors in parentheses. For the list of controls, see Table 8.
*** p<0.01, ** p<0.05, * p<0.1

4.3 Transitions

Examining the relation between patience and the exit rate out of unemployment provides the final and crucial test of the two alternative models of time discounting. Theoretically, δ is negatively related to the probability of moving from unemployment to employment (EXPO3), while β is positively related to the exit rate (HYPO3). So, if the patience indicator captures variation in δ, a negative relation between patience and transition probability is expected. Alternatively, when the indicator measures variation in β a positive relation between patience and the transition probability is expected. In that case, the findings cannot be explained by the standard exponential discounting model.

The transition equation is estimated with a probit model: the estimation results are presented in Table 10 and Appendix D. The coefficient of the patience sum variable is positive but insignificant in the specifications including and excluding controls (without the control for benefits).[17] The marginal effects (average and estimated at

[17] Only the results using patience sum are presented here: for the original patience variable, the number of observations is very low and the results are inconsistent.

different patience levels) are also positive and insignificant. An explanation could be that the measure of patience captures a combination of β and δ. However, when the unemployment benefit control is added (column (3)), the patience coefficient is positive and significant ($p<0.10$). The average marginal effect is also positive and significant, as are the marginal effects estimated at various patience levels.[18]

The sign of the patience sum coefficient is robust to different definitions of transitions and alternative patience indicators. Moreover, the relation between patience and the exit rate is significant in various cases. The general results are confirmed when instead of the patience sum variable a patient dummy (note 12) is used (see rows 'High patient level' of Table 10): the patient dummy is positive and significant ($p<0.05$) in specifications including controls (with and without unemployment benefits). If the patience indicators would capture variation in δ, a negative rather than a positive relation between the patience variable and the exit rate can be expected. The empirical findings can therefore not be rationalised by the exponential discounting model. The results can be explained however by the hyperbolic discounting model: when the patience variable measures heterogeneity in the short-run patience β, the findings are in line with the theoretical predictions.

A second test of the two alternative models of time discounting exploits the predictions on the relative size of the reservation wage effect and job search intensity effect on the exit probability: the (negative) reservation wage effect dominates in the exponential, whereas the (positive) job search effort dominates in the hyperbolic discounting model. Table 10 illustrates that, across a variety of specifications, job search intensity is significantly and positively related to the probability of making a transition to employment. In addition, the results for the models without controls indicate a negative but insignificant relation between reservation wage (level or log) and the exit rate. However, when controls are included, this relation becomes positive (and significant when the log reservation wage is used). Consistent with the hypothesis derived from the hyperbolic discounting model (HYPO3), these results imply that variation in exit rates is mainly driven by search effort. Through a positive effect on job search intensity, patience indirectly affects the exit rate positively.

[18] The marginal effects turn only just insignificant at higher levels of patience.

Table 10 Transitions to employment, search effort and reservation wages

	Transition (probit)		
	(1)	(2)	(3)
Patience sum	0.0693	0.110	0.214*
	(0.0972)	(0.108)	(0.124)
High patient level	0.261	0.383**	0.552**
	(0.187)	(0.194)	(0.225)
N	273	257	204
Applied for a job	0.466**	0.679***	0.900***
	(0.215)	(0.209)	(0.256)
# applications	0.0590***	0.0965***	0.103***
	(0.0187)	(0.0207)	(0.0241)
# channels	0.0762*	0.135**	0.159**
	(0.0451)	(0.0540)	(0.0694)
N	312	296	212
Reservation wage	-0.0148	0.0361	0.0222
	(0.0253)	(0.0283)	(0.0313)
Log reservation wage	-0.0830	0.642**	0.658*
	(0.249)	(0.314)	(0.346)
N	270	255	182
Controls (without UB)	No	Yes	No
Controls (with UB)	No	No	Yes

Note: Entries represent coefficients: see Appendix D for marginal effects. Clustered (at individual level) and robust standard errors in parentheses. For the list of controls, see Table 8. All coefficients and standard errors of the specific variable are estimated with separate models.

*** p<0.01, ** p<0.05, * p<0.1

The empirical finding concerning reservation wages contrasts with the general theoretical prediction of a negative relation between reservation wages and the transition probability: it can be expected that job seekers with a higher reservation wage are – by definition - more selective in accepting a job offer and will for that reason have a longer unemployment spell (ceteris paribus). This result may be due to unobserved heterogeneity: the reservation wage may not just measure the likelihood that job offers are refused, but may also be positively correlated with the job offer probability – the latter implying a positive relation between the reservation wage and the exit rate.

5. Conclusion and discussion

This paper builds on the work of DellaVigna and Paserman (2005) and tries to integrate insights from behavioural economics into a job search model, one of the cornerstones of modern labour economics. By exploiting theoretical predictions of the relation between patience and job search behaviour, this study tests empirically the exponential versus the hyperbolic discounting model. In line with the predictions of the hyperbolic model, the results show that patience is significantly positively related to job search intensity and orthogonal to the reservation wage. The relation between patience and the exit rate from unemployment to employment is positive and in some cases significant. An explanation for insignificant relations between patience and the probability to exit unemployment could be that the measure of patience captures a combination of short-run and the long-run patience. The empirical findings also demonstrate that job search effort positively affects the exit probability and dominates the reservation wage effect: this suggests that there is an indirect positive relation between patience and the transition probability. The empirical findings thus favour the hyperbolic rather than the exponential discounting model.

The results have important implications for social security and labour market policy. The behaviour of hyperbolic job searchers is mainly affected by immediate costs and benefits, whereas long-term payoffs are of minor importance. Furthermore, hyperbolic discounting models emphasize the relevance of commitment devices – which are ineffective instruments in a world consisting of exponential discounters. Rather than implementing an unemployment scheme that provides long-term incentives to find a

job, it would be more effective to implement job search commitment mechanisms – for instance through setting-up individual action plans and by intensifying monitoring of job search effort (combined with sanctions). Although earlier research on the effectiveness of search monitoring is mixed, more recent empirical evidence supports that more stringent monitoring of job search substantially reduces the duration of unemployment (Card, Kluve, & Weber, 2009). It is striking that both the use of individual action plans and job search monitoring are on the rise in OECD countries (OECD, 2007).

An interesting area for future research would be to assess optimal unemployment insurance schemes under hyperbolic discounting. This may be particularly relevant because hyperbolic discounting introduces a different type of moral hazard. As the hyperbolic job seeker tends to procrastinate search activities, the level of job search intensity is not just non-optimal from a societal point of view, but also from the individual's long-run perspective. In the standard exponential framework, long unemployment spells are the result of the individual's optimizing behaviour, whereas under hyperbolic discounting lengthy durations of unemployment are (partly) attributable to non-optimal decision making.

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Appendix A: FUTURE items

Table A1 Correlation matrix

	future01	future02	future03	future04	future05	future06	future07	future08	future09	future10	future11
future01	1										
future02	0.6301*	1									
future03	0.3183*	0.4489*	1								
future04	0.0057	0.0506*	0.3195*	1							
future05	-0.1032*	-0.0484*	0.1544*	0.3086*	1						
future06	0.2736*	0.3239*	0.1247*	-0.0586*	-0.0751*	1					
future07	0.2934*	0.2506*	0.1504*	-0.0195	-0.2076*	0.2299*	1				
future08	0.3526*	0.3808*	0.2049*	0.0261	-0.1119*	0.3205*	0.4470*	1			
future09	0.1407*	0.1552*	0.3671*	0.1839*	0.0893*	0.0336*	0.1691*	0.1113*	1		
future10	0.1321*	0.1886*	0.3675*	0.1784*	0.1457*	0.2056*	0.0678*	0.1043*	0.4515*	1	
future11	0.1765*	0.2441*	0.4619*	0.2715*	0.1715*	0.1329*	0.1080*	0.1393*	0.4494*	0.5388*	1

Note: the correlation coefficients are based on the entire male sample (N=14074).

* $p<0.0001$

Table A2

KMO measures

future01	0.7548
future02	0.7265
future03	0.8207
future04	0.7292
future05	0.7050
future06	0.7863
future07	0.7352
future08	0.7900
future09	0.8008
future10	0.7643
future11	0.8087
Overall	0.7706

Table A3 Factor analysis: All FUTURE items

Variable	Factor loadings	Uniqueness	Scoring coef.
future01	0.5370	0.7117	0.15900
future02	0.6244	0.6102	0.21569
future03	0.6799	0.5377	0.26643
future04	0.2667	0.9289	0.06051
future05	0.0854	0.9927	0.01813
future06	0.3386	0.8854	0.08059
future07	0.3384	0.8855	0.08052
future08	0.4214	0.8224	0.10798
future09	0.4914	0.7585	0.13652
future10	0.5316	0.7174	0.15615
future11	0.6028	0.6366	0.19948

Note: All eleven FUTURE items are included in the factor analysis, which is estimated with maximum likelihood. The eigenvalue of the first factor (retaining 6 factors) is 2.60, explaining 45 percent of the total variance. The results presented in the table represent estimates retaining only the first factor.

Appendix B: Behavioural proxies and statements

Table B1 Behavioural proxies and statements

Smoker Question: *"Do you smoke cigarettes?"* (Smoker = 0 if "No"; 1 if "Yes, daily" or "Yes, occasionally")
Drinker Question: *"Do you consume over four alcoholic beverages each day?" (*Drinker = 0 if "No"; 1 if "Yes")
Spend (7-point scale) Question: *"Would you indicate on a scale from 1 – 7 how you use the money that is left after having paid for food, housing and other necessaries? (1 means you want to spend the money immediately - 7 means you want to save as much money as possible)"*
Planning (7-point scale) Question: *"Do you find it difficult to control your expenditures?" (1 very difficult –7 very easy)*
Period Question: *"Which of the following time periods is the most relevant to you when planning household expenditures and savings?* (Period = 1 if "next few months"; 2 if "next year"; 3 if "next few years"; 4 if next 5 to 10 years"; 5 if "beyond the next 10 years")
Financial situation Question: *"What is the current financial situation of your household?"* (Financial situation= 1 if "making debt"; 2 if "drawing on savings"; 3 if "can just manage"; 4 if "some money is saved"; 5 if "a lot of money is saved")
Manage on income Question: "*How difficult/easy are you able to manage on your income*?" *(1 very difficult –7 very easy)*

Appendix C: Controls

Table C1 Controls: descriptives

Variable	Mean	Std. Dev.
Age	43.66	13.40
Unemployment rate	5.90	1.70
	Percentage	
Married	42.90	
Main earner	72.75	
Nr of children:		
None	40.17	
One	14.34	
Two or more	45.49	
Education level:		
Pre-vocational (VMBO) or below	31.01	
Pre-university (HAVO/VWO)	21.45	
Senior vocational (MBO)	15.65	
Vocational college (HBO)	18.55	
University	13.33	
Region:		
North	15.94	
East	20.87	
South	30.14	
West	33.04	
Unemployment benefits*	58.95	

Note: the descriptives presented here are for the sample used in the job search intensity analyses (with controls, excluding UB, N=345.
* The sample with controls including UB is used (N=229).

Appendix D: Marginal effects

Table D1 Marginal effects of patience sum: search intensity and transitions

	Average	ME at different levels of patience sum				
	ME	-2	-1	0	1	2
Results without UB						
Applied for a job	0.0798***	0.0942***	0.0904***	0.0820***	0.0704***	0.0573***
	(0.0280)	(0.0347)	(0.0349)	(0.0300)	(0.0217)	(0.0125)
# applications	0.650**	0.490***	0.562**	0.644**	0.737*	0.845
	(0.327)	(0.177)	(0.240)	(0.319)	(0.416)	(0.534)
# channels	0.200**	0.200**	0.222**	0.246*	0.273*	0.302
	(0.0859)	(0.0859)	(0.108)	(0.133)	(0.163)	(0.197)
Transition	0.0317	0.0287	0.0303	0.0317	0.0329	0.0339
	(0.0312)	(0.0250)	(0.0284)	(0.0312)	(0.0335)	(0.0352)
Results with UB						
Applied for a job	0.131***	0.147***	0.152***	0.136***	0.105***	0.0700***
	(0.0334)	(0.0300)	(0.0410)	(0.0364)	(0.0212)	(0.00927)
# applications	0.889**	0.599***	0.725***	0.877***	1.061**	1.284*
	(0.353)	(0.143)	(0.227)	(0.340)	(0.491)	(0.692)
# channels	0.327**	0.245***	0.281***	0.322**	0.369**	0.424*
	(0.142)	(0.0746)	(0.103)	(0.137)	(0.180)	(0.232)
Transition	0.0573*	0.0445**	0.0510**	0.0569*	0.0618	0.0653
	(0.0331)	(0.0180)	(0.0259)	(0.0329)	(0.0381)	(0.0407)

*** p<0.01, ** p<0.05, * p<0.1